MODERN TRENDS IN ANATOMY TEACHING

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SUMMARY

Human anatomy is a cornerstone of medical education. Traditionally it is taught by cadaver dissection and didactic lectures. Nowadays traditional teaching methods give way to new strategies which are implemented in different medical schools around the world. The tendency is to move away from “passive” learning, which lectures represent, and to introduce new forms of actively engaging the students: problem-based learning (PBL) and team-based learning (TBL). In this article we review those methods and discuss their applicability in the Bulgarian Medical Universities.

Key words: anatomy teaching, cadaver dissection, team-based learning, Bulgarian Medical Universities

INTRODUCTION

Anatomy is widely appreciated as being among the most significant components of medical education. The study of anatomy through the dissected cadaver, in addition to didactic lectures, is still viewed as a unique and defining feature of the medical curriculum. However, it may be that we are now entering a time of paradigm shift, aided by new understandings and new technologies, the traditional teaching methods give way to new strategies which are implemented in different medical schools around the world. Sometimes these new strategies are quite radical and their appropriateness and applicability is still being evaluated.

In this article, we briefly review the use of the cadaver dissection as a major anatomy teaching tool and discuss its role in the modern curriculum. Then we review and discuss other teaching methods implemented in a variety of medical schools, with an emphasis on our personal anatomy teaching experience in some of them. Finally, we discuss the applicability of those strategies in the Bulgarian Medical Universities in general and in the Medical University Varna in particular.

Cadaver dissection

Cadaver dissection has been the paradigm of anatomy teaching since the Renaissance, and the defining experience of medical teaching since the 16th and 17th centuries. At first students only observed cadaver dissections but later the so called Paris method of giving each student his or her own cadaver to work on gained popularity around Europe (17). Thus, for centuries now, dissection has been

encultured into the medical education to an extent that it has become one of its universal features.

Today the majority of published papers on anatomy teaching strongly recommend the use of dissection. Proponents of dissection generally identify a range of benefits that may spring from dissection (1,2,6). These benefits mostly fall into three categories: knowledge acquisition, skills, and attitudes.

Knowledge acquisition is the most fundamental benefit. It includes: development of cognitive anatomical knowledge and its specific vocabulary; appreciation of three-dimensional relationships and anatomical variability; laying the foundations for the study of other disciplines where knowledge of structure is essential (e.g. physiology, microbiology and pharmacology).

Skill-based benefits include developing fine motor control and a touch-mediated perception of the cadaver ? patient and developing competence in diagnostic imaging and training for the medical specialties.

Finally, in terms of attitudes, the benefits of dissection include promoting professionalism through a direct encounter with the cadaver, development of respect for the physical body, better appreciation of life and death at a higher philosophical level. Additionally, dissection promotes attitudes facilitating the ability to work in a team (9).

Among the disadvantages are health and safety issues for those handling cadaver material, the practicalities and cost of using cadavers, undesired emotional issues. Some studies have reported dissection as causing extreme anxiety and emotional disturbances in some students (3,4) and, at the other end of the spectrum, levels of desensitisation which may result in an undesirable detachment from death (20). Despite the doubts of some anatomists that dissection may not be the best means by which students can acquire and retain anatomical knowledge the overwhelming majority of
anatomy teachers and students are convinced the dissection is the paramount of anatomy and medicine. In a study of the attitudes of anatomists in Europe towards the methods of teaching best fitting a series of learning outcomes for anatomy, most anatomists (69%) favored the use of cadaveric dissection above other teaching methods (16). In the same study it is reported that human cadaver dissection gained more approval when the skills-base was considered rather than just the knowledge-base of an anatomical course. It seems that the nature of dissection, as an unique experience, may indeed have promoted the sense of a “rite of passage” in medical doctors (10). Therefore, dissection remains a fairly constant component of anatomy teaching and is still widely considered the cornerstone of medical training in general.

The changing role of didactic lectures

Traditionally, in addition to dissection, the anatomy curriculum includes a substantial number of didactic lectures. However, in the last two decades another trend emerged in some of the leading medical schools – moving away from “passive” learning, which lectures represent, by limiting the lecture hours and introducing new forms of actively engaging the students.

In the USA in 1984, the Association of American Medical Colleges (AAMC) General Physicians Professional Education (GPEP) report recommended curriculum change at all traditional medical schools toward problem-based, student-centered learning with an emphasis on integration of basic and clinical sciences (13). The changes involved a reduction in lecture hours (learning discrete facts), with more emphasis on teaching concepts and principles. Since then in the US new teaching strategies started to be implemented, in replacing lectures, like problem based learning (PBL) and team-based learning (TBL).

Problem Based Learning (PBL)

The introduction of PBL aims to enhance the clinically oriented thinking in the anatomy curriculum. It is done in addition to dissection and lectures. It represents discussion of clinical aspect using clinical vignettes, through which students learn to merge the clinical side with the underlying basic science concepts. However, studies at the University of Maastricht in the Netherlands have suggested that PBL tends to leave many students dissatisfied with their basic science knowledge, particularly in gross anatomy. During clinical clerkships they expressed a need for more anatomy training (5,18).

Team based learning (TBL)

A further step in the direction of moving away from the mechanical memorization and the role of students as passive listeners is the TBL. The latter is an instructional strategy originally developed by for business courses (11), and recently, medical schools have been adopting this strategy (19).

In the last few years, numerous medical schools adopted TBL in the delivery of basic sciences (14), clerkships and the residency programs (7). TBL is particularly useful because of its emphasis on teamwork, mastery of content, and problem solving skills for clinical application. TBL is very suitable for medical gross anatomy, because it requires students to learn anatomical facts, from which they develop anatomical concepts for clinical problem solving. It also requires consistent preparation and attendance. Compared to passive learning associated with traditional lectures, TBL strongly enhances the active participation and individual responsibility of students in the learning process (14), leading to a better retention of knowledge in the long run (24).

Herein we give a description of TBL as it was implemented in anatomy and embryology teaching in New Jersey Medical School, USA (24). It was introduced in 2004 as a response to “The Jubilee Curriculum”, in celebration of the 50th anniversary of the school. At that time the author was a member of the Anatomy teaching team. The concept of the Jubilee Curriculum included an increase in active learning modalities with a concomitant decrease in lecture time. A description of the course is given below.

Course structure:

- No anatomy lectures;
- 110 hours of dissection (4 students per cadaver);
- 17 Embryology and 4–5 clinical correlation lectures;
- 40 hours TBL.

Characteristics of TBL:

- Students are assigned to teams of eight;
- All teams receive a series of assignments and learning issues derived from anatomy textbook readings and the lab dissections, to be prepared outside of class prior to team discussions;
- Once a week the teams meet to discuss the assigned learning issues, sometimes using cadavers, radiographs, skeletons, etc.;
- TBL discussions start with an ungraded multiple choice quiz, taken individually. Immediate assessment of quiz performance allows to monitor each student’s level of preparation and provide necessary feedback. Following the individual quiz, teams discussed the assigned “learning issues” (90 min) that ensures deeper understanding and solidifies the learned material;
- The course coordinators circulate among the teams to clarify difficult issues and to ask probing questions;
- The team as a group retakes the same quiz (20 min) by selecting one common answer for each question. The course directors use the Immediate Feedback Assessment Technique (IF-AT, Epstein Educational Enterprises) forms for the group quizzes.

Evaluation of TBL

The coordinators evaluated the possible effect of TBL on student performance by comparing the unit and NBME subject exam scores between the traditional curriculum years 2002 and 2003 and 2005–2006 when TBL was fully
implemented. The charts presented on fig. 1, 2 and 3 are prepared on the basis of the results presented by Vassan, De Fouw and Holland in their article from 2008 (24). A statistically significant improvement of the exam results both from the unit exams and NBME subject exam were recorded with the introduction of TBL (fig.1).

![Fig. 1. Student grades from unit NJMS exams (Aver NJ) / NBME subject exam](image)

Within the results from NJMS unit exams the ratio between fail/pass/high pass/honors is also shifted towards a better student performance in the TBL years (fig.2). In the two years that the TBL was implemented virtually no fail was recorded and the high pass and honors significantly increased.

![Fig. 2. Ratio: fail / pass / high pass / honors from NJMS unit exams](image)

In NJMS TBL was implemented only in anatomy teaching. Other basic sciences like histology and physiology continued to apply the traditional curriculum in their teaching. The comparison of the results from the NBME subject exams shows a steady improvement in anatomy while no such improvement in histology and physiology was registered (fig.3).

The authors conclude that the implementation of TBL, with concomitant drastic reduction of didactic lectures, results in a statistically significant improvement of student performance at NBME subject exam, which is the most objective criterion for the effectiveness of anatomy teaching in the USA. Some of the concrete benefits include stimulation of learning anatomy on a daily basis, better long-term retention of the acquired knowledge, stimulation of academically weaker students and avoiding their failure (22-24).

![Fig. 3. Student grades from NBME subject exams in Gross Anatomy, Histology and Physiology.](image)

**DISCUSSION**

**The role of dissection**

Despite the doubts of some anatomists that dissection may not be the best means by which students can acquire and retain anatomical knowledge the overwhelming majority of anatomy teachers and medical students are convinced that dissection is the paramount of anatomy and medicine (15). Indeed, the amount of time devoted to dissection remains fairly constant even in schools which are pioneering other teaching methods (24).

Cadaver supply varies greatly from one school to another, as well as across different countries. For example in NJMS, USA only four students are assigned to one cadaver. In KCL and UCL the proportion is approximately 8-9 to one cadaver. In our school in the past as a rule there was one cadaver per 14-15 students. However, in the recent years the cadaver supply was so scarce that practically all the teaching was performed on prostheses. Likewise, many anatomy departments worldwide have adopted prostheses as their primary teaching method (3,21). These problems require adjustments of the teaching approaches in order to achieve good results.

The anatomy curriculum in Bulgaria is rather extensive and is known to give a solid foundation for further medical education. Traditionally it is based on cadaver dissection and didactic lectures since the establishment of The Medical Faculty in the Sofia University in 1918. The cadaver supply varied throughout the decades. Nowadays, despite the difficulties in cadaver supply in Bulgarian Medical Schools, the role of the dissection does not seem to be questioned. These problems are considered to be temporary and hopefully will be resolved by passing a new bill regulating cadaver donation. However, meantime minor adjustments of the curriculum are required to fit with the predominant use of prostheses.

The implementation of more active forms of learning like TBL, described above, is more typical for medical schools overseas. This is due to the overall differences in medical education, cultural, social and psychological specifics and
the fact that in the last few decades the hours and academic staff allotted to gross anatomy in the USA have significantly diminished. Therefore, we think that elimination of lectures and implementation of TBL, in the form described above, is unrealistic for the European Medical Schools, including the Bulgarian ones.

However, we are strongly convinced that certain principals and elements of these strategies should inevitably be implemented in our anatomy teaching. In our view these are:

1. Introduction of some form of PBL with the use clinical vignettes in order to stimulate students’ critical thinking and clinical perspective of anatomical facts; in this respect the use of MRI, CT and PET scan images should also be increased.
2. Introduction of frequent quizzes to evaluate and stimulate the levels of student preparedness.
3. Use of handouts in every practical in order to sharpen the attention to more complex interpretations of anatomical facts and enhance individual active participation in the class discussion.
4. Including a certain amount of clinical lectures, presented by clinicians.
   The introduction of the above adjustments requires more time to be devoted to preclass preparation by the academic staff for preparing handouts, quizzes, images, etc. Now, that the Bulgarian Medical Schools have introduced teaching in English for foreign private students the responsibility is even greater to keep up with the contemporary trends in anatomy teaching and provide compatible anatomy education.

REFERENCES