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CONTENT

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THE ANATOMY OF TEACHING ANATOMY

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Abstract

Anatomy as a medical and clinical science is in a downward spiral. In the past, anatomical skills and knowledge were gained through didactic lectures and complete dissection of the body via personal tuition. This approach has been modernised by the addition of special study modules, problem-based workshops, computers, plastic models and other teaching tools. Evidence suggests that, in some centres, dissected cadaver-based anatomy is no longer a priority. The present trend is likely to undermine the vital role of anatomy in life sciences and medical practice.

Modern medical curricula are giving less importance to anatomy education and to the acknowledged value of dissection. Universities have even abandoned dissection completely in favor of user-friendly multimedia, alternative teaching approaches, and newly deûned priorities in clinical practice. Anatomy curriculum is undergoing international reformation but the current framework lacks uniformity among institutions. Optimal learning content can be categorized into the following modalities: (1) dissection/prosection, (2) interactive multimedia, (3) procedural anatomy, (4) surface and clinical anatomy, and (5) imaging.

Key words: gross anatomy**,** teaching anatomy, curriculum, cadaver, dissection, multimedia

Introduction

"Doctors without anatomy are like moles. They work in the dark and the works of their hands are mounds." Tiedemann, Heidelberg, 1781–1861.

It is crucial to teach fundamental principles of anatomy from the beginning of medical school on which to expand over time. These principles are expectedly best taught during dissection and further enforced with supplementary visual aids. Anatomy itself is relevant to the majority, if not all, healthcare specialties and not only to surgery. Healthcare professionals should be formally examined on anatomy as part of their degree and weight should also be put onto learning basic developmental anatomy to thoroughly appreciate the origins of physiology and steps leading to congenital abnormalities.

Anatomy, like any other taught module, needs to be constantly revised and examined to demonstrate competency, especially when integrated into the clinical setting as students and even after graduation Yet, graduates are expected to retain and rely on the knowledge from their preclinical years for the rest of their careers. After all, patients have expectations from medical students too, irrespective of their level of clinical training.

Anatomy education has entered another Renaissance to deliver newer and more innovative methods of teaching, but at the cost of centuries-old practice. Vesalius, referred to as the founder of modern human anatomy, struggled to make university dissection mandatory in the 16th century and its signiûcance is again being questioned today in search for substitutes. Multimodal methods to teach anatomy and basic principles of surgery have gradually become the most popular options among all medical institutions. Although, dissection still seems to be the favorite method of teaching as well as providing optimal examples of pathology by both students and teachers alike .

As educational practices evolve to suit the needs of patients, so do the dissection laboratories adapt to the changing needs of students. Dissection theatre designs from the Renaissance have been revamped to suit current requirements. The commonest layout is to accommodate an entire year into one large room ûlled with numerous dissection tables for small-group tutorials or workstations in smaller adjacent rooms.

Gross anatomy is highly regarded by students as being clinically relevant compared to other subjects; but with dilemmas like the increasing number of new medical institutions particularly in economically developing nations increased shortage of cadaver donation and their preservation, medical faculties are in discussion of eliminating the dissection laboratory altogether in favor of teaching conventionally undermined skills such as professionalism. Many instructors believe that there is insufûcient evidence in the literature to indicate dissection as being the most effective method of teaching gross anatomy after the introduction of technological advancements; yet, bias and an absence of standardization among teaching preferences leads to difûculty in objectively validating its contemporary signiûcance (Winkelmann, 2007).

The addition of new disciplines (e.g., communication skills, professionalism, and ethics) into the medical curriculum has led to a reduction in total hours of anatomy teaching and factual content (Parker, 2002; Moxham and Plaisant, 2007; Rainsbury, 2007; Drake et al., 2009) despite students preferring longer anatomy courses. Furthermore, increased weighting in anatomy within overall assessment has been identiûed as a motivational factor for students to learn the subject more thoroughly (Wormald et al., 2009).

Anatomical variation and Team spirit

Anatomical variation is one of the most important concepts in modern medicine. Even a layman knows that no two individuals have identical anatomy and pathoanatomy. As students get exposure to different cadavers, they learn the principles of both anatomical variations and developmental anomalies. Thus, the future doctor is likely to acknowledge the complexity and uniqueness of the whole body. This realisation is essential when a doctor is confronted with amorphous clinical entities such as where to localise a hysterectomy or colectomy, and where and how to insert a pacemaker, an artificial joint or a bypass vessel.Unfortunately, reduced student exposure to dissection and dissected specimens, and anatomy teaching using a computerised and standardised 'visible man', plastic bones, models and computer-generated simplified images will compromise future doctors' clinical astuteness - a recipe for misdiagnosis and eventual malpractice. Although the new information age that is fuelled by fast computers has reduced 'rote learning', cognitive skills in anatomical concepts have direct relevance to clinical skills. The ability to call on these skills is essential for emergency medicine where, at the spur of the moment, one is required to make a clinical decision that entails life or death, litigation or job satisfaction.Group activity is often an inherent feature of the traditional dissection room. In psychological parlance, people working for a common good are likely to benefit from group cohesion and the team-spirit of colleagues.

SUGGESTED CONTENT FOR AN OPTIMAL MODERN CURRICULUM

Curricula on gross anatomy and organogenesis were proposed by the American Association of Clinical Anatomists (AACA) at the turn of the millennium . The initiative to maximize learning from acompact course can be categorized in the following sections in addition to the recommended national framework (McHanwell et al., 2007) designed by the Education Committee of the Anatomical Society of Great Britain and Ireland (ASGBI) and EACA : (1) dissection/prosection, (2) multimedia, (3) practical procedures, (4) surface and clinical anatomy, and (5) radiological imaging.

Dissection/Prosection

This involves teaching gross anatomy with cadaveric dissection and/or prosections preferably guided by demonstrators. Active observation and participation in cadaveric dissection helps the understanding of three-dimensional (3D) structures through curiosity and self-exploration (Lachman and Pawlina, 2006; Collins, 2008) while promoting both psychosocial development and attitudes towards professionalism and teamwork (Pawlina and Lachman, 2004; McLachlan and Patten, 2006). However, Collins (2008) suggests that prosections are sufûcient to aid anatomy learning of university students so that dissection, increasingly becoming a rare commodity in health education, could be reserved only for postgraduate surgical trainees. Plastination is a relatively new advancement in cadaveric science; an effective technique of tissue preservation of entire organs or cross-sectional body slices (Dhingra et al., 2006) introduced by von Hagens et al. (1987). Using polymers such as resin, silicone, and polyester give differing mechanical properties that ultimately result in robust, dry, odorless, and life-like specimens, which can be used well in an educational capacity in gross anatomy (Reidenberg and Laitman, 2002) and radiology (Dhingra et al.,2006). Preservation and dissection of the highest quality allow students to repeatedly study the specimens with minimal wear and tear, similar to the rationale behind using plastic models, while maintaining the natural variance or pathology that plastic models lack. Plastination permits realistic visualization of anatomical concepts that are simply too difûcult to describe. Nevertheless, plastinated prosections should ideally be used adjuvant with cadaveric dissection for full appreciation of the interactions between body systems and to understand the body as one entity. Once again it is emphasized that the cadaver must not be dismissed as obsolete (Older, 2004) since exposure to dissection develops important cognitive skills (Slotnick and Hilton, 2006) and manual dexterity (Moore, 1998; McLachlan et al., 2004) required by all medical practitioners. Mc Keown (2003) sums up dissection as an opportunity to reinforce familiarization and respect for the body and integration of theory into clinical practice. Nonetheless, it would certainly be a shame not to take full advantage of the available technology to supplement revision of the learning objectives from dissection classes (Durosaro, 2008).

Interactive Multimedia

Teaching anatomy with computerized learning packages dubbed as ''anatomical informatics'' so that students know exactly what to expect beforehand and how to best spend limited time in the dissection room. The future of anatomy teaching must rely more on visual aids outside the dissection room as students who accessed web-based computer-aided instruction resources scored signiûcantly higher on examinations than those who never accessed the online content (McNulty et al., 2009). The rationale is that students will naturally forget topics covered in dissection class and resources like web-streamed lectures and instructional videos could prove vital for revision. Anatomy teaching and healthcare education as a whole will advance after wide distribution of personal digital assistants (PDA) and other wireless devices (Trelease, 2008) that store essential texts and atlases. Atlases of internal imaging and projections of major organs onto body surfaces have been compiled onto an interactive CD-ROM (Putz and Pabst, 2002), in which real-time video sequences of gastroscopy imaging, colonoscopy, bronchoscopy, and ultrasound of heart valves were also featured. There is scope to include learning tools like magniûed laparoscopic imaging sequences and an accelerated video-recording of the entire alimentary canal using capsule endoscopy . Capsule endoscopy used in both normal and pathological cases led to half of medical students achieving a rate of 80% sensitivity in detecting small bowel lesions as novice readers (Collins , 2006).

To overcome the dramatic decrease in time dedicated to neuroscience (Drake et al., 2009), an interactive 3D atlas computer software and a mobile-based application have been launched in neuroanatomy education (Nowinski et al., 2009) whereby instructors can rapidly customize test criteria for their students to be done in their own time. Also, randomization of cerebral and vascular anatomy slices within the software can create versatile tests for practice and self-assessments for student users. Vascular anatomy can also be better visualized using virtual contrast injection to convert MRI and CT imaging into 3D virtual reality movie sequences. Otherwise, study tools, revision sessions, and examinations can be completed at individual pace, and progression can be measured objectively between time intervals using interactive online e-learning modules (O'Byrne et al., 2008). In addition, DVD demonstrations may be introduced to overcome the ongoing shortage of qualiûed anatomy instructors. Although this is a step up from handing a manual to students, it does not take into account that each individual student has a personal pace of learning.

Multimedia has gained substantial user approval in providing opportunities to study microscopic anatomy consisting of histology and pathology (in relation to genetics) through virtual microscopy (Durosaro et al., 2008) and a vast library of web-based multimedia animations. Yet, the inclusion of microscopic anatomy depends on the institution and may not necessarily exist within the teaching block of anatomy. Regardless of its time of introduction within the course, the topic itself can be better explored using software magniûcation with associated labeling. Furthermore, multimedia resources are to be used in amalgamation with widely accepted traditional teaching practice rather than students losing out on the art of handling actual microscopes (Pratt, 2009).

Procedural Anatomy

Practicing clinical procedures requires thorough knowledge of anatomy, especially for emergency protocols [e.g., sites of significance for lumbar puncture, cricothyrotomy and paracentesis] on either cadavers or plastic models. Helpful demonstrations have also been put on CD-ROM such as the Virtual Procedures Clinic by Boon et al. (2002b) for easy reference. An advanced emergency procedural training program at the University of California uses an online syllabus, videos, and lectures alongside hands-on practice with unembalmed cadavers, models, and ultrasound (Tabas et al., 2005). Having completed self-assessments after the course, all students reported a statistically signiûcant increase in their comfort level, understanding of the procedural indications and how to perform emergency procedure revolving around deep venous access, tube thoracostomy, and cricothyrotomy.

Surface and Clinical Anatomy

This anatomy is applicable to patient care as anatomical landmarks and clinically relevant structural outlines are deûned. There is ample opportunity to practice physical examinations (by inspection, percussion, palpation, auscultation, and instructions) early in medical education to prepare for life-long clinical interaction. Simultaneously, there is an opportunity to study the musculoskeletal system (Pabst, 2002), which is often understated in curricula. Whereas multimedia may compliment the learning process, nothing could substitute the practical experience gained within peer-groups and familiarizing oneself with living anatomy in a safe environment before handling patients. In fact, compared to students on the new systems-based course inûuenced by GMC's Tomorrow's Doctors (McKeown et al. 2003) discovered that students on the ''old curriculum'' attained a greater knowledge of surface anatomy.

Medical Imaging

Imaging has become more important diagnostically and in anatomy teaching, which has created a need for new expertise to interpret radiography, ultrasound, metabolic imaging, and multiplanar (virtual 3D) constructions such as high resolution CT cadaveric scans (Durosaro et al., 2008). Recent studies showed that integrated ultrasound imaging courses used in UK (Wright and Bell, 2008), Germany (Pabst, 2002), and USA (Rao et al., 2008) were positively received by both students and staff. Radiology education offers in vivo visualization of anatomy and physiology as well as insight into pathological processes. Yet, radiological images or anatomical models cannot substitute the beneûts of conventional dissection (Gundermann and Wilson, 2005) but hybrid teaching modalities would undoubtedly contribute to better understanding and retention.

Challenges & opportunities

At this juncture, reflection is needed on the failures and successes of anatomy curricula and how to teach the principles of anatomy to tomorrow' doctors in order to develop their clinical skills. In the nutshell, is the dissecting room a relic of the past or inspiration for the future? Some of the dissenting challenges that have to be faced are that:

a. Anatomy is said to be an exhausted science.
b. Dissection-based learning is increasingly less popular.
c. The contents taught in anatomy are ill-defined.
d. The insecurity of cadaveric resources makes it risky to maintain cadaver-based teaching. This shortage reinforces the need to take advantage of new technologies and communications.
e. Teaching methodology and the goals of learning anatomy are discrepant. In many departments, with lecture-based teaching and many hours of dissection, the excessive content prevents students from discerning between what is essential and what is accessory in clinical practice.
f. Finally, the professional situation of anatomists has been devalued. Given their often non-medical training

background and promotion expectations, anatomy teachers can give more importance to research than to teaching.

Reduction in anatomy instruction currently causes problems for medical professionals when identifying structures, analysing images, choosing surgical approach routes and deciding on possible consequences.

Technology should be incorporated into curricula, but not totally replace cadaver-based teaching, which should take place early in the programme and be clinically orientated as it is a key element at the start of medical education and training. The recommendations mentioned below are meant to keep cadaveric material available for our students. This provides an early, active learning encounter with mortality where facts are verified from the primary source, discoveries enjoyed and checked against the interpretation of others leading to a three-dimensional understanding of the body, its variation and pathology. In the process, students' manual dexterity and team-work and communication skills will develop and improve. All this will give them confidence and enrich their clinical competence.

Does the dissecting room still have a place in educating our students? Our answer is a qualified yes - a sound knowledge of anatomy is essential to define accurately and treat successfully the problem presented by patients. Dissection remains the most powerful way to learn anatomy as a dynamic basis for solving problems.

Conclusions and recommendations

1. We should aim towards a teaching of anatomy that is clinically oriented and as applicable as possible with closer links between basic scientists and clinicians to enhance teaching and research. Anatomy is a living subject, not a collection of facts learnt early and then forgotten. Retaining anatomical facts requires constant practical application so these must be taught by scientists and clinicians with a clinical perspective.
2. There should be a debate at every level in medical schools. This debate should highlight areas of concern, explore in depth and define a common minimum core anatomy curriculume. The perception of the depth of knowledge required by both student and examiner varies widely.
3. Teaching must be enhanced with a critical look at both teachers and methods. The dominance of research must be reassessed to establish an equitable cohabitation with teaching. The place of basic science, especially anatomy in basic surgical teaching, must be examined
4. Planning strategies to compensate for the acute shortage of cadaveric material in the region because of restrictions imposed by various sources. We feel that we should maintain cadaver-based teaching of anatomy, together with computer-assisted teaching as an adjunct.
5. With increasing pressures to admit more students into medical programmes, the student/staff ratio should be improved so that the quality of small group teaching is maintained.
6. The regional anatomical society or body that holds regular scientific meetings, and discusses and publishes anatomical research through the establishment of a regional anatomy journal.
7. Encourage regional and international links with other anatomical societies, departments or institutes for exchange visits and feedback to keep up with contemporary educational trends in the discipline and to encourage collaborative research. Such societies have created a renewed and more dynamic outlook for anatomy. Multilateral meetings between anatomists from all over the world are being fostered and the publication of a new edition of anatomical terminology has been promoted.

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ANATOMIC LANDMARKS FOR SAVE SPINAL AND EPIDURAL ANESTHESIA

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Abstract

The **aim** of this study was to determine the position of the conus medullaris, dural sac, Tuffier's line, and conus medullaris-Tuffier's line distance using imaging technique and to evaluate their relation to age and to the type of the lumbosacral junction

Methods. The study was cross-sectional of 120 adult participants, who underwent MR imaging of lumbosacral spine. Each vertebra was divided into 3 equal segments (upper, middle, and lower), and intervertebral disc space was also assumed as one segment. All segments from S3 lower to T12 upper segment were numbered consecutively. The position of the conus medullaris, dural sac and Tuffier's line was determined by the vertebral segment or intervertebral disc space at the same level. Patients were stratified into high/low conus medullaris position (cutpoint: L1 middle segment, high/low dural sac position (cutpoint: S2 middle segment) and short/long conus-Tuffier's distance (cutpoint: 14 segments).

Results. Low conus was more frequent in individuals older than 50 years than in individuals younger than 50 years (69% in >50years versus 59.7% in d"50years), whereas short conus-Tuffier's line distance was more frequent among >50 years old (72.4% in >50 years versus 53.2% in d"50 years; $p < .05$). There was a larger number of individuals with high conus among patients with sacralization than among patients with lumbarization (50% with high conus in sacralization versus 25% in lumbarization). Similarly there was a significantly smaller number of patients with low dural sac among patients with sacralization than among patients with lumbarization (50% with low dural sac in sacralization versus 100% with low dural sac in lumbarization; $p<0.05$).

Conclusion. In conclusion, precaution should be considered in using the Tuffier's line as a landmark during lumbar puncture and spinal block in older individuals. Low position of the dural sac in lumbarization should be relevant to the dural sac puncture and requires more caution during caudal epidural anesthesia.

Key words: conus medullaris, dural sac, lumbosacral junction, magnetic resonance

Introduction

Conus medullaris is the cone-shaped terminal part of the spinal cord, usually located between the 12th thoracic (T12) vertebra and the 3rd lumbar (L3) vertebra. Tuffier's line is a clinical landmark defined as a horizontal line connecting the superior aspect of the iliac crests, used as a reference line to localize L4/L5 intervertebral disc space before performing a lumbar puncture [1]. The dural sac (i.e. the subarachnoid space) ends at the level of S3 in infants and at S2 in adults and children.

MR imaging studies evaluated a variable conus medullaris and Tuffier's line position according to age, gender, and race [2, 3, 4]. Misidentification of L4/5 intervertebral disc space causes conus medullaris iatrogenic trauma during anesthesia and lumbar puncture procedures. It is important to know the level of the lumbar spine where the needle is being inserted. One of the main reasons for counting the intervertebral space before spinal block is the avoidance of cord damage and executing this procedure safely [5]. There are no previous studies evaluating the variable dural sac termination in subjects with transitional lumbosacral junction. It is also possible to puncture the dural sac accidentally during caudal epidural anesthesia, leading to extensive spinal anaesthesia.

The aim of this study was to determine the position of the conus medullaris, dural sac, Tuffier's line, and conus medullaris-Tuffier's line distance using MR imaging and evaluate their relation to age and to the type of the lumbosacral junction.

Subjects and methods

After institutional review board approval, a total of 120 patients with low back pain (between 18 and 80 years old), who underwent lumbosacral spine MR imaging were included in the study. Patients with kyphoscoliosis, history of previous spine surgery, spinal fracture, congenital spinal anomalies, malignancy, tethered cord and thickened filum terminale were excluded from this study. MR imaging examination of the lumbosacral spine was preformed with 1.5 T MR unit (Signa HDI) with a spinal surface coil. The imaging protocol consisted of a sagittal T1-weighted fast spin-echo sequence (FSE) (repetition time msec/echo time msec, 800/14; section thickness, 4 mm; field of view, 360x360 mm; matrix, 448 x 224), sagittal T2-weighted turbo spin-echo sequence (3520/102; section thickness, 4 mm; intersection gap, 10 mm; echo train length of 24), and a transverse T2-weighted fast recovery fast spin-echo (FRFSE) sequence at one or multiple levels (4.660/120; section thickness, 4 mm; intersection gap, 0.6 mm; echo train length of 27; field of view, 200x200 mm; matrix 320 x 256). Diagnostic imaging was performed and evaluated by a diagnostic radiologist.

One vertebra and the disc bellow it was assumed as one unit. The vertebra was divided into 3 equal segments (upper, middle, and lower), and the disc space bellow was the fourth segment of the unit. All segments were numbered consecutively from S3 lower segment to Th12 upper segment (from 1 to 34). A horizontal line was drawn from the most distal part of the spinal cord and the dural sac on mid-sagittal MR images perpendicular to the longitudinal axis of the spine. The position of conus medullaris and the dural sac was determined by the corresponding vertebral segment or the disc space at the same level. Coronal MR Images were used for determination of the Tuffier's line position. The line connecting the top of iliac crests on coronal MR images which included iliac crests and vertebral bodies was assumed as the Tuffier's line. The position of this line was corresponded with Tuffier's line on A-P lumbosacral X-ray radiographs **(Fig1)**.

The presence of sacralization (developmental abnormality in which the first sacral vertebra becomes fused with the fifth lumbar vertebra) and lumbarization (nonfusion of the first and the second segments of the sacrum so that there is one additional articulated vertebra and the sacrum consisting of fewer segment) was evaluated by a diagnostic radiologist.

The statistical package SPSS 13 for Windows (Chicago, Ill, USA) was used for analysis. Kolmogorov-Smirnov test was used to test the normality of the variables. The relationships between age and positions of the conus, Tuffier's line, or dural sac were analyzed by Pearson2 s correlation test. To provide a measure of association between conus medullaris position, conus-Tuffier's line distance, dural sac termination and the age and the type of the lumbosacral junction chi square test was used. The patients were stratified into patients with high conus (conus medullaris position equal and higher than middle L1 vertebra) and low conus (conus medullaris position lower than middle L1 vertebra) as well as patients with short conus-Tuffier's line distance (conus-Tuffier's distance equal and less than 14 segments) and long conus-Tuffier's distance (conus-Tuffier's distance more than 14

Fig. 1. Mid-sagittal T2-weighted MRI of lumbosacral spine, determining the position of the conus medullaris and the dural sac termination. Coronal T2-weighted MRI of the lumbosacral spine showing Tuffier's line at the level of L4/L5 segment

segments) and patients with low dural sac termination (dural sac equal and lower than middle S2) and high dural sac termination (dural sac higher than middle S2). The probability of a patient to have a low conus, short conus-Tuffier's distance and low dural sac according to their age and the type of the lumbosacral junction (normal or transitional) was determined. The results were considered significant at $p < 0.05$.

Results

MR images from 120 patients (66 males, 54 females) were assessed . The age of the patient group, mean ± SD (range), was 48 ± 12 (18–80). The position of the conus medullaris, Tuffier's line, and the dural sac was evaluated according to the units of the thoraco-lumbar spine. The conus medullaris position was median (range)- L1M (T12M–L2M), the dural sac position was S2M (L5L-S3M), and the Tuffier2 s line position was L4L5 (L4M–L5L). The calculated distance, mean ± SD (range), between the conus medullaris and the dural sac was 23.7 ± 2.25 (18–29) segments, which corresponded to about 4.5–7 units of the vertebral body and intervertebral space. The calculated distance, mean ± SD (range), between the conus medullaris and Tuffier's line was 13.9 ± 1.8 (9–20) segments, which corresponded to about 2–5 units of the vertebral body and intervertebral space. The minimal distance was about 2 units of the vertebral body and intervertebral disc space. There were no cases where Tuffier's line overlapped the conus medullaris. The position of the conus and conus-Tuffier's line distance was negatively correlated with age (Pearson2 s correlation coefficient = "0.162 (p =0.07) and -0.211 (p =0.02).

There was larger number of patients with low conus in the age group older than 50 years, (69% with low conus versus 31% with high conus) than in the patients younger than 50 years (59.7% with low conus versus 40.3% with high conus; p= .384). There was larger number of patients with low dural sac termination in the age group =<50 years, (56.7% with low dural sac versus 45.3% with high dural sac) than in patients older than 50 years (43.3% with low dural sac versus 54.7% with high dural sac; p= .289).

Short conus-Tuffier's line distance was significantly more frequent among patients older than 50 years (72.4% with short distance versus 27.6% with long distance; p < .05) than in patients younger than 50 years (53.2% with short distance versus 46.8 % with long distance, p < .05). The cut-off point was 14, which corresponded to about 3.5 units of the vertebral body and intervertebral space.

The study group included 8 patients with sacralization and 12 patients with lumbarization. In patients with sacralization, the conus medullaris, the dural sac and the Tuffier's line, were positioned, median (range), at L1U (T12M–L2M), at S2U (S1M–S2/S3), at L4/5 (L4M–L5L), respectively. In patients with lumbarization, the conus medullaris, the dural sac and the Tuffier's line, were positioned, median (range), at L1L (Th12–L2L), S2L (S2M–S3M), L5U (L4L5–L5M), respectively. There was larger number of patients with high conus in the group with sacralization (50% with high conus versus 50% with low conus) than in patients with normal lumbosacral joint and with lumbarization (25% with high conus versus

Fig. 2.

75% with low conus; p=.519) **(Fig.2).** There was also a larger number of patients with high dural sac in patients with sacralization (50% with high dural sac versus 50% with low dural sac) than in patients with normal lumbosacral joint and with lumbarization (100% with low dural sac; p< .005). The low termination of the dural sac was a common finding in the group of patients with lumbarization **(Fig.3)**. The positions of the conus medullaris, Tuffier's line, and the dural sac of patients with sacralization were higher than in those with lumbarization or without transitional vertebrae. There was no significant difference in the conus-Tuffier's line distance between the patients with normal lumbosacral joint, with sacralization and lumbarization. Short conus – Tuffier's line was found in 63% of patients with normal lumbosacral joint, in 50% of patients with sacralization and in 66.7 % of patients with lumbarization.

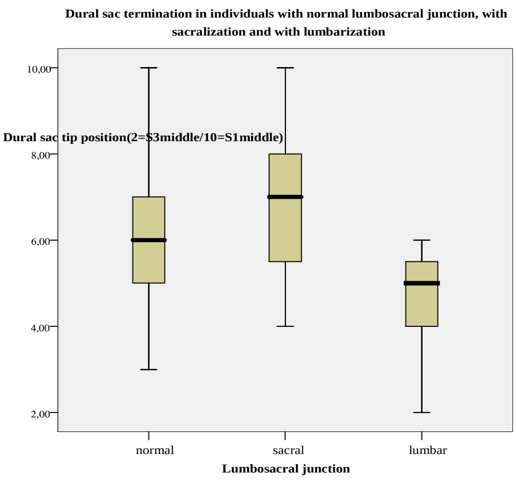

Fig. 3.

Discussion

This study was undertaken to delineate the anatomic landmarks important to execute safely the procedures of spinal anesthesia, lumbar puncture and caudal epidural anesthesia. Our findings demonstrated that both conus medullaris and Tuffier2 line were placed slightly lower in older patients. A cutpoint of 50 years was chosen to compare the positions of the conus medullaris, the dural sac and the Tuffier2 line. Shortening of the conus-Tuffier's distance compared with patients younger than 50 years, was verified in advanced ages (older than 50 years). Demiryürek et al. showed that conus medullaris was lower in females than in males [6]. Kim et al. showed a negative correlation between old age and the position of conus medullaris, but they did not report any sexual dimorphism in old ages [7]. In older patients with osteoporosis, age-related disc degenerative changes, reduced heights of the vertebral bodies, the Tuffier's line is higher and the conus-Tuffier's line is shorter [8]. We also found a significant negative correlation between age and conus-Tuffier's line distance.

The patients with spinal fracture and collapsed vertebra, (usually women) were excluded from our study. The risk of shortening conus-Tuffier's line distance was reported in old osteoporotic women [9, 10]. There are several reports on damage of conus medullaris by lumbar puncture needle during lumbar anesthesia, particularly in women [11, 12]. The identification of Tuffier's line with palpation through a variable amount of subcutaneous fat would be harder in obese individuals. Previous studies showed that trained anesthesiologists fail to correctly identify the lumbar interspaces by physical examination [13]. Our results showed that there is a safe zone of at least 2 vertebral bodies and disc spaces (9 vertebral segments) between conus medullaris and Tuffier's line.

This study was undertaken to delineate the anatomical features of the sacro-coccygeal region relevant to dural sac (DS) puncture during caudal epidural anesthesia. Caudal epidural block (CEB) is a reliable and effective technique commonly used in pain practice. Having accurate knowledge of sacral anatomy and its anatomical variations is very important for avoiding complications that may occur during dural puncture. The dural sac (i.e. the subarachnoid space) ends at the level of S3 in infants and at S2 in adults and children [14, 15]. It is possible to puncture the dural sac accidentally during CA, leading to extensive spinal anaesthesia. Therefore, the needle or cannula must be cautiously advanced into the sacral canal, after crossing the sacro-coccygeal ligament. The distance between the sacral hiatus and the dural sac is approximately 10 mm in neonates. It increases progressively with age (>30 mm at 18 years), but there is a significant inter-individual variability in children [16]. Our result showed a low termination of the dural sac with short distance between the dural sac and the sacral hiatus in individuals with lumbarization. In addition to the dural sac, the sacral canal also contains a venous plexus, which is part of the valveless internal vertebral venous plexus. It was reported that in adults the volume of the caudal canal, excluding the foraminae and dural sac, ranges from about 10 mL to 27 mL. This wide variability in volume accounts for some variations in block height with caudal anesthesia [17, 18]. There is an evidence that adipose tissue in the epidural space diminishes with agå. Òhis decrease has been linked conceptually to higher block levels for similar epidural doses of a local anesthetic. Igarashi et al and Saitoh et al. reported that the decrease in epidural space adipose tissue with age may be a dominant cause for the age-related changes in epidural dose requirements [19]. Slight moving up of the dural sac in the caudal canal with aging was noted in our study.

In conclusion, precaution should be more considered using the Tuffier's line as a landmark during lumbar puncture and spinal block in older individuals. Low position of the dural sac in lumbarization should be relevant to the dural sac puncture and requires more caution during caudal epidural block.

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DERMATOGLYPICS IN PATIENTS WITH PSORIASIS

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Abstract

The aim of the study was to evaluate dermatoglyphic patterns found in patients with psoriasis and to detect differencies compared to the control group of healthy examinees.

We studied the frequencies of various types of skin ridges on the first phalanx in patients with psoriasis. In order to explore hands'dermatoglyphic changes in psoriatic patients we examined hands of 60 psoriatic patients and 60 healthy controls. Prints were taken by the printing Cummin's and Midlo method.

The results showed that the most present patterns were loops, with an increased number of whorls and a decreased number of arches in patients compared to controls. There were no significant differences regarding the side and no sex specific patterns found in patients and in the control group.

Although there are some differences in present dermatoglyphics in patients with psoriasis, further investigations are planned to confirm them.

Key words: skin, patterns, psoriasis

Intorduction

The palms and soles of primates have ridge skin. Such ridge skin can be patterned or patternless. The areas of hand that may be patterned are distal pads of phalanges, the inter-digital pads and the hypothenar and thenar eminences. Patterns may be in a form of loops, whorls and arches on digits (Fig.1). The patternless configurations are composed of straight and gently curved ridges. In patterns, the triradius is an importanat configuration (Fig.2). Loops are accompanied by at least two triradii, loops are associated with one; arches do not have triradii (1).

Dermatoglyphics is the study of these patterns made by epidermis on fingers, palms and soles. They are formed during intrauterine life, between the 7th and the 12th week of gestation. During this period genetic and environmental factors can influence their formation. Dermatoglyphics can be useful in diagnosis of hereditary diseases (2). Psoriasis is a heritable disease with a polygenic mode of inheritance with variable penetrance affecting 1-5% of the population worldwide. Skin lesions are results of hyperproliferation of epidermis and of time shortening of the transpodition of keratinocytes from basal to corneal layer of epidermis. In healthy subjects this time is 26-28 days, whereas in psoriatic individuals lasts only 3-4days. The hereditary nature of psoriasis and common embryological origin of the skin and dermatoglyphics were motives for this study (3,4).

This study of fingerprints' patterns is important in anthropology and medical genetics, because of their possible diagnostic usefulness.

The aim of the study was to evaluate dermatoglyphic patterns present in patients with psoriasis and to detect some differencies compared to the control group of healthy examinees.

Material and method

The sample included sixty clinically diagnosed patients with psoriasis, of whom thirty males and thirty females. Sixty healthy controls of whom thirty males and thirty females were randomly chosen from the general population .Other inclusion criteria were the following the age range of 18-60 years and good health declared by physical examination. Individuals with neurological disorders, alcohol or drug abuse were excluded from the study. Samples were taken during 2012. Written informed consent was obtained from all participants after they had receved a complete description of the study's aim and procedures.

All ten fingers and both hand palm prints were taken using the standard ink and roller method (5). The results were analysed using the Cummins and Midlo" classification. Finger patterns were dadided as loops-L, whorles-W and arches-A and counted (Fig.1) palmar ridges and triradii were also noted (Fig.2). Frequence tables were made. We compared the frequencies between various fingers, hands and sexes in examined and control group. The diferrences of present patterns were tested using Kolmogorov-Smirnov test for two samples. P value <0.05 was considered to be significant.

The study was approved by the Ethics Committe of our Institution.

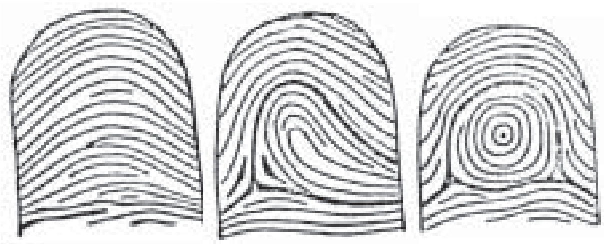

Fig. 1. Quantitative values: arch, loop, whorl

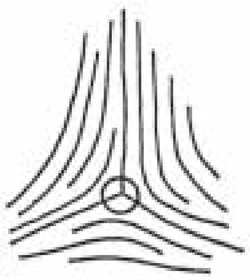

Fig. 2. Triradius

Results

Table 1 presents the results of the right hand of female controls (l>w>a) with an increased number of loops on the fifth finger. Table 2 presents the results of the right hand of the patients (l>w>a) . Table 3 shows the results of the controls left hand where loops were the most frequently found, followed by arches on the second and third finger. Table 4 shows the results of the left hand in female patients.

Tables 5 and 6 illustrates the results of the right hand in male healthy controls (l>w>a). Tables 7 and 8 gives the results of the left hand in controls and patients with an increased number of arches on the second and third finger of the left hand in patients, although loops were the most present.

There was no significant difference regarding the side, sex or patient-control relations.

The most frequently found triradii were a and d, followed by b, c and t.

Discussion

Dermatoglyphic patterns revealed loops (ulnar ones) to be predominant pattern in both male and female patients as well as in the control group, with an increased number on the thumb and on the middle finger. Whorls were the next present pattern, mostly found on the fourth finger. Arches were rare except for the second and third finger of the left hand in the control group.

Kumar found an increased number of loops, especially on the fifth digit, which coincided with our resulta (6). Pour-Jafari showed differences in different skin patterns between patients and controls. Those frequencies were not statistically different according to types of fingers, hands (left or right) and sexes in our study, too (7). An increased ridge count and atd-angle was found by Nagar (8). Verma descovered an increased number of arches on the fourth and the fifth finger, a higher number of whorls in females as we discovered in our study, a lower number of whorls in males and an increased total ridge count in patients with psoriasis (9). In Lou Zhongzhi's paper whorl paterrn was increased on the third finger in male patients and on the fifth finger in both

Table 1. Right Hand / Controls / F

Fingers	Thumb		Index		Middle		Ring		Little	
	N	%	N	%	N	%	N	%	N	%
Pattern										
Arch	3	10,00	7	23,33	5	16,67	2	6,67	1	3,33
Loop	11	36,67	11	36,67	18	60,00	15	50,00	24	80,00
Whorl	10	3,33	10	33,33	6	20,00	9	30,00	5	16,67
Complex	6	20,00	2	6,67	1	3,33	4	13,33	/	/
Totals	30	100,00	30	100,00	30	100,00	30	100,00	30	100,00

Table 2. Right Hand / Psorijaza / F

Fingers	Thumb		Index		Middle		Ring		Little	
	N	%	N	%	N	%	N	%	N	%
Pattern										
Arch	1	3,33	1	3,33	1	3,33	1	3,33	2	6,67
Loop	16	53,34	18	60,01	20	66,67	17	56,67	23	76,67
Whorl	10	33,33	10	33,33	9	30,00	10	33,33	5	16,66
Complex	3	10,00	1	3,33	/	/	2	6,67	/	/
Totals	30	100,00	30	100,00	30	100,00	30	100,00	30	100,00

Table 3. Left Hand / Controls / F

Fingers	Thumb		Index		Middle		Ring		Little	
	N	%	N	%	N	%	N	%	N	%
Pattern										
Arch	2	6,66	8	26,66	8	26,67	3	10,00	1	3,33
Loop	21	70,02	14	46,66	17	56,67	18	60,00	23	76,67
Whorl	5	16,66	5	16,66	4	13,33	9	30,00	5	16,67
Complex	2	6,66	3	10,00	1	3,33	/	/	1	3,33
Totals	30	100,00	30	100,00	30	100,00	30	100,00	30	100,00

Table 4. Left Hand / Patients / Psorijaza / F

Fingers	Thumb		Index		Middle		Ring		Little	
	N	%	N	%	N	%	N	%	N	%
Pattern										
Arch	1	3,33	2	6,67	3	10,00	/	/	1	3,33
Loop	17	56,67	18	60,00	22	73,33	21	70,00	27	90,00
Whorl	7	23,33	8	26,66	5	16,67	8	26,67	2	6,67
Complex	5	16,67	2	6,67	/	/	1	3,33	/	/
Totals	30	100,00	30	100,00	30	100,00	30	100,00	30	100,00

Table 5. Right Hand / Controls / M

Fingers	Thumb		Index		Middle		Ring		Little	
	N	%	N	%	N	%	N	%	N	%
Pattern										
Arch	/	/	4	13,33	4	13,33	1	3,33	3	10,00
Loop	18	60,00	13	43,33	21	70,01	14	46,67	21	70,00
Whorl	7	23,33	8	26,67	4	13,33	13	43,33	5	16,67
Complex	5	16,67	5	16,67	1	3,33	2	6,67	1	3,33
Totals	30	100,00	30	100,00	30	100,00	30	100,00	30	100,00

Table 6. Right Hand / Psorijaza / M

Fingers	Thumb		Index		Middle		Ring		Little	
	N	%	N	%	N	%	N	%	N	%
Pattern										
Arch	1	3,33	4	13,33	2	6,67	/	/	/	/
Loop	23	76,67	16	53,33	20	66,67	14	46,67	26	86,66
Whorl	3	10,00	10	43,34	7	23,33	14	46,66	1	3,33
Complex	3	10,00	/	/	1	3,33	2	6,67	3	10,00
Totals	30	100,00	30	100,00	30	100,00	30	100,00	30	100,00

Table 7. Left Hand / Controls / M

Fingers	Thumb		Index		Middle		Ring		Little	
	N	%	N	%	N	%	N	%	N	%
Pattern										
Arch	3	10,00	5	16,67	5	16,67	1	3,33	3	10,00
Loop	17	56,67	15	50,00	18	60,00	16	53,33	20	66,67
Whorl	6	19,00	9	30,00	4	13,33	10	33,34	7	23,33
Complex	4	14,33	1	3,33	3	10,00	3	10,00	/	/
Totals	30	100,00	30	100,00	30	100,00	30	100,00	30	100,00

Table 8. Left Hand / Patients / Psorijaza / M

Fingers	Thumb		Index		Middle		Ring		Little	
	N	%	N	%	N	%	N	%	N	%
Pattern										
Arch	1	3,33	8	26,67	4	13,33	1	3,33	/	/
Loop	21	70,00	18	60,00	23	76,67	14	46,67	27	90,00
Whorl	2	6,67	2	6,67	1	3,33	11	36,66	3	10,00
Complex	6	20,00	2	6,66	2	6,67	4	13,34	/	/
Totals	30	100,00	30	100,00	30	100,00	30	100,00	30	100,00

male and female patients on both hands. The arched pattern was decreased on the second phalanges (10).

In conclusion, we believe that, in addition to other markers examined in population who are susceptible to psoriasis as well as in patients with psoriasis dermatoglyphic analisys will, be included due to its advantages such as easy method of taking palm prints, fast results and cost-effectiveness.

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SEX-SPECIFIC DIFFERENCES OF MORPHOLOGICAL CHARACTERISTICS AND NUTRITION IN ADOLESCENTS AT AGE 16

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Abstract

The aim of this study was to evaluate sex-specific differences of anthropometric parameters in Macedonian adolescents at the age 16.

This study included 200 adolescent students (110 males and 90 females) at the age of 16 from the city of Skopje. Twelve anthropometric parameters were measured which define longitudinal, circular and transversal measures of skeleton using standard equipment and measurement technique. The following nutritional indicators were calculated: weight–for-age (BW), height-for-age (BH), BMI (kg/m^2). Two skin-folds were measured: triceps and subscapular.

The majority of anthropometric parameters were with higher mean values in boys. We found a significant sex-specific difference in body height, body weight, elbow and knee diameter, waist circumference, mid-upper-arm circumference in favour of males and triceps and subscapular skin-fold in favour of females. Values of the 50th percentile were: 70 kg for BW, 175 cm for BH, 22.27 kg/m^2 for BMI in males and 58 kg for BW, 162 cm for BH and 21.84 kg/m^2 for BMI in females.

The found values are recommended to be applied for evaluation of deviations in growth and nutrition in 16-years-old Macedonian adolescents.

Key words: adolescents, nutritional anthropometry, obesity

Introduction

Physical structure of child and adolescents body in the period of growth and maturation is systematically studied over 150 years [1]. Linear growth and physical development are two processes that cannot be separated on different levels: molecular, cell or somatic. More body dimensions have the same pattern of growth with increasing the body mass and body height, while body proportions are developing differently. Growth in height and increasing body weight which are treated as most valid indicators of physical growth do not happen in the same time. Growth in height is a result of development of bone tissue (lower extremities and vertebral column, part of the axial skeleton) while increasing body mass is a result of growth of nerve, muscle tissue, respiratory system etc. [2]. Studding this phenomenon will contribute to better understanding of biological variations of human body.

The period between childhood and adulthood is called adolescence. This period is divided in two stadiums: early adolescence (10 to 14 years) and late adolescence (15 to 19 years). This dynamic period in the development is marked with rapid changes in body composition and body constitution. Body constitution mainly depends on distribution of fat tissue related with level of sex hormones [3]. Muscle and fat distribution are changeable during life. Habits of daily eating, level of physical activity and hormone level could influence distribution of muscle and fat, contrary to bones that grow until the pubertal period is finished and after they remain the same.

WHO has pointed to increased obesity in 15-20% of people all over the countries in Europe. They emphasize this problem to be very serious, especially in late puberty and adolescence as a very vulnerable period of life when teenagers develop the eating habits and get the perception of their own physical bodies [4]. There are some anthropometric indicators for evaluating nutritional status in children, adolescents and adults. The most used and validated is body mass index (Quetelet index = weight/height^2) [5]. It can be used as an alternative indicator for direct measuring of body fat. It is an easy and simple method for early detection of nutritional status in children and adolescents. BMI is sex and age specific and it is referred as BMI for age [6].

Anthropometric measurements of human body, especially in the period of childhood and adolescence are needed in clinical practise for evaluating the growth and development and they can be good indicators of health and nutrition of youth population [1, 3, 7].

Our aim was to evaluate anthropometric parameters of 16-years-old adolescents, living in the urban area of the city of Skopje.

Subjects

Data were obtained from a cross-sectional sample of students of two high schools in Skopje. The sample included 200 healthy students (110 males and 90 females) at the age of 16, from selected schools and classes, who gave their consent for participation in the research. In order to avoid errors in the selection of the sample, volunteer students were not included. Subjects were grouped according to sex and age. The University Human Research Ethics Committee approved the experimental protocols.

Anthropometry

For evaluation of morphology of adolescents' body twelve anthropometric variables were selected and measured according to the International Biological Programme (IBP): for assessment of longitudinal skeleton dimensionality: body height (BH), for assessment of transversal skeleton dimensionality: elbow diameter (ED) and knee diameter (KD); for assessment of body mass and circular dimensionality: body weight (BW), chest circumference (CHC), waist circumference (WC), hip circumference (HC). Measurements were made during school hours, not interrupting the lessons. The following standard anthropometric instruments were used: for measuring body height anthropometer by Martin, with 1 mm reading accuracy; "John Bull" caliper square for determination of skin-folds with pressure of 10 g/cm^2 and precision of 0.1 mm; elastic band, also with 1 mm reading accuracy, for measuring circumferences; and caliper square for measuring of diameters with reading precision of 1mm.

According to the WHO recommendations for assessment of nutritional status in children the following indices were calculated: BMI (as a ratio of body weight and height squared), weight–for-age, height-for–age. Every adolescent has his/her own anthropometric file with the following data: date of birth, date of examination and sex.

For the aim of categorization of the anthropometric indices' values, the following percentile cut-off points were used: < 5th percentile for the category of extreme low values; from the 5th to 85th percentile for mean value; from 85th to 95th percentile for the category above average values; and above the 95th percentile for extremely high values.

Statistics

The data were analyzed with descriptive statistics represented by measures of central tendency and its deviation (arithmetic mean value ± and standard deviation) along with ranges expressed in percentiles. Testing of sex-specific differences was done with independent t-test. Differences for p <0.05 were considered to be statistically significant. The statistical package for the social sciences (version 13.0, SPSS Inc, Chicago, IL) was used for all statistical analysis.

Results

The study included 200 Macedonian adolescents (90 females and 110 males) at the age of 16, from the city of Skopje. Mean values and standard deviations of the examined anthropometric parameters in 16-years-old adolescents and their sex-specific differences are presented in Table 1. The following anthropometric parameters: body height (cm), body weight (kg), BMI, elbow diameter (cm) and knee diameter (cm) were with higher mean values in males. The 16-years-old males had body height of 175.15 ± 6.48 cm (mean and standard deviation), weight 70.37±11.47 kg and BMI 22.97±3.91 kg/m^2. In 16-years-old females mean values were: 162.46±5.93 cm for body height, 58.81±8.77 kg for body weight and for BMI 22.22±3.24 kg/m^2.

Mean values were larger in boys for transverse diameters: 6.94±4.83 cm for elbow diameter (ED), and 9.67±0.65 cm for knee diameter (KD). The mean values in females were as follows: 5.59±0.42 cm for ED and 9.56±7.73 cm for KD.

Significant differences were found (p<0.05) for BH, BW, ED and KD in favour of males.

Table 2 presents the results of the mean values of measured circular parameters: mid-upper-arm circumference (MUAC), chest (CHC), waist (WC), hip (HC) and calf circumference (CC) and two measured skinfolds: triceps and scapular. Mean values for mid-upper-arm circumference, chest, waist, hip and calf circumference for males were as follows: 28.42 ± 3.67 cm for MUAC, 88.56 ± 8.35 cm for CHC, 78.19 ± 9.27 cm for WC, 91.36 ± 11.91 cm for HC and 34.83 ± 3.6 cm for CC. Mean values for 16-years-old females were: 25.79±2.80 cm for MUAC, 88.24±6.40 cm for CHC, 72.73±8.86 cm for WC, 92.85±7.09 cm for HC and 34.84±3.11 cm for CC. Mean values for all measured anthropometric parameters were higher in boys except for the mean value of calf circumference which was higher in girls.

Statistically significant sex-specific differences (p<0.05) in circular parameters were found in mid-upper-arm circumference and waist circumference in favour of male subjects.

Triceps and subscapular skin-folds as indicators for subcutaneous fat component had higher values in females and sex-specific differences were registered for both parameters (p<0.05) in favour of females.

Table 1. Body height, body weight, BMI, elbow and knee diameters in 16-years-old adolescents (mean and standard deviation)

Males (n=110)	**Mean ± SD**	**Min**	**Max**
Body height (cm)	175.15 ± 6.48*	152	192
Body weight (kg)	70.37 ± 11.47*	50	110
BMI	22.97 ± 3.91	17.63	42.44
Elbow diameter (cm)	6.48 ± 0.38*	5.60	6.90
Knee diameter (cm)	9.67 ± 0.65*	8.2	11.2
Females (n=90)	**Mean ± SD**	**Min**	**Max**
Body height (cm)	162.46±5.93	150	174.5
Body weight (kg)	58.81±8.77	45	85
BMI	22.22±3.24	16.69	29.75
Elbow diameter (cm)	5.59±0.42	4.80	6.80
Knee diameter (cm)	9.56±7.73	7.3	10.3

*p<0.05

Table 2. Mid-upper-arm, chest, waist, hip and calf circumference, triceps and subscapular skin-fold in 16-years-old adolescents (mean and standard deviation)

Males (n=110)	Mean ± SD	MIN	MAX
Circumferences (cm)			
Mid-upper-arm	28.42 ± 3.67*	21	40
Chest	88.56 ± 8.35	59	112.5
Waist	78.19 ± 9.27*	63	108
Hip	91.36 ± 11.91	81	131
Calf	34.83 ± 3.6	26	46
Skin-folds (mm)			
Triceps	12.60± 5.31	5.4	36.0
Subscapular	10.86± 4.08	6.4	24.2

Females (n=90)	Mean ± SD	MIN	MAX
Circumferences (cm)			
Mid-upper-arm	25.79±2.80	20	36
Chest	88.24±6.40	73	115
Waist	72.73±8.86	58	108
Hip	92.85±7.09	78	125
Calf	34.82±3.11	28	47.50
Skin-folds (mm)			
Triceps	17.12± 4.74 *	9.0	32.2
Subscapular	13.57± 4.23 *	7.6	25.2

*p<0.05

Table 3. Percentile values for indexes height-for-age, weight-for-age, BMI, triceps skin-fold and subscapular skin-fold in 16-years-old male adolescents

Percentile	5th	10th	15th	25th	50th	75th	85th	90th	95th
Body height (cm)	165.17	168	169.35	171	175	179	181.65	183	184
Body weight (kg)	55	56	59.35	60.25	70	78	80	85	90
Triceps skin-fold (mm)	6.49	7.38	7.8	8.4	11.4	14.9	18.13	20.42	23.48
Subscapular skin-fold (mm)	6.69	7	7.27	8	9.8	12.55	14.8	16.66	19.46
BMI	18.56	18.90	19.48	20.34	22.27	24.73	26.49	27.43	30.20

Table 4. Percentile values for indexes height-for-age, weight-for-age, BMI, triceps skin-fold and subscapular skin-fold in 16-years-old female adolescents

Percentile	5th	10th	15th	25th	50th	75th	85th	90th	95th
Body height (cm)	152.5	155	158.2	158.2	162	166.87	169	170	170
Body weight (kg)	46.8	49	52	52	58	65	68.6	69.4	77.2
Triceps skin-fold (mm)	10.09	11.2	13.07	13.85	16.4	20	21.2	23.6	26.3
Subscapular skin-fold (mm)	8.8	9.6	9.8	10.2	11.9	16.35	18	19.06	21.2
BMI	17.96	19.04	19.63	20.24	21.84	24.59	26.08	26.74	28.18

Percentile values for BH, BW, TSF, SSF and BMI for male and female subjects are shown in Table 3 and Table 4 respectively. The 16-years-old males displayed the following cut-off points in the range from the 5th to the 85th percentile for the parameters: height–for-age from 169.35 cm to 181.65 cm; weight-for-age from 55 kg to 80 kg and BMI from 18.56 kg/m^2 to 26.49 kg/m^2. Female subjects at the same age had the following cut-off values: from 158.2 cm to 169 cm for height-for-age; from 59.35 kg to 80 kg for weight-for-age; and from 18.56 kg/m^2 to 26.49 kg/m^2 for BMI. Cut-off point for height-for-age index for the 50th percentile in males had shown higher values (175 cm) than in females (162cm). Percentile values for triceps and scapula skin-folds from 5th to 85th percentile were from

6.49 mm to 14.8 mm for triceps skin-fold and from 6.69 mm to 26.49 mm for subscapular skin-fold in male subjects. Females at the same age had the following percentile values: from 10.09 mm to 21.2 mm for triceps skin-fold and from 8.8 mm to 18 mm for subscapular skin-fold.

Values of the 50th percentile were: 70 kg in boys and 58 kg in girls for BW, 175 cm in boys, and 162 cm in girls for BH and 22.27 kg/m^2 in boys and 21.84 kg/m^2 in girls for BMI.

Discussion

The majority of biological variations in adults in all populations depend of growth and maturation during the childhood period and adolescence, including the prenatal period. That is why studying of this phenomena can contribute to better understanding of human body composition variations.

In our study we measured several anthropometric parameters in 16-years-old adolescents and the aim of this study was to assess the growth and nutrition status. We found sex-specific differences at this age related to the following parameters: body height, body weight, elbow and knee diameter, waist circumference and mid-upper-arm circumference (in favour of boys) and triceps and scapula skin-fold values in favour of females. Our results are in agreement with the results reported in other studies [7, 8, 9, 10].

Growth in height and increased body weight are treated as most valid indicators of physical growth. When populations share genetic background and environmental factors, average height is frequently characteristic within the group. Exceptional height variation (around 20% deviation from average) within such a population is usually due to gigantism or dwarfism; which are medical conditions due to specific genes or to endocrine abnormalities [11]. Mean values of body height and weight in our male subjects were 175.5 cm and 70.37 kg, and the values of the same parameters in female subjects were 162.46 cm for BH and 58.81 kg for BW. Our values were similar with the values found in US adolescents presented with 175.3 cm for BH and 74.4 kg for BW in males and 161.9 cm for BH and 63 kg for BW in females [12].

Distribution of fat tissue and the main changes that occur in body during the childhood and adolescence are of great interest of researchers. Males accumulate more fat tissue on the body during the adolescence contrary to females. It is necessary to have the unique reference for screening the body growth in children and adolescents. Other countries implement the standards for growth of children under 5 years of age, but there was a gap between these standards and the existing growth reference for older children. Now it is widely accepted to use descriptive samples of population that reflect a secular trend towards overweight and obesity. It is necessary to construct growth references so that obesity can be recognized [13].

Body mass index (Quetelet index = weight/height^2) is the most used and validated indicator for direct measuring of body fat, for early detection of nutritional status in children and adolescents [5, 6].

In our subjects, mean values for BMI were slightly higher in male subjects, but we did not find sex-specific difference for BMI. Cut-off values of BMI for the 85th and 95th percentile were higher in our male subjects at the age of 16 years (26.49 kg/m^2 and 30.20 kg/m^2) than in the male subjects examined by Cole (24.19 kg/m^2 and 29.14 kg/m^2) (14). In our female subjects aged 16 years, BMI values for the 85th and 95th percentile were 26.08 kg/m^2 and 28.18 kg/m^2 against Cole's relevant results of 24.54 kg/m^2 for the 85th percentile and 29.56 kg/m^{2}for the 95th percentile [14].

The results of our study that refer to circumferences have shown sex-specific differences between male and female in waste and mid-upper-arm circumference ($p<0,05$), while mean values of calf and chest circumferences were slightly higher in males and mean value of hip circumference was higher in females.

Triceps and subscapular skin-folds as indicators for subcutaneous fat component and a valuable technique for evaluating the nutritional status had higher values in females and sex-specific differences were registered for both parameters. Comparing our results of percentile values for triceps and subscapular skin-folds with mean values and percentiles for triceps and subscapular skin-folds values measured in Turkish adolescents at the age of 16 years in both males and females, have shown that Macedonian male adolescents at the age of 16 years have higher mean values (12.60 mm for TSF and 10.86 mm for SSF) versus Turkish male adolescents (10.3 mm for TSF and 9.6 mm for SSF). In our female subjects the mean values were: 17.12 mm for TSF and 13.57 mm for SSF, contrary to mean values of Turkish female adolescents: 14.9 mm for TSF and 12.3 mm for SSF [9].

Conclusion

Every populations share their own genetic background and environmental factors, so anthropometric characteristics of the body are frequently distinctive within a group. This also can be confirmed by comparing the results from anthropometric measurements of body parameters for assessment of longitudinal, transversal and circular skeleton dimensions in Macedonian population with a representative sample of other populations at the same age. Anthropometric measurements of human body are needed in clinical practise for evaluating the growth and development as indicators of health and nutrition of youth population. The found values in our study are recommended to be applied for evaluation of deviations in growth and nutrition in 16-years-old Macedonian adolescents.

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CT AND MR IMAGING OF THE MOST COMMON NEOPLASMS OF THE URINARY BLADDER

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Abstract

Urinary bladder neoplasms are disease with a variety of pathologic features.Primary urinary bladder neoplasms represents 7% of all malignant diseases in men, and 2% of the total number of such in women. Ninety-five percent of bladder neoplasms arise from the epithelium,and mesenchymal tumors represent the remaining 5%.

We present 183 patints who underwent CT and MR imaging with final diagnose of tumor in the urinary bladder. From the CT and MR features most of the tumors, over 173 were diagnosed as urotelial tumors, there were some tumors with more specific findings - 2 were specified as squamous cell carcinomas, 7 as adeno-carcinomas and 1 as a leiomyosarcoma. Cystoscopy with transuretral resection of the bladder tumor (TURBt) was performed to all patients for histopatological diagnosis and it proved one leiomyosarcoma,one new squamous cell carcinoma (total 3) and diagnosed 11 adenocarcinomas.

Key words: urinary, MR imaging, CT imaging, bladder, neoplasms

Introduction

Primary urinary bladder neoplasms represents 7% of all malignant diseases in men, and 2% of the total number of such in women, and this disease account for 2%–6% of all tumors in the United States (1).

Bladder neoplasms can arise from any of the bladder layers. They are broadly classified as epithelial or nonepithelial (mesenchymal),with over 95% being epithelial.Epithelial tumors with differentiation toward normal urothelium are urothelial. Urothelial tumors exhibit a spectrum of neoplasia ranging from a benign papilloma through carcinoma in situ to invasive carcinoma. Other primary epithelial tumors include squamous carcinoma and adenocarcinoma. Much rarer epithelial tumors are small cell/neuroendocrine carcinoma,carcinoid, and melanoma.

Nonepitelial (mesenhimal) tumors derived from mesenchymal tissue- muscle, nerve, fat, fibrous tissue, and blood vessels.These tumors arise from the submucosal portion of the bladder wall and therefore more often appear as smooth intramural lesions.The most common types are rhabdomyosarcoma, typically seen in children, and leiomyosarcoma,a disease of adults. Rarer mesenchymal tumors include paraganglioma,lymphoma, leiomyoma, and solitary fibrous tumor.

Aim

The aim of this study is to present our experience in the evaluation of morphological characteristics of bladder tumors using CT and MR imaging methods compared with patohistological diagnoses after transurethral resection of the bladder tumors (TURBt) with a review of most specific clinical and radiologic features of the most common bladder neoplasms.

Material and methods

In a period between January 2010 and January 2012 a search of our database identified 183 patints who underwent CT and MR imaging of urinary bladder and their final radiology diagnosis was tumor in the urinary bladder. CT examination was performed on 131 patients and MRI was performed on 52 patients. Patients were between 32 and 83 years of age (mean age 61 years), and painless macrohematuria was the main clinical symptom.

CT studies were performed with MDCT scanner. Siemens Volume Zoom - 4 Slices, SYNGO Software (Gantry rotation spreed of 0.6 s, tube voltage of 120kV, tube current 280 mAs, collimation of 2.5mm, and pitch of 1). Patients were instructed not to void 2 hours before CT examination. Iodinated contrast material was administered intravenously as 80ml of iodinated contrast (Omnipaque 300). Oral contrast material was administered as 500 ml of 2% solution of gastrographin, 30-60 min prior to the examination. Imaging of the urinary bladder was perfomed 60 sec. after completion of contrast injection. Scanning is started from the symphysis and upwards, in incremental contigious sections of 3 mm.

MR studies were performed at 1.5 T on a MR scannert (Siemens) with a phased-array pelvic coil. Conventional T1-weighted spin-echo images (TR/TE, 550/9; 512×192 matrix; 20-cm field of view; 6-mm section thickness; 2-mm intersection gap; 4 signals acquired) and T2-weighted fast spinecho images (TR range/TE range, 4.000–5.500/80–120; 256×256 matrix; 24-cm field of view; 6-mm section thickness; 2-mm intersection gap; 4 signals acquired) were obtained. Subsequently, fast multiplanar spoiled gradient-echo images with fat suppression (180–300/1.7–4.2; 70° flip angle; 512×92 matrix; 20-cm field of view; 6-mm slice thickness; 2-mm intersection gap; 2

signals acquired) were obtained in the axial plane before and after gadopentetate dimeglumine (Magnevist, Berlex) injection (0.1 mmol/kg). Enhanced images were acquired during the arterial phase (20 sec), which was immediately followed by the venous phase. The acquisition time was 52–86 sec for each phase. Sagittal and coronal gadolinium-enhanced images were added if the tumor was located in the base or the dome of the bladder.

After these radiological imaging procedures, cistoscopy with transuretral resection of the bladder tumor (TURBt) was performed to all patients for patohistological diagnosis.

Results and discussion

183 patints underwent CT and MR imaging. CT was performed on 131 patients and were identified bladder tumors with morphological characteristics for: urotelial tumors-98 appears as an intraluminal papillary or nodular mass, 28 were identified as focal wall thickening, one as an urachal, adenocarcinoma, one was suspected for squamous cell carcinoma and one had CT characteristics for leiomyosarcoma. On these two patients was performed MR imaging and from the MR features were diagnosed squamous cell carcinoma and leiomyosarcoma. MR imaging was performed on the 50 more patients - most of the tumors, 42, were diagnosed as urotelial tumors, but there were some tumors with more specific findings – 1 more was specified as squamous cell carcinomas and 6 as adeno-carcinomas (block tumors with prostate).

Cystoscopy with transuretral resection of the bladder tumor (TURBt) was performed to all patients for histopatological diagnosis and it proved 168 transitional cell carcinomas ,one leiomyosarcoma,one new squamous cell carcinoma (total 3) and diagnosed 11 adenocarcinomas.

Urothelial Carcinoma

Urothelial (transitional cell) cancer is the most common urinary tract cancer and it occur the most frequently in the bladder . It is considered to be a disease of the elderly population, i.e. 80% of diagnosed patients are between 50 and 80 years of age, but of the new cases, 3.1% occur in patients under the age of 44 years and 8% occur in patients aged 45–54 years (2). It is the fourth most common cancer in males and the tenth most common cancer in females. A male-to-female ratio of frequency is 3–4:1, however, in women it is diagnosed at a more advanced stage and has a higher mortality rate than in men (3).

Over 80% of patients have hematuria as a major symptom, which is typically macroscopic and painless (2), but also can have voiding symptoms such as frequency, dysuria and pelvic pain and pressure.

The most common etiologic factors for urothelial tumors are cigarette smoking, related to duration and amount of smoking (4) and occupational exposure to chemical carcinogens such as beta-naphthylamines (5), bladder stones, chronic infection and irritation, as well as drugs such as phenacetin and cyclophosphamide, and arsenic in drinking water ani-line dyes (6). Cigarette smoking is thought to be the causative factor in 50%–60% of men and one-third of women who develop bladder cancer (7). The relative risk of current smokers for death from bladder cancer is 3.3 in men and 2.2 in women. Iatrogenic risk factors for urothelial tumors are therapeutic irradiation of neighboring organs. Although it is rare, there is a genetic predisposition to the development of urothelial tumors in some fami-lies (8).

Most, 80%, urothelial tumors are located at the bladder base , and can be papillary, sesile or nodular. Predictors of behavior include depth of invasion, multiplicity, history of prior tumors, tumor size, and grade in decreasing order of importance (2). This type of carcinoma has a tendency to be multicentric, and they occur in up to 30-40% of cases (1). Upper tract tumors occur in 2.6%–4.5% of bladder tumor cases and are seen most frequently when multiple bladder lesions are present (9). Pathologic stage is the most important predictor of survival. The TNM classification from the American Joint Committee on Cancer is in widespread use.

Patient with gross hematuria is suspected for urotelial tumor, and the standard imaging work-up has shifted from excretory urography to cross-sectional modalities such as ultrasonography (US), CT, and magnetic resonance (MR) imaging for diagnose, althoy cystoscopy and biopsy are the standard of reference for bladder evaluation. Imaging is important for accurate staging and treatment planning. Complete evaluation of the urothelial tract (both upper and lower) is indicated because of the propensity for multicentric disease.Superficial tumors may not be evident with any imaging study and are not staged radiologically. At CT , urothelial carcinoma appears as an intraluminal papillary or nodular mass or focal wall thickening . Bladder tumors enhance early , approximately 60 seconds from injectionof contrast and may be readily detected with multidetector CT(Fig. 1, 2).

Accuracy for staging of primary tumor with CT has ranged from 40% to 85%. Sensitivity and specificity for detecting perivesical invasion with multidetector CT are improved over those of conventional CT, at 92% and 98% respectively, with an accuracy of 96%, if performed more than 7 days after biopsy (10).

MR imaging is the most superior imaging modality because of using surface coils, three-dimensional sequences and fast dynamic imaging. The highintrinsic