

Structure and assessment of a short intense clinical anatomy course shortly before clinical studies

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SUMMARY

In many traditional medical courses topographical anatomy has been one of the first subjects studied and, even when the courses were well related to function and clinical problems, students had forgotten much of what they have learned when confronted by the need to recall the information during clinical studies. To overcome this, anatomy learning in Oxford has been divided into a first year course, in which the underlying principles of body structure are studied, and a newly designed intensive 3-week clinical anatomy course taken just before the start of clinical studies. The aim is to ensure both that students have enough anatomy to understand the other preclinical subjects, and that they start clinical training with a high level of knowledge of those features of topographical and functional anatomy that are particularly relevant to examination of patients, diagnosis of diseases with an anatomical component, and simple clinical procedures. The course is intensive, 8 hours per day for 3 weeks. Each day has an orientation lecture and two practical sessions, each interspersed with a short lecture by a practicing clinician illustrating the clinical use of the anatomy being studied. Assessment of student progress occurs on-line

at the end of each week, with questions on normal anatomy or consequences of an anatomical lesion. One advantage of the on-line assessment has been the detailed analysis that is rapidly generated, which facilitated improvement of the question bank.

INTRODUCTION

In many traditional courses including that which existed previously in Oxford, topographical and functional anatomy was one of the first subjects studied, and many students had forgotten what they have learned when confronted by the need to recall the information during their clinical course 3-6 years later. Oxford University is committed to maintaining a very strong science base in medical studies for all its annual intake of 150 students, and maintains a separation between preclinical studies and hospital attachments. Our students complete their preclinical vocational studies and examinations in 5 of the 6 terms of the first two years of the course. They then spend the following 4 terms studying self-selected aspects of medical science through a series of alternative 'options', undertake a short research project, and are examined on this and on their ability to ana-

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lyze and evaluate unseen primary research literature in a "Medical Sciences" examination at the end of their third preclinical year. The additional year of the honours medical science course, combined with the study of topographical anatomy in year 1, made the problem of recall in clinical years particularly acute even though the anatomy and science was always related to function and clinical problems. To overcome the problem, Oxford has divided students' topographical / functional anatomy learning into a first year course, in which the underlying principles of body structure are studied in a systems-based approach, with appropriate clinical illustrations and covering various but not all regions of the body, and a newly-designed intensive Principles of Clinical Anatomy course, which the students take between their final examination in Medical Sciences in May/June and the start of clinical training in September.

STRUCTURE / DESIGN OF THE COURSE CURRICULUM

The first year course (24 weeks) occupies essentially one morning per week, with related microscopic anatomy occupying one further morning per week. It presents anatomy in a systematic way, dealing sequentially with the musculo-skeletal system, circulatory and respiratory systems, alimentary, renal and reproductive systems all linked to the teaching in other disciplines. In the second year (16 weeks of vocational study) neuroanatomy is studied in an integrated neuroscience course. Neuroanatomy practicals occupy one morning per week for 10 weeks. Students then start the 4 terms of self-selected medical science.

The new Principles of Clinical anatomy (PCA) course (which was trialed in 2003 on a small number of students reading medicine as a second degree, and introduced in 2004 for the entire cohort of 150 students) aims to ensure that students start their clinical training with a high level of knowledge about those features of topographical anatomy which are particularly relevant to the examination of patients, diagnosis of disease processes with an anatomical component, and simple clinical procedures. It takes as a starting point the fact that our students have some prior understanding of human anatomy, but need to review some aspects and to extend their knowledge and understanding body-wide. It was not

designed to cover all aspects of human anatomy but to emphasize the most clinically important features. To achieve these aims, the course is intensive: 8 hours per day for 13 days and a final review morning. Each day follows a similar pattern: orientation lecture (45 min), followed by morning and afternoon practical session (3h) each interspersed with a short (30 min) lecture by a practising clinician who illustrates the use to which the anatomy being studied will be put.

During the practical sessions, half the students study prosected anatomy, living anatomy and imaging anatomy in small groups, guided by senior staff and demonstrators (trainee surgeons); the other half study a computer-assisted learning (CAL) programme which includes descriptions, diagrams and photographs of anatomic specimens, sections, medical images (radiographs, CT, MRI, ultrasound), problem-based learning via clinical scenarios and self-evaluation questions and model answers. This is available throughout the course on the university intranet. Each element of the body is studied in relation to common clinical conditions and procedures to which it is subject. Students have a syllabus which details 'core' and other interesting applied topics and which is available on request. The 'core' material has been strongly influenced by the benchmark document issued by the Anatomical Society of Great Britain and Ireland and which is available on its web site (www.anatsoc.org.uk).

The project requires substantial teamwork. For each week, 3 members of academic staff, one of whom has responsibility for that week, and one on hand to cover gaps; 8 surgeons-in-training who act as demonstrators, and ten clinicians who give the short clinical lectures. A small team of IT specialists maintain the CAL material and deal with technical aspects of the on-line assessments.

It is, in essence, a new approach to the problem of training medical students in anatomy, as it provides a guided refreshment of knowledge acquired and needed in the first two years and a fast, condensed preliminary to clinical studies which stresses very practical aspects needed for dealing with patients, at the time when our students are about to embark on their clinical course.

The programme for each of the three weeks is illustrated in Tables 1-3.

Tables. Tables 1-3 show the timetable for the Oxford Principles of Clinical Anatomy course in weeks 1 (Table 1), 2 (Table 2) and 3 (Table 3). CAL - computer-assisted learning.

Week 1 – Musculoskeletal System & Cranial Nerves

Content; Time	Monday	Tuesday	Wednesday	Thursday	Friday
8.30 Main Lecture 9.00-9.45	Introduction Cranial nerves	Spine & back	Upper limb & Hand	Lower limb; compartments	Imaging the musculo-skeletal system
Break					
Practical: prosections; living; imaging; CAL 10.00-11.15 11.45-13.00	a) Skull b) Eye, orbit, eyelids	a) Vertebral column b) Spinal cord, spinal nerves	a) Control of hand (forearm) b) Control of hand (intrinsic)	a) Hip control, replacement b) Knee control, prostheses	a) Lower limb innervation b) Imaging limbs
Short clinical lecture 11.15 -11.45	Facial reconstruction	Degenerative disc disease & spinal injuries	Hand surgery	Limb fractures, compartment syndromes	Review period
Break					
Practical: prosections; living; imaging; CAL 14.00-15.15 15.45-17.00	a) Control of face b) Control of jaw & tongue	a) Shoulder & its control b) Elbow & its control	a) Upper limb vasculature b) Upper limb innervation	a) Ankle & foot control, injuries b) Lower limb vasculature	On-line assessment week 1; 20x5 Q in 45 min Two groups: 14.15-15.00; 15.15-16.00
Short clinical lecture 15.15-15.45	Neurological examination	Spinal & plexus anaesthesia	Upper limb nerve injuries	Vascular surgery	
Evening	Preparation; CAL	Preparation; CAL	Preparation; CAL	Preparation; CAL	

Week 2 – Cardiovascular & Respiratory Systems

Content; Time	Monday	Tuesday	Wednesday	Thursday	Friday
Main Lecture 9.00- 9.40	Functional heart anatomy	Great Vessels: aorta; carotid; vertebral; pulmonary	Anatomy of breathing	Upper GI tract: mouth, pharynx, swallowing	Imaging the chest
Practical: prosections; living; imaging; CAL 10.00-11.15 11.45-13.00	a) Mediastinum b) Heart & coronary vessels	a) Great vessels, thorax b) Great vessels: abdomen & pelvis	a) Thoracic wall & pleura b) Lungs	a) Mouth and tongue b) Jaw and chewing	Review session
Short clinical lecture 11.15 -11.45	Cardiac surgery	Vascular disease & effects	Lung disease	Imaging ear, nose & throat	
Practical: prosections; living; imaging; CAL 14.00-15.15 15.45-17.00	a) Imaging the heart b) Foetal heart, defects	a) CNS vasculature b) Extracranial head & neck vasculature	a) Nose, nasopharynx b) Larynx	a) Ear, ext/middle b) Compartments of the neck	On-line assessment week 2; 20x5 Q in 45 min Two groups: 14.15-15.00; 15.15-16.00
Short clinical lecture 15.15-15.45	Cardiovascular imaging	Stroke	Upper resp tract disease	Organisation of the neck	
Evening	Preparation; CAL	Preparation; CAL	Preparation; CAL	Preparation; CAL	

Week 3 – Gastrointestinal, Urinary & Reproductive Systems

Content; Time	Monday	Tuesday	Wednesday	Thursday	Friday
Main Lecture 9.00- 9.40	Gastrointestinal system & peritoneal cavity	Urinary & Male Reproductive System	Female reproductive system	<i>Review session on abdominal & pelvic organs</i>	<i>DR and prosectors available for revision all day</i>
Practical: prosections; living; imaging; CAL 10.00-11.15 11.45-13.00	a) Oesophagus & stomach b) Small & large bowel	a) Urinary system b) Urethra, male perineum	a) Ovaries, uterus, vagina b) Pelvic floor, female perineum		
Short clinical lecture 11.15 -11.45	Endoscopy of GI tract	Urinary system, prostate, vasectomy, testicular cancer	Obstetric anatomy in practice		
Practical: prosections; living; imaging; CAL 14.00-15.15 15.45-17.00	a) Liver & pancreas b) Anterior & posterior abdo walls; surface relations	a) Testis, vas, prostate, penis b) Inguinal region & hernias	a) Review autonomic NS b) Review lymphatic system	On-line assessment week 3; 20x5 Q in 45 min Two groups: 14.15-15.00; 15.15-16.00	Saturday: Resit on-line assessment week 3 Monday: Viva voce September: Final on-line resit assessment am Final Viva voce p.m.
Short clinical lecture 15.15-15.45	Liver failure & transplant	Renal transplantation	Breast anatomy, imaging & surgery		
Evening	Preparation; CAL	Preparation; CAL	Preparation; CAL		

The practical sessions have two principal components.

- Prosections: small groups (~6 students) examine selected prosected specimens with the help of a demonstrator;
- Surface and living anatomy, imaging (radiology, CT, MRI, ultrasound): students examine themselves and selected images with the help of a demonstrator.

In all of these sessions and in the assessments (see below) emphasis is placed on helping the students not only to acquire the relevant information but also to *use* that information in logical and deductive ways to arrive

at diagnoses and to guide simple clinical practical procedures and possible treatments.

ASSESSMENT

Student progress is assessed at the end of each week of study with an on-line set of 20, 5-part extended match or true-false questions, many of which are based on an illustration of either normal anatomy or the consequences of an anatomical lesion. All questions are extensively assessed by clinically qualified staff. All illustrations can be presented in colour, short movies can also be used as illustrations. One problem with the use of true-false and extend-

ed match questions is the need to create incorrect options. This makes it imperative to provide immediate feedback of the correct answers so that incorrect answers do not become 'learned' by the students.

The questions were marked on a simple '% correct' basis and it was intended that the pass mark should be 66% for each week. One great advantage of electronic assessment has been the detailed analysis that is rapidly generated and which informs the generation and modification of questions. In the first year of the course (2004) (see Fig. 1) marks for weeks 2 and particularly week 3 were much lower than for week 1. Careful examination of the questions revealed several questions which needed improvement and, in 2005, the marks for the 3 weeks were almost identical, though weeks 2 and 3 were just a little lower. The gap widened again a little in 2006 (in which the mean mark is also shown in the graphs below, but not in the crucial cut-off pass-fail area).

The advantages of online assessment are that marking and feedback is 'immediate'; statistical analysis of how difficult the students found each part of each question is easily generated, staff marking time is minimal and manual marking errors are avoided. Set against this, on line assessment only allows selection of an answer until text recognition is better, there is the need to generate 'false' answers, the question bank takes considerable time and effort to create (but provides for the future). We have, of course, only just started to explore the possible sophistication of on-line assessment, but it would clearly be very important to test out the impact of procedures such as negative marking of, for example, 'life-threatening' mistakes.

CONCLUSIONS

1. Students have repeatedly commented that, by the end of the course, they felt that they

had acquired the anatomical knowledge necessary to examine patients with confidence that they lacked before the course.

2. In each year, 4-6 students have scored >90% in each of the three weeks.
3. With on-line assessment, inter- and intra-examiner variability is completely eliminated.
3. Marks for the cohort of students and also for each individual part of each question are available within minutes of the end of the examination. This means that 'rogue' questions can be immediately spotted to facilitate decisions on resits/vivas.
4. More importantly, the relative difficulty of each part of each question is quantified and a bank of questions of known difficulty will enable the creation of increasingly robust assessments in the future.
5. Student feedback was very positive in all the 3 years passed (2004-2006), despite the fact that the course comes just one week after their final preclinical Medical Science examination!
6. Having seen the results, external examiners have requested that on-line assessment is used for all preclinical core examinations.

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Figure 1. Distribution of marks of the ~150 students for each of the three weeks of the Principles of Clinical Anatomy course in years 2004, 2005 and 2006.

