WJMER

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In this edition, these topics and more....

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About WJMER

The World Journal of Medical Education and Research (WJMER) (ISSN 2052-1715) is an online publication of the Doctors Academy Group of Educational Establishments. Published on a quarterly basis, the aim of the journal is to promote academia and research amongst members of the multi-disciplinary healthcare team including doctors, dentists, scientists, and students of these specialties from around the world. The principal objective of this journal is to encourage the aforementioned, from developing countries in particular, to publish their work. The journal intends to promote the healthy transfer of knowledge, opinions and expertise between those who have the benefit of cutting edge technology and those who need to innovate within their resource constraints. It is our hope that this will help to develop medical knowledge and to provide optimal clinical care in different settings. We envisage an incessant stream of information flowing along the channels that WJMER will create and that a surfeit of ideas will be gleaned from this process. We look forward to sharing these experiences with our readers in our editions. We are honoured to welcome you to WJMER.

Editorial Board

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Cover page design and graphics	:	Sreekanth S.S
Type Setting	:	Viji Shaji
Contact	:	wjmer@doctorsacademy.org.uk

WELCOME

Dear Colleague,

We are delighted to bring to you the third edition of World Journal of Medical Education and Research (WJMER). At WJMER, we are cognisant that medicine is a vast and dynamic area undergoing rapid advances, with an ever burgeoning demand placed on it by the general public to ensure good quality healthcare. It is therefore essential to have a global perspective on different aspects of research, recognition of symptoms, management of diseases, interesting cases (both common and rare), clinical audit and topical issues. The mission of WJMER is to reconcile seemingly disparate healthcare practices in different parts of the world, and to encourage publications and research from pioneers in the profession globally.

This edition proudly brings an array of selected articles from the large scale cross-sectional study of medical students and their education in Egypt to management of cerebral vascular events in the paediatric age-group in the United Kingdom. The global theme continues as one transverses continents and oceans to visit the Indian subcontinent to report on the renowned KARMIC medical student event where the Nobel Laureate Professor Robin Warren, who discovered the relation between *Helicobacter pylori* and gastric ulcers, graced with his presence. Use of advanced technology is described in the article regarding geometric morphometrics to analyse loss of glenoid tissue in shoulder injuries. Several articles inform readers on aspects of surgery such as specifics of the operating theatre and patient positioning (illustrated by informative photographs), different types of needles and sutures, techniques and application of suturing, and pre-operative optimization of surgical patients. In addition, career based articles such as introducing one to career options in plastic surgery, tropical medicine, genito-urinary medicine and forensic pathology have been included for those inclined to find out what these careers involve.

Special thanks is owed to Dr Narisa Damanhuri and Dr Mayura Damanhuri who acted as guest editors for this edition and provided us with thoughtful comments and constructive criticism that helped us to sharpen the focus of the articles.

We hope that you find this edition of WJMER as enjoyable and indeed stimulating to read as it was for us to compile it.

With very best wishes,

Ms. Karen Au-Yeung, BSc (Hons), MB BCh, MRCS
Editor – WJMER
Associate Director for Undergraduate Medical Education
Doctors Academy Group

Dr. Ahmed Hankir, MBChB
Associate Editor – WJMER
Lead for Medical Humanities, Global Health and Psychiatry
Doctors Academy Group

Professor Stuart Enoch, MBBS, MRCSEd, PGCert (Med Sci), MRCS (Eng), Ph.D
Editor-in-Chief – WJMER
Executive Director
Doctors Academy Group

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Clinical Audit
DAUIN 20130011

Use of CURB-65 scoring in Community Acquired Pneumonia

Ms Karen Au-Yeung, BSc, MBBCh(Hons), MRCS
Core Surgical Trainee, Stepping Hill Hospital, Stockport
Address for correspondence: kauyeung2012@gmail.com

Keywords:
Community Acquired Pneumonia, CURB-65 scoring, clinical guidelines, audit, accident and emergency

Introduction

Over the past two decades, clinical guidelines have become increasingly widespread and have influenced many aspects of everyday practice. Potential benefits conferred by clinical guidelines include increased consistency and quality of care, increased quality of clinical decision, medico-legal protection for healthcare professionals, gaps in public policies being identified and delivery of improved and cost effective healthcare.[1] To further understand the management of community acquired pneumonia, an audit of the clinical pathway used in the Accident and Emergency (A&E) department of Princess of Wales Hospital, Bridgend, UK, was performed.

Methodology

The Princess of Wales Hospital radiological database was searched using the query "consolidation" between September 2008 and February 2009. Three hundred and thirteen potential cases were found, and of those one hundred were identified to have pneumonia on the electronic database. Hospital acquired pneumonia, paediatric and pregnant cases were excluded. These one hundred cases were audited based on the appropriateness of investigations, severity and prognostic features of each case as well as the overall medical management.

Results

The initial investigations for community acquired pneumonia (CAP) listed in the guidelines include full blood count (FBC), urea, creatinine and electrolytes (U&Es), arterial blood gases (ABG), atypical viral titres, blood cultures if the noted body temperature is greater than or equal to 38°C, chest radiographs (CXR), electrocardiogram (ECG) and sputum for culture and sensitivity (see appendix). It was observed that very few patients had atypical viral titres measured, hence this parameter was excluded from the audit. As seen in Figure 1, the vast majority of patients had FBC, U&E, ECG and CXR done. 16% of patients did not have their U&E recorded as their blood samples had haemolysed requiring a further sample. Only 17% of patients had ABGs performed and 40% had sputum cultures collected. Figure 2 shows that blood cultures were taken from 29 patients. However out of those, only eight had a temperature greater than or equal to 38°C. On the other hand, it was observed from the cohort study that blood cultures were not done for nine patients despite having a temperature of 38°C or higher.

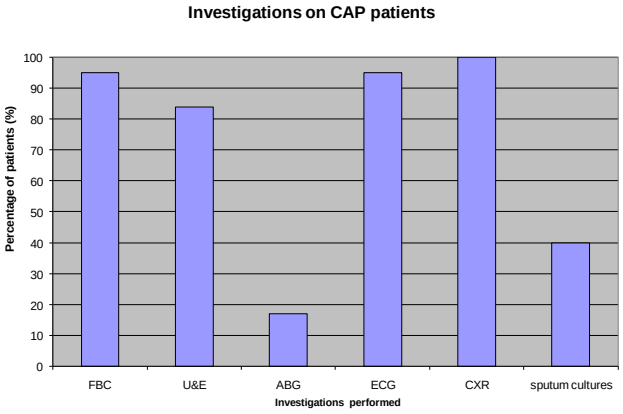


Figure 1: *Percentage of patients with community acquired pneumonia who undergone initial investigations.*

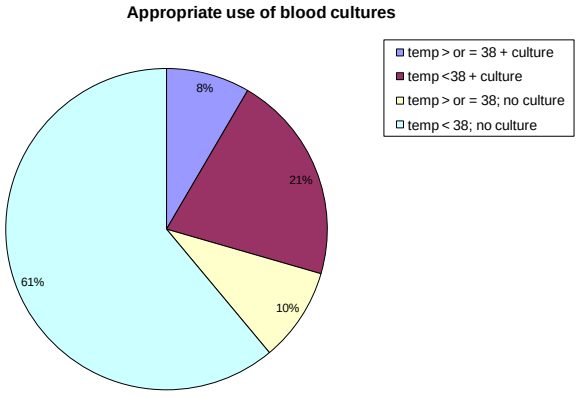


Figure 2: *Percentage of blood cultures performed based on body temperature.*

Initial assessment of CAP severity was performed using the CURB-65 scoring system whereby a point is scored for each of the following: new mental confusion (abbreviated mental test score less than 8), urea >7mmol/L, respiratory rate of over 30/min, low blood pressure (systolic blood pressure <90mmHg, and/or diastolic blood pressure <60mmHg) and age over 65.[2] The overall picture of CAP severity presenting to A&E over the period of September 2008 and February 2009 is illustrated in Figure 3, with 13% presenting with a CURB-65 score of 0, 29% scoring 1/5, 26% scoring 2/5, 20% scoring 3/5, 10% scoring 4/5 and none scoring 5/5.

Apart from CURB-65 score, poor prognostic features such as co-existing disease (ischaemic heart disease, cancer, chronic lung disease, diabetes mellitus, CVA), WCC <4 or >20, hypoxia (sats <92%, or pO_2 ≤60mmHg), multilobar involvement and albumin <35g/L also influence the severity of CAP. A positive blood culture result is also a marker of poor prognosis which is listed on the clinical pathway. However, as cultures do take several days to grow, this parameter was not included in the assessment of CAP severity.

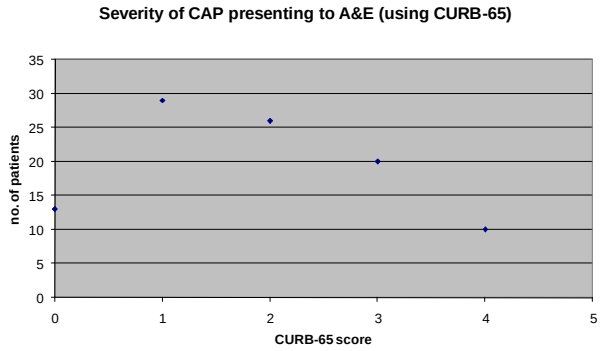


***Figure 3**: Overall picture of severity of pneumonia patients presenting to A&E.*

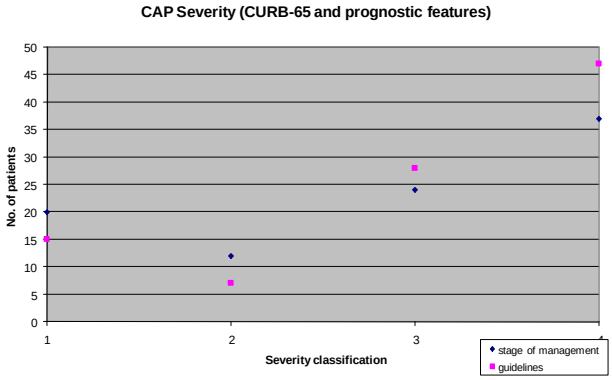


***Figure 4**: CAP severity classed according to CURB-65 and prognostic features. Class 1 : CURB-65 score 0-1, no poor prognostic features; Class 2: CURB-65 score 2, no poor prognostic features; Class 3: CURB-65 score <3, 1 poor prognostic feature; Class 4: CURB-65 score 3 or greater or 2 or more poor prognostic features.*

Patients were stratified into 4 different classes in accordance to the severity as per the local guidelines illustrated in appendix. Patients with no poor prognostic factors were classified into either class 1 or 2 dependent on their CURB score and age. Patients with one poor prognostic feature were automatically placed into class 3 or above and those with two or more poor prognostic features, or have a CURB-65 score greater than 3 were treated as severe CAP (class 4). Figure 4 illustrates that the majority of patients attending A&E were classified to have moderate to severe CAP when the prognostic features are taken into account.

Discussion

In general, all patients with CAP received a CXR in this cohort study as the initial selection of patients was achieved by using the radiographic database. Only 17% of patients had ABGs performed in view of it being an invasive test and may not be appropriate for patients with high oxygen saturations on air. Request for sputum sample was documented for only 40% of patients. The low percentage for sputum sample request may be partly attributed to the fact that not every patient with CAP was able to expectorate, however, these figures can definitely be improved upon.

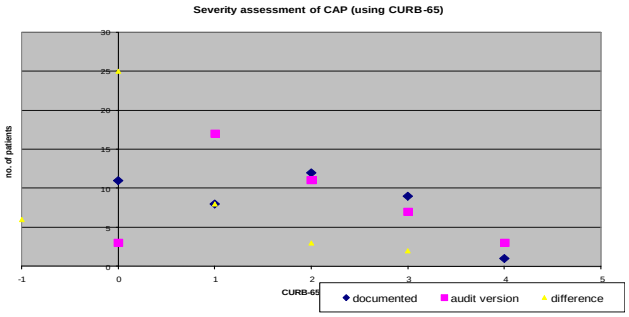


***Figure 5**: Severity assessment of CAP patients using CURB-65 in 40 patients who were scored in notes. Blue represent the amount of patients with the corresponding CURB-65 score documented in the notes. Pink shows the reassessed CURB-65 score using data from the notes from the same cohort of patients. Yellow records the difference in the CURB-65 score between the documented and audit version (calculated by audit score – documented score).*

Although the CURB-65 is a straight-forward simple scoring system, there are discrepancies between the documented score and the score marked independently during the audit using the data from A&E admission card, as illustrated in Figure 5. The blue indicator marks the CURB-65 score documented in the notes, the pink indicator marks the score marked independently and the yellow indicator represents the difference between the independent score marked in the audit process and the documented score (i.e., audit score – documented score). As seen below, 25 patients had identical scores, but there were differences in scores for 19 patients, with 2 patients having a difference of 3 points. Possible reasons for the dissimilarities include scoring systems using patient vital

signs at different points in time (i.e., systolic blood pressure of 89 on admission, which improved to 92 when patient was seen), or different cut-off points used, for example several patients were documented as scoring 1 point for respiratory rate, when the documented as 28 breaths per minute.

In terms of management compatibility with the trust guidelines, Figure 6 illustrates the differences in CAP severity classification between the management plan for patients (according to whether they were admitted and type of antibiotics given) and that which is suggested by clinical guidelines (according to CURB-scoring and presence or absence of poor prognostic features).

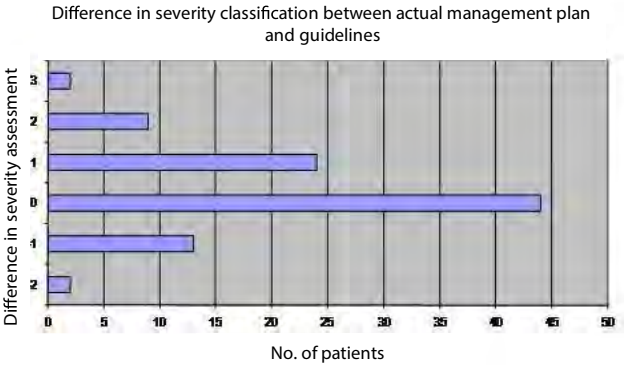


Figure 6: Differences in CAP severity classification between management plan for patients (according to whether they were admitted and type of antibiotics given) and that which is suggested by clinical guidelines (according to CURB scoring and prognostic features). This is calculated by clinical guideline class- actual management plan class i.e., a score of -2 means guidelines underestimated management plans by 2 classes, and a score of +2 means that according to the guidelines, the management plan should have been stepped up by 2 classes.

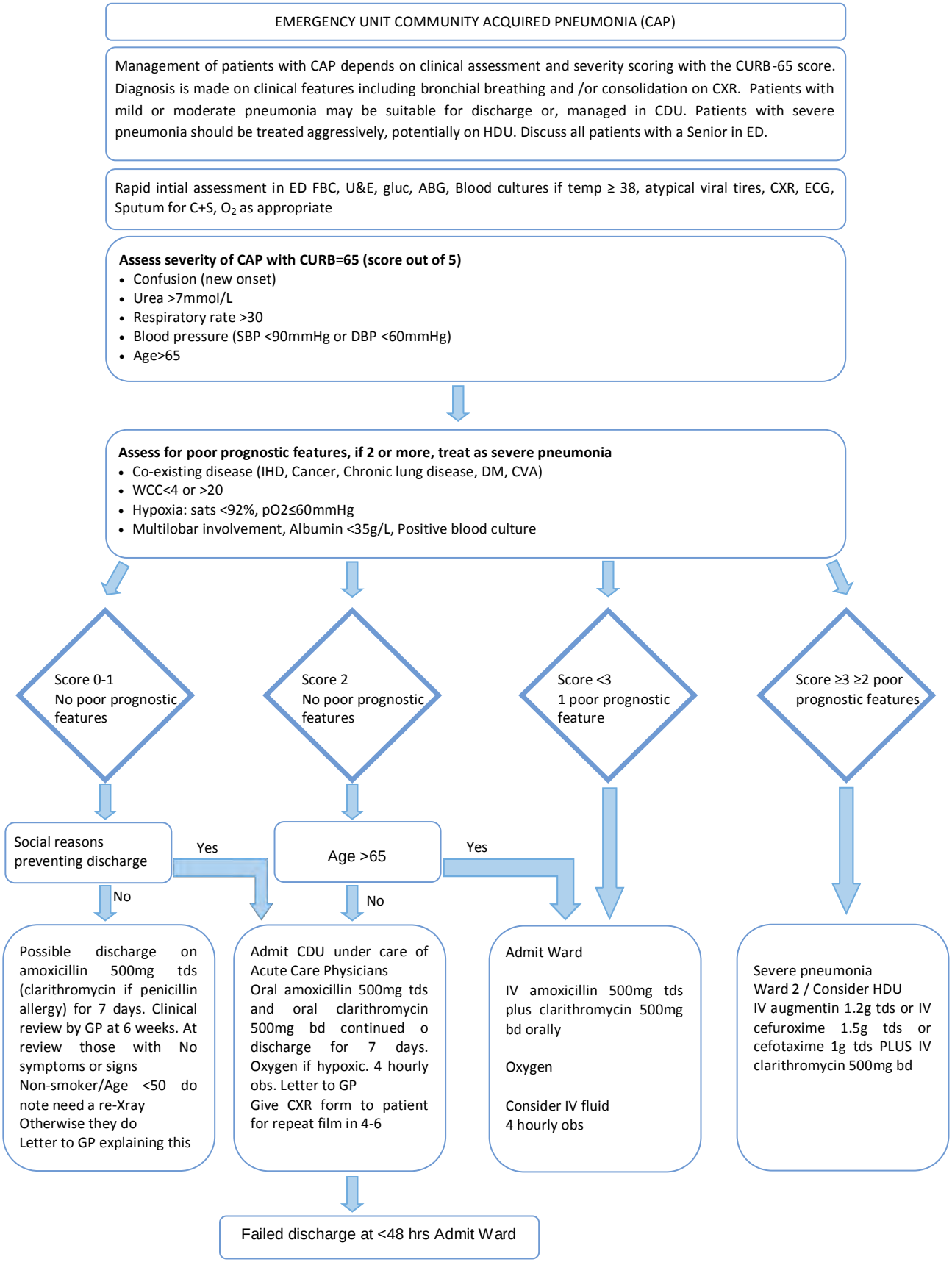
For example patients required admission if they were in class 2 or above, and only required intravenous antibiotics if they were in class 3 of the severity stratification. A score of -2 means guidelines underestimated management plans by 2 classes, and a score of +2 means that according to the guidelines, the management plan should have been stepped up by 2 classes. After comparison of the actual management plan with the recommended guidelines, it was found that only 44% of cases were identical to that suggested by the guidelines. The remaining patients were more often managed as having a lower severity compared to the scoring system. Possible reasons include the artificial cut -off points in the guidelines, for example patients with a white cell count of 19.9 are not considered to have a poor prognostic feature, but if they had a slightly higher white cell count of 20.1, they are automatically placed into a class 3 CAP or above, even if they have a CURB-65 score of 0.

Conclusion

Clinical guidelines provide us with guidance in management of diseases, and are particularly useful in conditions such as CAP, which is widespread and is immensely varied in terms of severity. However, this audit demonstrates that clinical management does not always follow the pathway, particularly with judicious use of blood cultures, sputum sample requesting, accuracy of CURB-65 scoring and management of patients in accordance to risk stratification. This lack of adherence to the published guidelines is consistent with findings in literature[3] should be addressed by dissemination of the above article to junior doctors in Princess of Wales Hospital. However, one must remember that these guidelines are only a protocol and when faced with difficult or unusual CAP cases, deviance from these guidelines is acceptable, provided sound clinical judgment is applied.

Appendix

Princess of Wales Hospital, Bridgend, UK, Emergency Department Community Acquired Pneumonia (CAP) Guidelines



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Quality of educational environment among Egyptian medical students using DREEM questionnaire

Dr Randah Mohamad Helal, MD
Lecturer of Public Health
Faculty of Medicine, Mansoura University, Egypt

Dr Ragaa El-Masry (MD)
Lecturer of Public Health
Faculty of Medicine, Mansoura University, Egypt

Dr Abdel-Hady El-Gilany, MD
Professor of Public Health
Faculty of Medicine, Mansoura University, Egypt

Address for correspondence:
Dr Randah Helal: ranhel2000@yahoo.com

Keywords:

Educational Environment; DREEM questionnaire; Medical Education; Medical Curriculum; Student Satisfaction.

Abstract

Background: In order for educationalists to provide the highest quality of teaching to their students it is a prerequisite to enrich the environment in order to make it conducive of learning. This can be achieved by identifying the weaknesses of the milieu the student is immersed in so that they maybe ameliorated. .

Objectives: To assess the quality of the educational environment in Mansoura College of Medicine, Egypt using a validated tool.

Methods: A Cross-Sectional study using the Arabic and English version of the validated Dundee Ready Educational Environment (DREEM) questionnaire. The authors distributed 950 questionnaires and collected 845 completed questionnaires from students across the six years of the MBChB program during the academic year 2011/2012.

Results: The mean total score was 92.6 ±23.37 out of a maximum of 200 (46.3%) indicating plenty of problems. There were no individual areas of excellence identified. The following three areas achieved a score of less than one (a) presence of a support system for stressed students (b) absence of boredom during studying (c) memorization of facts (learning by rote). The scores of the subscale were as follow: students' perceptions of learning 20.03/48, perceptions of teachers 22.96/44, academic self-perceptions 14.43/32, and perceptions of atmosphere 20.45/48 and social-self perceptions 14.75/28. Clinical students showed more positive perception than preclinical students in most of the domains. The student's perception of the teacher was the only domain that showed significant difference between male and female participants.

Conclusion: The majority of the students (60.9%) responded 'plenty of problems' to educational environment and so improvement is required across all five domains of the educational environment[6].

Introduction

The learning environment has been defined as, '*Everything that is happening in the classroom or department or faculty or university*'.[1] It was also defined as the, "*Environment experienced or perceived by the students as well as by the teachers*". These perceptions would be based on three important facets which includes: the physical environment, emotional climate, and intellectual climate.[2]

As universities continue to become more student oriented, student perceptions of higher educational facilities and services are becoming increasingly important.[3] Meaningful learning correlates positively with the students' perceptions of the educational environment, which impacts on students' learning experiences and outcomes. It influences how, why and what students learn.[4] A conducive environment has a positive and significant impact on students' learning, academic progress, and well-being.[5]

In order for educationalists to provide the highest quality of teaching to their students it is a prerequisite to enrich the environment in order to make it conducive of learning. This can be achieved by identifying the weaknesses of the milieu the student is immersed in so that they maybe ameliorated. Accordingly, it is essential to utilize appropriate methods and instruments to assess the educational environment in order to ascertain what is happening, inorder to ascertain the progress.[6,7]

Various methodologies have been utilized to investigate educational climate. Recent studies include qualitative approaches[8] or the use of questionnaires.[6,9,10] Of these,

only the DREEM (Dundee Ready Educational Environment Measure) questionnaire[6] is specific to the unique environment experienced by students on medical and healthcare-related courses. This instrument has been applied to a number of undergraduate courses for health professionals' worldwide.[11] However, it is clear that such questionnaires cannot reveal the whole story. While they may be valuable in identifying areas of concern shared by a majority of students, they yield no insight into the underlying reasons for these responses.[5]

This tool can be used to highlight the strengths and weaknesses of an educational institution, compare the performance and effectiveness of different medical schools, and make comparisons among students in different years of study and differences between the genders.[4] In addition, it is used to help modify the curriculum, comparing past and present curricula and evaluating the efficacy of a university program.[12] It can help medical and health schools to recognize their educational priorities and introduce more effective measures as a result. Furthermore, it enables institutions to compare their performances and productivities with their peers, which can be educationally insightful.[13] Most researchers agree upon the usefulness of the DREEM inventory as a useful basis for strategic planning and resource utilization.[14]

To the best of our knowledge, no studies have been conducted in Egypt that assess the medical educational environment. So the objectives of this study were to assess the quality of the educational environment using DREEM as perceived by the preclinical and clinical years' medical students so that corrective measures could be taken to enhance students' learning experiences and to test whether there is any difference in the students' perceptions according to gender and academic phase.

Methodology

Study location

This study was carried out in the faculty of medicine, Mansoura University during the academic year 2011/2012. The faculty gives a traditional 6-year course: the first three years represents the preclinical stage and is devoted to basic medical sciences while the last three years represents the clinical stage during which students rotate to different clinical departments . The curriculum depends heavily on the use of lectures. All activities are teacher centered which consists of information gathering and 'regurgitation' with few open discussions or problem -solving sessions. The learning task is to reproduce the subject matter in the final examination.

Our target group included the students in all of the 6 grades which were subdivided into preclinical and clinical students. This study was approved by the Vice Dean of the Students' Affairs in the Faculty of Medicine, Mansoura University.

Sample size was calculated online.[15] A pilot study was done on 137 students, from which the mean of the total score was found to be 90.3±19.1 and by considering the worst expected as 92.3, the sample size was 564 with 95% confidence level and 80% study power. This number is multiplied by 1.5 to compensate for the design effect of the cluster sampling technique employed. Thus the final sample size was 846.

The students were selected from all the six grades in proportion to their total numbers and they were interviewed at the practical sessions after taking permission from the respective heads of departments. Each section/round was considered as a cluster. The authors gave brief explanations of the objectives and the method of filling out the questionnaire. Students were also assured of their anonymity and the confidentiality of their responses. The researchers collected the completed questionnaires at the same session. The authors distributed 950 questionnaires and collected 845 completed questionnaire (response rate =88.9%).

Instrument

We used the combined DREEM questionnaire in English and Arabic without modification as applied in Saudi Arabia.[14] The DREEM contains 50 statements relating to a range of topics directly relevant to education climate. Students were asked to read each statement carefully and to respond using a 5 point Likert-type scale ranging from strongly agree to strongly disagree. It is important that each student applies the items to their own current learning situation and responded to all the 50 items.

Scoring the DREEM

Items are scored: 4 for Strongly Agree (SA), 3 for Agree (A), 2 for Uncertain (U), 1 for Disagree (D) and 0 for Strongly Disagree (SD). However, 9 of the 50 items (numbers 4, 8, 9, 17, 25, 35, 39, 48 and 50) are negative statements and should be scored 0 for SA, 1 for A, 2 for U, 3 for D and 4 for SD. The 50-item DREEM has a maximum score of 200 indicating the ideal educational environment as perceived by the students. A score of 0 is the minimum and would be a deeply worrying result for any medical educator and warrant intervention (0-50 Very Poor, 51-100 Plenty of Problems, and 101-150 More Positive than Negative, 151-200 Excellent). Items that have a mean score of 3.5 or over are real positive points. Any item with a mean of 2 or less should be examined more closely as they indicate problem areas. Items with a mean between 2 and 3 are aspects of the climate that could be enhanced.[16]

As well as the total DREEM score, the data was later regrouped according to the five domains, as questions about perception were in different locations in the original questionnaire. These domains are: Students' Perceptions of Learning (12 items/ maximum score 48), Students' Perceptions of Teachers (11 items/ maximum score 44), Students' Academic Self-perceptions (8 items/ maximum score 32), Students' Perceptions of Academic Atmosphere (12 items/ maximum score 48) and Students' Social Self-perceptions (7 items/ maximum

score 28). The interpretation of the subscales was as follow. Students' Perceptions of Learning (0-12 Very Poor, 13-24 Teaching is viewed negatively, 25-36 A more positive perception, 37-48 Teaching highly thought of), Students' Perceptions of Teachers (0-11 Abysmal, 12-22 In need of some retraining, 23-33 Moving in the right direction, 34-44 Model course organizers), Students' Academic Self-perceptions (0-8 Feelings of total failure, 9 -16 Many negative aspects, 7-24 Feeling more on the positive side, 25-32 Confident), Students' Perceptions of Academic Atmosphere (0-12 A terrible environment, 13-24 There are many issues which need changing, 25-36 A more positive attitude, 37-48 A good feeling overall), Students' Social Self-perceptions (0-7 Miserable, 8-14 Not a nice place, 15-21 Not too bad, 22-28 Very good socially).[16]

Data analysis: We analyzed the collected data using SPSS version 16. A descriptive analysis of the collected data was done in the form of frequencies and mean ± SD. Student's t-test was used to compare the means between different groups. $P \leq 0.05$ was chosen as the level of statistical significance.

Results

*The mean age of the participants in the study was 20.24±1.51. Male and female students accounted for 39.8% and 60.2%; respectively. Students enrolled on basic sciences in the preclinical phase accounted for 43.8% of the respondents and the remaining 56.2% were enrolled in the clinical phase, (Table 1).

		Number	%
Sex	Male	336	39.8%
	Female	509	60.2%
Stage:	Preclinical	370	43.8%
	Clinical	475	56.2%
Academic year	1	158	18.7%
	2*	33	3.9%
	3	179	21.2%
	4	171	20.2%
	5	144	17.0%
	6	160	18.9%
Age (mean ± SD):	20.24±1.51		

Table 1: *Sociodemographic characters of the medical students in Mansoura University during the academic year 2011/2012.*

**The small number of grade 2 as the total number of students is about 200 students.*

Item	Mean±SD
Items with score less than one	
There is a good support system for students who get stressed	0.90±1.05
I am rarely bored on this course	0.99±1.27
I am able to memorize all I need	0.96±1.09
Items with score between two and three	
The teachers are knowledgeable	2.76±0.97
I am too tired to enjoy this course	2.67±1.39
The teachers are patient with patients	2.31±1.06
I am confident about my passing this year	2.14±1.34
Cheating is a problem in this school	2.18±1.38
The teachers have good communication skills with patients	2.42±1.00
My social life is good	2.21±1.38
The teaching is well focused	2.01±1.25
The teaching over-emphasizes factual learning	2.41±1.39
I have learned a lot about empathy in my profession	2.67±1.15
I feel comfortable in class socially	2.10±1.32
The atmosphere is relaxed during seminars/tutorials	2.11±1.30
I found the experience disappointing	2.23±1.42
The teachers give clear examples	2.27±1.20
The teachers are well prepared for their classes	2.23±1.20
My accommodation is pleasant	2.73±1.28
The teaching is too teacher-centered	2.43±1.35
I feel able to ask the question I want	2.36±1.23

Table 2: *The items of the learning environment with scores less than one and those between two and three as reported by the medical students in Mansoura University during the academic year 2011/2012.*

By studying each item of DREEM separately, no item achieved a score of greater than 3.5. Most of the items had a score of less than two which identifies problem areas that should be examined more closely, the lowest score (less than 1) achieved for three items which were: "There is a good support system for students who get stressed" (0.9), "I am rarely bored on this course" (0.99) and "I am able to memorize all I need" (0.96). Eighteen items achieved a score between 2 and 3 which translates as aspects of the climate that could be enhanced. These items are shown in Table 2.

Domain	Max. score	Sample score (% from total score)	Categorization of subscale	Number	%
Total DREEM	200	92.6±23.37 (46.3%)	Very poor	29	3.4%
			Plenty of problems	515	60.9%
			More positive than negative	295	34.9%
			Excellent	6	0.7%
Students' perception of learning (SPL)	48	20.03±7.76 (41.7%)	Very poor	141	16.7%
			Teaching is viewed negatively	465	55.0%
			More positive perception	222	26.3%
			Teaching is highly thought of	17	2.0%
Students' perception of Teachers (SPT)	44	22.96±5.57 (52.2%)	Abysmal	18	2.1%
			In need of some retaining	364	43.1%
			Moving in the right direction	444	52.5%
			Model course organizer	19	2.2%
Students' Academic Self - perception (SAS)	32	14.43±5.46 (45.1%)	Feeling of total failure	125	14.8%
			Many negative aspects	415	49.1%
			Feeling more on the positive side	284	33.6%
			Confident	21	2.5%
Students' Perception of Atmosphere (SPA)	48	20.45±6.83 (42.6%)	Terrible environment	102	12.1%
			Many issues need change	517	61.2%
			More positive attitude	216	25.6%
			Good feeling overall	10	1.2%
Students' Social Self-perception (SSS)	28	14.75±3.86 (52.7%)	Miserable	32	3.8%
			Not a nice place	354	41.9%
			Not too bad	433	51.2%
			Very good socially	26	3.1%

Table 3: *Description of the five domains of the learning environment as reported by the medical students in Mansoura University during the academic year 2011/2012.*

Table 3 shows that the majority of the students (60.9%) responded *'plenty of problems'* to educational environment in the faculty of medicine with a total score of 92.6±23.37 (46.3% of the total score 200). Agreement of Students' social self- perception achieved the highest percent (52.7%) among students followed by Students' perception of Teachers (52.2%). More than half of the students reported *'teaching is viewed negatively*' for students' perceptions of learning (SPL, sample mean score 20.03/48). However, 52.5% perceived that teachers

are '*moving in the right direction*' for students' perception of teachers (SPT, sample mean score 22.96/44). The higher percentage of the students (49.1%) had an academic self perception that was '*Many negative aspects*' (SAS, sample mean score 14.43/32). Furthermore, faculty atmosphere was perceived as '*Many issues need change*' (SPA, sample mean score 20.45/48). More than half of the students (51.2%) thought that the society they live in is '*not too bad*' (SSS, sample mean score 14.75/28) while 41.9% believed their society is '*not a nice place to be*'.

Domain (Total score)	Academic stage			Gender		
	Preclinical	Clinical	P	Male	Female	P
Total (200)	90.22±22.28	94.47±24.04	0.009	90.92±24.24	93.71±22.73	0.09
Students' perception of learning (48)	20.23±7.62	19.87±7.87	0.50	19.54±7.92	20.35±7.64	0.13
Students' perception of Teachers (44)	21.54±4.90	24.06±5.81	≤0.001	22.06±5.74	23.55±5.38	≤0.001
Students' academic self -perception (32)	13.79±5.42	14.92±5.45	0.003	14.19±5.61	14.59±5.36	0.29
Students' perception of atmosphere (48)	19.94±6.43	20.84±7.11	0.06	20.39±7.01	20.49±6.71	0.84
Students' social self-perception (28)	14.72±4.15	14.77±3.63	0.85	14.76±3.96	14.73±3.80	0.92

Table 4: *Variation of the domain mean scores according to gender and educational stage of the medical students in Mansoura University during the academic year 2011/2012.*

Clinical stage students showed more positive perception than preclinical stage students regarding the total educational environment (94.47±24.04 versus 90.22±22.28), Students' perception of Teachers (24.06±5.81versus 21.54±4.90) and Students' academic self–perception (14.92±5.45 versus13.79±5.42) with statistical significance (Table 4).

Students' perception of Teacher is the only domain that showed significant difference between males and females with a more positive perception being observed for female than male (23.55±5.38 and 22.06±5.74); respectively.

Discussion

There has been growing interest and concern about the role of the learning environment in medical education. Educational environment is one of the most important factors in determining the success of an effective curriculum.[17]

The results of this research revealed a mean overall score of 92.6/200 for the DREEM items, this mean score between 50 and 100 indicating potential problems.[16] In medical schools with a traditional system, scores are found to be below 120; however, in modern, student-centered systems, the mean score is generally much higher.[18] Similar results were reported by Hassan et al,[19] in Khartoum (99.5/200), Aghamolaei and Fazel,[20] in Iran (99.6/200), Al-Hazimi *et al*,[13] In King Abdul Aziz University, Saudi Arabia (102/200) and Lokuhetty *et al*,[21] in Sri Lanka (107.43/200) and Nahar *et al*,[22] in Bangladesh (110/200). The similarity of the results could be due to similarity in the educational environments.

The mean total score higher than 120 was reported by Riquelme *et al*,[23] in Pontificia Universidad Católica de Chile (127.5 /200) (63.8%), Avalos *et al*,[24] in Ireland (130 /200) (65%), Shehnaz *et al*,[25] in United Arab Emirates (135/200) (67.5%) indicating relative satisfaction with the environment but with room for improvement.

The highest reported score was (156.1/200) (78%) in the study of Palmgren and Chandratilake,[26] in chiropractic training institutions and in some studies from the United Kingdom: (70.4%)in the study of McKendree,[27] and (71.5%) in the study of Miles and Leinster.[28] These high scores mean that these universities have modern systems with the existence of an excellent educational environment.

In this study, the scores of the subscale were: students' perceptions of learning 20.03/48, perceptions of teachers

22.96/44, academic self-perceptions 14.43/32, perceptions of atmosphere 20.45/48 and social-self perceptions 14.75/28. These scores are similar to those reported by Al-Hazimi *et al*,[13] in Saudi Arabia and Aghamolaei and Fazel,[20] in Iran, these comparable results might be explained by the traditional system that was established in these universities. However Abraham *et al*,[17] reported higher scores in an Indian medical school with a traditional system. Lokuhetty *et al*,[21] in Sri Lanka and Shehnaz *et al*,[25] in United Arab Emirates found that the majority of the subscales were towards the right position and this is due to the innovative curriculum they use in these universities. Al-Hazimi *et al*,[12] conducted a 'study on three traditional and one innovative medical schools, the mean scores for the traditional medical schools were lower than the innovative one. Students from traditional schools rated their learning and teaching environment significantly lower than their counterparts in the innovative medical school.

Furthermore, no item received a mean score ≥3.5. The item "*I am able to memorize all I need*" (0.96) received the lowest score This item scored below 2.0 in many other studies.[12,29] This finding may be due to the high volume of the curriculum that needs further review and reduction from our faculty. Also Palmgren and Chandratilake,[26] in chiropractic training institutions found that their students were stressed by memorization of too many facts in their chiropractic program that might be focusing on the retention of too many facts rather than the attainment of practical skills. Another item with lowest score is "*the presence of a good support system for students who get stressed*" (0.9), this view has been supported by others.[14,19,26] Health care students are exposed to a diversity of pressures, many of which may cause stress,[30] and it is a very important issue to be addressed as the educational institutions should have a student-friendly environment with a proper support system that may help to alleviate the anxiety expressed by the students and consequently help to diminishthe number of students who fail courses. Support systems are more available in innovative health care educational institutions than the traditional ones,[12] The item "*I am rarely bored on this course*" (0.99) needs further exploration to identify the potential causes of boredom with curriculum overload potentially being one of the causes, this was in agreement with Arzuman et al,[29] in Malysia and Hassan et al,[19] in Khartoum.

Clinical stage students showed more positive perception than preclinical stage students regarding the majority of the subscale scores, the preclinical students did not complete three items of DREEM questions related to clinical contact and this may explain that difference. This was also viewed by Aghamolaei and Fazel,[20] in Iran.

More positive perception was observed for female than male for the total educational environment and most of the subscale scores but Students' perception of Teacher was the only significant one. This is in agreement with Fidelma et al,[18] in UK and Nahar et al,[22] in Bangaladish who found that females rated the educational milieu higher than their male counterparts but Abraham et al,[17] in India and Aghamolaei and Fazel,[20] in Iran found no significant difference with respect to the gender of the student. On the other hand Mayya and Roff,[4] in India reported lower scores among females than males.

Conclusion

The majority of the students (60.9%) responded 'plenty of problems' to educational environment as the mean total score was 92.6±23.37. More than half of the students reported '*teaching is viewed negatively*' for students' perceptions of learning, teachers are '*moving in the right direction*' for students' perception of teachers and the society they live in is '*not too bad*'. Forty-nine percent of the students had an academic self perception that was '*Many negative aspects*'. Furthermore, faculty atmosphere was perceived as '*Many issues need change*'. Clinical students showed more positive perception than preclinical students in most of the domains. Students' perception of Teacher is the only domain that showed significant difference between males and females.

Recommendations

From our results we found that improvement is required across all five domains of the educational environment. For example reduction of the curriculum as much as possible in order to be more memorable and decrease the students' boredom, the presence of a proper support system for those exposed to different forms of stress, the methods of teaching should be changed to help the students to develop competence, confidence and different skills and making stress on student centered teaching rather than teacher centered teaching, the teachers should have more training courses to be more knowledgeable, presentable with better communication skills with the students, finally we should provide the students with a more relaxing and interesting learning atmosphere for a proper learning outcome.

Study limitation

This is a single center study and its results cannot be generalized to all Egyptian Faculties of Medicine.

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Disclaimer: The contents of this manuscript are solely the responsibility of the authors.

The main message

- The educational environment has a significant impact on students' learning and academic progress.
- Mansoura Medical School educational environment was assessed by the students as having '*plenty of problems*'.
- Improvement is required in all the domains of the educational environment.

Current research questions

- We need further research to answer some questions as the underlying causes of the students' boredom during their courses.
- There is a need for multi-center nation-wide study including both public and private medical education to give a full picture of the learning environment and facilitate inter-faculties comparison.
- Corrective measures should be developed, tested, implemented and evaluated

Authors' contributions

- Helal R: Conception of the research idea, data collection, data entry and drafting of the manuscript.
- El-Masry R: Research design, data collection and analysis, review of literature and revision the manuscript.
- El-Gilany A: Coordination of the whole research process, data interpretation and revising the manuscript for intellectual contents.

All authors approved the manuscript for publication.

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An Introduction to Forensic Pathology

Miss Fatima Saeed
3rd Year Medical Student,
University of Manchester

Dr Helen Denley, MB ChB, PGCAP, FRCPath
Consultant Histopathologist,
Manchester Royal Infirmary

Address for correspondence:
Miss Fatima Saeed: Fatima.saeed@student.manchester.ac.uk

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Introduction

Forensic pathology is the relevant application of medical and scientific knowledge to determine the cause and manner of death.[1] Clinical forensic pathologists may also examine live patients usually when criminal foul-play such as abuse or sexual assault is suspected. A forensic pathologist is often called upon to solve cases of medico-legal interest which may be a crime scene or a civil case.[2]

Forensic pathology is a sub-specialty of histopathology (study of cells and tissue samples) and requires a degree in medicine and initial post-graduate training (foundation training programme in the UK) despite the legal nature of the profession. Further training differs from country to country, but the UK forensic pathologist training will be explored in greater detail later in this article.

Your first exposure to this specialty may well have been through popular TV shows such as CSI. This chapter explores the everyday life of a forensic pathologist and will hopefully dispel some of the common myths depicted in the media.

Life as a Forensic Pathologist

Most of your work is actually laboratory based, but more experienced forensic pathologists will be regulars at the crime scene. Laboratory-based doesn't mean that you are constricted to the confines of toxicology or histology; it mostly involves the dissection of those who have passed away. Post-mortems will be the hallmark of your career. It is common to be called out in the middle of the night as you can't delay a crime scene investigation.

According to the British Association in Forensic Medicine (BAFM), most forensic pathologists in England work in relatively small clusters outside of the NHS. However some continue to work within the NHS, and others remain within University departments (such is the case for most of Wales, Scotland and Northern Ireland).[3]

Although working abroad is not common place, it is possible for those keen enough to pursue this aspect of the career pathway. You must seek permission from your Deanery Trust, the Postgraduate Medical Education and Training Board (PMETB) and the College Advisory Training Team (CATT) before beginning your training in order for it to be counted towards your Out Of Programme Training (OOPT) or Research (OOPR). Undertaking research (in the UK) follows identical requirements and if accepted will contribute towards your OOPR.

There are also numerous conferences to increase your understanding of the current global perspective and standard of pathology. The Coroner's Autopsy is one such example which was held on the 1st of November 2011. It is aimed to directly address some of the common tripwires for pathologists when performing autopsies and provide a platform for voicing questions and having them answered. If your budget allows it, the British Association in Forensic Medicine (BAFM) hosts a delightful selection of high-profile conferences around the world including one in Saudi Arabia.

Training

After successful completion of the 2 year long foundation training, you can apply for entry into the Histopathology programme. According to the Royal College of Pathologists (RCPath) this should take about 5 years to complete, with a minimum of 4 years to cover the necessary breadth and depth of study.[2] To receive your Certificate of Completion of Training (CCT) you are required to show 4 things:

- Satisfactory completion of the Histopathology Curriculum
- Satisfactory outcomes in assessment carried out at your workplace
- Completion of the RCPath's Year 1 Assessment
- Completed (and passed!) the Fellowship Examination of RCPath (FRCPath) exam; part 2 can be undertaken in relevant subspecialties (cytopathology, neuropathology, paediatric pathology and **forensic pathology**).

- Completion of the Annual Review of Competence Progression (ARCP) outcome 6. This is much like the portfolio accumulated throughout your medical career.

The histopathology Curriculum is split in 4 stages – A, B, C and D. Each must be completed satisfactorily and you cannot move on until the preceding stage had been completed.

Stage A – this is a 12 month long process where you will be introduced to the basic principles of histopathology. By the end, you need to be able to successfully complete a workplace-based assessment, Multi-Source Feedback (MSF), the ARCP and the RCPath's Year 1 Assessment.

Stage B – is between 13 to 36 months of training, with a minimum of 24 months of training to satisfactorily pass this stage. You will be assessed through the FRCPath part 1 and also progression in the ARCP.

Stage C – is between 24 to 48 months but a minimum of 42 months training is required to pass this stage. You will need to complete workplace-based assessment, show progression in the ARCP and pass the 2nd part of the FRCPath exam in either histopathology or a relevant subspecialty.

Stage D – is between 43 to 60 months of training but a minimum of 60 months training is required to pass this stage. Completed the required workplace-based assessment outcomes, completed the entire histopathology curriculum and attained an ARCP outcome of 6 (all areas covered).

Atop this you will be required to sit a universal pathology assessment in ST3 and ST5 known as the Multi-Source Feedback (MSF) and ST3 MSF is normally done in Stages B/C and ST5 in Stage D.

You will then be awarded the CCT.
That was a general review of the training to be completed prior to subspecialisation. In regards to the subspecialty, forensics, you must complete a minimum of 3 years in a recognised training programme (usually after Stage B):

- You will need sound knowledge of the legal system of the UK (you will be required to give impartial testimonials about evidence in court.)
- Be aware of the role boundaries of various professions (policemen, Coroner, yourself, senior investigator etc.)
- Knowledge of how to investigate common crime scenes and how to record this information
- You have to know the way other professions can help you in your investigation (odontologists, entomologists, archaeologists and even other forensic scientists)
- Be able to carry out post-mortem examinations and with that the common findings to situations such as homicide, suicide, OD, infant death and other deaths under suspicious circumstances. This includes techniques used to investigate e.g., imaging
- Have sound knowledge of the lab practices used to investigate evidence.
- Have a clear idea of what an expert is defined as and what is expected of them
- Know the risks posed by a crime scene/post-mortem examination (the bodies) and appropriate risk minimizing behaviour.
- Understand the facilitation that visual aids can provide in presenting complex issues (in court, conferences, meetings etc.)

Competition ratios for histopathology are virtually non-existent, however, you should be prepared to uproot dependant on where the training posts are.

The Future

Currently, there is increasing interest in using less invasive methods for performing autopsies – more specifically through the use of imaging.[4]

In addition, the Royal College of Surgeons hosts a national research conference to award 4 medals for outstanding research publications in the field of histopathology and related subspecialties. The gold medallist (Dr Daniel Hodson, 2011) published a paper on the role of specific proteins in the control of mRNA – a key component in the cell cycle (impaired in cancers). Dr Hodson plans to use this information to develop better treatments for lymphomas.

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Pre-Operative Optimization of Surgical Patients

Ms Naima Poonja
Final Year Medical Student
Manchester University
Address for correspondence: naima.poonja@student.manchester.ac.uk

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Introduction

Surgery is a fast-paced, rewarding specialty where patients can make dramatic recoveries as a direct result of the technical skills of the operating surgeon. Conversely, even with the most experienced surgeon, major complications can arise as a result of surgical interventions. This article aims to address the variety of issues that can arise peri-operatively. Some of these drawbacks may be ameliorated if patients were adequately optimised before undergoing surgery.

Pre-operative Assessment

Prior to undergoing operative procedures, patients undergo pre-operative assessment to identify and address issues which may affect the peri-operative phase. Pre-operative assessment includes a consultation, examination, baseline investigations and if necessary, further investigations. Particular attention is paid to patients' co-morbidities, functional state and whether or not they are on any anti-coagulants or anti-platelet agents. Blood tests are performed in the vast majority of patients including full blood count (FBC), renal function tests (U&Es), and a clotting screen. An electrocardiogram (ECG) is performed in patients over 50 years of age or in those with a known cardiac background. Chest radiograph (CXR) is indicated if the patient has chest signs or symptoms detected in pre-operative assessment, is a smoker, known cardiac failure or suffer from respiratory conditions such as Chronic Obstructive Pulmonary Disease (COPD). Additional investigations such as echocardiograms, exercise tolerant test or pulmonary function tests may be required in patients with known or suspected cardiovascular and/or respiratory disease. Not only do these tests provide us with a baseline, it also highlights additional issues which will need addressing or in some cases, even postponing or cancelling the operation until the issues has been attended to.

Pre-operative Optimisation

Various conditions including diabetes mellitus, cardio-respiratory diseases, anticoagulants require a more thorough work-up and are discussed in greater detail below.

Diabetes mellitus

The main concern in the diabetic patient is fluctuations in plasma glucose surrounding the period around the time of surgery. Patients undergoing a general anaesthetic are required to be starved for at least six hours to reduce to the risk of aspiration. During the operation, surgery induces a stress response, where catabolic hormones are triggered causing a state of insulin resistance as well as increased gluconeogenesis process. In addition, the secretion of insulin by beta-islet cells of the pancreas is also reduced as a result of surgical stress. As a result, a state of hyperglycaemia ensues.

In order to minimize the deleterious effects of surgery to these patients, where possible, these patients are prioritized in theatre lists to diminish the period of starvation. For a morning list, patients on oral glycaemic control have the morning dose omitted, whilst those on an afternoon list are allowed an early light breakfast. Patients on metformin, especially if they have an element of renal impairment should have the metformin omitted the morning of surgery, to reduce the risk of lactate acidosis. The use of variable rate intravenous insulin infusion (VRIII), previously known as "sliding scale" may be considered if patients have an erratic blood glucose control, are insulin controlled, or if they are undergoing major surgery. In order to maintain optimal plasma glucose levels, capillary blood glucose (CBG) is checked on an hourly basis and the VRIII adjusted accordingly aiming to achieve optimal blood glucose of 6 - 10 mmol/ L. For diabetic patients on insulin, NICE guidelines suggest to consider use of long acting insulin alongside VRIII in insulin controlled diabetics during the peri-operative process and to manage these patients according to local trust guidelines.[1]

Intraoperatively, the anaesthetist should monitor plasma glucose levels regularly, as optimal glucose control reduces infection and microvascular complications, which can predispose to development of leg ulcers and gangrene.

Post-operatively, patients are encouraged to return to normal eating and drinking as soon as they are able.

Once normal diet is established, patients are returned to their pre-operative diabetes regime.

Patients on anti-platelets and/or anti-coagulants

Antiplatelet therapy (i.e., aspirin, clopidogrel) use is widespread amongst the UK population. Indications include primary or secondary prevention of thrombo-ischaemic events such as cardiac, intracranial or vascular diseases; and for ensuring stent or graft patency e.g., in patients after angioplasty. In the UK, aspirin is usually stopped 5-7 days and clopidogrel 10 days before surgery. Both are restarted 24-48 hours after. This is done to reduce the risk of perioperative haemorrhage. However, evidence exists to show that continuation of aspirin perioperatively may actually decrease incidence of stroke, peripheral arterial disease and myocardial infarction peri- and postoperatively.[2,3]

In the patient taking an anti-coagulant (i.e., warfarin), therapy is usually stopped at least 5 days before surgery. Discontinuation of warfarin is crucial in those surgeries with higher bleeding risks (i.e., open thoracic or abdominal surgery). In procedures where bleeding risk is low (i.e., routine dental procedures or skin procedures) withholding warfarin may not be necessary.

If discontinuing anti-coagulant or anti-platelet therapy increases the risk of thrombotic events significantly (i.e., in patients with pre-existing mechanical valves), bridging therapy may be needed. Bridge therapy is a temporary supplementation of either subcutaneous low molecular weight heparin (LMWH) or intravenous unfractionated heparin (UFH) to reduce risk of thromboembolic events as heparin has a much shorter half-life compared with its counterparts. High risk patients, for example, patients with metallic heart valves, severe thrombophilia or recent large pulmonary embolism will require bridging therapy, but for those at low or moderate risk, for example patients atrial fibrillation and no other risk factors, bridging therapy may not be required. Guidance on VTE risk stratification is available on the American College of Chest Physicians published guidelines.[4]

The INR ratio is always checked prior to surgery. An INR of <1.5 is usually acceptable for low risk surgeries. This must be discussed with the anaesthetist and surgeon prior to surgery. If a patient is on unfractionated heparin, aPTT ratios are monitored every 4-6 hours.

Postoperatively, warfarin is restarted at 24-48 hours after the operation with supplementary heparin therapy. Once INR reaches therapeutic levels, heparin is discontinued.[5]

Respiratory conditions

Patients with respiratory tract infections, even if they are merely suffering from a simple cold, can be a concern as these infections can predispose to secondary bacterial infections, and may even lead to serious complications such as pneumonia or respiratory failure due to the manipulation of the airway during induction of general anaesthetic. In elective cases, these patients are often postponed and re-listed following recovery from their illness.

Smoking also adversely affects the lungs and smokers are advised to abstain for at least 8 weeks prior to surgery if possible. If not, abstinence 24 hours prior to surgery has also shown benefit by minimising mucus secretion and increasing oxygenation in small calibre airways. Patients' immune response has also been shown to be boosted following cessation of smoking.

Patients with chronic obstructive pulmonary disease (COPD) or asthma must be adequately controlled on therapy before being subjected to general anaesthesia, as they are at higher risk of developing bronchospasm during induction, and are at greater risk of contracting atelectasis and pneumonia post-operatively. If asthmatics are symptomatic (widespread wheeze, cough, increased sputum production) then surgery should be delayed or cancelled until adequate control is regained. Similarly, in an acute exacerbation of COPD, surgery should be delayed or cancelled until the patient is asymptomatic for at least 3 months.

Cardiovascular diseases

The cardiovascular system is placed under strain in surgery as a result of pain, increased cardiac demands due to anaesthetic-induced hypotension, haemorrhage and stress response invoked by surgery. Potential cardiac complications, particularly in association with cardiothoracic surgery, include cardiac arrhythmias (secondary to electrolyte disturbances or mechanical stimulation of the heart), thromboembolic events such as myocardial infarction all have severe consequences hence a constant cardiac and blood pressure monitoring is required by the anaesthetist.

Patients who have had a recent myocardial infarction (within the last 6 months) are at higher risks of having a re-infarction. If at all possible to postpone the surgery until six months after the event, this would significantly reduce patient morbidity. If surgery is an emergency and cannot be delayed, then diligent peri-operative monitoring is essential to reduce risk of re-infarction.

Congestive heart failure should be optimized as much as possible prior to surgery as being loaded with intravenous infusions and positioned flat on the operating table can aggravate this condition. Diuretic use, diligent use monitoring of fluid status and inotropic support should be considered in these patients.

Patients with permanent pacemakers necessitate particular attention during the peri-operative stage. Pacemakers are used to maintain the regular heart rate when the cardiac conduction system fails. Although modern-day pacemakers are robust, they still can malfunction during surgery, hence assiduous cardiac

monitoring is required, particularly intra-operatively. In addition, it is important for pacemakers to be converted to the asynchronous or "safe mode". This is because surgical instruments such as unipolar diathermy may interfere with pacemaker function. Electrocautery can potentially increase the rate of capture of the pacemaker and also induce ventricular fibrillation. Where possible the use of bi-polar electrocautery is recommended in these patients, but if uni-polar electrocautery is obligatory, then the diathermy pad should be placed as far away as possible to the pacemaker.

Patients with severe valvular heart diseases, particularly stenotic heart valves, also add challenges to the anaesthetic process. Those with stenotic heart valves have a relatively fixed cardiac output and are unable to compensate for the reduction in systemic vascular resistance caused by the vasodilatation effect of general anaesthetic. Valvular heart diseases also predispose patients to develop endocarditis. However, there is insufficient evidence supporting routine pre-operative antibiotic prophylaxis against endocarditis.[6] NICE guidelines currently recommend that antibiotic prophylaxis is **not** needed in the following cases:

- Those undergoing dental procedures
- Non-dental procedures involving upper and lower GI tract, genitourinary tract (urological, gynaecological, obstetric procedures and childbirth), upper and lower respiratory tract (ear, nose and throat procedures and bronchoscopy).

For other major operations, endocarditis prophylaxis should be considered.

Other medications

Most medications apart from those listed above can be given on the morning of surgery. Cardiac anti-hypertensive drugs need not be omitted prior to surgery unless there is a specific indication. Oral hypoglycaemics, as discussed above, and antidepressants are usually stopped the morning of surgery. Patients on oral steroids may require intravenous hydrocortisone intra-operatively to prevent hypo-adrenal or 'Addisonian' crisis. Oral contraceptive pill (OCP) if possible should be stopped four weeks prior to surgery to reduce the risk of developing venous thromboembolic events occurring.[7]

Conclusion

Although surgery is not without risks, patient morbidity and mortality can be significantly reduced if they undergo thorough preoperative assessment and optimization prior to surgery. With adequate preparation, diligent monitoring, an astute anaesthetist and a well behaved patient, complication rates can be curtailed to a minimum.

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An Introduction to Genito-Urinary Medicine

Mr Pouya Mafi
Year 3 Medical Student
Hull York Medical School

Dr Ranjababu Kulasegaram, FRCP
Consultant Genito-urinary/HIV Medicine
St Thomas Hospital, London

Address for correspondence:
Mr Pouya Mafi: mafi.pouya@gmail.com

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Introducing GUM

The principal role of genitourinary medicine relates to prevention, diagnosis and control of sexually transmitted diseases. It is mostly an outpatient-based speciality and a great proportion of the work centres around managing patients with HIV at various stages of the disease. The work also involves some non-infectious genital diseases such as dermatoses. In recent years, the role of GUM physicians has extended to include management of sexual dysfunction, provision of contraception, colposcopy and health promotion.

Some common interventions undertaken by GUM physicians include:

- Sexual screening
- Taking microbiological samples from genitals
- Speculum examination
- Use of antimicrobials to treatment infections
- Lab skills such as microscopy

In the NHS, sexual health is an area of priority with new initiatives being introduced regularly. Despite the bulk of work taking place in outpatient clinics, there are opportunities to get involved in community clinics and with inpatient HIV care.

Life as a GUM physician

GUM is a rewarding speciality and is almost unique in that a great proportion of the patients are otherwise fit and ambulatory young adults. Bacterial infections can be treated effectively and this makes the profession one of the very satisfying careers in medicine. Viral STIs cannot always be treated, but patients can be managed effectively by clear explanation and advice. If you are looking for something challenging there is the option to get involved with HIV medicine. This is one of the fascinating and rapidly expanding areas of genitourinary medicine. HIV has now become a long term chronic illness and patients can be difficult to manage on the grounds of their complex medical conditions in addition to psychosocial issues.

GUM physicians play a key role in STI prevention by directly providing information on risks of disease transmission to patients. During some stage of their training, they are expected to provide ward-based commitment to HIV patients and to participate in a GUM on-call rota for acute patient management and advice.

GUM physicians have very favourable working hours, mostly 9am to 5pm, with the exception of some after-hours clinics which may finish at around 9pm. The interdisciplinary team that you will be working with involves specialist nurses, health care assistants, social workers, health advisors and laboratory technicians, as well as community specialist youth and HIV services.

As a GUM physician you will usually run two clinics a day with approximately 10 to 20 patients per clinic. The patients that you will be dealing with are very diverse in terms of cultural and social background and sexual orientation. GUM medicine involves a great deal of interaction with youth and young adults since they are the people at highest risk of sexually transmitted infections. The patients can be either self-referred or referred from a general practitioner or any other medical specialist such as urology, general medicine, ophthalmology, paediatrics and emergency units.

Perhaps one of the best things about GUM is that the on-calls can often be done remotely through consultation on the phone. As mentioned previously, the bulk of work is in outpatient clinics with sufficient time provided for completion of administration, and varying degrees of study, research, teaching and management dependant on the individual.

GUM physicians are involved in dealing with diseases which are still stigmatized in today's society. Therefore it is vital to be able to establish rapport quickly with your patients in order to facilitate full disclosure of issues and obtain a complete history.

Some of the personal qualities required for this speciality are:

- Interpersonal skills to deal with highly emotional patients
- Ability to establish rapport quickly and put patients at ease
- Having an interest in others and their relationships

These skills are crucial for the effective and appropriate management of patients.

Research work can involve taking part in international sexual health and HIV related conferences to publish findings. Furthermore, there is the possibility of taking time out after the third year of training for continuing research. Some trainees might opt to undertake the OOPE (Out Of Programme Experience), which can involve 9 months in Zambian HIV prevention projects, time out to complete a diploma in Tropical Medicine and Hygiene, or possibly even completion of an MSc in sexually transmitted infections.

Training

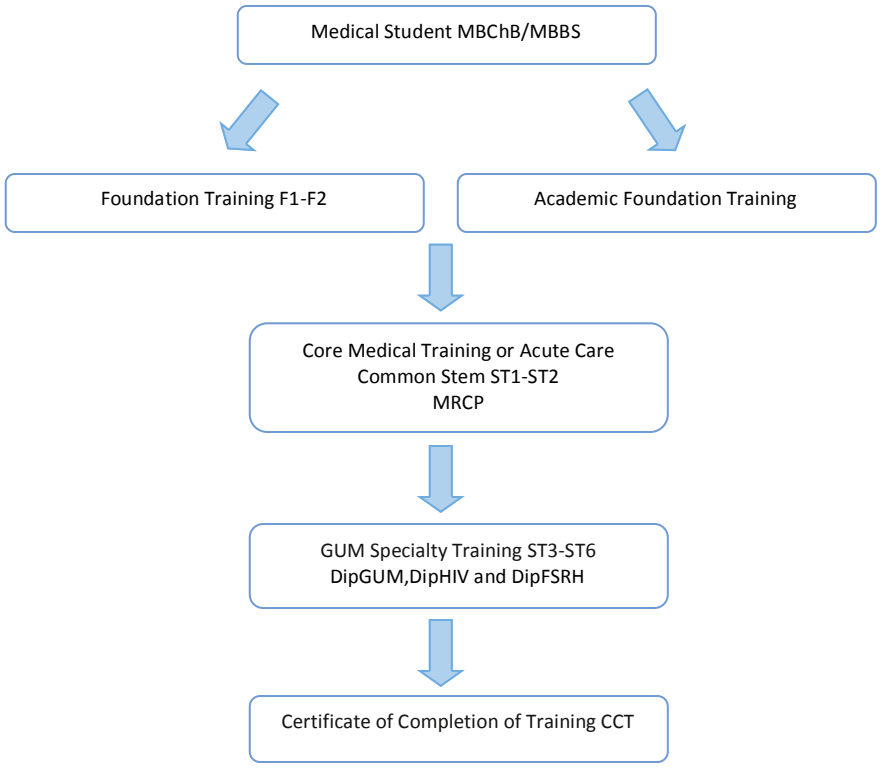
Trainees wishing to pursue a career in GUM must first complete two years of core medical training or ACSS training. In 2011, there were a total of 74 applicants applying for 37 available posts giving approximately 2 applicants per post.During training from ST3 Level, trainees have a number of specific assessments they must pass including GU Medicine, HIV and Faculty of Sexual Reproductive and Health (FSRH) diplomas.

The Future

The field of GUM has been revolutionised since the introduction of combination antiretroviral therapy and its application in HIV treatment. Whilst this has not resulted in the complete treatment and eradication of HIV, it has provided a great basis for early treatment and management.

In an attempt to cure HIV a treatment which involves targeting latent HIV reservoirs is being investigated. This concept is based on the activation of latent HIV infection so that infected immune cells start producing HIV. The HIV kills the infected cells and, when treated with antiretroviral drugs, new cells will not get infected. Consequently, all infected cells are killed off leaving only healthy cells behind.

However, we still do not know how HIV latency works and there is a great knowledge gap in this field. It is thought that it will simply be a matter of time before the knowledge to completely transform the lives of those affected by HIV is acquired. The question is whether you want to be part of it or not?



After the completion of the foundation years 1 and 2, doctors wishing to pursue a career in GUM need to complete 2 years of core training in either a Core Medical Training programme (CMT) or Acute Care Common Stem (ACCS) programme. Following successful completion of MRCP and work place based assessment during the 2 year core training programme, trainees need a minimum of 48 months of speciality training to certificate of completion of training (CCT).

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The Scope of Medical Education in Egypt

Dr Nada Maged Maurice
Fourth year medical student
Alexandria University, Egypt
Address for correspondence: nadamaurice_92@yahoo.com

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Education, Egypt, Medicine, Challenges, Career

"*In Egypt, the men are more skilled in medicine than any of human kind*". Such was the ancient Greek poet Homer's remark in his epic poem 'Odyssey'. Undoubtedly, the 'Egypt' Homer was alluding to in his masterpiece was that of the Pharaohs; ancient Egypt, the era and civilization of which, to this day, Egyptians remain boastful and proud.

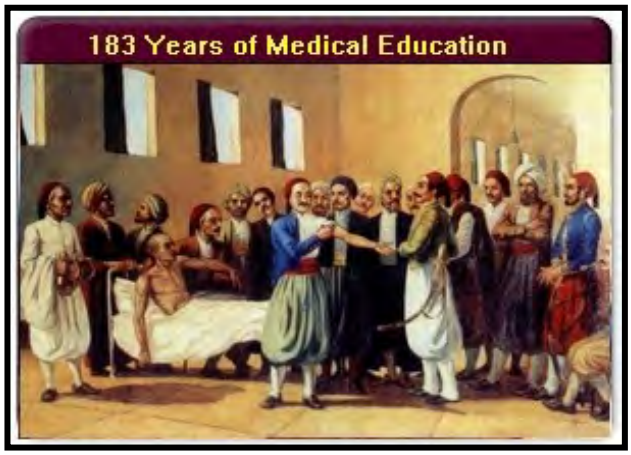

Figure 1*: Kasr-Al-Ainy University.*

Whether this statement was factual or mythological, it is regretful that in today's world, the practice of medicine and the state of medical education in Egypt have slipped from the summit while the legacy of the 'Odyssey' lives on. The primary purpose of this exposition is to discuss the various opportunities in the industry of medicine that exists in modern Egypt.

Medical Schools

The majority of medical education in Egypt is delivered through public medical schools, that is to say, medical schools that are funded by the government and exist as part of public universities. There are 14 public schools of medicine throughout Egypt; the oldest, largest and most famous of which is Kasr Al-Ainy medical school located in Cairo, the capital city. It was originally founded in 1827 following a French assembly in Paris. The renowned French physician, Clot Bey, was appointed the first president of the school. Kasr Al-Ainy remains to this day amongst the most prestigious medical schools in the Middle East.[1]

The Process of Entry

Matriculating into medical school is no simple matter. In Egyptian culture, a doctor is a highly esteemed, respected and important figure in society and as enumerated

Figure 2*: Kasr-Al-Ainy Medical School.*

above, a majority of medical schools in Egypt are public. Thus, high school students undertaking 'el Thanaweya el Amma' or national high school examinations vie against fierce competitors to secure a position in medical school. The competition is extremely high. The statistics speak volumes for themselves; last year, the admissions office only accepted students who scored more than 99.1% in their high-school examinations! A limited number of places are reserved to IGSCE, American Diploma students and those with equivalent diplomas from any other country. These facts illustrate that there are major issues that need addressing in the educational system in Egypt.

Medical Education: Challenges and Chances

Medical education in Egypt is six years in duration. The first three years of medical school are concerned with the study of basic medical sciences, whilst the final three years are focused on clinical sciences. There are many challenges faced by medical students in Egypt today. To begin with, a pressing problem is the large number of

students. In my cohort -fourth year at Alexandria University- for instance, there are over 1000 pupils. Even when divided into smaller groups for clinical ward rounds, the number of students is still too large to be able to facilitate effective learning. Also, facilities and resources are scanty, thus the quality of education delivered is not of high standard. In addition, examinations arguably test how much the student was able to memorize rather than inculcating ethical reasoning and speculation (as is the case in many medical schools in the West such as those in the United States). Therefore, following examinations, a large proportion of students sadly forget most of what they had learned.

'Education, 'educational progress', 'improvement of education'... are but some of the phrases oft repeated by students, faculty members, officials... etc for decades without being heralded by any change. However, some medical schools have succeeded in upgrading their teaching systems. For example, Alexandria Faculty of Medicine, to which I belong, has introduced an 'integrated system' of learning as opposed to subject-based learning adopted by most Egyptian medical schools. During the course of their first three years, students now learn their basic medical sciences through studying different body systems. By way of illustration, the 'Cardiovascular System' module would include the anatomy and physiology of the cardiovascular system, the microscopic illustrations of cardiac muscles, different pathological conditions of the heart, drugs used to treat heart failure, hypertension… etc. Those who originally suggested proceeding with this novel method of education argued that in studying Anatomy, Physiology, Pathology…etc as entirely separate entities, students would not be able to interlink the information. The human body is one unit and splitting it up into separate subjects, books and examinations makes it more difficult to understand and grasp its different aspects. Although during the implementation of this new system numerous problems have been encountered, it reflects, certainly in my opinion, a progressive change in medical education in Egypt.

With communication advancement, Egyptian medical schools are now in touch with other universities across the globe and many student exchange programmes have been carried out for a number of years. There are also other societies that coordinate student exchanges such as IFMSA,[2] a non-governmental organization representing associations of medical students. It embraces 108 national and local organizations in 103 countries on six continents. Needless to say, these exchange programmes bring about benefit not only to medical students themselves, but to their universities and countries as well.

Agreements between universities worldwide have been established evidenced by the fact that Egyptian medical schools nowadays, accommodate a large number of students of different nationalities and identities. At Alexandria University, Malaysians and Palestinians are among the most common foreign students one would meet.

***Figure 3**: A group of Alexandria University textbooks –organ-system based for first three years of medical study (incomplete series).*

The Working World

At the end of the six years of medical school, the student is granted an MB BCh. The medical school graduate then has to spend an obligatory 12-month-long internship at one of the University or Government Teaching hospitals after which a medical license as a General Practitioner (GP) is awarded.

Graduate students have a limited number of options. It is important to bear in mind that what specialty a student is to pursue in his/her career depends on his/ her grades during medical school. This naturally frustrates many good students who were just not able to deal with the educational system and its drawbacks so were not able to achieve enough marks and consequently were denied the freedom to choose the specialty they wished to practise.

To clarify the 'fate' of a medical school graduate, the pattern of health care in Egypt must be alluded to. Health care is provided mainly through the two broad categories; government health care and private health care.

(i) Government Health Care

Government health care constitutes the greater part and is the only option available to low-income residents of which the majority of the Egyptian population is

comprised. It includes primary health care represented by family health units and centres on the one hand and district, general and teaching hospitals on the other hand. A family health unit is a place that provides health care for 'the whole family' as is evident by its name. Within it, details about all members of each family served should be carefully recorded; history of illnesses, investigations, immunizations received… etc. Simple maladies should be diagnosed and treated there; patients are otherwise referred elsewhere with more specialized equipment and personnel. Each family health unit *should* be equipped to serve around 500-3,000 families in rural areas and 5,000 – 10,000 families in urban areas.[3]

Figure 4: *Primary health care unit in Egypt.*

After completing their internship year, it is mandatory for doctors who wish to be eventually employed by the Ministry of Health (the majority, to be sure, because there are only limited alternatives as will be subsequently clarified) to spend from six months to a year in rural areas (most likely), in family health centres or public hospitals. This process is named 'el Takleef' or 'the assignment'. Also according to their grades, medics are allocated to one of Egypt's 28 governorates (from nearer their homes to farther away) to work in the public health sector. It must be noted that due to the huge financial problems faced by the country, these doctors end up in secluded areas with extremely low pay, limited facilities and resources.

To make matters worse, fresh-graduates are regretfully not educated or trained well enough to start practising medicine on their own. Their supervisors if any are present (this fresh graduate may find his or herself the only doctor in a family health unit), may or may not be willing to teach them or may be only a couple of years older without much more experience. After their 'Takleef' the doctors are allowed to return to their place of origin to be employed in public hospitals there.

One may ask why - in spite of the six years of medical education in addition to the internship year - do these doctors aren't adept to properly dealing with a patient, thinking systematically and being able to diagnose common problems…etc? To answer this critical question, we must go back to medical school. The truth of the matter is that what is taught in medical school does not fully prepare the students for actual work in the clinical reality. Theories, text-books, learning information by heart… all this could be sufficient for exams, but to apply that information on human beings is an entirely different story. Not to be misunderstood, during clinical years students do interact with patients and are taught to communicate with them, examine them and so on. However, when there are about fifty students craning their necks to see one patient and at the same time are trying to hear and understand what the consultant is saying, the result is invariably unsatisfactory. Furthermore, a large proportion of patients taught upon are chronic patients whose faces and names are recognized and learnt by every student and who have been in and out of teaching hospitals for years and could describe their own case as well as any doctor (from hearing it explained to students repeatedly) to the extent that they sometimes teach students! Being taught off-the-book simple, straightforward or even complicated cases and told to learn them well because this is what you will find in your clinical exam discourages students from anything other than to fully comprehend that particular case and ignore everything else. This brings us to a huge problem I must refer to. It is the fact that most students care about little other than achieving high marks, full-marks in fact on their every examination… This is their sole ambition. They do want to become good physicians undoubtedly, but get side-tracked on the way. Why this obsession with grades? From high-school throughout university this inborn craving is only intensified. This is because competition is perpetually intense.

Cumulatively, from the first year until the final year, those with the highest examination grades, the top 8% or so from among 1000-1400 students are offered residencies and teaching jobs in the medical school they graduated from as well as training at University hospitals. This is the most fortunate group. They are guaranteed a relatively well-paid job and guaranteed being taught for the rest of their careers by university professors. Of course, the higher your ranking is the more likely the possibility you will be able to pick a residency of your choice before the places run out. This is the reason students fight for high scores.

Others who were not among the top 8% may be offered positions of residency only, without teaching jobs, while the vast majority must acquiesce to being employed by the Ministry of Health in governmental hospitals. The disadvantages of which have already been detailed.

(ii) Private Practice

Why not private practice then? Private practice consists of private hospitals and clinics. Doctors there are

considerably well-paid because the service is much more cost-demanding and generally much better than public health service. Nevertheless, competition is fierce in this sector, so a junior doctor without a lot of experience will seldom find employment in a private hospital.

To set up a private clinic requires financial resources, the pay from government jobs is extremely low so the young doctor has no money to afford it… and so the cycle goes on…

Figure 5: *Dar-El-Foad private hospital.*

Career Options Abroad

Due to the complicated issues of employment, many students, from the moment they set foot into medical school mindful of what lies ahead, make up their minds to complete their studies and medical careers abroad after graduation. Our bachelor degree is not accredited by most countries especially non-Arab countries.

Consequently, around campus one could frequently see students with USMLE preparation books or hear others chatting about PLAB orientation sessions and the like…
Despite these high aspirations, completing one's studies abroad is no trivial matter. It requires extremely hard work and dedication, adaptation to a foreign educational system without actually knowing how it works (which is difficult), a lot of studying to pass exams that are not similarly structured to the ones found in Egypt… etc. Also, resources are essential; you cannot travel abroad without considerable means. Thus, travelling is not an option for some.

Hence, our problem is complete; students working very hard to get high marks through learning by heart, an educational system that is not well structured and virtually no prospects upon graduation unless you were among the top students or had the means to travel abroad.

Simple Solution?

Does a simple solution exist to these interrelated problems? It is doubtful. In my opinion, the only answer is to raise the country's socio-economic condition. We would then be able to build new universities so students would not have to achieve a 99.1% mark to get into medical school, have more resources and facilities to improve educational methods, upgrade public health care facilities that have reached a shockingly sub-standard level, raise doctors' salaries…

Until that happens, I believe medical education should be adjusted to become more community-based. The 'products' of medical school should be well oriented about the problems of their community and how best to solve them. This is in part achieved through teaching 'Community Medicine' at medical school. What remains is to apply the theoretical knowledge practically.

The number of students entering medical school each year should be decreased as well. Several attempts to produce that have been made, but each year, high-school students score higher and higher grades so force their way into medical school despite any efforts made to diminish their number. These unnatural grades are as said earlier nothing but a mere reflection of an obsolete high-school educational system which in turn also needs upgrading.

To recapitulate, this inter-woven vicious cycle that exists cannot be broken except with participation of every member of the community through increasing awareness and instigating change that will pave the way to prosperity. It is not the simple matter of learning new techniques or increasing the number of rooms or putting clean curtains up in an examination room that need to be corrected, those are all just pieces of the puzzle. The pieces therefore need to come together for the picture to become complete and a pleasant spectacle to behold…

Silver Lining

On the bright side however, some Egyptian students were and are still able to surpass these tremendous problems and become eminent at what they do. Dr. Magdy Yacoub, the world-renowned cardio-thoracic surgeon was after all once a student at Cairo (Kasr Al-Ainy) University. He is among those who were able to succeed and make their way through the medical career gallantly despite all the obstacles that attempted to thwart them from achieving their goals.

Conclusion

To sum up, it is undeniable that there are numerous problems affecting the state of medical education in Egypt, many seemingly unsolvable. However, to give in to these drawbacks, to let oneself be overwhelmed by their magnitude, to submit to mediocrity, to abandon hope that these issues could, in time, get better is to lose the challenge.

As the Irish playwright George Bernard Shaw once said, *"People are always blaming their circumstances for what they are. I don't believe in circumstances. The people who get on in this world are the people who get up and look for the circumstances they want, and if they can't find them, make them."*

And 'make them' is the inspiration...

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Issues Surrounding Childhood Stroke :
A Case Report and Review of the Literature

Mr Leslie Cheng, MSc
5th Year Medical Student
University of Manchester
Address for correspondence: lesliecheng@gmail.com

Keywords:
Childhood Stroke, Cerebral Vascular Accident, Cerebral Ischaemic Event, Thrombolysis, Anticoagulation.

Abstract

Childhood stroke is a neglected area of research, and the lack of evidence makes its management a challenging area for clinicians. The UK childhood stroke guidelines are discussed in conjunction with the American guidelines, and the areas of controversy are highlighted. This case report explores the medical, surgical and critical care issues surrounding the management of paediatric ischaemic stroke in detail, including issues of thrombolysis, anticoagulation, and complications of acute ischaemic stroke. Due to the heterogeneity of underlying childhood stroke aetiology, primary and secondary prevention measures pertinent to this case are also discussed. Finally, recommendations for stroke aftercare are briefly summarized.

Case presentation

A 16-year-old girl presented to the emergency department at 0600 hours in the morning and was noted to have dense right-sided hemiparesis (facial droop, weakness in upper and lower limbs) and global aphasia. As the patient had been asleep since 01:00 h, her symptoms were only observed by family members when she awoke at 5:00 h, hence the exact time of onset of the stroke could not be ascertained.

On admission, the patient's Glasgow coma score was 9 (eye-opening: 2, verbal: 2, motor: 5). She was extremely agitated, hence required intubation and sedation for computed tomography (CT) of her head. The CT scan demonstrated a thrombus occluding the left middle cerebral artery with no distal flow, resulting in a large infarct of the associated territory.

The consensus amongst senior physicians was that the patient was unsuitable for thrombolysis given that the time of onset to that of diagnosis was greater than the three hour time-frame, and that the infarct was at high risk of haemorrhagic transformation due to its large size. She was given a dose of 300mg of aspirin and subsequently arranged for transfer to the intensive care unit at a specialist hospital later in the day.

The patient had a complex cardiac history of a large, congenital ventricular septal defect. She had undergone pulmonary artery banding and a modified Fontan procedure with intra-arterial conduit at the age of 2, and was consequently warfarinised. However, historical medical records revealed poor compliance to warfarin for a number of years. For a period of 5 years from 2003, it was noted that she has not attended any cardiology review appointments for unknown reasons, before being followed up again in 2008. In addition, she stopped taking warfarin about 3 weeks prior to this event through her own volition, which is suspected as the most likely precipitant of the stroke.

Upon transfer to the intensive care unit, the patient was maintained on sedation and mechanical ventilation. Neurosurgeons were consulted regarding concerns of the risk of raised intracranial pressure (ICP) with the possibility of requiring decompressive surgery. It was decided for the patient's intracranial pressure to be monitored by insertion of an ICP bolt.

The patient's ICP had been noted to be continually labile, and continued to require mechanical ventilation. Attempts to withdraw sedation for neurological assessment were complicated with associated rises in ICP, poor cerebral perfusion pressures, and agitation, all of which had to be corrected by reintroducing sedation.

A transthoracic echocardiogram did not reveal an intracardiac thrombus, and showed that the Fontan circulation intact. A magnetic resonance (MR) scan confirmed the diagnosis and did not show significant brain swelling.

On day 9 the patient was reinstated on anticoagulation (warfarin). She was extubated on day 10 as was noted not to require invasive ventilatory support. Over the next few days, she demonstrated steady neurological improvement and her agitation had decreased. By day

13, she was stable enough to be transferred to the stroke unit.

Clinical Problem

Stroke or cerebral vascular event is defined by the World Health Organisation (WHO) as a "focal neurological deficit of cerebrovascular cause persisting for longer than 24 hours or leading to death".[1] Childhood stroke, although relatively infrequent compared to stroke in adults, represents a significant cause of mortality in children and also a major cause of disability. It is estimated that stroke affects 2-3 of 100,000 children per year.[2]

Stroke management has revolutionized in the last decade since the publication of the National clinical guidelines for stroke in 2000. Stroke units in the country are equipped to administer acute treatment, which adults have access to.[3] The management of adult stroke is also well supported by a substantial body of evidence. This is, however, not the case in the management of stroke in children, which is still a neglected area of research. Many areas of acute medical treatment remain controversial. The lack of evidence and experience in dealing with childhood stroke makes the management of childhood stroke a clearly challenging issue, taking into account the significant impact stroke has on a child's future.

Causes of Stroke in children

Part of the difficulty in establishing treatment guidelines can be attributed to the heterogeneity of underlying aetiology in childhood stroke. A wide range of disorders can lead to stroke in children (Table 1). The most common underlying disorders are cerebrovascular diseases and cardiac abnormalities.[4] The ratio of ischaemic stroke to haemorrhagic stroke in children is roughly 1:1 compared to that of adults which is 2:1.

Genetic
Dyslipoproteinaemia (Familial hypercholesterolaemia) Connective tissue disorders (Marfan syndrome) Mitochondrial encephalomyopathies (MELAS, MERRF) Neurofibromatosis type I
Thrombophilic states
Antithrombin deficiency Protein C or S deficiency Clotting factor deficiencies Malignancy Oral contraceptives Diabetes mellitus Sickle cell disease
Cerebral Vascular Abnormalities
Moyamoya disease or syndrome Cerebral vasculitis Arterial dissections
Cardiac Abnormalities
Congential heart disease (Ventricular/atrial septal defect, Fallot's tetralogy, coarctation of aorta) Diseases of heart valves Arrhythmias Cardiomyopathies (MI, myocarditis, atrial myxomas)

Table 1: Some causes of childhood stroke.[4]

Diagnosis, Investigations and Management

Children with stroke can present acutely with hemiparesis, or with more subtle features such as seizures, behavioural alterations and a lower conscious level.[1] Diagnosis of stroke in children can be difficult. Other diseases mimicking ischaemic stroke should be excluded, namely haemorrhagic stroke, electrolyte imbalances such as hypoglycaemia, epilepsy, or brain tumours.[5] For instance, an urgent CT scan may help in differentiating between ischaemic and haemorrhagic subtypes of stroke.

The Royal College of Physicians has published recommendations in 2004 for the diagnosis and management of paediatric stroke (patients age between 1 month and 18 years) to address the lack of published guidance relating to childhood stroke management.[1] The

publication has identified controversial areas surrounding childhood stroke management, but has not committed to giving specific recommendations.

The American Heart Association has also released guidance for childhood stroke management (2008).[4] Despite being more comprehensive than the Royal College's guidelines with recommendations organised into aetiological subtypes, recommendations are similarly based on observational data and are non-prescriptive. Due to the universal lack of substantial evidence in childhood stroke literature, current recommendations are drawn from adult guidelines, theoretical frameworks and anecdotal sources.

The rest of this section serves to summarise the recommendations based on a combination of these guidelines.

Urgent imaging is required for all patients to establish the diagnosis and to aid subsequent management. The main stroke subtypes are arterial ischaemic stroke, venous thrombosis, and haemorrhagic stroke. Imaging modalities which may aid diagnosis and management include MR, CT or ultrasound. In some instances, catheter angiography may be necessary if non-invasive imaging is inconclusive. CT or MR venography studies can be used to investigate for presence of a venous event. Further imaging at a later day (e.g., when MR scan becomes available) may be important in determining cerebrovascular changes.[4]

Additionally, all children with stroke will need to be investigated for causative diseases to aid in management and prevention of recurrent stroke. For instance, patients with arterial ischaemic stroke may require a thrombophilia screen and a transthoracic echocardiogram.[1]

Acute Care

The standard ABCD (airway, breathing, circulation, disability) approach in the emergency care of a child should be employed.

The patient's airway should be secured if there is a suspicion that the patient is unable to maintain his/her own airway adequately. Patients with a low to moderate GCS or brain stem abnormalities are at particular risk. These patients will most likely require endotracheal intubation and anaesthetic/critical care support.[5]

Of immediate concern are the child's oxygen requirements.[5] Hypoxic patients should be supplemented oxygen with their oxygen saturation maintained above 94% to prevent further brain damage, and have their oxygen saturation levels continually monitored.[3]

Depending on the suspected cause of stroke, paediatric neurological or cardiological input is beneficial and should be sought early.[1]

Specific Medical Management

Once radiological confirmation of the stroke diagnosis has been obtained, specific treatments can be considered. This subsection deals with ischaemic stroke.

Thrombolytic therapy

There is currently no consensus on whether thrombolytic therapy is indicated in children with ischaemic stroke. Scant evidence exists for the use of thrombolytic treatment (rtPA) in children.[12,14,15,16] In adults, the risk of haemorrhagic transformation associated with thrombolytic therapy is 6%.[3] The rate in that of children is unknown. One study of 2904 ischaemic child stroke patients with 46 receiving thrombolysis showed "unclear benefit".[2]

One question worth considering in the patient presented in this report is whether she would have benefited from thrombolytic therapy. The paediatric stroke guidelines define childhood as less than 18 years of age.[1] Although it is generally accepted that emergency thrombolysis is not indicated in young children,[6] its indication in patients belonging to the adolescent age group has not been addressed. Individual case reports have shown some success in its use.[7,8] In adults, treatment with alteplase is recommended in confirmed ischaemic stroke if the time of presentation is <3 hours of stroke onset.[3] Before larger studies on the safety of thrombolysis in children become available, the decision to administer thrombolytic therapy in children has to be an individual clinical judgment.

In practice, thrombolysis is rarely used in paediatric stroke patients. The reluctance of administering thrombolysis may be attributed to the fact that most child stroke cases do no present within 3 hours of onset, and the lack of published evidence regarding the safety of thrombolysis.[9] An American study of[5,8,13] paediatric patients with ischaemic stroke revealed that less than 1% of patients received thrombolytic therapy.[10] The study also showed that aggressive treatment of stroke in children, such as catheter or surgical interventions, are uncommon.

Anticoagulation & Aspirin

Ischaemic stroke is most commonly caused by a thrombotic or embolic event. Furthermore, patients with stroke are at risk of venous thromboembolism associated with immobility. However, patients are also at risk of gastrointestinal bleed, and infarcted brain areas can undergo haemorrhagic transformation in the days following the acute event.[3] These contrasting sets of risks should be balanced up when considering anticoagulation therapy, and should be informed by clinical observations and radiological evidence.

It is recommended that anticoagulation should be started in patients with arterial dissection or venous sinus thrombosis. Anticoagulation in children with cardiac

embolism is controversial (associated with increased risk of haemorrhage) and should therefore be discussed with a relevant consultant paediatrician.[1]

Aspirin 5mg/kg/day is indicated in patients with arterial ischaemic stroke confirmed by imaging, but without radiological signs of intracranial haemorrhage or sickle cell anaemia. Children with specific diagnoses such as sickle cell disease and moyamoya syndrome should be assessed by specialist teams for treatment which may include tranfusions and surgery.[1]

Other Measures

The patient's cardiovascular status should be monitored at least in the initial period. Stroke patients are at risk of secondary myocardial infarction and cardiac arrhythmias. Electrocardiogram changes associated with stroke include ST depression and T-wave inversion. Often blood tests may reveal raised cardiac enzymes. Serious arrhythmias should be treated as they can be life-threatening.[5]

Blood Glucose Control

Hyperglycaemia after an acute ischaemic stroke is associated with poor outcomes. Based on recommendations for adults, blood glucose levels should be maintained between 4 and 11 mmol/l.[3]

Blood Pressure Control

The patient's blood pressure should be controlled within normal parameters. Both hyper- and hypotension are related to poor outcomes.[3]

Hypertension is thought to worsen cerebral oedema, haemorrhagic transformation, and damage to blood vessels. Hypertension spontaneously resolves after the first day of stroke. Whether or not to treat hypertension in the initial presentation of stroke should be judged clinically. An exception is patients who are about to receive thrombolysis should have their systolic blood pressure stabilized below 180mmHg before therapy.[5]

Hypotension can lead to impaired cerebral perfusion and neurological compromise.[5] The patient's arterial pressure should be balanced with the patient's cerebral pressure requirements. This is discussed in further detail in the section on critical care monitoring.

Temperature Control

Acute post-stroke pyrexia is associated with a poor prognosis.[5] It is recommended by the Royal College of Physicians that normal temperatures be maintained below 37.2°C.[3] Pyrexia should be investigated for causes (e.g., post-stroke, infective endocarditis), and patients will need their temperature to be monitored for secondary infections. There is little evidence to support inducing hypothermia in ischaemic stroke despite its purported neuroprotective potential.[5]

Finally, scoring methods such as the Acute Physiology and Chronic Health Evaluation II (APACHE II), when used with the patient's GCS, can aid in identifying seriously ill patients who require more support and possible intensive care services.[11]

Critical Care Monitoring

Patients with declining consciousness should be ventilated and transferred to either a neurosurgical or paediatric ICU in view of the possibility for requiring neurosurgical intervention. A study of 75 patients requiring intensive care support showed that delayed transfer (>5 h) is an independent risk factor of poor outcome.[12] Intensive care units have a critical role in close monitoring of stroke patients after acute measures have been administered and are associated with better outcomes.[10]

Other patients who are considered for transfer to intensive care are those who require mechanical ventilation, invasive treatments, sedation, and/or those who exhibit other serious neurological signs such as seizures. A third of children with stroke will need some form of intensive care.[10]

Intracranial Pressure

Intracranial pressure is the pressure within the cranium relative to atmospheric pressure. It is typically monitored by insertion of an intracranial sensor into a lateral ventricle, thereby sensing the pressure of cerebrospinal fluid within the ventricle. Generally, the cerebral perfusion pressure (CPP) of brain tissue is equivalent to the difference between mean arterial pressure (MAP) and intracranial pressure (ICP), as represented in the equation, CPP = MAP – ICP. In simpler terms, the arterial pressure (MAP) has to overcome the pressure in the cranium (ICP) to drive blood into the brain to perfuse its tissues (CPP). To ensure adequate brain tissue perfusion, the cerebral perfusion pressure (CPP) has to be maintained at a reasonable level. Patients with stroke commonly have raised ICP secondary to post-infarct oedema and haemorrhage. If the ICP is too high, the CPP may fall to a level too low for good cerebral perfusion, further compounding the damage to ischaemic brain tissue. Patients with raised ICP may demonstrate changes in their level of consciousness, which has to be taken seriously.[13]

Malignant Middle Cerebral Infarction (MMCAI) is a serious complication of ischaemic stroke characterized by space-occupying oedema of the infarct area, leading to raised intracranial pressure and subsequent herniation.[14, 15] It is associated with a high rate of death, and surviving patients are left with severe disability. MMCAI tends to occur between 1 and 5 days of stroke onset, and patients deteriorate neurologically with a declining level of consciousness.

Current opinion in the medical community supports the use of decompressive craniectomy in paediatric patients with a fall in conscious level with a substantial MCA infarct.[15] This is in line with the indications for surgical intervention in adults.[3]

It is important to note that there is no evidence to support the use of ICP monitoring in patients with middle cerebral infarction. In fact, ICP monitoring may delay surgical treatment of MMCAI, a point illustrated in a recent five-centre review of 10 paediatric stroke cases with MMCAI.[15] Three of the patients in the study had ICP monitoring in place, and all three patients died of herniation without decompression treatment. Conversely, all patients treated with decompression went on to significant neurological improvement. This is the only article in the medical literature describing the occurrence of MMCAI in children.

Similarly, medical treatments such as mannitol and hyperventilation to alleviate intracranial pressure secondary to large infarct oedema have not been proven and may delay life-saving surgery.[3, 14]

Haemorrhagic Transformation

Haemorrhagic transformation of cerebral infarcts may be symptomatic or asymptomatic, and commonly occurs within the first 14 days of stroke onset. Use of antithrombotic agents, antiplatelets or anticoagulants all contribute to a higher likelihood of transformation.[3]

Seizures

Up to 14% of stroke patients can also present with early (those occurring within 2 weeks of stroke onset) or late seizures.[16] Seizure activity in post-stroke patients is related to poor outcomes.[5] The risks of developing late seizures are associated with large-sized infarcts, early seizures and cortical lesions. Two European studies have cited the rate of seizures in adolescents and young adults aged 15 onwards to be about 6% to 11% in the first year post-stroke.[16] Not all patients will need anticonvulsive treatment depending on the frequency and severity of seizures. Studies have shown that patients with early seizures may not require long-term anticonvulsive medication. Status epilepticus is a life-threatening condition and requires immediate intravenous treatment.[16] Furthermore, patients with late, recurrent seizures are at a risk of falls, and may not be suitable for long-term anticoagulation.

Miscellaneous

Patients in intensive care will need to have adequate nutrition and hydration.[3] Stroke patients are susceptible to infections such as pneumonia and urinary tract infections. This is partly due to immobility and also artificial ventilation, which heightens the risk of aspiration.[17] Immobile patients are also at risk of venous thromboembolism.[3] Hence, the benefits of prophylactic anticoagulation have to be balanced with the risk of cerebral haemorrhage.

Care after Stroke

Patients and their parents often feel isolated due to the limited number of services dedicated to children with stroke. Therefore, an appropriate range of existing paediatric services should be offered to all patients and their carers, with guidance on how to utilize these services.[1]

Long-term Medical Management & Secondary Prevention

It is essential that chronic medical management of stroke is in place. Short-term stroke recurrence rates in children have been reported to range from 8% to 42%, depending on the presence of underlying risk factors.[18] Patients at particular risk of second strokes are those with raised lipoprotein (a), protein C type I deficiency, or vascular abnormalities. Children with stroke should have a clearly delineated plan to reduce their risk of a second event.

The long-term medical management of stroke depends on the underlying aetiology. Some of the factors that should be taken into consideration include dissection of cranial vessels, cardiogenic embolism, prothrombotic states, vasculopathy, sickle cell disease and recurrent stroke while on aspirin.[6]

The consequences of non-compliance with drug therapy can be disastrous, as is seen in this case. The challenging issue is in getting children of young age to understand the rationale behind treatment and the implications of non-optimal anticoagulation. Education has to extend beyond the child's parents or guardians as they may have a more effective role in ensuring that the child takes his/her medication.

Rehabilitation

As with adult stroke victims, rehabilitation is key to functional improvement and recovery. Often, children will need help with reintegrating back into the community and school.

Detailed discussions on each of the rehabilitation services are beyond the scope of this report, but they can be broadly classified into initial and long-term rehabilitation. Initial rehabilitative measures include sensorimotor rehabilitation, speech and language therapy, assessment of cognition, mood and behaviour, and an early assessment of disability.[1]

The Royal College of Physicians has emphasized the need for long-term measures to be integrated with the child's "educational, social and emotional needs". Children will need help in the community and schools, such as special needs in education. Also, the transition of care from paediatric to adult services has to be coordinated, as with the patient discussed in this case. This transition takes place typically between the ages of 16 and 19.[1]

Prognosis of Stroke Patients

The prognosis of stroke patients is variable and dependent on many factors. Very few studies, which have analysed the prognostic data in children, have been found. More than 50% of children with stroke will have long-term cognitive or motor impairment.[19] Haemorrhagic stroke in children is associated with a higher rate of death than ischaemic stroke.[10]

Both a low GCS on presentation and mechanical ventilation for neurological reasons have been cited as independent predictors of mortality and morbidity. Still, critically ill stroke patients who receive appropriate intensive care interventions are more likely to do better than those who did not.[20]

Ethics

All children, regardless of their age, should be consulted if possible in all decisions in accordance with the Children Act 1989. This includes taking their feelings and wishes into consideration. In terms of consenting for any form of interventions, patients have to be assessed for Gillick competence. If the child is deemed to be competent to make a decision, their wishes should be followed.[1]

An issue arising from this case is the fact that the patient had not been reviewed in clinic for a period of 5 years, and it is highly likely that her anticoagulation was suboptimal. This has undoubtedly exposed the patient to significant risks of developing complications due to her underlying heart condition. Ethical dilemmas which extend beyond the realm of paediatric stroke care are illustrated in this example. Whose responsibility is it to ensure that children attend and comply with their medical issues? The three main parties implicated would be the patient herself, her parents or guardians, and healthcare professionals involved in her care. And if the parents or guardians fail to meet the medical needs of the child, should they be accountable? Finally, what social systems are in place to prevent such neglect from occurring? These are difficult questions to pose, but needs to be considered in order to optimize paediatric care and safeguard children.

Another pertinent issue arising from this case is the question of whether a child who voluntarily stops taking medication truly understands the full implication of his/her actions. It is difficult for any child to be on long-term treatment, which the child may feel is meaningless to be on if s/he does not understand the rationale behind treatment and the consequences of not doing so. If a child refuses or stops treatment out of his/her own volition, is s/he fully competent to do so? As members of the healthcare profession, we can pre-empt such behaviour by communicating effectively with the child and his/her family members, especially when the child is old enough to understand. At the same time, we should be sensitive to the environment the child is growing up in if there are concerns that the child might need social support.

Summary

Prevention of stroke is a crucial but overlooked area, as is illustrated in this case. As childhood stroke is relatively uncommon in comparison with adult stroke, children at risk of stroke and their guardians may not fully comprehend the utility of prophylactic medication. In the context of the United Kingdom, robust social healthcare systems have to be in place to ensure that patients under paediatric care have a safe transition to adult care.

The lack of familiarity with childhood stroke also extends to healthcare professionals. Even a classic presentation of stroke in a child can prove to be alarming to a medic. Physicians have to be trained to recognize the signs of stroke and be aware of the immediate steps to take.

Until further research evidence becomes available, the management of stroke in children remains an individualized approach, and will continue to be a highly challenging area.

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Introducing a Career in Tropical Medicine

Ms Jennifer Khan-Perez
Fourth-year medical student
The University of Manchester
Salford Royal NHS Trust

Dr Katherine Ajdukiewicz MBChB, FRCP, DTMH
Consultant in Infectious Diseases and Tropical Medicine,
Honorary Senior Lecturer Manchester Medical School
The University of Manchester, Manchester Academic Health Science Centre, Pennine Acute Hospitals NHS Trust North Manchester General Hospital

Address for correspondence:
Dr. Katherine Ajdukiewicz: katherine.ajdukiewicz@pat.nhs.uk

Introducing Tropical Medicine

With worldwide pandemics of tuberculosis (TB), Human Immunodeficiency Virus (HIV), malaria, emerging infections such as SARS (severe acute respiratory syndrome caused by SARS coronavirus), and pandemic influenza, and the complexities of increasing drug-resistance such as extended drug-resistant tuberculosis (XDRTB), Tropical Medicine is a challenging, contemporary and exciting specialty. Tropical Medicine encompasses all organ systems of the human body and requires input from a multitude of medical specialities in particular neurology, dermatology, gastroenterology and respiratory medicine.

Tropical Medicine is a sub-speciality of infectious diseases. There are currently four tropical medicine centres recognised for training in the UK which include Northwick Park and the Hospital for Tropical Diseases in London, Birmingham Heartlands Hospital and Liverpool Royal Hospital. Training in Tropical Medicine may be as a sole specialty or combined with General Internal Medicine, Microbiology or Infectious Diseases. Experience abroad is required for training (12 months), and there is the potential to subsequently pursue a career overseas. A majority of tropical disease specialists in the UK (over 75%) work in academic medicine.

Life as a Tropical Medicine Consultant

Tropical medicine is actually, strictly speaking, a misnomer for the speciality encompasses both tropical *and* general infectious diseases. It includes management of both community and hospital acquired infections on the ward and in high dependency/intensive care settings. There is also the challenge of managing infections which can cause immunocompromised states i.e., HIV which can lead onto AIDS and subsequently, render them more prone to acquiring opportunistic infections. Expertise is needed in optimizing antimicrobial therapy and meeting the challenges posed by the antimicrobial arms race which is becoming an inexorably complex issue due to mass migration and availability of therapeutic agents.

As a consultant in tropical medicine, a typical week is likely to involve clinical work in both an in-patient and out-patient setting as well as conducting research and other academic pursuits. The workload often includes pre-travel clinic, often with complex patients with multiple co-morbidities; management of patients with exotic infections including schistosomiasis, tuberculosis, leprosy, hydatid disease.

The variety of cases that present to the specialist in tropical medicine is truly wide-ranging from on-call work which may consist of managing pyrexia in someone returning from a country where viral haemorrhagic fever or malaria enter the differential diagnosis to likely Pneumocystis pneumonia in someone requiring ICU.

As in other areas of medicine, the tropical medicine consultant adopts a holistic approach to treating patients with infectious diseases by working in a multi-disciplinary team, particularly in the context of communicable diseases such as tuberculosis and HIV – they are tasked to conduct contact tracing, and facilitate adherence of therapy. There is close liaison with public health colleagues particularly when notifiable diseases such as malaria, cholera and tuberculosis are diagnosed.

Training

Career prospects are variable within Tropical Medicine. As outlined above, there are only four centres accredited for Tropical Medicine training in the UK and therefore competition for training positions is fierce. There are few consultant positions available although Infectious Diseases units also look after tropical/travel related infections.

Tropical medicine involves straddling the academic and clinical realms and therefore medics who aim to reconcile the seemingly disparate dimensions in medicine need look no further and this, no doubt contributes towards it allure. Many other specialities are integrated into tropical medicine including virology, clinical pharmacology, public health, epidemiology, vaccines and genitourinary medicine; enhanced training in these areas is required. The variability in career structure makes allowance for greater flexibility in future career pathways and cultivating areas of interest. It is noteworthy that for those who have monetary incentives, tropical medicine

may not appeal as there is very little opportunity in the private sector.

Facts and Figures

Tropical Medicine encompasses several subspecialties including Medical Microbiology, Tropical Medicine and Virology. Posts for training places in Infectious diseases currently include one place in each of East Midlands (North), East of England, Oxford and West Midlands, with two places in the East Midlands (South).

Completion of Core Medical Training (CMT) or Acute Care Common Stem (ACCS) with acquisition of full MRCP (UK) is required before entry into Specialty Training at ST3.

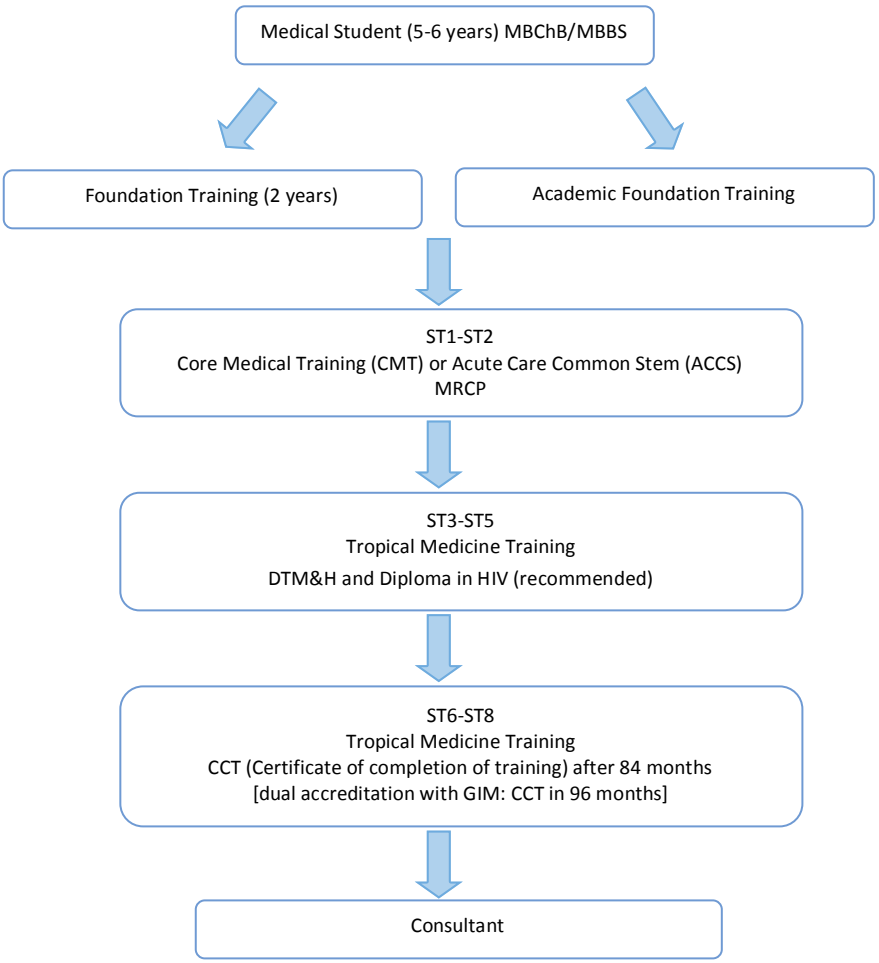
The Diploma in Tropical Medicine & Hygiene (DTM&H) is a three month full-time course for qualified doctors recommended for those who wish to specialise in tropical diseases. The DTM&H has clinical, practical and public health components with a strong epidemiological focus. It is run once or twice a year in two main UK institutions (London School of Hygiene and Tropical Medicine and the Liverpool School of Tropical Medicine). Courses are highly subscribed with limited places and often have an international student population. Most doctors undertaking this course do so with the intention of working abroad in poorly-resourced areas, or have an interest in working in travel clinics in the UK.

The Diploma in HIV Medicine (Dip HIV Med) run by the Worshipful Society of Apothecaries London is also recommended for training in Tropical Medicine. The syllabus covers core knowledge in HIV expected for registered medical practitioners who have regular clinical contact with HIV patients.

The Future

Tropical Medicine embraces a multi-faceted, worldwide paradigm, which includes under its remit infectious diseases in both developing and the developed health economies. It is bewildering to appreciate that only decades ago, literally millions of people were dying from preventable infectious diseases. Since the advent of vaccinations, certain diseases were completely eradicated. So what does the future hold? Perhaps that is to be determined by the vision of those who occupy the ranks of tropical medicine…..

> *"Adding nothing superfluous, and omitting nothing necessary"*
>
> – Graham Green, Stanboul Train



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The Use of Geometric Morphometrics as a New Method to Analyse Glenoid Bone Loss after Shoulder Dislocation

Mr Thomas Key, BSc
Final Year Medical Student
University of Manchester

Address for correspondence:
Mr Thomas Key: Thomaskey6452@doctors.org.uk

Professor Lennard Funk, BSc MBBCh, MSc, FRCS (Tr&Orth), FFSEM(UK)
Orthopaedic Surgeon Shoulder and Upper Limb Specialist
Wrightington Upper Limb Unit & The University of Manchester.

Abstract

Background - Glenoid bone loss occurs at the anteroinferior and posteroinferior aspects of the glenoid rim in anterior and posterior instability respectively. This morphological change in the shape of the glenoid fossa predisposes to increasing instability.

Aim - The aim of this study was to use geometric morphometrics to quantify changes to glenoid morphology in traumatic shoulder instability.

Methods - 3D models of the surface of the glenoid fossa were created using CT scans from 8 patients with 5 dislocations and 3 controls. Ten landmarks, corresponding to the same anatomical sites between samples were digitized onto the surface of the glenoid fossa. Shape information was extracted from the landmark co-ordinates and analysed for variation in the geometric properties of the glenoid fossa using geometric morphometrics.

Results - Results showed that the areas of most pronounced variation between the dislocation and control groups were as expected, at the anteroinferior, and posteroinferior glenoid regions.

Conclusions - This indicated that geometric morphometrics allows variation in the geometric properties of the glenoid fossa after dislocation to be accurately analysed at a good level of detail in three dimensions.

Clinical Relevance - Compared to conventional techniques using single glenoid measurements from 2 dimensional images, morphometrics represents an exciting new avenue for analysing the morphological changes to the glenohumeral joint involved in shoulder pathology.

Introduction

Bony Bankart lesions are common and described in up to 71% of individuals following anterior shoulder dislocation.[6] The extent of bone loss increases with number of dislocations.[21] In posterior shoulder dislocation, the opposite occurs with bone loss from the posterioinferior aspect of the glenoid rim as shown in Figure 1.[10,20] The extent of bony bankart lesions is widely dependent on the method of injury with high impact injury in contact sports hypothesized to result in most extensive bone loss.[4,23] The decrease in articular surface area and loss of uniform concavity of the glenoid fossa acts to de-stabilize the glenohumeral joint and increase the risk of re-dislocation.[22]

Clinically the extent of bone loss is important for planning the appropriate surgical treatments to re- stabilise the shoulder joint in an individual who has experienced multiple re-dislocations.[1,11] In these patients, Computed Tomography (CT) is the imaging modality of choice in the quantification of glenoid bone loss with a high sensitivity of 93%.[8,17] Accurate CT interpretation by a radiologist involves viewing 2D slices of the glenohumeral joint which can also be used to form a 3D reconstruction of the joint. Quantification of glenoid bone loss is largely

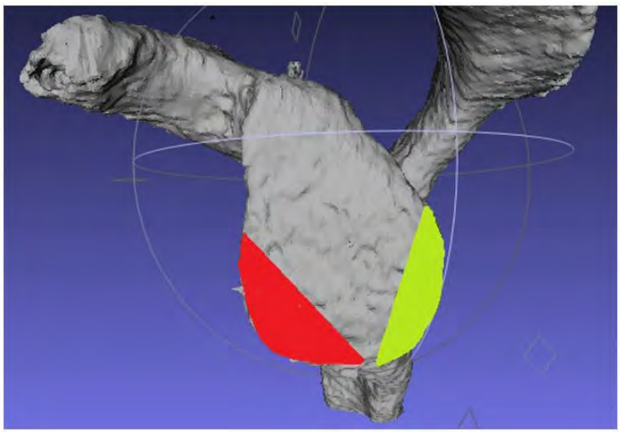

Figure 1: *A 3D model of the glenoid fossa from the control group indicating the most common areas of bone loss after glenohumeral dislocation.*
Red - Shows the Anterioinferior aspect of the glenoid fossa where bony bankart lesions are common after anterior dislocation.
Green – Shows the Posteroinferior aspect of the glenoid fossa where reserve bony bankart lesions are common after posterior dislocation.

subjective based on the radiologists overall clinical impression and no exact criteria are used in analysis of bone loss. Several novel studies used sagittal views of the glenoid to compare which typical features of glenoid bone loss most closely relate to rate of re-dislocation.[8,2] Of three measurements for quantifying bone loss; cross sectional area, maximum glenoid width and maximum glenoid length, the most statistically significant was reduction in maximum glenoid width.[2] These measurement techniques based on single measurements taken are still relatively crude and few studies using more detailed and accurate ways to quantify glenoid bone loss are reported in the literature.

Morphometrics is a method for defining the shape of an object taking into account all features with the object with the exclusion of size, orientation and position.[5,15] The object or specimen, in this case a 3D CT image of the glenoid fossa is represented in a form that can analysed using morphometrics by digitising a number of landmarks over the surface of the object. These landmarks each represent the same equivalent point from the surface of the glenoid. Landmarking functions to provide unique information from each specimen but corresponding shape information across the dataset to represent the morphology of the glenoid fossa.[5,15] Shape information is extracted by closely aligning the landmark points using a method known as procrustes superimposition.[5]

This study aims to use morphometrics as a more accurate method for quantification of changes in glenoid morphology following shoulder dislocation. The primary objective of this study is to assess if geometric morphometrics can be used to quantify a significant morphological change in the glenoid fossa after glenohumeral dislocation. The secondary aim is to determine if there is a critical quantitative change in glenoid morphology corresponding to each number of glenohumeral joint re-dislocations.

Materials and Methods

Dataset

This was a retrospective study using CT scans of 8 patients all with a history of shoulder pathology. For the control group, patients were required to have no previous shoulder pathology involving the glenoid fossa with no history of instability. Of the 4 patients initially selected for the control group one was excluded due to previous history of suspected instability described in the patient's notes. Patients were divided into two categories, the control group (n=3) and the dislocation group (n=5). The control group included 2 males and 1 female with an age range 21-57, mean age of 39 years, each with a CT scan of one shoulder. This gave 3 sets of CT images, two left and one right with a range of shoulder pathologies but no bony pathology to the glenoid. The dislocation group included 5 males with an age range 26-44 years with a mean age of 34 years. All patients in this group had dislocated their right shoulder, 3 anterior dislocations and 2 posterior dislocations. All patients in the dislocation group had received stabilisation surgery. Any CT scans taken after surgery, were after bankart repair of the labrum, which involves no glenoid bone replacement. Of the patients who had undergone the bone replacement technique known as the Latarjet procedure, all CT scans were taken pre-operatively before surgery altered the bony morphology of the glenoid.

3D model formation

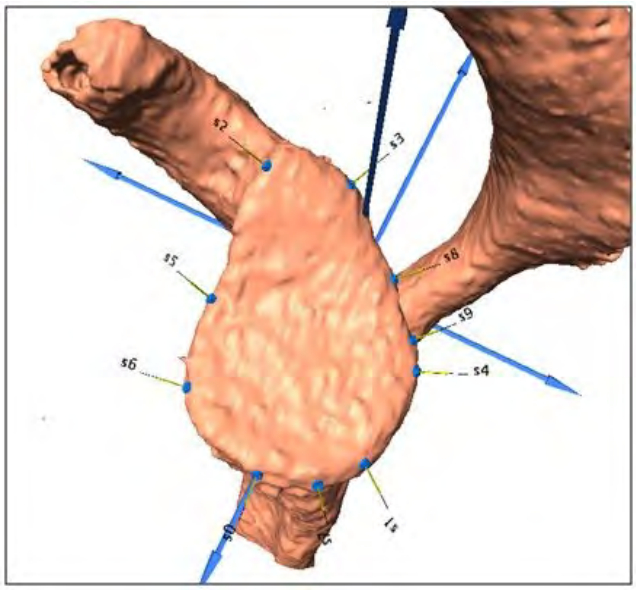

Figure 2: *A 3D model of the surface of the glenoid fossa from the control group. The location of the landmark points are indicated by the blue circles and numbered according to the description.*

Anonymised CTs were obtained as a stack of 2D CT .dicom format images for each of the 8 patients. These were viewed using the freeware 3D slicer software.[18] Using the editor module of this software package, segmentation of each set of dicom images was achieved. Segmentation was carried out manually by using a threshold value. The threshold value for each image was individually determined by using the grayscale value from the centre of the glenoid fossa on the axial view. All voxels in the source volume in the range that had been selected by the threshold value were then labeled. Using these segmented images, the model maker module was used to create a 3D representation of the glenohumeral joint which was exported in the .stl file format.[18] Using the Meshlab software these files were individually imported.[3] The 3D model was cropped involving removal of all bones separate from the scapula, principally the humerus and acromion. Removal of the humerus allowed a clear view of the glenoid fossa. Some of the CT images were CT arthrograms, these were included due to the small number of available scans. In these cases the radioopaque dye used in the arthrogram is highlighted by image segmentation as it has a similar density and

therefore grey value to bone. The areas infiltrated by the dye were deleted to leave a clearly defined glenoid fossa and glenoid rim. These 3D surface mesh models were exported in the .ply file format. A set of 10 landmarks were digitized onto the glenoid fossa in three dimensions using Landmark version 1.3.0.[25] Landmarks were chosen to correspond to sites identifiable across all 9 glenoids as shown in Table 1 and displayed in Figure 2.

Landmark	Position
S 0	anterior aspect of the infraglenoid tubercle
S 1	posterior aspect of the infraglenoid tubercle
S 2	anterior aspect of the supraglenoid tubercle
S 3	posterior aspect of the supraglenoid tubercle
S 4	most posterior aspect of the posterior glenoid curvature
S 5	most medial aspect of the anterior glenoid curvature
S 6	most anterior aspect of the anterior curvature
S 7	midpoint of the infraglenoid tubercle
S 8	point of posterior curvature in line with the superior aspect of the spine of the scapula
S 9	point of posterior curvature in line with the inferior aspect of the spine of the scapula

Table 1: *Details the position of the 10 landmarks digitized onto the glenoid fossa.*

Landmark points were chosen which represented areas of the glenoid rim marked by features common to the glenoid area of the scapula across specimens. The supraglenoid and infraglenoid fossa were chosen as there is little variation in these sites between individuals. The supraglenoid tubercle represents this insertion of the long head of biceps tendon and the inferior glenoid tubercle the insertion of the long head of the triceps.[9] Other landmarks were chosen to give a good spread of points around the glenoid rim particularly at the posteroinferior and anteroinferior edge where bone loss is most common following posterior and anterior dislocation respectively. The landmark points were individually digitised onto the surface mesh of each glenoid fossa to ensure accurate placement. Landmark co -ordinate values in the X,Y and Z axis were then exported in the .dta file format.

Shape Analysis - Geometric morphometrics was used to quantify the variation in shape of the glenoid fossa between the control and dislocation group using the MorphoJ morphomterics software.[16] To quantify the shape difference, co-ordinates of the landmarks digitized onto the surface of the glenoid fossa were extracted. Shape of an object is defined as the objects geometric properties with the exclusion of size, position and orientation.[15] For the quantification of shape variation, Procrustes superimposition of the landmark points was performed. Variation between the configurations of landmarks digitized onto the glenoid fossa after procrustes superimposition is entirely due to variation in the geometric properties of the object.[5] To achieve this, Procrustes superimposition excludes the contribution of size, position and orientation in three steps.[14] Firstly the landmarks from the glenoid fossa are scaled to a unit size.[12] Secondly the landmark configurations are moved to a common position and thirdly are rotated to the position of best fit so there is minimal distance between all the landmark points.[12] This gives the procrustes fit for the landmark configuration. Some landmarks have more variation than others. Procrustes fit acts to average this variation, so shape variation is spread out as evenly as possible between individual landmark points of the landmark configuration.[13] Using the procrustes fit a wireframe graph was used to show variation of the landmarks points between the control and dislocation groups. A wireframe graph simply connects the landmark points so the position and variation of the landmarks points can be visualised.

Principal component (PC) analysis was used to analyse shape variation from the landmark configurations of all the glenoid fossa used in the study. PC analysis which examines patterns of variation between data points in a multidimensional space allows the major patterns of variation to be visualised in a graphical form.[16]

Results

From the scatter of PC scores shown for both the dislocation group and control group in Figure 3, a number of observations can be made. The outer extremes of PC scores are connected to show the maximum variation in each group. Firstly the scatter of PC scores shows there is greater variation in the shape of the glenoid fossa seen in the dislocation group compared to the control group. Secondly it shows that there is overlap in the geometric properties of the control group compared to the dislocation group.

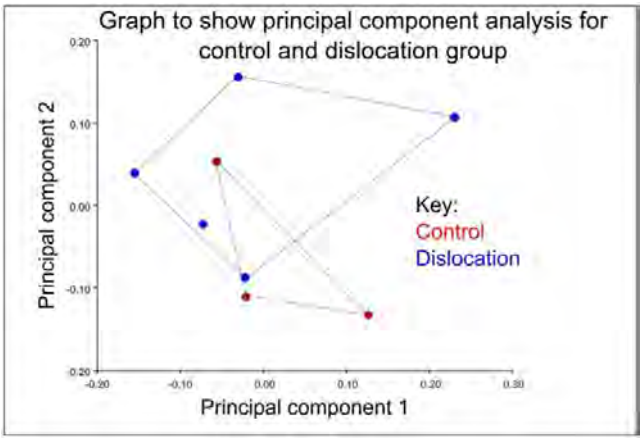

Figure 3: *A graph to show the principal component analysis for the shape of the Glenoid Fossa. Scatter points include both the control and the dislocation group. Each point represents a plot of the Principal component score for one sample.*

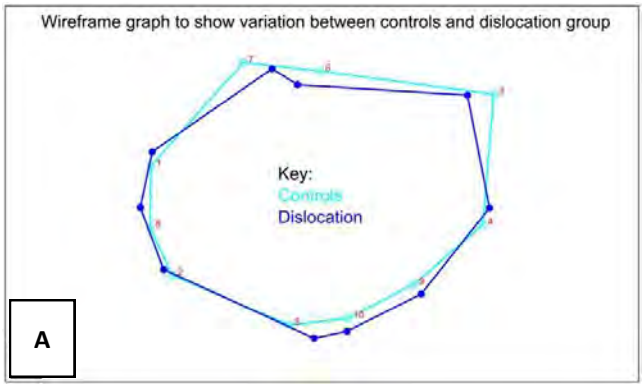

Figure 4 (A): *A wireframe graph to show the variation of the landmark configurations representing the shape variation of the glenoid fossa between the control and dislocation groups.Orientation the same as the glenoid fossa in figure 4(B).*

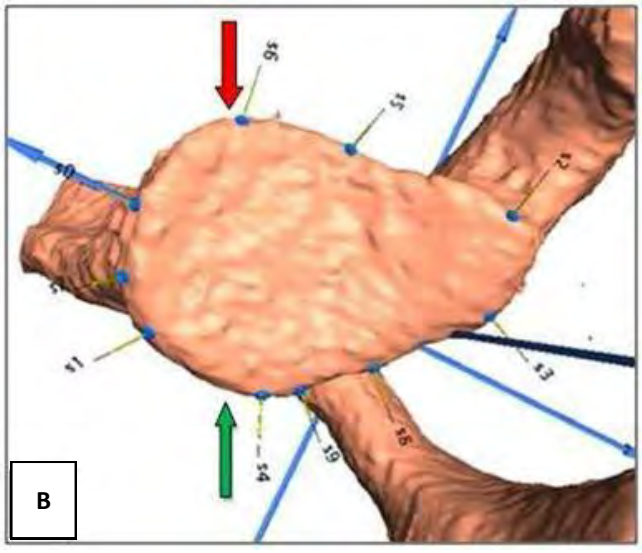

Figure 4 (B): *3D model of a left glenoid fossa from the control group to provide anatomical context and orientation for the landmark points digitized onto the glenoid surface. The green arrow pointing to the normal posterior edge and the red arrow to the normal anterior edge. Each number on the wireframe graph corresponds to the landmark number from the 3D model +1.*

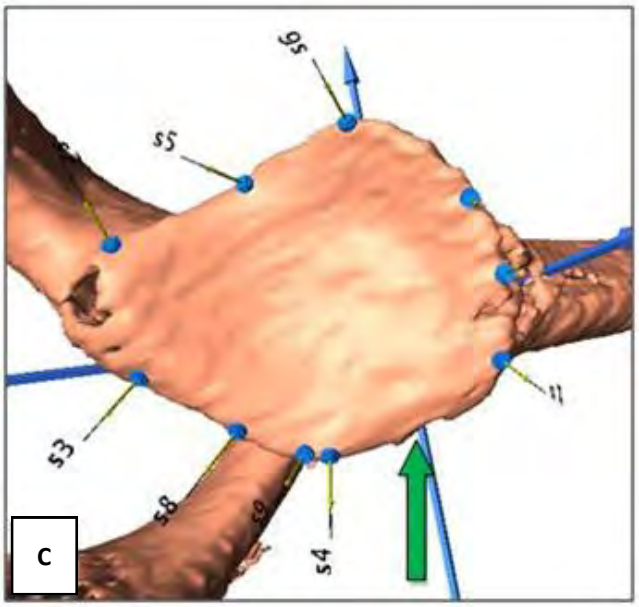

Figure 4 (C): *3D model of a right glenoid fossa with the most severe bone defect at the posteroinferior aspect of the glenoid rim following recurrent posterior dislocation. Green arrow marks the area of posterior flattening of the glenoid rim as a result of bone loss.*

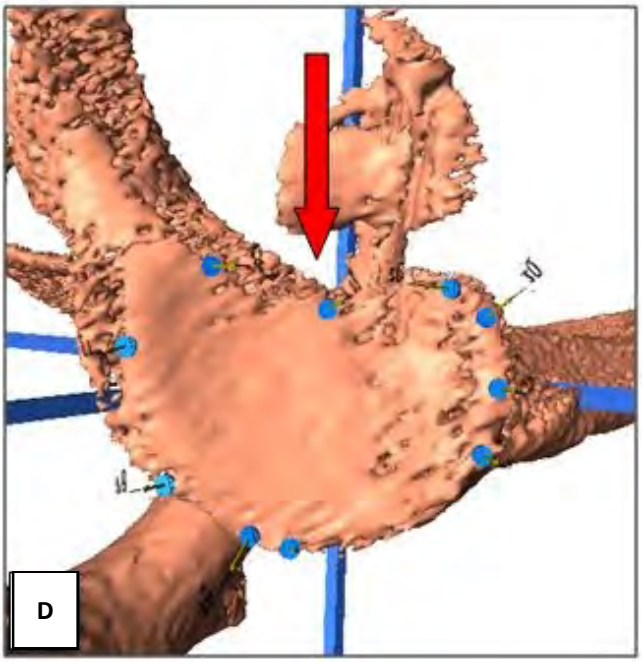

Figure 4 (D): *3D model of a right glenoid fossa with the most severe bone defect at the anterior aspect of the glenoid rim. Fractured loose bone can be seen separate from the glenoid rim as a result of recurrent anterior dislocations. Red arrow marks the area of flattening to the anterior glenoid rim to the extent that it is now concave in nature.*

Anterior glenoid Rim

The wireframe graph in Figure 4(A) comparing the landmarks of the control and dislocation groups

highlights a number of areas of the glenoid fossa where variation is seen. In the dislocation group there is considerable movement of point 6 (marking the most medial aspect of the anterior glenoid curvature) and point 7 (marking the most anterior part of the anterior curvature) towards each other compared to the control group. In the control group the graph shows the glenoid rim as a normal convex shape, whereas in the dislocation group, the contour of the anterior glenoid rim is concave at its midpoint. This suggests an overall morphological change in the anterior curvature of the glenoid rim. Figure 4(D) a model of a glenoid from the dislocation group with recurrent anterior instability shows a large bony deficit from the anterior glenoid rim. The normal contour of the anterior edge of the glenoid is concave in nature due to extensive bone loss. Comparing this to a normal control glenoid fossa shown in Figure 4(B) where the contour of the anterior glenoid rim is convex demonstrates the general trend seen in the wireframe graph of 4(A).

Posterior Glenoid Rim

In the wireframe graph points 9, 10, 5 and 2 along the posterior edge of the glenoid rim demonstrate differing trends in the contour of the posterior rim of the glenoid fossa between the control and dislocation groups. The posterosuperior aspect of the glenoid rim has a similar contour between the dislocation and control group. However at the posteroinferior aspect of the glenoid rim in the dislocation group, point 2 (marking the posterior aspect of the glenoid rim) and point 5 (marking the most posterior aspect of the posterior glenoid tubercle) are further away from each other compared to the control group. This gives the appearance of an increased flattening of the posterior-inferior glenoid rim. The morphology of the posterior glenoid rim after posterior dislocation can be directly seen by comparing Figure 4(B) (a normal glenoid) to Figure 4(C) (a glenoid from a patient with recurrent posterior dislocation). Here the green arrow of Figure 4(C) shows flattening of the posteroinferior aspect of the glenoid rim compared to the same region of Figure 4(B) where the posterior rim is convex in nature. This comparison supports the general trend of posteroinferior glenoid rim flattening in the dislocation group compared to the control group seen in the wireframe graph.

Discussion

Several studies have tried to find a critical level of bone loss to relate to the number of dislocations.[7,8] One study proposed a critical level of bone loss at 13.4% below which the average number of re-dislocations were 6.3 and above which the average number of dislocations were 10.1.[8] This seems a rather arbitrary figure and provides no real clinical relevance for the treatment of shoulder dislocation. The reason that these conclusions with few useful applications exist is due to a large variability in bone loss after dislocation between individuals. The PC scatter results showed large variation in glenoid shape after dislocation with the wireframe graph showing most variation at the anterior-inferior and posterior-inferior glenoid rim. This variation is most likely due to the varying degrees of glenoid bone loss between the samples of the dislocation group. Even in individuals with the same number of dislocations bone loss varies greatly due to factors such as the force of impact of the injury and the exact mechanism of injury.[19] This explains why extensive variation is seen in the glenoid morphology of the dislocation group in this study and also why it is so difficult to relate the extent of bone loss to the number of re-dislocations.

A number of different techniques have been used to measure the shape of the glenoid particularly in relation to pathological glenoid morphology following dislocation. In anterior dislocation a common feature of anteroinferior glenoid bone loss is the flattening of the anterior curvature.[6,8,24] Studies have utilized this feature to quantify bone loss after traumatic anterior shoulder dislocation by measurements such as the length of an anterior straight line and reduced maximum glenoid width[7]. In one study reduced maximum width was shown to be clinically significant in relation to re-dislocation rates. However, these measurements based on 2 dimensional images only take into account a small proportion of the 3 dimensional angled surface of the glenoid fossa.[2] A study investigating glenoid morphology related to atraumatic posterior dislocation used CT images to measure tilting angles of the glenoid as a measure of glenoid concavity.[10] The glenoid was classified using these measurements as concave, flat or convex. Results showed the glenoid was the conventional concave shape in 78% of the controls with no history of instability.[10] However the patients in the dislocation group almost all had glenoid bony changes such as glenoid retroversion resulting in a flattened or convex glenoid surface.[10] Results from our study showed that using morphometric analysis to compare the control group to the dislocation group; it accurately identified the areas of glenoid bony deficit both antero-inferiorly and postero-inferiorly in the patients with anterior and posterior dislocation respectively. We therefore believe the use of geometric morphometrics represents a more complete method for analysing glenoid morphology. Using a single measure from a 2 dimensional image or measuring angles to give an overall interpretation of the morphology of the glenoid fossa provides only limited shape information. The method of landmarking and morphometric analysis takes into account a wider range of geometric components from the glenoid. Morphometrics using landmarks digitized around the glenoid therefore offers a more comprehensive three dimensional analysis of glenoid morphology. Results from this study show that using geometric morphometrics, variation of each of the landmark points can be analysed

to give information about variation in glenoid morphology at different regions of the glenoid fossa. In addition this information can be combined to examine geometric variation of the glenoid fossa as a whole when comparing morphology before and after dislocation.

There were limitations of this study. The technique is new and challenging to undertake at the moment. Also, the dataset is too small to make any statistically valid conclusions on the amount of glenoid bone loss significant and relevant to aid treatment decisions. Further exploration into the use of morphometrics to study glenoid morphological changes is required.

Conclusions

Despite the limitations of the study a number of valuable conclusions can still be drawn from this project. The results show that geometric morphometrics has many advantages over other techniques which have been reported in the literature to analyse changes to glenoid morphology. Morphometric analysis of a three dimensional surface representation of the glenoid fossa provides much more extensive data for analysis of glenoid geometry. This study showed areas where variation is most common at the anteroinferior and posteroinferior aspects of the glenoid fossa following anterior and posterior dislocation respectively. The techniques used in this study highlights possibilities to analyse glenohumeral morphology to a high level of geometric detail in a wide number of shoulder pathologies. In addition, morphometrics could help establish which variations in glenoid morphology occurring naturally in the population predispose to certain groups of shoulder pathology. Further research using morphometrics to quantify shoulder morphology has exciting potential as an additional tool for determining the surgical management of patients with recurrent dislocation.

Acknowledgments

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An Introduction to Plastic Surgery

Mr Reza Mafi
Fifth year medical student,
Hull York Medical School.

Mr Sandip Hindocha, MD, MBChB, MPhil, MRCS
Speciality Registrar, Department of Plastic Surgery
Whiston Teaching Hospital, Liverpool.

Address for correspondence:
Mr. Sandip Hindocha: hindocha2001@yahoo.com

Keywords:

Medical Careers; Plastic Surgery; Reconstructive Surgery; Aesthetic Surgery; Oncoplastics.

Plastic surgery is an enormously varied speciality. Whilst encompassing a wide range of aesthetic surgeries it predominantly deals with reconstructing and restoring function in all areas of the body. The cosmetic potential of the speciality understandably draws attention from and is better publicised by the media. However the pivotal role of a plastic surgeon lies in the former aspect of the speciality, re-establishing function in reconstructive operations.

The many sub-specialities within plastic surgery span a huge range, both anatomically and in terms of skills required. They include breast reconstruction, cleft lip and palate surgery, hand surgery, lower limb trauma, burns, reconstruction following head and neck cancer surgery, laser surgery, cutaneous malignancies and also microsurgery. Specialising in microvascular surgery enables surgeons to repair nerves and tendons following trauma to maintain function. Oncoplastics is yet a further subspeciality, in which breast reconstruction is specifically performed following mastectomy in breast cancer patients. This is just one example of the extensive interaction between plastic surgery and other specialities. Others include general surgery, orthopaedics, dermatology, neurosurgery, maxillofacial surgery and gynaecology. All these specialties rely on plastic surgeons for reconstructive advice in any area of the body. In addition plastic surgeons that specialise in burns liaise with burns anaesthetists in highly specialized intensive therapy units.

Life as a Plastic Surgeon

Plastic surgeons undertake such varied schedules across such a range of different areas that there is usually no typically “average day”. However, duties of an average working week will include outpatient clinics, theatre, on-call rota work as well as dealing with on-call referrals. Each week there will be approximately 3-4 operating sessions involving around 30 patients, but this can change depending on the specific caseload for that week. The plastic surgeon will have 1 to 2 four-hour outpatient clinics each week, and they will also be responsible for monitoring patients on the wards. They will generally speaking work for approximately 10 hours a day but this can vary depending on their stage of training and the operation that is being performed.

Approximately 50% of referrals to plastic surgery come from primary care, 30% from emergency departments and the remaining 20% from other surgical specialties. There is a great deal of on-call demand and subsequently plastic surgeons will frequently find themselves working out-of-hours. This often involves dealing with emergency cases such as burns, facial trauma and so forth. The operation time varies significantly ranging from 20 min in a percutaneous needle fasciotomy for Dupuytren’s contracture to 10 hour operations in immediate bilateral DIEP (Deep Inferior Epigastric Perforator) flap in breast reconstruction.

However the role of plastic surgeon may extend far beyond the hospital setting. Due to their expertise in restoring function following trauma and burns their presence is highly valued following disastrous events worldwide. In addition a considerable number of plastic surgeons participate in a charity organisation called “operation smile”. During which they voluntarily travel to developing countries and repair cleft lips and palates of children. As a consequence the opportunity to travel abroad and improve and pass on clinical knowledge and skills has become an integral part of the speciality’s on-going development.

Plastic surgery can be a demanding career, in which the ability to remain calm in stressful situations must be coupled with a meticulous nature that pays very close attention to aesthetic detail. Equally a high degree of manual dexterity is paramount for success. The majority of plastic surgeons boast impressive achievements in academic research alongside the required motor skills, a fact that reflects both the competitive nature of the speciality and its place at the forefront of cutting edge research.

Outside of the operating theatre a Plastic surgeon's duties continue and involve taking the patient's mental state into consideration. Some patients are addicted to aesthetic surgery and will never be satisfied with their looks. In this case it is the surgeon's responsibility to identify those at risk.

In the UK plastic surgeons can choose to either focus solely on private work, dedicate their time to NHS patients or a balance of the two. The ratio of private to NHS work depends predominantly on the surgeon's preference and the number of hours that they wish to work.

Training

Applying for subspecialty training occurs through a very competitive national selection process held twice a year. In 2011, the competition ratio for ST3 posts in Plastic Surgery was 15:1, which is higher than the average competition ratio for other surgical specialties. Furthermore, in 2010, there were only 9 posts available at ST3 level. One can expect to do service SHO posts, clinical fellow posts or research prior to applying for an ST3 post. Only few progress directly from CT2 to ST3.

Posts are found throughout the country, with 50 NHS plastic surgery units and centres in the UK. Even though more females are being attracted to plastics, currently 86% of this speciality is dominated by male surgeons.

According to the British Association of Plastic Reconstructive and Aesthetic Surgeons (BAPRAS), for every 100,000 people one consultant plastic surgeon is needed. In 2010, a survey found that the number of consultants for plastic surgery represent only 5% of England's entire consultant surgical workforce. It is expected that the number of posts for Consultant Plastic Surgeons will therefore be on the rise, and there will therefore be a similar rise in training posts.

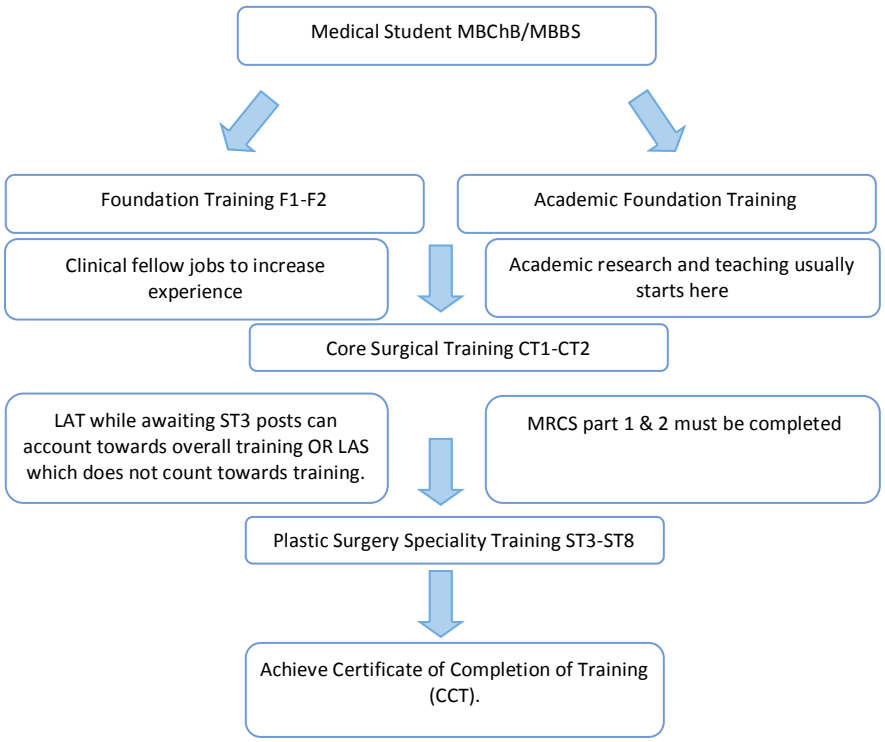
Facts and figures summary:		
Competition ratios	2010	15:1
	2011	8:1
	2012	16.6:1
Available posts 2013 (ST3)[1]	26 NTN posts, 12 LAT posts	
Deanery with most places available (2013)	Scotland (7 NTNS, 1 LAT)	
Number of Plastic surgery units in NHS	50	
Male to female ratio	6:1	
Speciality training duration	6 years	
Mean age to get a full time consultancy job	40	
Salary (NHS)	£74,504 to £100,446	

The Future

Current research topics consist of exploring areas which currently pose challenges in achieving the optimal patient outcome. Among the most significant are wound repair, scarring and nerve healing. Other advances which will be implemented in the near future range from gene therapy for treatment of diabetic wounds to the development of synthetic skin for those lacking sufficient skin following major trauma such as burns or diseases.

Furthermore the use of stem cell therapy is being scrutinised due to its restorative properties. For instance, stem cells derived from adult adipose tissues can be differentiated into bone, cartilage or fat depending on patients' requirements.

Tissue engineering and microsurgery which currently account for a considerable portion of reconstructive surgery are being constantly developed. With the first full face transplantation being completed in Spain in 2010, and numerous successful hand transplantations the future looks promising.



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An Introduction to Public Health Medicine

Ms Katie Millichamp
4th Year Medical Student
University of Manchester, and
Salford Royal Foundation Trust

Dr Pip Fisher, MBChB, BSc, MRCP, DFFP, DRCOG, DTMH, MCommH, PGCertEd
Clinical Lecturer for Social Inclusion
University of Manchester

Address for correspondence:
Ms Katie Millichamp: Katie.millichamp@student.manchester.ac.uk

Introducing Public Health

Public Health is defined by the Faculty of Public Health as, "The science and art of promoting and protecting health and well-being, preventing ill health and prolonging life through the organised efforts of society."

Exciting and challenging, public health is a true multidisciplinary specialty, allowing the practitioner to regard health as a whole, with the aim of putting preventative strategies in place to improve the general health of the population. Unlike many other specialties public health is not only focused on illness, but also on the promotion of "well-being".

Life as a Public Health Consultant

The three key areas of Public Health are Health Improvement, Improving Services, and Health Protection. The majority of projects that a consultant works on will fall into one of these categories, and will require the specialist to identify areas in a health setting in need of change. They need to have the ability to bring these changes about, and to monitor and assess the efficacy of the whole process.

Usually, specialists will be working on several projects at the same time, and the work involved will range from governmental meetings, to managing an emergency health crisis, to research or teaching. As a result, the workload is highly unpredictable and extremely varied.

Public Health specialists work in a variety of different settings, often outside of the usual constraints of the NHS, and usually within the Public Sector. Examples of these include local NHS organisations, the Military, Academic institutions or international organisations such as the World Health Organisation. Due to the breadth of public health, many consultants refine their specialty even further and focus on the health improvement of a specific population group.

In order to ensure a project continues through to completion, a Public Health specialist may have to liaise and work with a wide range of people from various disciplines, such as politicians, teachers, dieticians and local authorities. The consequences of local action can also contribute to changes on a national level, with guidance recommended by the Department of Health. Some recent changes as a result of Public Health policy include issues such as nutrition labelling, the health of asylum seekers, the health impacts of climate change, and obesity.

Like any specialty, a career in Public Health has its challenges, most notably through the recent changes in the structure of the Public Health system. One of its most notable drawbacks is the lack of hands on clinical practice, and so specialists must have a keen interest in addressing the bigger picture. The administration aspects of the job can be off-putting for some, with regular reports, committees and management issues, as well as the challenges of political involvement.

Facts and Figures

The Public Health specialty programme is a run-through pathway; candidates apply at ST1 level, following 2 years of Foundation Training and full GMC registration. It is important to note that as the specialty is not limited to medics, competition for training posts is high; applicants from non-medical backgrounds are often highly qualified. In addition to these requirements, a Masters in Public Health is a desirable quality. Those who have completed this or with other appropriate experience may have a reduced ST training time.

The training programme is split into 3 phases; Phase 1 (ST1/2) is focused on developing a sound knowledge base, Phase 2 (ST2/3) includes an attachment at the Health protection unit, and in Phase 3 (ST3-5) trainees undertake postings in special interest areas.

Recent recommendations by the Centre for Workforce intelligence are that there will be no changes to the number of training posts at ST1 level in the next 3 years. In 2010, 74 posts for ST1 training were available in total, all of which were filled.

The Future

Public Health is a specialty undergoing huge amounts of change. The formation of the new integrated Public Health England service (an amalgamation of the current Health Protection Agency and the National Treatment Agency for Substance Misuse) will shift control of health services from Primary Care Trusts to Local Authorities (LA). Public Health services in each LA will be lead by a

Director of Public Health, with the aim to integrate other services (such as Education and the Police) to implement appropriate changes at a local level.

Nevertheless, the threat of emerging public health crises is persistent, and the need for specialists in the prevention and management of these issues remains.

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An Overview of Sutures in Surgical Practice

Dr Katie Young, BSc (Hons), MB ChB (Hons).
Academic Foundation Trainee
North Bristol NHS Trust, Bristol.

Address for correspondence: katie.c.e.young@gmail.com

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Introduction

Suturing has been used throughout the ages to help human tissues heal, by approximating the wound edges and reducing the dead space. Historically, plant or animal fibers were used for thread and the needles were shaped from animal bone or bits of metal. In the modern era, sterilized sutures and needles have mostly replaced these materials but the essential principles remain the same.

Sutures, and the needles on which they are mounted, are available in a multitude of shapes, sizes and materials. Each material has its own unique properties, benefits and disadvantages; hence, they are tailored according to the specific requirements of the wound. When closing wounds with sutures, it is important to understand these properties to achieve the best possible healing result.

Types of Sutures

Sutures can be categorized by whether they are natural or synthetic, absorbable or non-absorbable, or if they are monofilament or braided (see glossary for definitions). In modern medicine, especially in developed countries, the vast majority of sutures are synthetic. Natural materials, such as silk, are used to secure surgical drains but other materials such as catgut have been phased out as they can sometimes invoke an inflammatory response.

Absorbable Vs Non-absorbable

Absorbable sutures such as polyglactin (Vicryl) and polydioxanone (PDS) are gradually broken down over time by various processes such as hydrolysis and proteolytic enzymatic degradation and absorbed by the body. These sutures are suitable for tissues that heal rapidly such as the stomach, bowel, bladder and subcutaneous tissues. They retain their tensile strength during the initial tissue mending process, and as tissues heal, the suture strength declines at a known rate for each material type (see Table 1). Absorbable sutures are also commonly used for subcuticular wound closure to which if done in appropriate circumstances can produce better cosmetic results.

Absorbable Sutures

Name	Raw materials	Type	Tensile strength retention in vivo	Absorption	Tissue reaction
Monocryl	Poliglecaprone 25	Monofilament	~50-60% at 1 week ~20-30% at 2 weeks 0% within 3 weeks	By hydrolysis 90-120 days	Minimal acute inflammatory reaction
PDS	Polydioxanone	Monofilament	~70% at 2 weeks ~50% at 3 weeks ~25% 4 weeks	By hydrolysis 180-210 days	Slight reaction
Vicryl	Polyglactin 910	Monofilament or braided	~75% at 2 weeks ~50% at 3 weeks	By hydrolysis 56-70 days	Minimal acute inflammatory reaction
Vicryl*rapide*	Modified polyglactin 910	Braided	~50% at 5 days	By hydrolysis 42 days	Minimal to moderate acute inflammatory reaction

Table 1: *Properties of different absorbable sutures.*

Non-absorbable sutures, synthesized from a variety of non-biodegradable materials such as nylon and polypropylene (see Table 2), are indicated for repair of tissues with slow healing times such as ligaments and tendons. They are also used in fixation of hernia meshes to reduce recurrence rates and in blood vessel repair and

vascular anastamoses with grafts where loss of tensile strength would have disastrous consequences. Non-absorbable sutures are sometimes used for skin closure, particularly where skin opposition is placed under tension or at risk of infection. In these cases, interrupted suturing technique is more frequently used as the removal of one or two stitches would not affect the wound healing process of the rest of the wound. However, non-absorbable sutures for skin closure will require removal post-operatively, usually between three to fourteen days depending on the healing potential of the patient and the location of the wound (discussed in more detail below).

Non-absorbable sutures					
Name	**Raw materials**	**Type**	**Tensile strength retention in vivo**	**Absorption**	**Tissue reaction**
Silk	Fibroin (organic protein)	Braided	Progressive degradation may lead to gradual loss of tensile strength over time.	Gradual encapsulation by fibrous tissue	Acute inflammatory reaction
Wire	316L Stainless steal	Monofilament or multifilament	Indefinite	Non-absorbable, remains encapsulated in tissue.	Minimal acute inflammatory reaction
Nylon	Polyamide 6 and 6/6	Monofilament	Progressive hydrolysis may lead to gradual loss of tensile strength.	Gradual encapsulation by fibrous tissue	Minimal acute inflammatory reaction
Ethilon	Polyamide 6 and 6/6	Monofilament	Progressive hydrolysis may lead to gradual loss of tensile strength.	Gradual encapsulation by fibrous tissue	Minimal acute inflammatory reaction
Prolene	Stereoisomer of polypropylene	Monofilament	No degradation or weakening by tissue enzymes.	Non-absorbable, remains encapsulated in tissue	Minimal acute inflammatory reaction
Expanded PTFE	Polytetrafluroroethylene	Monofilament	No degradation or weakening by tissue enzymes.	Gradual encapsulation by fibrous tissue	Minimal acute inflammatory reaction

Table 2: *Properties of different non-absorbable sutures.*

Monofilament Vs multifilament

Monofilament describes a suture made from a single strand. They glide smoothly through tissues with minimal friction, and more importantly, they do not have pockets in which microorganisms can harbor. Monofilament sutures are particularly favoured in vascular, tendon and nerve repairs. However, monofilament sutures can be difficult to handle, especially those with memory (see glossary) as they have a tendency to spring back to their original form. In order to reduce chances of knots unraveling, a minimum of five throws are required as opposed to the usual three throws in a normal surgical tie.

Multifilament or braided suture composes of several strands that are twisted together. Braided sutures have the best handling qualities, and are preferred in bowel surgery. However, their interstices can be ideal for bacteria growth that can become problematic as the suture may encourage bacteria to track into the wound. This is known as suture track sepsis. This setback can be greatly reduced by coating the sutures.

Wire sutures

Stainless steel wire sutures are only used in special circumstances such as orthopaedic bone fixation or the closure of sternotomy wounds in cardio-thoracic surgery. Stainless steel is virtually inert, but rate of steel suture breakages are relatively high due to metal fatigue.

Suture Gauge

Suture gauge or diameter of the thread was described traditionally when sutures were thicker and size 1 described the finest suture. However, as sutures became finer, the description system was taken backwards as smaller sutures were called size ‘0’, then size ‘00’ (2/0), ‘000’ (3/0) and such like. In time, these sizes were known by the United States Pharmacopeia (U.S.P.) classification system where 10/0 is extremely fine and used for delicate opthalmogical operations and size ‘0’ are thicker sutures for closing the abdominal wall. The suggested gauge of skin sutures for different body areas are described in Table 3 and the suggested suture gauge for different types of tissue repair are presented in Table 4.

Body Site	Recommended Suture Gauge	Removal of Sutures
Face and Neck	5/0 – 6/0	3 – 5 days
Scalp	3/0	5 - 7 days
Limbs	4/0	7 – 10 days
Trunk	3/0	10 – 14 days
Back	2/0 – 3/0	10 – 14 days

Table 3: *Suggested suture gage for different body areas and respective timings of suture removal.*

Tissue Repair	Type of Sutures*	Suture Gauge*
Subcuticular closure	Monocryl, Vicryl Rapide	3/0, 4/0, 5/0
Arterial Repair	Prolene	5/0, 6/0
Bowel Repair	PDS / Maxon	2/0, 3/0
Microvascular Repair	Prolene	7/0, 8/0
Nerve Repair	Nylon	8/0, 9/0, 10/0
Closure of laparotomy wounds	PDS	1/0

Table 4: *Suggested suture type and guage for different types of tissue repair.*
** Examples only. Some surgeons may have other preferences.*

Choosing the Correct Suture

When selecting sutures, the surgeon takes many factors into account such as anatomical location, the type of wound and amount of stress the wound would be enduring after surgery. As discussed above, the type of material is important. In addition, the smallest gauged suture with sufficient tensile strength to support the wound should be selected. Where cosmesis is particularly important, for example wounds on the face, several finer gauge sutures will give a better cosmesis than fewer heavier gauged sutures.

Time for Removal of Sutures

The duration that non-absorbable skin sutures are left in-situ is dependent on the part of the body that the wound is located, as various parts such as the face have a better blood supply and will heal at a faster rate, hence sutures would be required to be removed at an earlier stage (between 3-5 days). Other body parts such as the back have a poorer blood supply and tougher skin, hence sutures are left in-situ for between 10 – 14 days. Other aspects which influence the rate of healing include patient factors such as age, nutritional status, general health and immunological compromise; surgical factors include the surgical technique, the choice of suture and suture material. The recommended times for the removal of sutures in other parts of the body are suggested in Table 3.

Needles

Surgical needles are required to guide sutures through the tissues. Needles must be sharp enough to penetrate the tissue, but not cause inappropriate damage, hence an understanding of different needle types is essential for making the correct choice when suturing.

Parts of the needle

The needle is made up of various parts as illustrated in Figure 1. The point is the part of the needle that extends from the tip to where the cross-section reaches its maximum width. The body forms the majority of the needle, and the swage is where the suture is attached and is continuous with the suture. The arc length is the length of the curve of the needle and is the measurement given on suture packages. The cord length, also known as the bite width, is the distance from the point to the swage (see Figure 2). The radius is the distance from the needle body to the centre of the circle along which it curves.

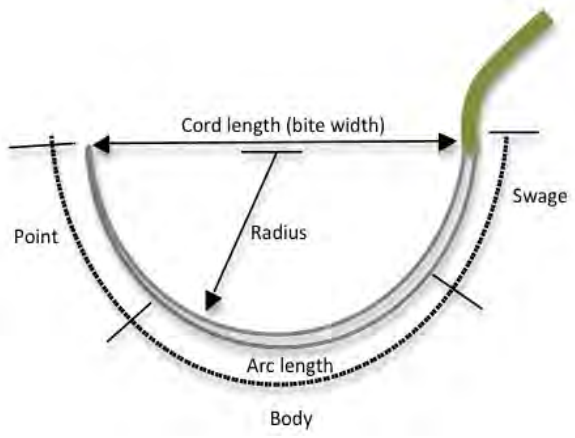

Figure 1: *The parts of a needle.*

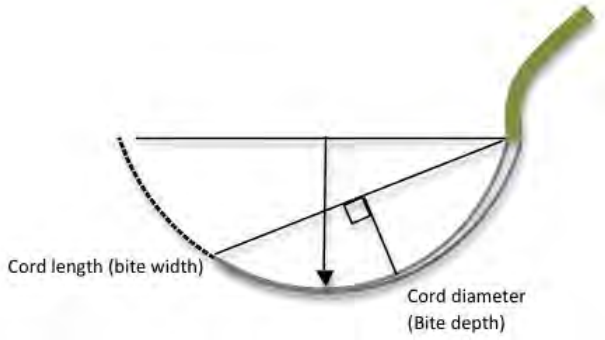

Figure 2: *The anatomy of the needle illustrating bite depth and bite width.*

Needle types

Needle types and shape vary considerably as seen in Figure 3, and their uses are described in greater detail below. Needles also come in different sizes. In general, smaller needles are required for finer work, whilst larger needles are required for penetrating and taking large bites of tissues such as closure of the abdominal wall.

Curved needles

Curved needles are usually mounted on a needle holder, and are used for most types of suturing. Some of the different types of curved needles are as follows:

- 1/2 circle needles - used for most purposes
- 3/8 circle needles - most commonly used for skin closure
- 1/4 circle needles - used for microvascular anastomoses
- 5/8 circle needles - used for hand closure of the abdominal wall
- J-needle - used for closure of laparoscopic port wounds.

Straight needles

Straight needles are hand-held and are used for mainly for subcuticular skin suturing, and securing of surgical drains. It is often quicker and more efficient to use the straight needle in closing skin wounds, but there is a slightly increased risk of needle stick injuries.

Needle tips

Round-bodied needles (Figure 4) have a smooth pointed tip that is designed to guide sutures into tissues by parting the tissue fibres to either side. They can be used for most soft tissues, such as the gut, fat or muscle. After the needle has passed through the tissue, the defect caused by the needle is filled by the suture material, which reduces leakage and is therefore useful particularly in intestinal or cardio-vascular operations.

Blunt taper point needles (Figure 5) have been designed to minimise needle stick injury risk, especially in cases where blood-borne viruses are a concern. The point of the needle is sufficient to penetrate muscle and fascia, but not skin.

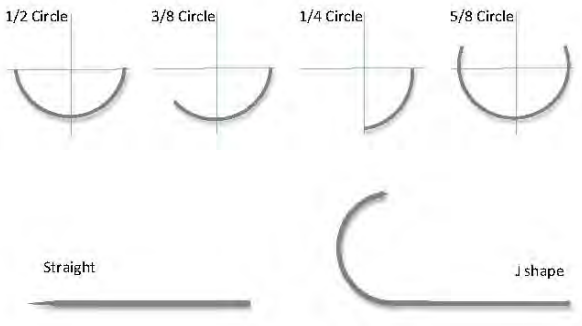

Figure 3: *Types of needle curves and bodies.*

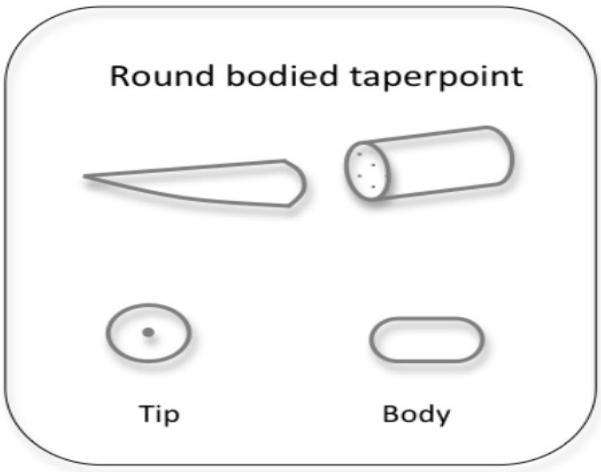

Figure 4: *Needle tips - round bodied taperpoint.*

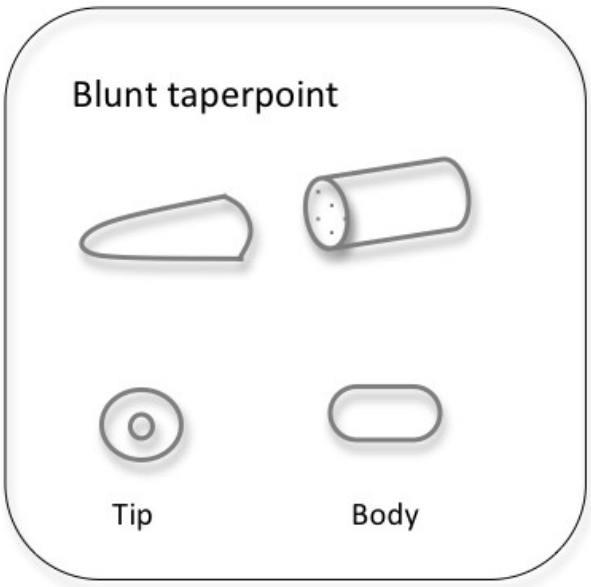

Figure 5: *Needle tips - blunt taperpoint.*

Tapercut (semi cutting) needles (Figure 6) combines aspects of both the cutting and the round bodied needles. The tip has a triangular profile but the needle then tapers out to that of a smooth round-bodied profile and are used to suture moderately tough tissues, for example atherosclerotic arteries or fascia.

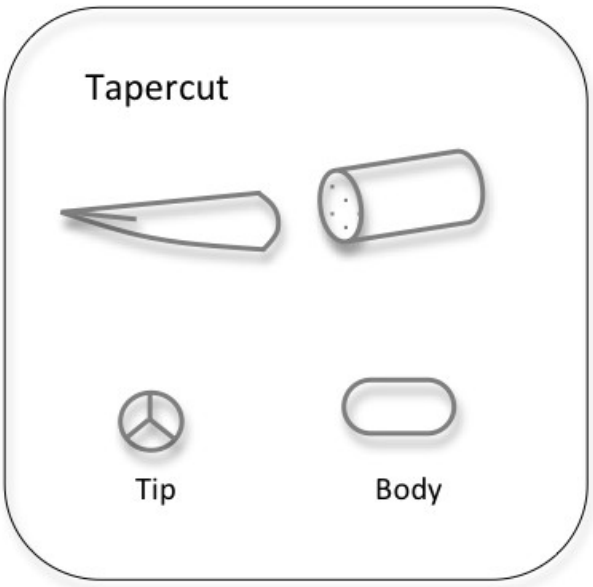

Figure 6: *Needle tips -tapercut.*

Cutting needles (Figure 7) are used for suturing tough or dense tissues, such as the skin. The curved cutting needle has three cutting edges, is triangular in cross-section with the apex of the triangle on the concave aspect of the curvature (i.e., inside surface of the needle curvature).

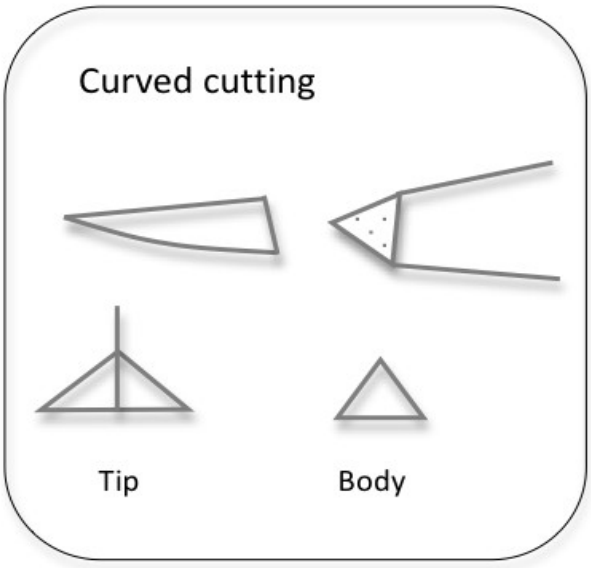

Figure 7: *Needle tips - curved cutting.*

The reverse curved cutting needle (Figure 8) is triangular in cross-section with the apex of the triangle on the convex surface (i.e., on the outside surface of the needle curve). The reverse curved cutting needle is stronger than the conventional cutting needle and has less propensity to cause tissue tear as the apex of the cutting edge is directed away from the wound.

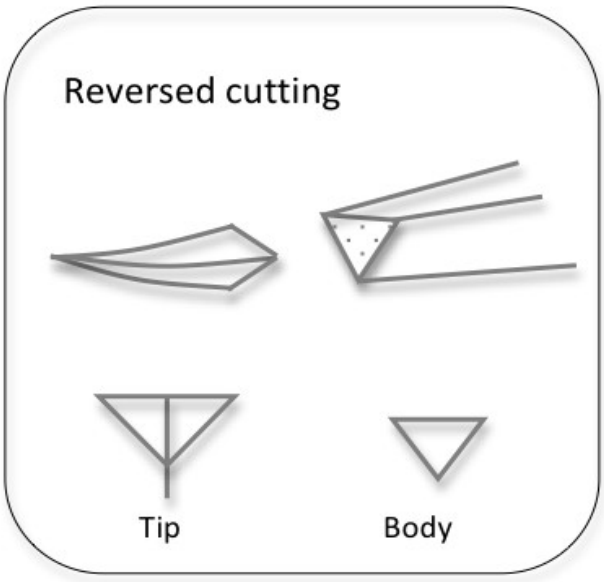

Figure 8: *Needle tips - reversed cutting.*

Summary

There are a variety of different sutures and needles. In order to select the most appropriate type, surgeons must have a working knowledge about the properties of the suture material and the rate of healing of different tissues. Although reading imparts theoretical knowledge, it is only when working with tissues and sutures that one truly appreciates these aspects.

Terms	Definition
Suture	The thread.
Needle	The sharp end to which the suture is attached. It guides the suture through tissues.
Gauge	The diameter of the suture. The greater the number, the finer the suture.
Tensile Strength	The stress (force per unit area) that a knotted suture can withstand before breaking.
Memory	The suture's inherent propensity to maintain its original form.
Braided	Suture made from several strands that are twisted together.
Monofilament	Suture made from a single strand.

Glossary.

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Operating Theatre:
Essential Concepts and Procedures

Mr Karl Walsh, BSc (Hons), MBChB
University of Manchester
Manchester Royal Infirmary
Oxford Road

Dr Jemma Boyle, MB ChB
Foundation Year Trainee
Salford Royal Hospital
Greater Manchester

Address for correspondence:
Mr Karl Walsh: mosc7kw2@doctors.org.uk

Introduction
The aim of this article is to introduce to the reader the basic but essential concepts that are part of an operating theatre set-up. As a medical student or as a junior doctor, these vital concepts are seldom explained by the busy surgical team. A firm knowledge of the basic principles will enable the student/ junior doctor to become an active participant in theatre and be able to understand the purpose and pitfalls of surgical methods. The basic concepts described within this article include: sterilisation, laminar flow, patient positioning, how to scrub for theatre, principles of tourniquet usage, diathermy, radiography and the different types of instruments used is some of the common surgical procedures.

Sterilisation
This is the most fundamental and crucial component in an operating theatre setting but frequently doesn't come to the attention of the surgical team. Sterilisation is the process whereby all viable micro-organisms are destroyed.[1] In practical terms it is measured by the probability of one single micro-organism surviving on 1 million items. The term 'sterilisation' refers to equipment and not human skin.

There are numerous methods available to sterilise surgical equipment. One such method involves the use of an autoclave. This is a piece of equipment that pressurises steam to approximately 134 degrees Celsius. The use of steam in this manner is an effective method for killing bacteria, mycobacterium tuberculosis, viruses and heat resistant-spores. The total sterilisation cycle lasts around 30 minutes. The autoclaves are regularly checked by independent organisations to reduce the risk of infection.[1]

Another method of sterilisation is incineration. This is a process whereby all materials are completely destroyed by the use of heat. This is used when a patient is suspected of having a transmissible spongiform encephalopathy (TSE), or when equipment comes into contact with high-risk tissues such as the brain, spinal cord or the eyes which increase the risks for patients to develop TSE. Therefore incineration destroys the pathogen and also the material it may have been transmitted onto. This prevents future cross contamination and hence sterilisation.[1]

A dry heat of 160 degrees Celsius is an effective method of sterilising non-aqueous liquids, air tight containers or ointments. However, this should not be used with non-stainless metals which have fine cutting edges. Finally, the use of chemical sterilisation with sterilising agents such as ethylene oxide, glutaraldehyde and peracetic acid can be employed.[1]

Theatre Set-up Including Laminar Flow
The theatre environment must be controlled in order to limit cross-contamination with micro-organisms. This involves measures such as controlling the temperature, humidity and air circulation within the theatre.

Air circulation can be controlled by vertical or horizontal laminar flow systems. Laminar flow involves a continuous flow of filtered air which passes through ventilators into the operating theatre. The system ensures that no air can travel back into the room. The air is filtered to reduce airborne micro-organisms which may cross-contaminate the sterile field. Studies have shown that the use of laminar flow reduces the rate of post-operative sepsis.[2]

Increasing the number of cycles of filtered air reduces the quantity of air-borne pathogens. With conventional operating theatres, one can expect 20-30 air changes per hour. This results in airborne micro-organisms typically in the order of 150-300 colony forming units/m^3. Laminar flow operating theatres have up to 300 air changes per hour. One can expect airborne micro-organisms to be in the order of 10 colony forming unites/m^3. [3,4]

The process was first pioneered in the 1960s by Charnley and was proven to result in a reduced number of post-operative wound infections. Normally, the temperature of the theatre is within the range of 20-22 degrees Celsius. If the temperature falls below 21 degrees Celsius, the patient is at risk of hypothermia during prolonged

procedures. For neonates, children and elderly patients, higher temperatures will be required for longer procedures. Another example is if a patient requires extensive debridement for the management of a large, dermal burn. In this instance, the temperature in theatre will be raised as burned patients can develop hypothermia.

Patient Positioning

During an operation, it is imperative that the patient is positioned correctly for a number of reasons. Firstly, the surgeon needs adequate and comfortable access to the anatomical site. The correct positioning is vital to minimise any trauma to anatomical structures. Furthermore, the position should not cause any unnecessary restriction on the patient's respiratory system. Some of the additional factors which need to be taken into consideration when positioning a patient include age, weight and the presence of comorbidities such as paraplegia.

Poor positioning may lead to nerve injury. For example, brachial plexus injury can result from stressing the patient's upper limb. Common fibular or saphenous nerve nerve damage may be acquired from poorly positioned leg supports. Careful positioning of the patient onto a comfortable operating table is important for maintaining patient safety.[5]

Pressure ulcers may also occur due to poor positioning of a patient. These tend to develop when the patient's own weight stresses a particular area of tissue for a prolonged period of time. Pressure ulcers are more likely to develop the longer the operation continues. Gel pads are commonly used to avoid pressure ulcers to vulnerable anatomical sites.[5]

There are numerous surgical positions. Each position imposes risks to anatomical structures.

Supine

This is the most frequent position used for most surgical operations, and involves the patient being laid flat on their back (Figure 1). Some of the most prominent pressure points in this position include the heel, the occiput and the sacrum.

Severe hypotension may arise if the Inferior Vena Cava is compressed against the vertebral bodies (particularly in pregnant or obese patients). Gastric regurgitation may occur, particularly in patients with a pre-existing hiatus hernia. The eye is at risk of direct or indirect trauma from the operating light causing corneal drying. This may occur within ten minutes of exposure, if not prevented appropriately.[5,6]

C8 and T1 nerve roots of the brachial plexus are predisposed to compression as these nerve roots are in close relation to the first rib, clavicle and the humerus. The risk can be reduced by preventing the patient's arm

Figure 1: *The Supine Position.*

from being abducted more than 90 degrees and keeping their forearm in pronation.[5]

Lithotomy

The lithotomy position involves the patient's legs being separated, with the hips flexed and the knees in varying degrees of extension. The legs are then supported by stirrups (shown in Figure 2). This position is utilised in gynaecological and urological surgery.

Figure 2: *The Lithotomy Position.*

Extreme flexion of the hip joints can cause neural damage by stretch (obturator and sciatic nerves) and by direct compression (femoral, peroneal and saphenous nerves).[5,6] The sites of direct compression are listed in Table 1.

Calf compression in the lithotomy position predisposes the patient to venous thromboembolism and compartment syndrome. The risk is increased if the patient's calves are held in this position for a prolonged period of time. Foot stirrups reduce the compression on the calves; however there is little evidence to show that this reduces the risk of compartment syndrome.[5,8]

Lateral

The lateral position involves the patient being laid ontheir side, usually with their arms stretched out perpendicular to the body. Their back is supported and the arm is rested on a pillow or an over-arm rest to prevent compression of the axillary neurovascular bundle (Figures 3 and 4). The lower limbs are usually flexed, with

some sort of padding between the legs to prevent saphenous and peroneal compression. This position is used for surgical access to the spine, the posterior skull or for renal procedures[5].

Figure 3: *The Lateral position. The overhanging arm is supported by a rest and a pillow is placed between the legs.*

Figure 4: *The lateral Position (Posterior aspect). A support rests against the patient's posterior trunk to hold the patient in place.*

Problems which can be encountered with this position include excess pressure on the side of the face, shoulder and breast. This position may also compromise lung expansion as the lateral surface of the ribs rest against the operating table.

Prone

Figure 5: *The Prone position. Ideally, two pillows should be placed on the chest and pelvis allowing the abdomen to move during respiration. The same effect can be achieved using a Montreal mattress or a Wilson frame to avoid compression on the abdominal wall.*

Whilst in the prone position, the entire anterior surface of the face, trunk and lower limbs face the operating table (Figure 5). This position is particularly useful for some types of spinal surgery.

Problems with this position include excess pressure on: the ocular orbit, the breasts, the genitals and the dorsum of the feet. Padding should be placed over the orbital ridges and a pillow placed over the chest and the pelvis to prevent pressure ulcers.

Pressure on the abdomen can compress the Inferior Vena Cava, reducing venous return and poor cardiac output. Ideally forearm support pads should be in place to limit the risk of ulnar nerve compression against the medial epicondyle of the humerus. There is also a risk of compression of the axillary neurovascular bundle against the humerus.[5]

Position	Pressure Sore Sites	Possible complications	Neural Damage	Mechanism of Neural Damage
Supine	Occiput Sacrum Heel	Inferior Vena Cava compression (obese, pregnant) Corneal Drying Gastric Regurgitation Severe hypotension	C8, T1	Direct compression at first rib, the clavicle and the humerus
Lithotomy	Calf Heel	DVT risk from calf compression	Obturator Nerve & Sciatic Nerve	Stretch forces from hip flexion
			Femoral Nerve	Direct compression at the inguinal ligament
			Peroneal Nerve	Direct compression at the neck of the fibula.
			Saphenous Nerve	Direct compression at the medial condyle of the tibia.
Lateral	Face Shoulder Breast	Compromise lung expansion	Peroneal Nerve	Direct compression at the neck of the fibula
			Saphenous Nerve	Direct compression at the medial condyle of the tibia.
			Brachial Plexus	Compression at the Axilla
Prone	Orbit of the Eye Breast Genitals Dorsum of the feet	Compromise lung expansion Poor Cardiac Output	Ulnar Nerve	Compression of the Cubital tunnel
			Axillary Nerve	Indirect compression against the humerus

Table 1: *Summary of the complications from different surgical positions.*

Preparing for Theatre

The scrubbing procedure reduces the cross contamination of micro-organisms that exist on the surgeon's hands, finger nails and forearms. Micro-organisms are removed by the combination of strong cleansing agents, including betadine and chlorhexidine, and a systematic cleaning procedure.

Prior to the surgical scrubbing procedure itself, you must change from normal clothes into scrubs, which are usually found in the theatre changing rooms according to size. You also need to put on theatre shoes. Most theatre staff will wear special clogs, however, if you don't have a pair of your own there are usually plenty of spares in the changing rooms – just ensure that you choose a pair without someone else's name in, as there is nothing more embarrassing than being accused of wearing your consultant's favourite shoes!

Next, you should remove all of your jewellery. The only acceptable jewellery to be worn in theatre is a plain wedding band. Some people may wear earrings, but ideally these should be removed as there is the risk of them falling out.

Once changed you should put on a theatre hat, prior to leaving the changing rooms. This should completely cover the hair. Once you get into the theatre, you will also need to put on a face mask. The most important point with the face mask is to ensure that you mould the firmer part around your nose, and ensure that it is comfortable. There is nothing worse than an uncomfortable mask for the duration of an operation, which you are unable to touch once scrubbed.

Another piece of protective clothing which is not always used is eye protection. These can come as separate pieces of equipment, or attached to the face mask. Many people will not use eye protection but it is strongly recommended, especially during operations with a lot of potential for blood exposure such as in vascular and orthopaedic procedures.

Scrubbing should take place in a designated scrub room within the theatre. At the start of a list, the scrubbing procedure should last for about 3-5 minutes. This time does not account for rinsing time. During the procedure, it is important that no contact is made with non-sterile objects. If the arms or forearms come into contact with non-sterile objects, the scrub procedure must restart. It is therefore advised that at all times during the procedure

the arms and forearms are carefully manoeuvred.

The surgical gown is packaged so that the person who is scrubbing in comes into contact with the inside of the gown whilst putting it on. After scrubbing, the hands must not come into contact with the outside surface of the gown. If this occurs, the gown will be considered as contaminated and must be discarded.

Whilst scrubbed in, the hands should be raised 20-30 degrees above the elbows, and must always be kept above waist height. The scrub person's hands are considered to be contaminated if the hands fall below the waist line. The areas of the surgical gown which are considered to be sterile are the sleeves and the front of the gown above waist height.

Surgical Scrubbing

Before starting to scrub in, it is essential to ensure that you have all of the equipment that you are going to need. This is because once you are sterile you are not allowed to touch anything non sterile. You should ensure that you have your theatre hat, face mask and eye protection on, and that your surgical gown and gloves are prepared to put on.

You should turn on the taps and make sure that the water is of an adequate temperature. You want it warm enough to lather up and remove dirt, but not so hot that it is unbearable for the length of time that you are required to wash your hands under it. There are two types of hand wash to choose from. The first of these is a chlorhexidine-based product, which may be referred to as "Hibiscrub". The alternative is an iodine-based product which might be referred to as "Betadine". The soap dispensers have levers attached to them so that once you have started to wash you are able to use your elbows to dispense the cleansing solutions. Once you commence washing, you should not use your hands to adjust the taps or dispense the cleaning solution.

If you are scrubbing in for the first time that day, you should scrub for approximately 5 minutes. This can then subsequently be reduced to 3 minutes. For the first minute, you should wash your arms and hands and then rinse. It is important to clean in a distal to proximal direction. For example, after washing your hands, you should then continue cleaning from your wrist down to your elbow. Once you have wash down to both elbows (as seen in Figure 6) you should then rinse. Whilst rinsing, you should tilt your hands up from your elbows and run your arms through the water in one direction. You should not pass your arms back and forth through the water.

You should then repeat this general wash for the second minute. During the third minute, you should clean your nails thoroughly using a nail pick and a nail brush provided as shown in Figures 7 and 8). The fourth and fifth minutes should concentrate on washing the hands. This involves making sure that you wash the dorsum and palms, in between the fingers and the wrists thoroughly. If you require more hand wash it is important to press the handles using your elbows as shown in Figure 9.

Figure 6: *Arms should be scrubbed to the point of the elbows.*

Figure 7: *A nail pick is used to clean under the fingernail.*

Figure 8: *The tips of the fingers are cleaned using a nail brush.*

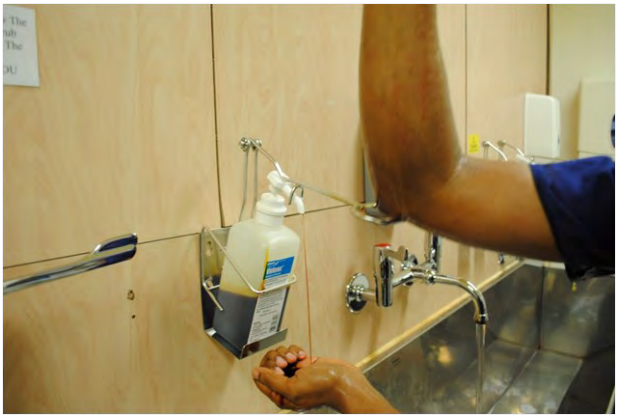

Figure9 : *The elbow should be used to press down on the lever to dispense cleaning agent.*

Once this process is complete, you should turn the taps off using your elbows only. Your arms should be positioned with your hands directly above your elbows, so that your elbow joint is forming a 90 degree angle. You should let the water drip off your arms, rather than shaking them.

Hands and arms are dried using sterile towels. You must dry one arm at a time, ensuring that you dry from hand to elbow continuously downwards, rather than returning to any sections. Once you reach the elbow, the sterile towel should be disposed of, and a new towel used for the other arm.

Now that the arms and hands are sterile, it is time to put on the surgical gown and gloves. You pick up the gown using both hands and allow it to open, ensuring that it does not touch anything else. As you are opening the gown the arm holes will become visible and you should slide your arms inside them, but keep your hands within the sleeves. A member of theatre staff will then pull the gown onto your shoulders and fasten up the ties at the back.

Keeping your hands inside the sleeves at all times, you should proceed to open up your sterile gloves and put them on (shown in Figure 10).

Figure 10: *Putting on gloves. Keep your hand within the surgical gown whilst donning the surgical gloves.*

The cuffs of the gown should be covered with the gloves because they are not water-resistant.

Finally, you must close the back of your gown. On the front of the gown, you will notice that there are some ties with a small piece of card attached to them. You should keep hold of the shortest tie, and hold the card in your hand. Give the card to a colleague, without touching them, and rotate in a circle to close the gown. Take hold of the longer tie, and secure the ties together with a knot.

Once the operation is complete, you are able to remove the protective clothing. You should start by removing the surgical gown first, followed by the gloves, and finally the mask. All should be disposed of in the appropriate bins. You should then wash your hands.

Skin preparation and draping

Prior to any surgical procedure, the patient's skin must be prepared in order to reduce the numbers of microbes on the skin surface. The cleansing solution used for this purpose needs to target a broad-spectrum of microbes, and must be fast-acting and tolerated by the patient. The patient's allergy status and surgeon's personal preference also have to be taken into account.

The main skin preparations used are either betadine or chlorhexidine, as used for surgical scrubbing. These are available in either aqueous or alcoholic preparations. The skin preparation is applied using sterile equipment starting from the centre and moving outwards.

The purpose of surgical draping is to create and maintain a sterile field. Different drapes will be used dependent on the anatomical site and the positioning of the patient.

Surgical Tourniquet

A pneumatic tourniquet is used in theatre to reduce the amount of blood loss whilst operating and also to help maintain a clear field of vision without blood obstructing the wound site. An image of a pneumatic tourniquet cuff is shown in Figure 11.

Figure 11: *Pneumatic tourniquet.*

Padding is placed around the arm where the tourniquet is to be placed (Figure 12). This is to protect the skin from trauma from the pressure of the tourniquet cuff. In local anaesthetic procedures, the patient may not tolerate the tourniquet for more than 20-30 minutes at a stretch. However when the patient is under general anaesthetic, tourniquets can be applied for longer (see below).

Figure 12: *Padding is placed around the arm before the tourniquet is put on the patient's limb.*

Tourniquets are applied at different pressures depending on the site of use and the age of the patient. In paediatrics, tourniquets are applied to children at a systolic pressure range between 140-250mmHg in the lower extremity and 155-190mmHg in the upper extremity.[9] In adults, there are two approaches for setting the tourniquet pressure. Tourniquets can be set to a fixed pressure (typically 250mmHg for the upper limb and 300mmHg for the thigh). Tourniquets may also be set at a fixed pressure above the systolic arterial pressure (100mmHg greater in the upper limb or 100-150mmHg greater at the thigh).[10] The tourniquet pressure is controlled by a tourniquet machine (Figure 13). The duration of time for which the tourniquet is to be applied is monitored by theatre staff. In principle the pressure and time of tourniquet usage should be kept at a minimum. Tourniquet use is monitored carefully because prolonged use can result in muscle fibre necrosis and micro-vascular injury leading to 'post-tourniquet syndrome'. This is when the patient has a swollen, pale, stiff limb. There is weakness however there is no paralysis.[10]

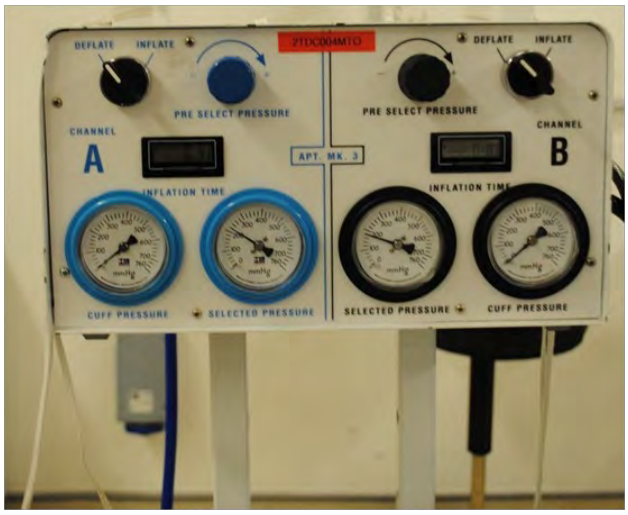

Figure 13: *Pneumatic Tourniquet machine.*

Tourniquet use is contraindicated at sites of vascular grafts and also in patients with pre-existing deep vein thromboses. Another important complication of prolonged use is tourniquet paralysis. It has been reported that in the upper limb, the median, ulnar and radial nerve distal to the elbow are vulnerable to tourniquet paralysis which can take up to 210 days post operatively to recover.[11]

The literature recommends that tourniquets are released for approximately 20 minutes after tourniquet application of 90-120 minutes. This is the point where ATP stores are depleted. The release of the tourniquet reduces the risk of ischaemic and neurological injury. The tourniquet is released for approximately 20 minutes and is then reapplied. At the end of an operation the tourniquet time should be documented.[10,12]

Tourniquet use can elicit pain in areas of muscle mass. There are various theories about the actual physiological mechanism of pain attributed to tourniquet application. One theory is that the ischaemia causes the release of local inflammatory mediators such as prostaglandins. This increases the excitation of local pain fibres. Another theory is that compression of the tourniquet continuously stimulates slowly conducting, unmyelinated, cutaneous C-fibres. Large nerve fibres are more susceptible to compression at the tourniquet site than these smaller C-fibres. The compressed larger nerve fibres are unable to inhibit the post-synaptic effect of the smaller C-fibres at the dorsal horn. This lack of inhibition of C fibres leads to the experience of tourniquet pain.[10,13]

Electrical Powering in theatre

A rigid clinical pendant system (Figure 14) is an integral part of the operating theatre. The pendent accommodates a number of electrical socket outlets, Anaesthetic Gas Scavenging Systems (AGSS) terminal units, data sockets and audio visual connectors. It can also be used to connect power drills (such as K-wiring, and a number of power saws used in orthopaedic procedures such as knee replacements).

Figure 14: *A rigid Clinical Pendent System.*

Surgical diathermy

Surgical diathermy requires the use of frequencies within the range of 400kHz – 3MHz. Low frequencies are not suitable as they can cause neuromuscular stimulation. High frequency currents enable enough energy to pass through to the tissue in order to heat up the particular area of tissue.

Monopolar diathermy involves an active electrode held by the surgeon which receives the high frequency current from a diathermy generator. Monopolar diathermy requires a complete circuit to be formed. The circuit consists of an arc between the active electrode, the patient's tissues and an active plate which is positioned underneath the patient. The circuit is completed by being connected back to the generator.

The monopolar diathermy device is able to cut through tissue via a continuous current or coagulate via a pulsed current. Tissue is cut through processes of initial dessication (cellular water is vaporised) and rapid tissue heating causing cells to destruct. Coagulation is possible as the pulsed signal seals the blood vessels without causing tissue disruption. In order to cut, the yellow button is pressed to produce a continuous output from the diathermy generator. In order to coagulate, the blue button is pressed to produce a pulsed output from the diathermy generator (Figures 15 and 16).

Monopolar diathermy can lead to burn complications. If a patient is not in full contact with the active plate then an incomplete arc exists. If the patient were to be in contact with a metal object, for example an intravenous drip stand or electrocardiogram electrodes, then this would complete the arc and result in a burn injury at the site where contact is made.

Figure 15: *Monopolar diathermy device. The yellow button cuts and the blue button coagulates.*

Figure 16: *A diathermy generator.*

Bipolar devices (Figure 17) are used for coagulation purposes and they do not require an active plate. Currency passes from each limb of the forceps and heats the tissue held between the two limbs. Bipolar devices are unable to cut through tissue. This is because there is no active plate and so a continuous arc cannot be formed between the electrode and the tissue, but instead between the two limbs of the forceps. Bipolar devices also cannot cut as the heat generated is insufficient to cause explosive vaporisation. For safety purposes the bipolar device is active once a foot pedal is pressed by the operating surgeon. Only when the foot pedal is pressed the device is able to be used (Figure 18).

Figure 17: *A Bipolar diathermy device (forceps).*

There are known complications of diathermy use in patients with a cardiac pacemaker in-situ. If diathermy is used near to a cardiac pacemaker, there is the chance that it may accidentally lead to contact between the active electrode and the pacemaker. If this happens, it may result in myocardial damage and lead to a cardiac arrest. Furthermore, the diathermy current can affect the circuits of the pacemaker which may lead to arrhythmias.[15]

Figure 18: *A Bipolar foot pedal.*

Finally, it is also important to take care with the application of alcohol gel when diathermy is going to be used. This is because alcohol gels are highly flammable and so if they are used at the site of a surgical wound, the diathermy could potentially ignite the gel and the skin underneath and surrounding it. If alcohol gel is applied, it should be placed away from the surgical site, or rubbed thoroughly into the patient's skin.[10]

Radiography

Radiography is used within many surgical specialities. X-rays are useful diagnostically as they allow the surgeon to image the bone during a surgical procedure. However X-rays are a source of ionising radiation. Overdoses of ionising radiation can lead to serious effects ranging from a mild burn to malignant diseases like leukaemia.

In order to regulate the use of X-rays and prevent such incidents, government guidelines have been published. There are two main regulations. The first is the Ionising Radiation Regulations 1999 (IRR99) which is to protect the staff from over-exposure to radiation. The second is the Ionising Radiation (Medical Exposure) Regulations 2000 (IRR(ME)2000) which is implemented solely to protect the patient.[1]

It must be clarified that the patient receives a low dosage of ionising radiation from each X-ray. Subsequently a patient has an extremely low risk of developing any unwanted effects from a single X-ray. However there is no 'safe' dose as every exposure can potentially cause some amount of tissue damage. Therefore the principle of 'As low as reasonably achievable (ALARA)' should be implemented. This means that the dose is as low as possible in order to obtain a perfect X-ray and ensuring that a repeat of the X-ray is not required.[1]

Staff members are at risk of over-exposure to radiation from the numerous radiographs taken in theatre over the course of many years. Therefore staff must wear protective jackets for each patient undergoing radiological investigation. Additionally, staff will wear a personal monitoring dosimeter which is processed in order to determine the value of the dose of ionising radiation the staff member has been exposed to.

The hospital appoints a Radiation Protection Adviser (RPA) who is a medical physicist who advises on staff and public safety in regards to IRR99. The RPA ensures that there are adequate contingency plans in case there is a malfunction with one of the X-ray machines.

When an X-ray is to be taken, the X-ray machines will flash a red light and an audible buzzer will signal the exposure time. Staff members without protective jackets should stand a minimum of 2 metres away from the X-ray machine, or ideally leave the room whilst the X-ray machine is in use.

All machines are serviced every 3 years to ensure that they are working safely. If there is an incidence in which a staff member receives a dose of 6mSv or greater or 30% greater than the dose limit, they should contact the dosimetry services.[1]

WHO Surgical Safety Checklist

In industrialised countries the rate of perioperative death for inpatient surgery is 0.4-0.8% and the rate of major surgical complications is 3-17%. It has been reported that half of major surgical complications are avoidable. It has been shown that the implementation of practices to reduce surgical-site infections and anaesthesia-mishaps have improved the rate of complications. Additionally, it has also been reported that highly co-operative team work also reduces the rate of complications .The World Health Organisation (WHO) introduced the WHO Surgical Safety Checklist. This checklist is designed in three parts.[17]

The first part is the 'sign in' checklist which is checked prior to the implementation of anaesthesia. This includes confirming the correct identity of the patient and also the correct site of surgery and whether consent has been granted. Pre-operative risks are also assessed, including the risk of the patient bleeding greater than 500ml, the risk of aspiration and the risk of anaphylaxis to medication.[17]

The second part is called 'time out'. This part of the checklist is performed prior to the surgical incision. Similar to 'sign in' the identity of the patient, the site of the operation and the correct procedure is checked. Following this, the surgeon, the anaesthetist and the nursing staff consider the possibilities of complications from the procedure. First, the surgeon considers the length of the operation or anticipated blood loss. The

anaesthetist considers whether there are any possible safety concerns in regards to the procedure. Finally, the nursing staff determine whether there are any issues with the operating theatre machinery and that a sterile field has been created for the procedure to take place. Additionally checks are performed whether the patient has been given prophylactic antibiotic within 60 minutes of the procedure.[17]

The final part is the 'Sign out' phase. This part of the checklist must be performed prior to the patient leaving the operating room. The surgeon, the anaesthetist and the nurse review any concerns they had. The nursing staff count (and later document) the numbers of swabs, scalpel blades and needles used in the operation. They also establish whether there were any problems with the operating machinery. Additional checks are performed to ascertain if prophylactic antibiotics have been administered within 60 minutes of the procedure, if applicable.[16,17]

Numerous studies have confirmed the efficacy of the WHO surgical safety checklist and that since its implementation there has been a reduction in the incidence of avoidable major complications during surgery.[16,17]

Surgical Equipment

This section will describe only the commonly used instruments in the operating theatre. Due to the many variations of instruments used between specialities, detailing all instruments is not within the remit of this chapter. The basic surgical equipment includes: scalpel handle and blades, forceps, needle holders, scissors, artery forceps, retractors and towel clips.

Scalpel blades and handles vary in size. In surgery, the most commonly used blades are sizes '10', '11', '15', '20' and '23' (Figure 19). A size '10' blade has a curved cutting edge and is used to make small surgical incisions in skin and muscle. It can also be used for more specialised types of procedures such as radial artery harvesting and inguinal hernia repair. A size '11' blade is a triangular shaped blade. It has a sharp tip ideal for making stab incisions and a flat cutting edge, ideal for chest drain insertion or opening of coronary arteries. A size '15' blade has a smaller cutting edge. It is ideal for making small and precise dissections, for example, excision of skin lesions. And finally a size '20' blade is similar in shape as a size '10'. It is used for larger incisions for general and orthopaedic procedures requiring large incisions e.g., an open laparotomy. A size '23' blade is 'leaf shaped'. It is used to make long incisions such as an upper midline incision of the abdomen.

The different blades are able to fit onto a scalpel handle (Figure 20). It is imperative that you take care whilst attaching the blade onto the handle. You should not grip the blade with your fingers but instead you should use a pair of forceps.

Figure 19: *(From Left to Right) Number 10,11,15,20,23 scalpel blades.*

Figure 20: *Scalpel handle.*

The two main types of forceps include serrated (Figure 21) and toothed dissecting forceps (Figures 22 and 23).Toothed forceps are known by this name as it has interdigitating teeth which holds tissue without it slipping (Figure 23). It is used to handle skin and dense tissue. Serrated forceps are used to handle and move delicate tissues during exploratory surgery without causing trauma. The surgeon holds forceps with his thumb on one side of the forceps and exerts pressure (in order to grip the tissue) onto the other arm of the forceps held in place by the index finger of the hand. It is also worth mentioning Babcock's forceps as in a similar nature to serrated edged forceps these also permit the handling of delicate tissue (Figure 24). It is held in a similar way to a pair of scissors or needle holders, to ensure a more

Figure 21: *Serrated edged forceps.*

Figure 22: *Toothed forceps.*

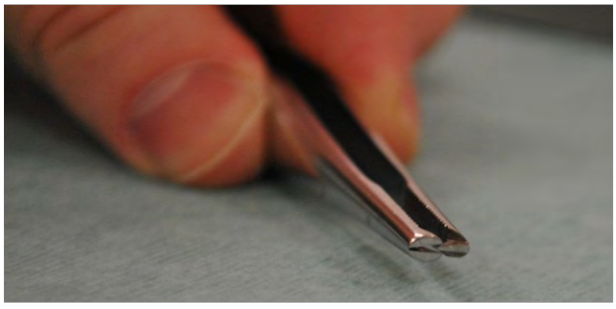

Figure 23: *The interdigitating teeth of the toothed forceps.*

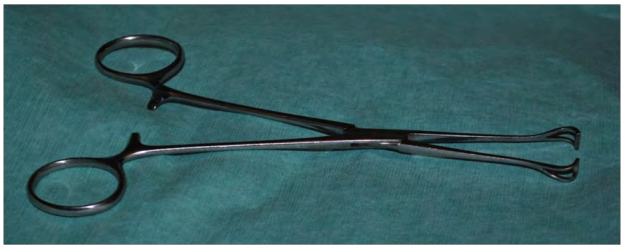

Figure 24: *Babcock's forceps.*

comfortable, firm grip of the tissue.

Artery forceps (Figure 25) are used to limit blood loss in theatre. Most types have a serrated edge that allows for a firm hold onto the artery. They are used to grasp onto an artery before it is ligated using a bipolar diathermy. There are different types, varying in size and shape. This is to suit the size of an artery that is to be held in place by the forceps (Figure 26).

Figure 25: *Artery Forceps.*

Figure 26: *Artery Forceps (From Left to Right) Halstead Mosquito Artery Forceps; Kocher Artery Forceps; Moynihan Artery Forceps; Rochester Artery Forceps; O'Shaughnessy Artery forceps.*

Needle holders are used in suturing. The needle holder has 4 key parts: the jaws, joints, the clamp and handles (Figure 27). The suturing needle is held in place between the jaws. The correct way to hold needle holders is thus; the index finger is positioned below the joint, whilst the thumb and ring finger are placed within the rings of the handles. This is shown in Figure 28.

Figure 27: *(From left to right) Debakey's needle holder, Kilner's needle holder.*

Figure 28: *The correct position to hold needle holders.*

Harold Gillies, one of the founding fathers of modern day plastic surgery, invented a needle holder which has scissor blades beneath the jaws (Figure 29). This is useful as a surgeon does not need to put down the needle holder or ask an assistant to use scissors to cut the suture thread after tying a knot.

Figure 29: *Gillies' Needle Holder. Note the scissors blades below the jaws of the needle holder.*

There are numerous types of scissors used in theatre. The main types are sharp ended and blunt ended scissors (Figures 30 and 31). In most surgical trays are the Mayo and the McIndoe scissors (Figure 31). These two types are blunted ended scissors. The Mayo scissors are used to cut sutures whilst the McIndoe scissors are used to dissect through tissue. The hardness of the scissors is important to a surgeon because scissors with harder edges stay sharp for longer and ease cutting through tissue or sutures. Different materials are used to ensure this: stainless steel or tungsten carbide. Scissors are held in a similar way to needle holders with the thumb and ring fingers passing through the rings of the scissors, the index finger supporting the shaft of the needle and the middle finger resting on one of the rings providing support.

Figure 30: *Sharp-ended scissors.*

Figure 31: *Blunt-ended Scissors. (From Left to Right) Mayo Scissors, McIndoe Scissors.*

There are too many different types of retractors to describe within this section. The two main types of retractors that will be discussed are self-retaining retractors and hand held retractors. Self-retaining retractors separate both edges of the tissue being excised (Figure 32). It has a ratchet mechanism that holds the two edges of the wound in place which frees up a surgeon's hand for him/her to use other equipment. The Mollison self-retaining retractor is commonly used for small skin incisions e.g., hand surgery, whereas Mayo-Adson and Cone self-retaining retractors are used to retract larger areas of tissue in neurosurgery for laminectomy procedures.

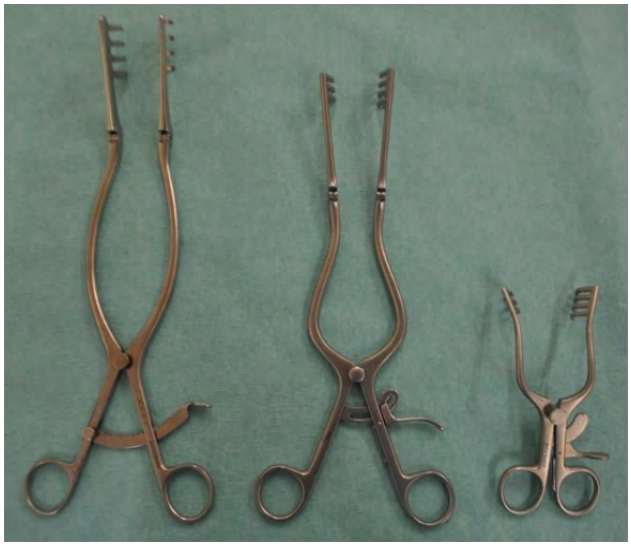

Figure 32: *Self-retaining Retractors. (From left to right) Mayo-Adson retractors; Cone retractors;Mollison retractors.*

Hand held retractors are used to hold other tissues and organs in place, improving the field of vision for the surgeon whilst operating. Usually the assistant in the operating theatre uses the retractors whilst the lead surgeon operates. The more commonly used types are: the Langenbeck retractor, Kilner's cheek retractor used in Oral and Maxillofacial surgery, Landon's and Doyen's retractor are both used in Obstetrics and Gynaecology, and skin hooks used mainly in plastic surgery (Figures 33 and 34). It is imperative that when you hold skin hooks that you do so with the utmost care in order to prevent an injury to yourself or a colleague. These instruments can lacerate skin with only a small amount of force.

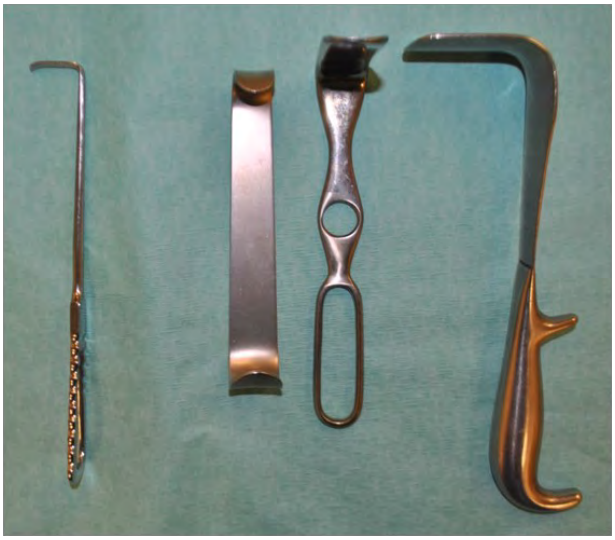

Figure 33: *Hand held retractors (From left to right) Langenbeck retractor; Kilner's cheek retractor; Doyen's retractor.*

Figure 34: *Skin Hooks. (From Left to Right) Kilner's Double skin hook; Gillie's skin hook.*

Figure 35 shows a surgical mallet and chisel. These instruments are mainly used in orthopaedics and both vary in size. These instruments can be quite heavy. It is important to hold them with a strong, firm grip in order to prevent dropping them and injuring a colleague's foot. Towel clips are used to secure the drape over the patient. The three main types Schaedel, Backhaus and Mayo's towel clips are shown in 36. Also the scrub nurse will also prepare antiseptic cleaning solution in a pot and attach a sponge to sponge holding forceps for the surgeon to clean the surgical area. In Figure 37, Rampley's sponge holding forceps are shown.

Figure 35: *(From left to right). Chisel and Mallet.*

Figure 36: *Towel Clips. (From left to Right) Schaerdal towel clip; Backhaus towel clip; Mayo's towel Clip.*

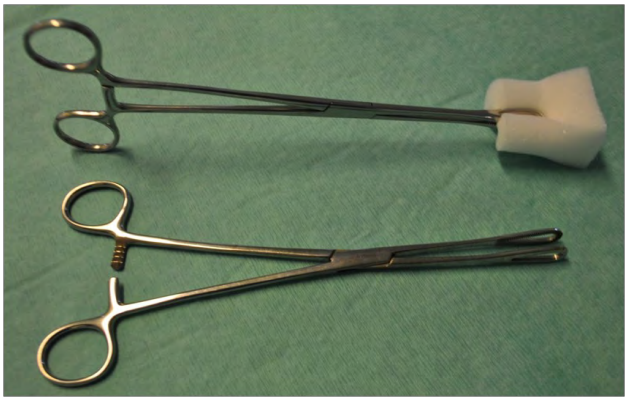

Figure 37: *Rampley's sponge holding forceps.*

Conclusion

In conclusion, there are numerous, important basic concepts about the operating theatre a student or a junior doctor must be aware of. Knowledge about diathermy and surgical instruments will allow the reader to identify these items in theatre and understand why they are used. Understanding the safety protocols of radiography and the WHO checklist will allow the reader to be safe within theatre but understand about patient safety also. Finally, this article teaches the reader how to scrub up for theatre. This will hopefully allow the reader to enhance and consolidate their surgical experience.

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An Introduction to Orthopaedic Surgery

Mr Hasan Mohammad
4th Year Medical Student
University of Manchester.

Mr Muthu Jeyam, MBBS, MRCS, M.Phil, FRCS (Tr & Orth)
Consultant Shoulder and Upper Limb Surgeon
Honorary Senior Lecturer
Salford Royal University Teaching Hospital.

Mr Rajat Verma, MSc, FRCS (Tr and Orth)
Consultant in Spinal Surgery
Salford Royal Foundation Trust and The Royal Children's Hospital.

Address for correspondence:
Mr Hasan Mohammad:
hasan.mohammad@postgrad.manchester.ac.uk

Orthopaedics is a surgical speciality that focuses on the treatment of injuries and abnormalities of the musculoskeletal system. This encompasses the bones, joints, muscles, tendons, nerves and ligaments, which are functionally required for a reasonable standard of life.

The term Orthopaedics is derived from the Greek language with 'Orthos' meaning straight/correct and 'paidion' meaning child. Although today Orthopaedics is not limited to paediatrics it includes people of all ages along with various sub specialities such as hand surgery, shoulder and elbow surgery, lower limb surgery, knee surgery, foot and ankle surgery, spinal surgery and trauma surgery.

It is a very rewarding speciality that provides the opportunity to address the clinical morbidity that has limited the patient's function and mobility, and restore the function. A common example is that of osteoarthritis of the hip joint, which makes gait both painful and restricted. Yet most patients who are treated surgically and have good physiotherapy follow up have excellent pain relief and mobility.

However Trauma and Orthopaedics is not a speciality for everyone. It demands sound diagnostic and surgical skills along with good spatial awareness, 3-dimensional reasoning, thinking and communicating effectively under pressure, and to work in a physically and intellectually challenging environment.

Life as an Orthopaedic Surgeon

Each day typically begins with an early morning ward round at about 7.30 am to examine patients who were operated the previous day and to monitor their recovery. Following this there is a Trauma meeting that involves several members of the multidisciplinary team (MDT);

- On call team – To discuss new patients admitted to the ward overnight.
- Core surgical trainees (CT) – To understand the patient's general health and learn the general principles of management, including the surgical options.
- Speciality Registrars (ST), Registrars, Middle Grade Doctors – To formulate a surgical plan, construct an operating list, liaise with theatre and anaesthetist, and provide appropriate input in the various stages of the patient's care.
- Consultants – To coordinate the meeting, decide on the most appropriate management and be responsible for the overall care for the patient.
- Medical students – To learn the fundamentals of Orthopaedics.
- Emergency physicians (A&E doctors) – To learn how the patients they have seen the previous day are managed by the orthopaedic team.
- Radiologists – To help junior doctors understand difficult X-ray and discuss/ascertain the need for any further investigation (e.g., CT scan for fracture of calcaneum or MRI scan for knee injury).

Next there is a focused ward round to see the patients on the morning list and to ensure they have been fasted, still consent to surgery, know what the procedure involves and that the correct body part/site/side is marked for surgery.

The morning theatre list then commences at around 9am and usually finishes sometime in the early afternoon. Following this patients from the afternoon list are seen and the afternoon list commences. At the end of the list a post ward round is performed to discuss with the patient the operation that has been performed and to check patient's observations.

Elective lists include operations such as hip and knee replacements and generally finish on time. Trauma lists cover many type of injuries such as fractured femoral necks, long bone fractures, soft tissue injuries and amputations; finish times are thus less predictable.

One of the advantages of being an orthopaedic surgeon is that it is very practical, very direct, produces immediate results and there is great variety of work on different days such as;

- Outpatient clinics (elective/trauma)
- Operation sessions (trauma/elective)

- On call
- Administrative work
- Clinical governance
- Educating and apprising the trainees
- Research

An orthopaedic surgeon will spend about half their time in theatre operating with the other half doing fracture clinics, ward work and elective clinics. Although clinics may not appear as exciting as theatre sessions, the post-operative clinic consultations are incredibly rewarding as you can observe the significant and often drastic improvement of the patient's quality of life.

Throughout the life of an Orthopaedic surgeon there is emphasis on deep vein thrombosis prophylaxis as they are most common in Orthopaedic procedures and emphasis is also given to strict infection control. An example being the space like scrubs worn during hip replacement operations. The reason so much caution is taken is that infection can lead to osteomyelitis, which can completely ruin any progress and may force the implant to be removed.

However unfortunately Orthopaedics does appear to be a male dominated speciality possibly as a reflection of the lack of part time/flexible work opportunities. The British Orthopaedic Association's 2009 census indicated that females comprise of just over 12% of trainees and 4.2% of consultant workforce.

There is also the opportunity for substantial private practice in the UK enhancing income further but this is dependent on the Surgeons results and experience as well as how much they split their time between private and NHS work.

In reward for the long working hours, demanding on-calls and the opportunity for private practice, the average earning of an Orthopaedic consultant surgeon in the UK is considered to be at par or perhaps more than most other Medical and Surgical specialities.

All consultants have the option of private practice enhancing income further but this requires all the appropriate documentation to be completed with private insurance companies such as Aviva. The time a Surgeon spends on private practice must not impact on their NHS work in their agreed NHS contract. However they can alter their NHS contract to go part time in the NHS to enhance the time they spend on private practice. So there is no overall rule to how much time one can spend in private practice but it is dependent on the individuals NHS contract.

Facts and figures

The competition ratios for a selection of different deaneries are shown below.

Deanery	Competition ratios 2009	Competition ratios 2010	Competition ratios 2011	Competition ratios 2012
London	CT 1; 6:1	CT1; 7:1	CT 1; 7:1 ST3; 9.7:1	
Yorkshire and Humber deanery	CT1; 4:1	CT; 4.5:1 ST1; 6:1	CT; 2.4:1 ST3; 5:1	
North Western	CT1; 13:1	CT; 6:1	CT; 4.5:1 ST3; 10.5:1	CT: 4.6:1 ST3: 7:1
National average				ST3: 3.8:1

The fiercest competition is for ST3 (Speciality Registrar) posts with an average of 10 applicants for every post meaning commitment, understanding and a good portfolio are mandatory. However in 2012 the competition for ST3 posts dropped somewhat to 3.8 applicants per post, probably due to increased number of posts.

The Future

There is increasing emphasis on evidence-based medicine for both new and established surgical techniques and in which circumstances they should be used to maximise outcomes.

For example, there is a greater prevalence of minimally invasive surgery in Orthopaedics. In upper limb surgery, large rotator cuff tears can now be treated through laparoscopic (keyhole) surgery. This also allows greater evaluation of the shoulder during surgery. Another example is the treatment of meniscal tears of the knee. Open surgery takes several weeks to recuperate and rehabilitate the patients whereas patients can recover within 48 hours of keyhole surgery. Keyhole surgery also results in smaller scars and lower rates of infection.

Over the last decade research has been looking at tissue engineering of cartilage using different growth factors such as TGF-β, IGF-1, FGF-2, and BMP-7 aiming to replace patient's damaged cartilage. An example would involve isolating mesenchymal stem cells and then growing and differentiating them into chondrocytes in the laboratory (Figure 1). These could then be seeded onto a biomaterial matrix and re implanted into the patient. Unfortunately this is currently far from clinical practice as most of this work is being performed on animal models, which haveseveral differences to humans. Once deemed safe on animals the work would then have to be successfully translated to humans in clinical trials before being

approved for use on the general population. More recently research has delved into the understanding of tendon and ligament healing processes as little is known about their regenerative capabilities.

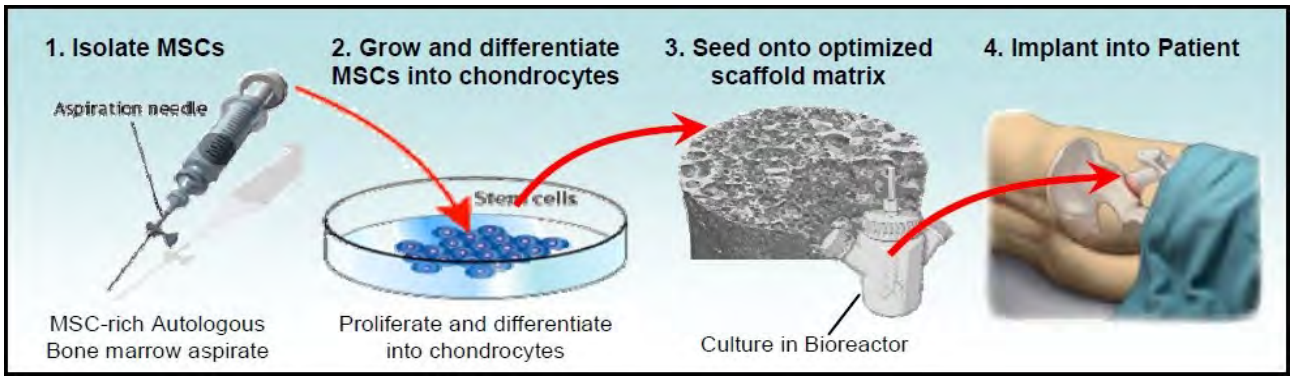
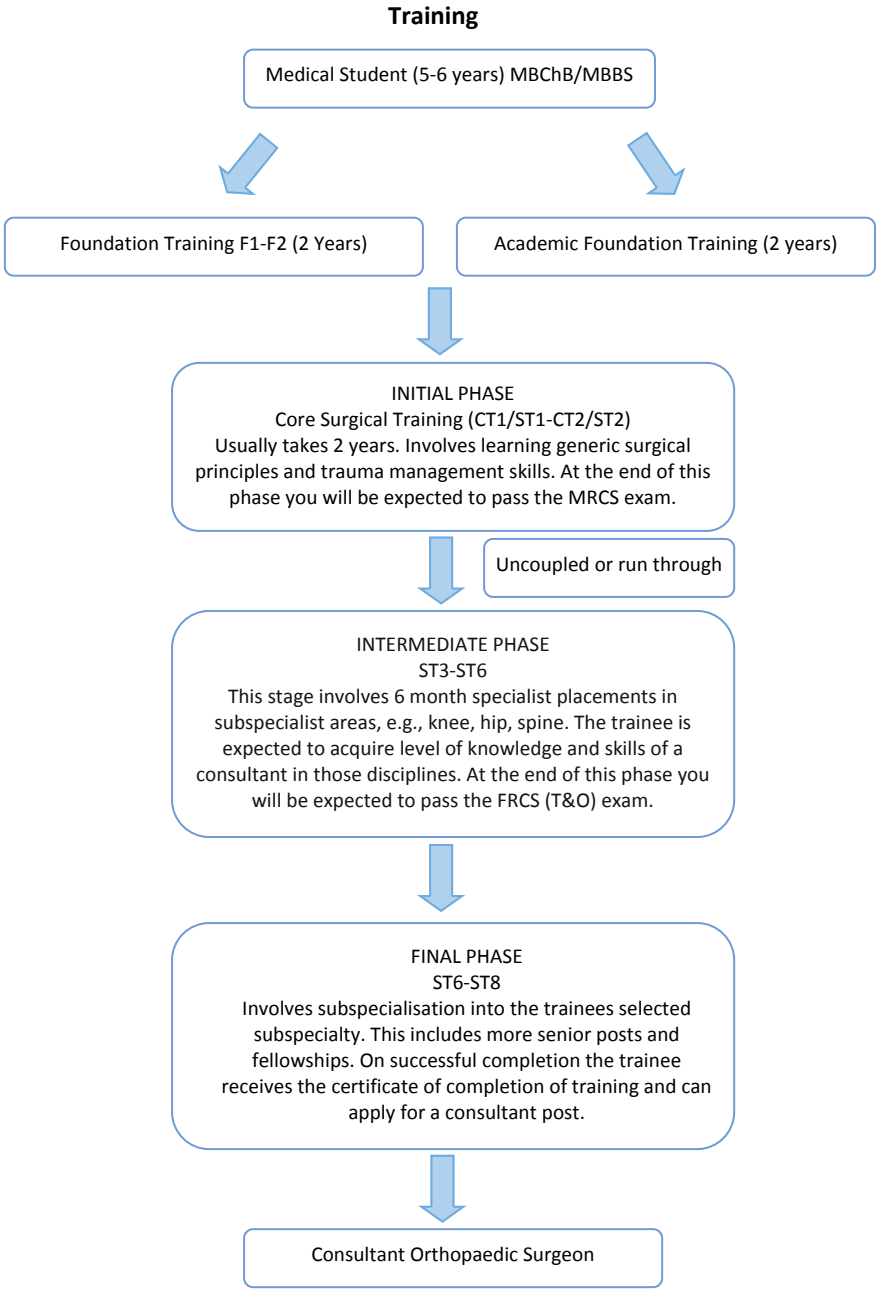


Figure 1: *Diagram summarising the potential clinical application of lab produced cartilage. With courtesy of Oseni A et al.*



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2nd Kolkata Annual Research and Medical International Congress (KARMIC), India, 2013: A Report

Mr Shubhajit Dutta
Medical Student
Bankura Sammilani Medical College
West Bengal, India
National Executive Member, Indian Medical Student Association

Dr Kalpajit Banik, MBBS
Agartala Government Medical College
Agartala, India
Senior Vice President
Indian Medical Student Association

Address for correspondence: info@karmic-imsa.in

Keywords:
KARMIC, IMSA, Doctors Academy, Robin Warren, Medical Research Conference

The term 'KARMIC' is derived from the Sanskrit word "karma", which means "deed" or "act" and more broadly means the universal principle of cause and effect, action and reaction, that governs all life, KARMIC also believes in the deed/act of exchange and sharing of knowledge to have the effect of enlightenment of the budding medical minds. Swami Vivekanda said, "let there grow a KARMOYOG among the youth." With great respect to the Indian culture, Indian Medical Students' Association (IMSA) named its annual conference as KARMIC. The previous edition of KARMIC was a huge success among the medical students and thereby established itself as one of the finest and largest undergraduate medical conferences of India. The Congress has proved to be a congregation of the upcoming pioneers of medical science of the country. It also brought together the Indian and the Global Medical students' fraternity on a common stage to bridge the gap by exchange of knowledge and experiences.

After the success of last year, IMSA had the immense task of ensuring a bigger and better KARMIC in the 2nd year of running this event in 2013. In the pursuit of excellence IMSA did what was never done before in any medical students' conference of the country. The Organizing committee created a milestone by having **Dr. John Robin Warren, Nobel Laureate in Medicine in the year 2005** for his discovery of Helicobacter pylori as the Chief Guest of KARMIC-2013.

And as it is said accomplishments are not possible without the support of others, IMSA is grateful to the Indian Council of Medical Research (ICMR), National Institute of Cholera and Enteric Diseases, IIEMS and last but, not the least Doctors Academy, UK for the support and help they have bestowed upon us in organizing the Kolkata Annual Research and Medical International Congress – KARMIC 2013.

Doctors Academy (www.doctorsacademy.org) is an International Consortium of Doctors, Dentists and Scientists that undertakes a diverse range of educational activities globally[1]. The aim of the Academy is to disseminate information, and exchange medical knowledge, technical and technological expertise between the professionals working in varied health care settings in resource-rich and resource-poor nations[1]. The relation with Doctors Academy has been special.

Doctors Academy has played a crucial role of helping us as the Knowledge Partner of IMSA since, KARMIC 2012 and then in HAMSA-2012 and now in KARMIC 2013.

This year KARMIC was hosted by Medical College, Kolkata, Asia's first medical college[2] on the 12-14 April 2013. The event was divided into workshop sessions on April 12 and paper presentations and deliberations on April 13 - 14.

Day 1- Workshop Day

Day 1 witnessed medical and dental students from different corners of the country actively take part in the following workshops:

- Problem Based Learning by Dr. Stuart Enoch, Doctors Academy, UK
- Communication Skills and CRIMP by Dr. Stuart Enoch, Doctors Academy, UK
- "Conducting Medical Research : Tools & Techniques" at NICED, Kolkata
- Dental Implants
- Laser in Dentistry at R.Ahmed Dental College, Kolkata
- Evidence Based Medicine, titled "Rememdium".
- "Artificial Intelligence in Medicine".

The workshops on PBL, Communication Skills and CRIMP were undertaken by the eminent medical educationalist Dr. Stuart Enoch. His teaching style was highly interactive, compared to the unidirectional lecturing style. Case based scenarios with real life emergencies were discussed and practical tips to deal with these situations helped consolidate knowledge that may be difficult to remember by just reading out of the textbook. The doctor-patient interaction session was particularly appealing as the audience were invited to participate actively. The Curriculum of Resource Independent

Medical Practice (CRIMP) also accomplished its aim of providing the students, the majority of whom belong to resource poor areas of India and Bangladesh, a structured framework and appropriate guidelines to undertake the best practice within the constraints of the available infrastructure and resources.

National Anatomy Challenge

Perhaps, the most awaited and the best session of KARMIC-2013 that created a lot of stir among the participants was the "National Anatomy Challenge". The 'National Anatomy Challenge for Indian Medical Colleges - 2013' was perhaps the first of its kind run by Doctors Academy in India. The first initial screening round was held in the multiple workshop venues simultaneously.

The next rounds which were organized on the second day of the conference were even more exciting as the participants gave their best effort with zeal to stream through the pre-quarter finals, quarter finals, semifinal and finals. This was done on a strict knock-out basis and

finally Mr Debmoy Ghatak from Kolkata emerged as the National Champion in the event. Doctors Academy was kind enough to award the winner with direct free entry into the World Anatomy Challenge to be held at Manchester, UK later in the year in August, 2013. In this context it has to be mentioned that this is the same competition where Ms Prachi Pophali, from Maharashtra who was the overall winner of KARMIC'12 emerged victorious in last year's World University Anatomy Challenge.

Guest Lectures

The biggest highlight of KARMIC for years to come was the keynote-lecture by Dr. John Robin Warren about his discovery of Helicobacter pylori and its role in pathogenesis of gastric ulcer. His eloquent description of the research he undertook, the initial serendipitous nature of his discovery, the early challenges, and finally the global acclaim and recognition that culminated in him winning the Nobel Prize in Physiology/Medicine in 2005 along with Dr Barry Marshall was both stimulating and captivating.

Other sessions witnessed

- An interactive session on ethics by Dr Dipanjan Mukherjee, Professor of Medicine, CNMC
- Lecture and discussion on cadaveric kidney transplant program by Dr Edwin Fernando, eminent Nephrologist from Chennai.

- Lecture by Dr. Sanjay Mehendale, Director, National Institute of Epidemiology(ICMR)
- Session on Chloroquine Sensitivity by Dr. A Mahapatra, Scientist, RMRC, Bhubaneswar
- Interesting and engaging Lecture by Dr. S. Panda, Scientist, NICED, Kolkata
- And yet another interactive session by Dr. Stuart Enoch, Doctors Academy, UK

Student Presentations

The student presentations were divided into Oral and Poster sessions where a total of 116 scientific papers and 12 case reports were presented by the medical students. All the 10 session winners were again given a second chance to present their research work on the last day of the conference to compete for the much coveted champion's trophy and a direct entry into the 5th International Medical Summer School (http://www.doctorsacademy.org/AcademyCMS/default.asp?contentID=769) and 3rd International and Academic Research Conference (http://www.doctorsacademy.org/AcademyCMS/default.asp?contentID=938) to be held at Manchester, UK in August, 2013. Mr Supreet Khare from AFMC, Pune was judged the overall winner by the esteemed panel of Judges headed by Dr. TK Lahiri, Prinicipal, Medical College Kolkata and Dr. TK Bose, Prof. and HOD, WBUHS.

Project MDM presentation

At KARMIC 2013 were also presented the results of the Phase-I of the nationwide research project carried out by Research-Wing IMSA titled Project-MDM (Malnutrition & Delayed Milestones), a Community research project[3].

In a nutshell, KARMIC 2013 was a hub of medical professionals who furnished the medical students with immense knowledge and new opportunities in the field of medicine. The overwhelming support of Doctors Academy, ICMR and Medical Students took KARMIC 2013 through its path of success…!

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Basics of Knot-Tying, Suturing and Applications

Ms Michelle Griffin, MBChB, MRes, MRCS
Academic Foundation Doctor, St George's Hospital, London
Address for correspondence: 12michellegriffin@gmail.com

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Surgical Skills, Knot Tying, Suturing, Tendon Repair, Techniques

Introduction

Suturing and knot-tying are essential skills for all doctors, not just those considering surgical specialties. The skills are also useful when lines and tubes require fixation to the skin – for example fixation of central lines and chest drains.

This article discusses the basics of suturing, knot tying and their applications including fixation of a surgical drain, repair of tendons and closure of laparotomy wounds.

Suturing Techniques

Simple Interrupted Suturing

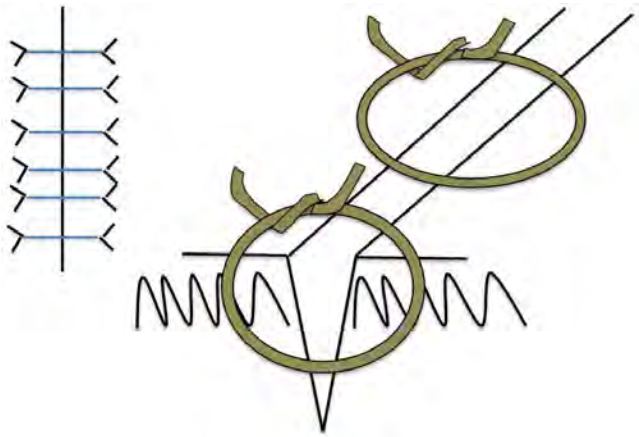

Figure 1: *Simple Interrupted Suturing Technique – separate individual sutures are placed to bring the opposing wound edges together.*

Indications

Simple interrupted suturing is the most commonly used surgical suture technique and is commonly used for closure of skin wounds. Interrupted sutures provides greater tensile strength and is particularly useful in areas where there are shear forces due to constant movement of surrounding tissues, for example, in the limbs. This suturing technique is also more forgiving as it allows the surgeon to make constant adjustments to properly align the wound edges. When a poorly placed stitch is made, it can easily be removed without having to redo suturing of the whole wound. However, simple sutures can cause a greater risk of cross-hatching (train tracks along the suture line).

Technique

As with all wound closures, it is imperative to ensure haemostasis and that the wound has been adequately cleaned and if necessary, debrided. In simple interrupted suturing, the needle is angled at 90 degrees to the skin within a few millimeters of the wound edge. The needle is passed through the superficial layer, through the middle of the wound, and in a separate bite, passed directly opposite through the opposing wound edge to exit equidistance to the wound edge as the initial entry point. A surgeon's knot is used either using a hand-tie or and instrument tie, followed by alternate throws to ensure a secure knot. The ends of the suture are then cut, leaving about 0.5cm of length at both ends. It is important to ensure the wound edges are everted and that the correct tension is applied, i.e. enough tension to approximate the wound edges but not so tight that the tissues become ischaemic. Further interrupted sutures are performed in accordance to Jenkin's rule until the wound is fully closed.

Simple continuous suturing

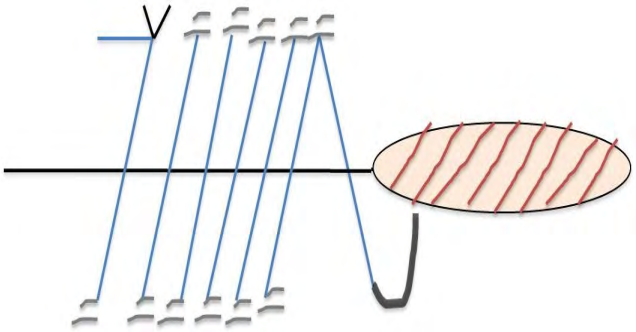

Figure 2: *Continuous suturing technique – initial suture placed as per simple interrupted technique but instead of cutting the suture, sequential bites are placed through the tissue and is only tied off and cut once the entire wound is closed.*

Indications

Continuous or running sutures are used in long wounds where deep sutures have already been placed allowing

good approximation of the wound edges. This type of suture may also be used to secure a split- or full-thickness skin graft. There should be less scarring with this technique because fewer knots are placed than with simple interrupted sutures. However, the number of needle insertions remains the same. Some of the advantages of the simple running suture, when compared to the simple interrupted suture, are the faster placement of sutures and the rapid re-approximation of the wound edges. The disadvantages include the inability to make fine adjustments along the suture line, puckering of the suture line if used on thin skin, possible cross-hatching, and the risk of dehiscence if the suture material ruptures.

Technique

The initial step of the continuous suturing technique is the same way as a simple interrupted suture, but once the needle is threaded through the tissues and tied, instead of cutting the suture, a series of simple sutures are placed evenly spaced in succession allowing tissue to gradually oppose without tying or cutting the suture material. At the end of the wound, a knot is tied between the tail end of the suture material where it exits the wound and the loop of the last suture placed.

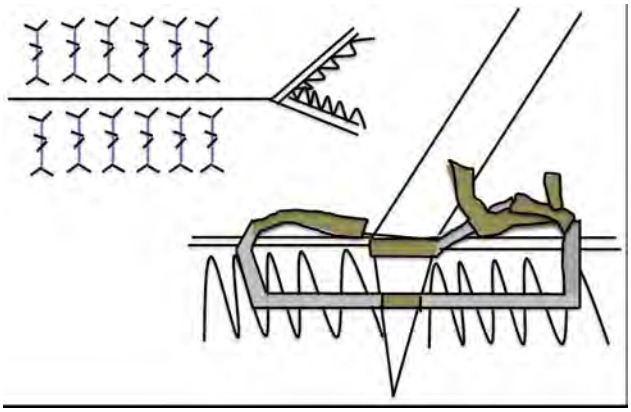

Figure 3: *Vertical Mattress Suture - initial suture placed as per simple interrupted technique, but instead of tying the suture, the needle is reversed, re-entered closer to the wound edge on the same side of the wound, and exited on the opposite side equidistance as the re-entry point to the wound edge. The suture is then tied using either hand or instrument.*

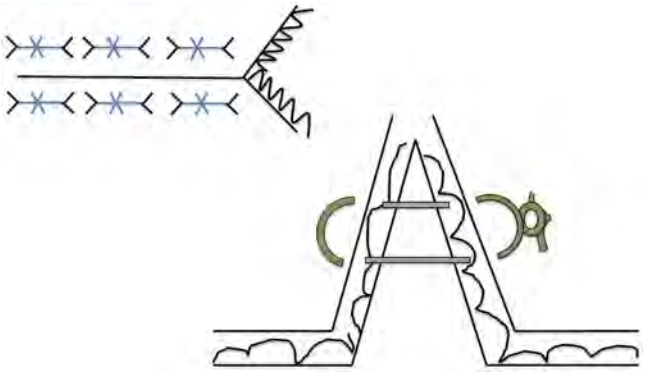

Figure 4: *Horizontal Mattress Suture - initial suture placed as per simple interrupted technique, but instead of tying the suture, the needle is reversed, re-entered approximately 0.5cm along the wound edge on the same side of the wound, and the exit point is directly opposite the re-entry point. The suture is then tied using either hand or instrument.*

Mattress Horizontal and Vertical Suturing

Indications

A vertical mattress suture is useful when maximum wound eversion and minimal tension across the wound is required. This technique can also be used for attachments to a layer of fascia. Some of the disadvantages of this suture are a high risk of cross-hatching due to increased tension across the wound and the four entry and exit points of the stitch in the skin. The horizontal mattress suture is similar, but is particularly used for fragile skin under tension where tension can be spread along the wound edge, reducing the risk of the suture cutting through the skin. Precise placement of each stitch and symmetrical bites are especially important with both these suturing techniques.

Technique

The initial bite of a vertical mattress suture begins as one would with a simple interrupted suture by penetrating the skin surface with the needle at 90 degrees and can be placed into deeper layers i.e. either through the dermal or sub-dermal layer. The needle then exits the opposite wound edge at the same distance from the wound. It is then reversed and the skin is re-penetrated by the needle on the same side but closer to the wound edge. The final

exit is through the opposing skin edge equidistance to the wound edge as the third bite, and the knot is then tied either by hand or using an instrument using the appropriate tension so as not to cause tissue ischaemia (see Figure 3). The horizontal mattress suturing technique is very similar but rather than reversing the needle closer to the wound edge, it is advanced approximately 0.5cm along the wound edge on the same side of the wound, and the exit point is directly opposite the re-entry point (see Figure 4).

Dermal-Subdermal Suturing

Indications

The subdermal technique buries the knot within the tissue and is particularly useful in deep gaping wounds where extra stitches can close the tissue dead-space and to reduce tension in skin stitches. The skin closure can then be completed by a beautiful tension-free subcuticular closure.

Technique

The dermal-subdermal suture technique is essentially a reversed simple interrupted suture, starting by taking a bite of the deep tissues with the needle curving upwards and exiting on the same side in the layer just beneath the epidermis. The needle is then reinserted directly opposite side just under the skin and exiting in the deep

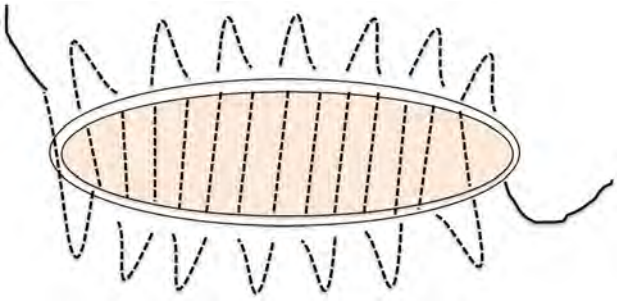

Figure 5: *Subcuticular suturing technique - The suture is secured at the apex of the wound, then horizontal sutures through the papillary dermis are placed on alternate sides of the wound in a sequential manner. Once the wound has been closed, the suture is again secured either in the form of a buried knot, with steri-strips or beads.*

tissues (similar depth to the first bite). The suture is then tied, resulting in a buried knot.

Subcuticular Suturing

Indications

Subcuticular suturing technique when done well provides an excellent cosmetic result, but should only be used when the tension and dead space are minimal. The epidermis is not penetrated, effectively eliminating the risk of cross-hatching.

Technique

The subcuticular stitch is anchored in the wound by a variety of methods, the most common being a deep dermal stitch near the apex of the wound. Beginning from the apex of the wound, horizontal bites through the papillary dermis are then taken on alternating sides of the wound. It is important that the needle penetrates the other side of the wound directly opposite the previous exit point to prevent travelling and creating a cosmetically inferior scar.

Knot Tying

Knot tying is a fundamental technique, used in every aspect of surgery from skin suturing to ligation of blood vessels to complex repairs of various tissues. The secret of tying a good knot is to ensure that it is secure and does not cause excess tension or cut through the structures it is trying to ligate. Whilst knot tying, it is important to avoid grasping the suture material with instruments (apart from the free end whilst performing an instrument tie) as this weakens the suture. In addition, monofilament suture material will require more throws, usually a minimum of five, depending on the operation.

Single handed reef Knot

A single-handed reef knot is the most frequently utilized knot in surgery. It should be practiced using the non-dominant hand, as the dominant hand may be holding the needle holder.

The figure above illustrates a step-by-step breakdown of performing a single-handed reef knot. The short end

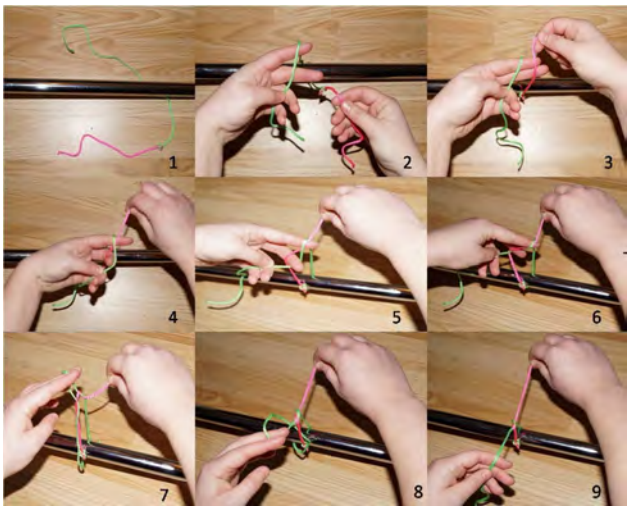

Figure 6a: *Single handed reef knot technique (first throw).*

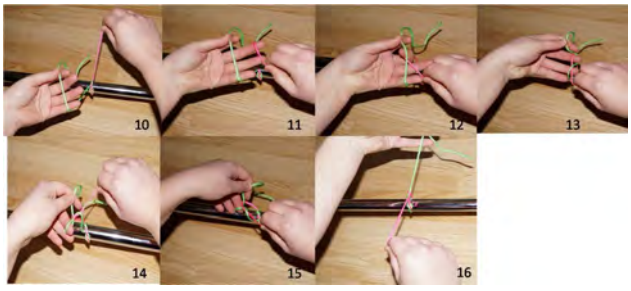

Figure 6b: *Single handed reef knot technique (second throw).*

(green) of the suture is held between the thumb and ring finger of the non-dominant hand with the palm facing upwards and the remaining length of suture draped over

the index finger. The long end (pink) should then be placed parallel to the short end over the index finger of the non-dominant hand, resulting in the formation of a loop in the suture. The index finger is then flexed in order for short end to be pulled through the loop, creating the first throw. In order for the knot to be secure, it is important to cross hands in order to ensure the knot is laid flat.

The second throw follows on from the first without releasing the previous suture ends, hence the non-dominant hand should still be grasping the short end (green). The non-dominant is supinated with the palmar aspect facing upwards, and as a result, the little finger of the non-dominant hand should be placed on top of the suture. The long end (pink) is draped parallel to the short end over the middle, fourth and fifth fingers. The middle finger is flexed and the short end is then pulled through the loop creating a second throw. A minimum of three throws is required in order for the knot to be secure.

The Surgeon's Knot

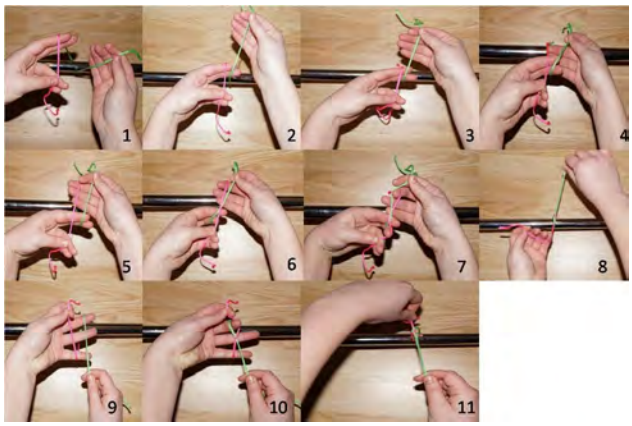

Figure 7: *Surgeon's knot technique.*

A surgeon's knot is a modified version of the single handed reef knot where two loops of the suture is passed in a single throw in order for the knot to become more secure and less easily unraveled between throws. Figure 8 illustrates a stepwise guide to performing a surgeon's knot. The initial throw begins as one would when performing a single handed reef knot. However once the short end of the suture is passed through the loop, rather than tightening the throw, the loop is held open by middle finger of the dominant hand. The middle finger of the dominant hand is then flexed so a second pass of the suture is placed through the loop. Once this throw is completed and tightened, revert to alternate reef knot throws.

Instrument tie

The instrument tie is a favoured by orthopaedic and plastic specialities as it requires less suture length. It is however difficult to perform when tying at depth. Figure 9 illustrates the steps of performing an instrument tie. The suture is looped around the needle holder. The short end of the suture is then grasped by the needle holder

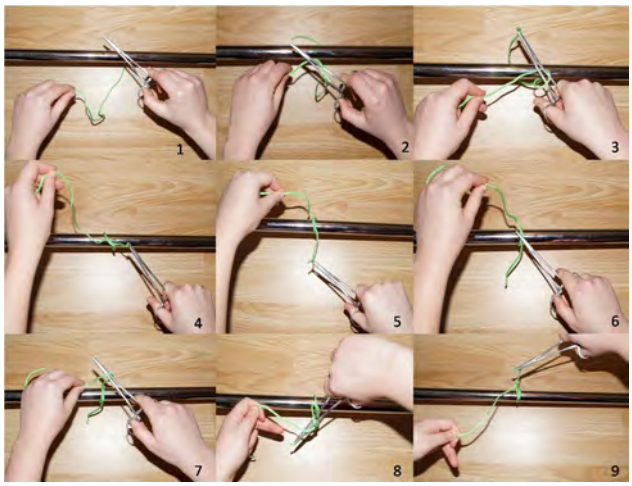

Figure 8: *Using an instrument to tie a knot*

and pulled through the loop to create the first throw. Alternate throws are performed by ensuring that the needle holder is always held over the suture so the suture material is passed in alternate directions when crossing hands as one would when performing a single handed reef-knot.

Securing a surgical drain

Surgical drains including chest drains are usually secured with a heavy silk tie, anchoring it to the skin. The simple interrupted skin stitch is placed near the drain site, then prior to it being cut, the suture material is tied securely with several ties to ensure that the drain does not fall out accidentally. It is particularly important in chest drains as if drains fall out prematurely, may result in re-accumulation of air or fluid in the chest (depending on the initial indication for placing the chest drain) and cause respiratory compromise.

Repairing a tendon

Tendon repair involves a combination of core and epitendinous sutures: core sutures to provide the main strength and epitendinous sutures to improve gap resistance and to enhance the strength of the repair[1].

Core sutures

The most common technique for placing core sutures in tendon repair is known as a modified Kessler's technique. The suture material is passed between the damaged tendon to oppose the two ends together, and is then looped outside the tendon at the non-damaged end. The suture is then reversed, passed through the opposing end with equal tension so that a greater number of suture material bridges the injured part of the tendon and hence strengthen the repair. Braided 3-0 or 4-0 non-absorbable sutures are best suited for core tendon repair, and the optimal number of suture strands is between four to six suture strands. In addition, the sutures should ideally be placed dorsally and knots should lie outside the repair site as this increases the biomechanical strength of the repair.

Epitendinous sutures

Epitendinous sutures were initially designed to improve tendon glide, but have the additional benefits of increasing the tensile strength by up to 50% and reducing the gap resistance of tendon repairs. The most commonly used epitendinous suture is a monofilament polypropylene material used either as a running locked, horizontal mattress, epitendinous or cross-stitched technique.

Sheath repair for tendon repair

The flexor tendons of the hand are enclosed by specialized digital flexor sheaths, which are often disrupted during the initial injury. Controversy exists as to whether the sheath needs to be primarily repaired as it may provide a barrier to extrinsic adhesion formation and increase the rate of return of synovial nutrition. However, apart from increasing the technical difficulties of tendon repair, there are also increased foreign material at the repair site and may even cause narrowing of the sheath and restrict the glide of the tendon. At present, there are no distinct advantages of sheath repair, and the decision lies with the individual surgeon.

Closure of a mid-line laparotomy wound

Midline laparotomy closures require careful attention to the underlying abdominal contents to ensure that these are not injured by an inadvertent slippage of the suturing needle. To date, literature suggests several ways of performing abdominal wound closure, including layered closure, mass closure technique, interrupted or continuous suturing, placement of retention sutures and the usage of different suture materials. The mass closure technique which includes all layers of the abdominal wall apart from skin and subcutaneous fat, has been shown to be faster to perform, more cost-effective and have equivalent if not better complication rates (e.g. wound dehiscence, wound infection, incisional hernia formation), hence is now the preferred closure method for most surgeons.

Technique

The abdominal contents are carefully returned to the abdominal cavity, ensuring that the bowel is in the correct orientation and covered with omentum. A plastic guard or large swab may be temporarily placed within the abdomen to protect the abdominal contents. Loop 0/0 PDS is often used on either a sharp or blunt-ended curve needle as PDS has a long half-life to allow adequate time for tissues to heal. Starting from the apex of the wound, each bite should include adequate amount of tissue from the linea alba, the rectus sheath, and if necessary rectus muscle to ensure that the suture does not cut through the tissues. Once the first suture has been placed on either side of the wound, the needle is either passed through the loop, or tied to anchor the knot, and a continuous technique under direct vision, following Jenkin's rule (1cm of tissue, 1cm between each bite) is performed. This allows an even spread of tension across the suture to minimize risk of tissue necrosis caused by excessive tension. As laparotomy wounds are often long, a second suture starting from the opposite end is required. The same technique is applied and the two sutures are tied in the middle of the wound using a minimum of seven throws, to minimize the risk of the monofilament suture being unravelled. Prior to completing the abdominal wound closure, a correct swab and instrument count must be achieved to ensure that all instruments are accounted for and that there are no outstanding material left within the abdominal cavity. The skin can then be closed most commonly with staples due to the contaminated nature of abdominal surgery.

Conclusion

In summary, this article has covered a range of surgical skills and techniques, from simple interrupted suturing and single handed reef knots, to tendon repair and abdominal wound closures. Throughout the surgeon's career, it is important to remember that even the most basic of surgical skills such as a securely placed knot with adequate tension can be the difference between an anastamosis succeeding or failing and, may, ultimately, be the difference between life and death. Although the theoretical aspects of the skills has been described in this article, there is no substitute for practicing these skills outside the operating theatre and, with time, transfer these skills onto real patients and perform successful surgeries.

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Image-based Medical Quiz"

Question: 1

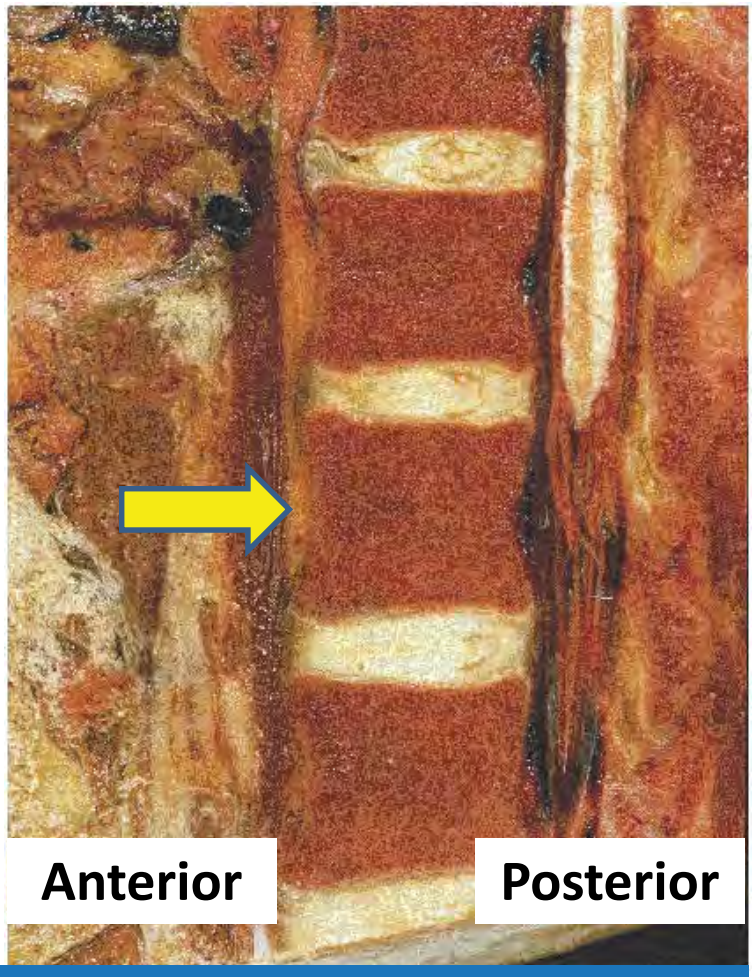
In which swimmer are the following muscles currently active?

- Piriformis
- Gemellus Superior
- Obturator Internus
- Gemellus Inferior
- Obturator Externus
- Quadratus Femoris

Question: 2

Sagittal Section of Adult Spinal Cord

Name the indicated vertebra (specific number).



ANSWERS:

Question 1: Swimmer 2
Question 2: L2 vertebra (in adults, the spinal cord ends at the level of lower border of L1)

Continued Medical Education

Question: 1 Extended Matching Question

THEME: Hepatobiliary Medicine

OPTIONS:

A. Hepatocellular carcinoma
B. Bacterial peritonitis
C. Tuberculous peritonitis
D. Peritoneal carcinomatosis
E. Budd-Chiari syndrome
F. Alcoholic liver disease
G. Nephrotic syndrome
H. Congestive heart failure
I. Constrictive pericarditis
J. Chronic Pancreatitis

INSTRUCTIONS:

For the options above, choose the most likely one for each of the clinical scenario described below. Each option may be used once, more than once or not at all.

QUESTIONS:

1. A 74-year-old man presents to his general practitioner with a 6-week history of abdominal discomfort and 'bloating'. He states that he has lost about a stone in weight in past 3-4 months and has also had some intermittent rectal bleeding. He appears mildly jaundiced. On abdominal examination, a mass is felt in the right iliac fossa. There is evidence of ascites with percussion dullness in the flanks. Plain abdominal X-ray is unremarkable but the ultrasound scan of the abdomen reveals multiple liver lesions.

2. A 59-year-old man who is known to consume large amounts of alcohol is admitted to the general medical ward with a 2-week history of confusion, jaundice and abdominal distension. On examination, he has palmar erythema, multiple spider naevi and a tense ascites. An ascitic tap reveals the ascites to be exudative in nature, with an elevated neutrophil count.

3. A 49-year-old lady of South Asian origin presents to her general practitioner with a 2-month history of tiredness, evening rise of temperature, night sweats and abdominal discomfort. She states that she might have lost about two stones in weight during this period & has problems opening her bowels. On examination, the abdomen is distended and has hyperactive bowel sounds. She also has ascites and the ascitic tap shows a high protein concentration. Plain radiograph of her chest demonstrates some evidence of right apical fibrosis. Erythrocyte sedimentation rate and white cell count are elevated.

ANSWERS: See below

EXPLANATIONS:

1. Peritoneal carcinomatosis refers to the presence of malignant cells within the peritoneal cavity. It can lead to the development of ascites. The signs and symptoms in this patient are suggestive of a colorectal carcinoma with liver metastases. Other recognized causes of malignant ascites include, carcinoma of the ovary, endometrium, breast, stomach and pancreas.

2. The history of alcohol abuse associated with the presence of palmar erythema, spider naevi and jaundice in this patient is strongly suggestive of alcoholic liver disease. Liver cirrhosis is the most likely cause of ascites in this patient. The confusion may be due to encephalopathy resulting from decompensation of his liver disease. A high ascitic neutrophil count may suggest the development of a spontaneous bacterial peritonitis.

3. Although tuberculosis commonly affects the pulmonary system, it can affect a number of other systems in the body. Intestinal tuberculosis is common in tropical countries and the patients may present with subacute intestinal obstruction secondary to small bowel adhesions. This may result in abdominal distention and hyperactive/tingling bowel sounds characteristic of intestinal obstruction. Ascites may or may not be present. The diagnosis of peritoneal tuberculosis can be made from ultrasound examination or CT scanning, which may demonstrate mesenteric thickening, ascites and lymph node enlargement. The right apical fibrosis on this patient's chest radiograph suggests chronic (or reactivation of old) tuberculosis.

Question: 2 Single Best Answer

THEME: General Pathology

Clinical Scenario:

A 63-year-old lady presents to her general practitioner with a three-month history of abdominal pain, tiredness, loss of appetite and weight loss. She also states that she has excessive sweating at night. On examination, she appears pale and weak, and her temperature is 37.8 °C. She is tender over the epigastrium and the left hypochondrium. Lymph nodes are found to be enlarged in her neck, axillae and groins. Liver function test reveals an elevated lactate dehydrogenase level. She was referred to the hospital to have an ultrasound of the abdomen, which revealed gross splenomegaly, together with free fluid in the abdomen and pelvis. There has been no history of trauma to her abdomen nor has she had any foreign travels. During laparotomy, the surgeons identified an enlarged spleen with several capsular tears & rupture and decided to do a splenectomy.

From the options below choose the ONE that you think is the most appropriate answer:

OPTIONS:

A. Carcinoid tumour
B. Kaposi's sarcoma
C. Non-Hodgkin's lymphoma
D. Infectious mononucleosis
E. Multiple myeloma

ANSWER: See below

Explanation:

The symptoms & signs in this patient are clearly suggestive of Non-Hodgkin's lymphoma, a malignancy of the lymphatic system. Approximately eighty-five percent of Non-Hodgkin's lymphomas are derived from a clone of B-cells and the remainder has a T-cell origin. Non-Hodgkin lymphoma may develop in any organ associated with the lymphatic system such as the spleen, lymph nodes and tonsils. The disease spreads from one lymph node group to another and the patients develop systemic symptoms with advanced disease. The common clinical presentations of Non-Hodgkin lymphoma include unexplained fever, night sweats, anorexia, weight loss, fatigue and the development of painless, generalized lymphadenopathy. Abdominal involvement of the disease may lead to abdominal pain, hepatomegaly or splenomegaly, nausea and vomiting. Lactate dehydrogenase levels are usually elevated in patients with Non-Hodgkin lymphoma. Ann Arbor staging criteria (Stage I - involvement of a single lymph node area; Stage II - involvement of two or more lymph node regions on same side of the diaphragm; Stage III - involvement of lymph node regions on both sides of the diaphragm +/- spleen; Stage IV - disseminated extralymphatic spread) is used to stage the disease.

ANSWERS:

Question 1: 1- D; 2- F; 3-C
Question 2: C

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