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ORIGINAL ARTICLE

REASONS FOR DIFFICULT TOPICS IN ANATOMY AND THEIR SOLUTIONS AS PER UNDERGRADUATE MEDICAL STUDENTS

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ABSTRACT

OBJECTIVE: To identify the topics difficult to understand in learning Anatomy and to investigate the reasons of difficulty and their possible solutions.

METHODS: This descriptive observational study was conducted at Army Medical College, Rawalpindi, Pakistan from April to November 2019. Open ended and validated questionnaires were filled by 205 undergraduate medical students at the end of their academic year to ensure that complete course of anatomy including gross anatomy, histology and embryology were covered by students. Students were asked to specify the problem area, the subtopics, give the reasons for topics being difficult and mention possible solutions they think will help them in better understanding of these difficult areas. The problems having 5 or less number of responses were not included in the analysis.

RESULTS: Embryology, histology & neuroanatomy were perceived as the most difficult areas by 89%, 62% & 61% of students respectively. Constraint of time (41% for gross anatomy & 26% for embryology), high difficulty level (35% for embryology & 29% for gross anatomy) and difficulty in differentiation of slides (34% for histology) were the main reasons for problems in understanding the topics. Use of more 3-D aids (61%) & revision classes along with written tests (39%) were commonest possible solutions for perceived difficulties by students.

CONCLUSION: Embryology has been perceived as the most difficult topic of anatomy by the students of second year MBBS followed by gross anatomy and Histology. Time constrain was suggested as main reason and Use of 3-D aids as main solution for difficulties.

KEY WORDS: Anatomy (MeSH); Embryology (MeSH); Gross Anatomy (MeSH); Histology (MeSH); Medical Students (MeSH); Neuroanatomy (MeSH); Difficult Topics (Non-MeSH).

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INTRODUCTION

Human anatomy is the science of structure and function of the body.[1] It is one of the subjects which are taught in the foundation years of medical school.[2] The subject is extensive as it is subdivided into gross anatomy which includes systemic (study organized by organ systems), regional (study based on regions and dealing with structural relationships among the parts of the body) and clinical anatomy (practical application of anatomical knowledge to solution of clinical problems)[3] along with neuroanatomy. Histology which is the science of tissues and elucidates the relationship between microscopic structure and function[4] and embryology which deals with the formation and early development, of an individual organism from fertilization of the egg (ovum) till birth.[5]

Undergraduate medical students of first two years of medical college study anatomy. This study mainly focuses on Bachelor of Medicine, Bachelor of Surgery (MBBS) students as they cover all the subdivisions of anatomy which is then applied on human subjects in clinical practice. Mostly, students in the beginning of their foundation year, face these difficulties as they are new to the course and type of study. Transition from high school to a professional college brings about a change in study pattern and methods, which students find difficult to manage. So, it is inevitable that the students do face problems in studies.[2]

Anatomy is one of the first subjects to be taught to students of all medical fields. Its subdivision into general anatomy, gross anatomy, embryology, histology and neuroanatomy makes it lengthy and difficult for students to produce as they have to cover all the aspects for better understanding of the subject. Different learning methods are available in every institution and latest techniques are also adapted depending on the applicability and resources available in a particular institution. These include lectures, demonstrations, illustrations, videos, small group discussions, dissection, and lab work. It also includes models which accurately demonstrate the structure to be studied. Radiographs are also used as and when required.[6] In embryology where 4-D models and animations are required, due to limited resources they are unavailable in most of the institutions which makes comprehension difficult. In histology, light microscopy is provided for teaching along with prepared slides.

The learning challenges faced in a particular subject not only depend on the subject and its understanding, but on the educational background of the student as well. In Pakistan, the national language is Urdu and it is used as a medium of learning and teaching in majority of the government schools as well and schools in rural areas. English is mostly taught as a subject and not as a

TABLE I: REASONS AND SOLUTIONS FOR EMBRYOLOGY PROBLEM TOPICS

Reasons	Number of Responses (Percentage*)	Solutions	Number of Responses (Percentage*)
Difficult overall	65 (35%)	More 3-D aids	114 (61%)
Not enough time given	48 (26%)	Important topics to be taught only	64 (34%)
Not exam oriented, too detailed	42 (22%)	Exam oriented teaching	40 (21%)
Lengthy	32 (17%)	More study time should be given	38 (20%)
Less lectures and study aid	26 (14%)	More lectures	25 (13%)
Rote memorization	14 (7.6%)	Revision	17 (9%)
Extracurricular activities	11 (5.9%)		

*Percentage out of those who responded

language. Only few schools in urban areas have English as their medium of instruction. For professional education in Pakistan, the standard language is English. When students from different educational backgrounds step into professional education, language barrier is also a major hindrance in understanding. Challenges with language are also highlighted in a study carried out in Bangladesh.[7]

For topics that are generally perceived difficult to understand in terms of orientation like cranial nerves, peritoneum, embryonic period; more emphasis is laid on their teaching.[6] Students are divided into small groups for discussion so that the problem can be identified and addressed individually. Clinical scenarios are given so that students should learn to apply their knowledge in clinical settings. Moreover, formative, and summative periodic assessments are also conducted. These include written examination, which has multiple choice questions (MCQs) and short essay questions (SEQs). The OSPE (Objective structured practical examination) includes identification and description of anatomical structures on bones, models and cadavers, identification of radiographic features and histological identification by viewing in microscope. Viva voce is also carried out to test the student's knowledge and grip on the subject.[6]

Medical students study anatomy as a vital subject, because to work on a human body, one needs to have thorough understanding of its structure and function.[8] Although teaching modalities have changed with the advancements in technology and the requirements of students still an appropriate method of alleviating a problem and adjusting teaching accordingly, is to ask them about the issues they face in learning subjects.

Student behaviors and seriousness towards studies should also be taken into account.[9] Students should be engaged by the teachers in identifying the challenges in learning subjects and identifying solutions to them. This study was conducted to recognize the challenging and identify problematic topics/subjects' areas in Anatomy.

METHODS

A cross-sectional descriptive study was conducted at Army Medical College, Rawalpindi, Pakistan from April to November 2019. An open ended and validated questionnaire was distributed to 205 medical students of second year MBBS of Army Medical College, Rawalpindi, Pakistan. Sample size was calculated using consecutive convenient sampling, with the reference prevalence of 90%* for difficulty topic for gross anatomy and absolute precision at 5%. Sample size was calculated using OpenEpi Software. Consent was signed by students prior to filling of questionnaire. Questionnaire was filled by students at the end of academic year to ensure that complete course of anatomy including gross anatomy, histology and embryology had been covered by students before filling the questionnaire. Questionnaire was formulated from a research article on perception of medical students of problem topics in anatomy.[6] In addition, questionnaire was also validated by the two senior medical educationists.

The study and questionnaire were approved by human ethics committee of Army Medical College, Rawalpindi, Pakistan. Complete biodata of students was requested along with 1st professional exams percentage so that responses could be related with their overall performance. Students were given a brief overview of aim of research

TABLE II: REASONS AND SOLUTIONS FOR GROSS ANATOMY PROBLEM TOPICS

Reasons of Difficulty	Number of Responses (Percentage*)	Possible Solutions	Number of Responses (Percentage*)
Not enough time	84 (41%)	Revision classes along with written tests	81 (39%)
High difficulty level	61 (29%)	Improve 3D orientation, animations, and models	79 (38%)
Extensive course	38 (18%)	More time to be given	64 (31%)
Less time for spotting	27 (13%)	Shorter lectures	19 (9.2%)
Poor 3D orientation	26 (12.6%)	Conducive environment in hostels	14 (6.8%)
Military routine	20 (9.7%)		
Few tests	14 (6.8%)	Demos in morning time	07 (3.4%)
Distracted by sports week	14 (6.8%)	Study guide	06 (2.9%)

*Percentage out of those who responded

TABLE III: REASONS AND SOLUTION FOR HISTOLOGY PROBLEM TOPICS

Reasons	Number of Responses (Percentage*)	Solutions	Number of Responses (Percentage*)
Unable to differentiate between slides	44 (34%)	Histology drawings should be removed	30 (23%)
Difficult drawings	27 (20.9%)	Mobiles should be allowed to take pictures of slides	18 (13.9%)
Mobiles not allowed.	20 (15%)	More tests should be taken	15 (11%)
Less time given	13 (10%)	More time to be given	11 (8.5%)
Mobiles not allowed	13 (10%)	Multi-head microscope should be used	11 (8.5%)
Less tests taken	08 (6.2%)	Teaching methodology should be improved	10 (7.7%)
Military routine	07 (5.4%)	More lectures	06 (4.6%)

*Percentage out of those who responded

and its importance for the students by the authors.

Questionnaire was divided into three sections, one for gross anatomy, histology, and embryology each. Students could mention topics they find difficult. Students were allowed to mention more than one topic where necessary. Students were asked to specify the problem areas and sub-topics. Limited guidance was provided by authors on the questionnaire requesting the students to be specific concerning the identification of problem topics. Give the reasons for topics being difficult. Mention possible solutions they think will help them in better understanding of these difficult areas.

Students were given ample time to fill the questionnaire in supervision of authors. After collection of questionnaires, data was sorted out and analyzed by the author herself and validated by two persons who were not involved in research. Problem topics and sub-topics that were related to each other were grouped as one topic like courses of arteries and nerves are grouped as one topic. Topics specified by students and total number of responses for these topics, possible reasons for these problems and their solutions given by students were summarized. The problems having 5 or less number of responses were not included in the table but mentioned in discussion. Data analysis was performed using MS Excel-2013.

RESULTS

Out of 205 students, 184 (89%) students perceived embryology difficult. Out of 184 students, 74 (40%) responded for embryonic period, followed by central nervous system (n=73, 39%), body cavities (n=43, 23%), urogenital system (n=28, 15%), head and neck (n=25, 13%), muscular system (n=18, 9%), gastrointestinal (n=16, 8.6%), fetal period and placenta (n=11, 5.9%), respiratory system (n=09, 4.8%), and gametogenesis (n=06, 3%). Student responses for reasons and solutions are given in (table I).

For gross anatomy, all 205 (100%) students responded with a total of 276 responses (few students gave more than one response). Neuroanatomy was perceived as most difficult area by majority of students (n=127, 61%) followed by abdomen (n=39, 19%), head and neck (n=35, 17%), upper limb (n=33, 16%), pelvis and perineum (n=31, 15%), and lower limb (n=6, 2.9%). The reason for finding these topics difficult and their possible solutions as responded by the students are presented in (Table II).

Histology was perceived as less difficult (n=129, 62%), as compared to embryology and gross anatomy. Histology of gastrointestinal system was perceived as most problematic by students (n=38, 29%), followed by reproductive system (n=31, 24%), central nervous system (n=23; 17%), urinary system (n=13, 10%), respiratory (n=12, 9%), endocrine systems (n=12, 9%), immune system (n=09, 6.9%), cell biology (n=08, 6%), cardiovascular (n=07, 5.4%) and integumentary systems (n=07, 5.4%). The reason and solutions of these problem topics, pointed out by students were given in (Table III).

DISCUSSION

Human anatomy is a field of science that studies the human body structures.[1] Anatomy is an important subject for medical students[2] and they must learn anatomy including gross anatomy, histology and embryology. Many clinical specialists consider knowledge of anatomy a prerequisite for performing safe and competent interventions in medicine.[3] Learning anatomy practically and with clinical approach is necessary for medical students to decrease the medical errors. Knowing the importance and clinical uses of anatomy, on the other hand, could help students improve their skills.[4]

Students perceived embryology as the most difficult subject (89%). Embryology being perceived as a learning challenge by the students with inability to follow and memorize the weekly changes occurring during early embryonic period thus making embryology an overall difficult subject. Our results were in contrast to the survey conducted by Kramer B, *et al.* whereby they found gross anatomy as the most difficult subject among their students followed by histology and embryology.[6] Studying embryology forms the basis for understanding the development of different systems and even the relation of viscera in gross anatomy.[10] According to students, not enough time is given to the embryology, as compared with other subjects. Students suggested 3-D aids for better spatial understanding of embryological changes. Hamilton J, et al. suggested the same 215 solution in their study conducted in Scotland.[11] On other hand, focusing only to learn the exam-oriented topics might make it easier for the students however, embryology is a subject that needs to be followed throughout in order to have a basic orientation. A block session on embryology over a period of 30 days

preferably at the start of course may be helpful in comprehending early concepts of development compared to once in a week lecture of embryology. Similar was done in a study recently done in U.K.[12]

Neuroanatomy was perceived as most difficult in gross anatomy, having a highest response rate, with cranial nerves being most difficult, followed by ventricles and cerebellum. These findings were relevant with similar study conducted by Hall S, *et al*.[13] In abdomen and pelvis, orientation of peritoneal cavity, peritoneal reflections and relations of viscera were the subtopics mostly pointed out. Osteology of skull, relations in head and neck, course, and relations of vessels in upper limb, hand and blood supply of upper limb were also found as problem areas in gross anatomy. The reason for these sub-topics lie in the fact that student consider gross anatomy as facts to be remembered as such and not to be understood by conceptualization. This concept needs to be changed by reforming our examination system which mainly rely on re-call instead of application of knowledge.[14]

Lack of time, high difficulty level and extensive course work are the reasons mostly pointed out by the students. Their solutions of more revision time and periodic written tests are in accordance with another study which pointed out the student's perception of not having enough time.[13] Another solution to problems topics is the use of 3D animations for better orientation. With decreasing number of available cadavers for dissection, 3D animation can help as one of the additional tools for better understanding of gross anatomy.[15]

Histology was not perceived difficult by most students, giving us a low response rate but those who did, they pointed out all the topics of histology as problematic which were covered in the course work. The reason pointed out by maximum number of students is difficulty in differentiating among the histology slides. From the student point of view slides might look like the same making it difficult to retain however, the problem can be solved by drawing what is seen under a microscope.[16] Students are of the view that histology drawing is a tedious job and eliminating it would solve the issue. They are unaware of the fact that drawing the histology slide is not only for exam purpose but seeing a slide and drawing it yourself is the true depiction of one's understanding of histology knowledge which has been reinforced time and again in different studies[17] and similar results were found in a latest study[18]. Lack of cell phone use is also a reason pointed out by students, without which they cannot have high quality pictures of the slides to study at home.[19]

It is important to note that the solutions given by students may not be always applicable and practical, because students do not have an idea about the resources which a particular institution has or can be arranged. Moreover, our study is limited in term of scale. We considered only a single year in our college; students' perception of difficulty may change as they move towards the clinical years. Also, we didn't compare, the year considered with same year of any other college. Whether their problem topics, reasons and solutions were the same or not, considering their teaching methodology and modalities is different than ours. These can be done in future in another study.

Including more 3-D aids will help students to improve their basic concepts of embryology. Instead of just learning the exam related topics, a brief course of embryology including all the week-by-week changes of early development will give students a better understand of embryology. For gross anatomy we need to amend our exam system, take it from recall to application level. Relying more on 3-D aids then the cadaveric dissection will not only improve their understanding of gross anatomy but will also deal with the problem of decreasing availability of cadavers. Drawing the microscopic view of histology slides will help students change the perception of all the slides looking the same and will also give them a clear concept of organization at tissue level.

CONCLUSION

Embryology has been perceived as most difficult topic of Anatomy among the students of second year MBBS followed by gross anatomy and histology. Time constrain is the main reason of difficulty. Including more 3-D aids was the proposed solution to help students with better understanding.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

KQ & MA: Conception and study design, critical review, approval of the final version to be published

SB: Acquisition, analysis and interpretation of data, drafting the manuscript, approval of the final version to be published

RabK & RehK: Analysis and interpretation of data, critical review, approval of the final version to be published

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST

Authors declared no conflict of interest

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DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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