BRIEF REVIEW

The value of dissection and human tissue in teaching anatomy to pre-clinical medical students:

A review

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Despite being an ancient discipline, the methods of teaching anatomy are constantly evolving. Medical schools continually strive to innovate their curricula, as a result of this, older practices including dissection, are being decreasingly used or are being replaced with more modern teaching methods. This literature review explores evidence for and the attitudes towards traditional and modern methods for teaching anatomy, particularly relating to the use of human tissue.

Keywords: Medical education, human anatomy

INTRODUCTION

Few would dispute the importance of teaching anatomy to undergraduate medical students. Knowledge of anatomy underpins the process of diagnosis which requires the utilisation of surface anatomy (Ellis 2001), interpretation of images (Vázquez et al. 2005) and the understanding of multi-dimensional anatomical relationships (Granger 2004). Anatomical language is essential when defining positions in the body and communicating with other medical professionals (Ellis 2001; Granger 2004; Kachlik et al. 2008; Older 2004). Furthermore, a thorough understanding of anatomy is crucial to surgery, particularly in minimally invasive techniques (Ahmed et al. 2011). Although anatomy becomes less important for some specialist trainees, such as psychiatrists, it is crucial for others such as radiologists and pathologists (Ellis 2001). Thus anatomical education is fundamental for the medical undergraduate.

Some methods of teaching anatomy are well-established, namely cadaveric dissection which has been performed in Britain for over 250 years (Newell 1995). Yet, the time spent teaching anatomy has recently declined (Drake et al. 2009; Vázquez et al. 2005). Many teaching posts have been abolished and full body dissection is disappearing altogether from the curriculum in some UK medical schools (Korf et al. 2008; Older 2004; Raftery 2006). In the past decade, the value of cadavers has been questioned: Peninsula medical school now offers a new integrated approach (McLachlan et al. 2004); and Warwick medical school has replaced cadavers with plastinated material (Fruhstorfer et al. 2011). The literature in the field is extensive as the debate over how best to teach anatomy continues (Korf et al. 2008; McLachlan 2004; McLachlan et al. 2004; Papa and Vaccarezza 2013; Patel and Moxham 2006; Rizzolo and Stewart 2006; Vázquez et al. 2005).

THE ARGUMENTS FOR THE USE OF HUMAN MATERIAL

There are strong arguments for and against the use of human material, as reviewed by McLachlan and Patten (2006). Using cadavers enables orientation in three-dimensions and visualisation of the relationships between structures (Granger 2004; Newell 1995; Older 2004). Organs can be located, removed and dissected and different tissue types explored (Korf et al. 2008). Dissection offers an authentic sensory experience, introducing the student to touching a stranger's body, simultaneously promoting active acquisition of knowledge (Korf et al. 2008; Newell 1995; Older 2004). This is vital for developing the problem-solving skills required for clinical practice (Rizzolo and Stewart 2006). In the dissecting room, students appreciate natural variation between individuals (Ellis 2001; Granger 2004; Korf et al. 2008; Newell 1995; Older 2004), and they are exposed to a range of pathologies (Newell 1995; Older 2004) which can be easily surveyed in a whole-body context, which is particularly useful for learning about systemic diseases (Parker 2002).

Parker (2002) argues passionately for the wider uses of dissection as a 'rite of passage', provoking students to consider issues such as respect, professionalism, confidentiality and the confrontation of death. These benefits are echoed in the literature (Granger 2004; Korf et al. 2008; Rizzolo and Stewart 2006). Older (2004) suggests the importance of mortality has been overshadowed by the quest to connect students with the living patient – such as the curriculum pioneered by McLachlan (2004). The dissecting room is often the student's first encounter with death and many have suggested the value of the student-cadaver relationship in preparation for the doctor-patient relationship (Granger 2004; Korf et al. 2008; Newell 1995; Older 2004) as well as promoting humanistic care (Rizzolo 2002).

THE ARGUMENTS AGAINST THE USE OF HUMAN MATERIAL

Despite the advantages, dissection is limited when teaching some anatomical systems (Parker 2002). McLachlan, et al. (2004) suggest that cadaveric material does not reflect living anatomy or cross-sectional images, which are the main context of contemporary clinical practice, leading to a lack of meaning for students. Rizzolo and Stewart (2006) partially solve this problem by combining dissection with imaging. It is true that dissection provides a poor textural experience and does not respond to movement, palpation or percussion (McLachlan et al. 2004). However, Older (2004) suggests this as a positive: providing a simplified understanding of static anatomy which can be later extrapolated to the living patient.

Processing cadavers is an expensive exercise, requiring skilled technicians and suitable facilities in order to prepare and manage the material appropriately and safely (Ellis 2001; McLachlan et al. 2004; Older 2004). Decreasing time spent utilising this material therefore has a decreasing benefit to cost ratio. Nonetheless, McLachlan (2004) admits that the teaching time required to effectively deliver his cadaver-less curriculum is also expensive.

ALTERNATIVE TEACHING METHODS

Critics have suggested that the advantages of dissection can be gained through alternative methods. In modern integrated curricula, new concepts and technologies have been incorporated (Korf et al. 2008; McLachlan 2004; Older 2004; Vázquez et al. 2005). The

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curriculum at Peninsula medical school replaces the cadaver with the living patient and teaches surface anatomy combined with medical imaging (McLachlan 2004). Furthermore McLachlan (2004) argues that this course provides self–directed learning (SDL) and teamwork through problem-based learning (PBL), practical skills through clinical skills and three-dimensional anatomy is learnt by projecting images onto and painting the living body. Humane issues, such as confronting death, are explored via the arts, humanities and clinical practice (McLachlan 2004). However, it seems unlikely this is as powerful as the unique experience of the student-cadaver relationship. In addition, McLachlan (2004) admits that lack of human variation is an issue.

The introduction of varied programs has, for the first time, provided comparators for the traditional curriculum (McLachlan et al. 2004; Vázquez et al. 2005). In 2005, a randomised controlled trial found that students taught using traditional methods had significantly better basic anatomical knowledge than those taught using an integrated approach (Hinduja et al. 2005). Another study showed that more students passed their exams when cadaveric dissection was used compared to those who used computer-based resources instead (Biasutto et al. 2006). Of 174 first and second year London medical students, 75% believed dissection to be the single most useful method of learning anatomy (Gogalniceanu et al. 2010). Almost every student (99%) disapproved of the proposal to close the Universities' dissection facilities (Gogalniceanu et al. 2010). Such evidence validates the use of traditional methods.

THE FUTURE

Anatomy education, particularly dissection, is highly regarded by clinicians, anatomists and students (Ahmed et al. 2010; Gogalniceanu et al. 2010; Older 2004; Patel and Moxham 2006). McLachlan et al. (2004) suggest that curricular changes 'reflect new ways of thinking about the best ways to deliver education. They are often based on disenchantment with a traditional model of education'. Furthermore, Patel and Moxham (2006) demonstrated that 92% of anatomists, both 'traditionalist' and 'modernist', were receptive to change.

There is value in creating additional resources enabling multi-modal approaches for future medical students (Rizzolo and Stewart 2006). However, it is concerning that there has been such a rapid and radical change in the way this essential discipline is taught with the sacrifice of well-established techniques (Ellis 2001; Older 2004). There is a lack of evidence for the efficacy of both traditional and modern methods of teaching anatomy (Rizzolo and Stewart 2006). Consequently, medical schools have innovated their curricula without adequate evidence of what method is most suitable (Older 2004). Some medical schools in America have eliminated dissection only to reinstate it again shortly after (Rizzolo and Stewart 2006). This recent divergence demands the establishment of a standardised core curriculum to ensure all medical schools produce doctors with an adequate understanding of anatomy (Older 2004; Raftery 2006).

Much of the literature concludes that the study of cadaveric material is pivotal to a sufficient understanding of anatomy (Ahmed et al. 2010; Biasutto et al. 2006; Ellis 2001; Granger 2004; Korf et al. 2008; Newell 1995; Older 2004; Papa and Vaccarezza 2013; Parker 2002; Raftery

2006; Rizzolo and Stewart 2006) and that modern cadaver-less methods are inadequate replacements (Korf et al. 2008; Older 2004). There are many advocates for the use of modern methods to complement, but not replace, the traditional approach (Biasutto et al. 2006; Older 2004; Papa and Vaccarezza 2013; Vázquez et al. 2005). However, these should be used only after their efficacy is validated (Ahmed et al. 2010)

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EDITOR'S NOTE

The authors of this article have also included an original communication in the current issue of JIAS. The article is based on this review and explores the usefulness of human tissue dissection, particularly focusing on potted specimens in comparison to other Anatomy teaching techniques.