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EDITORIAL

Avoid being Prey to Predatory: The Publishing Dilemma

'Publish or perish', the old adage is more germane than ever before as academicians nowadays are under constant pressure for the demand of number of publications, a causal element for their promotions, tenure, and funding. As a result, authors may wish for quick publications, when traditional publishing is known to be slow, subjective to some extent and may be less interested in one's work. This milieu coupled with the shift from print to online publications, created an unprecedented opportunity for predatory publishers to appear and establish, luring the young and inexperienced or those who anticipate merit with little effort.

Predatory publishing is an exploitative academic publishing business that deceive authors to publishing with fraudulent journals. These journals neither check the quality, legitimacy, integrity, or reliability of the article nor they provide the editorial or other services. Authors who publish in these journals, inadvertently harm their carrier being subjected to criticism afterwards and without any recognition/citation for their work. Eventually these publications defile the academic literature and the funds/grants utilized are wasted. A majority of these debatable journals are from low- and middle-income countries and authors from the same are at high risk of being victims.

Although difficult to differentiate from original publishers, there are typical characteristics of predatory publishing. The authors receive unsolicited email correspondence from these journals with flattering or poor language inviting for article submission. The correspondence often makes contradictory claims such as '*You need to submit within a week*' and then stating, '*You may submit whenever it is convenient for you*'. They always promise speedy publication implying the lack of proper peer-review process. Generally, these journals request a handling/processing fee at the time of submission in place of a publication fee. Some predatory journals offer attractive discounts on this fee.

Other characteristics of predatory publishing include, journal titles or websites mimicking original journals, or without a website of professional quality and editorial boards with unknown persons or all editors from a single institution. Typically, the authors' colleagues are not aware about such journals. The predatory journals or the publishers are neither listed in bibliographic databases nor indexed in scholarly databases such as ScienceDirect, Web of Science or PubMed. The papers published are of poor quality with meaningless results and with recurring typographical and factual errors. Additionally, the papers published in a single journal may have widely different focuses and may be of outside the journals' scope. Predatory journals also claim unrealistically high impact despite having recent commencement. They do not describe copyright agreements or strategies to manage misconduct or conflicts of interests.

To curtail the damage caused by predatory publishing, Jeffrey Beall, a librarian and assistant professor at the University of Colorado, created a list of potentially rogue journals and publishers (available at https://beallslist.net/) and updates it yearly. Unfortunately, the predatory publishing business continues to grow, evidently shown by the Beall's list and other similar lists. To avoid being easy prey for these journals, one can search for lists of established open access journals, such as the Directory of Open Access Journals (available at https://www.doaj.org/). However, some journals may not be catalogued in either whitelists or blacklists or that the journal is incorrectly classified in the wrong list. Therefore, the authors with manuscripts of their scholarly work need to carefully navigate open access or subscription journals before deciding to submit.

With the awake of COVID-19 pandemic, a high volume of papers and preprints are being published even in ranked and indexed journals in a matter of days. The senior scholarly authors, editors and reviewers are vested with the responsibility to ensure that the core value of 'peer reviewed' in academic publishing is not jeopardized and the scientific validity, trustworthiness, and ultimately the public health are not challenged in these instances.

I believe, a change in publishing business is imperative to curb the publishing dilemma. Essentially, authors need to take informed decisions as to where they submit their valuable work.

THINK ! CHECK ✓ SUBMIT >

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REVIEW ARTICLES

Donation of body for Anatomical Dissection in Sri Lanka: A Review

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Abstract

Anatomy remains central for Medical Education which forms the basis of efficient and safe medical practice. Dissection of a cadaver is deliberated as an essential and valuable tool in teaching macroscopic anatomy for medical students. Apart from gaining knowledge and skills, the anatomical dissection aids in cultivating humanistic values, behaviors, and attitudes which are essential assets for an empathetic future medical practitioner. This manuscript highlights the dynamic history of acquiring human bodies for anatomical dissection, with a particular emphasis on Sri Lanka. Knowledge on the source of cadavers, and the manner by which they have been obtained, is fundamental for medical students to realize the ethical and legal challenges associated with procurement of cadavers. This knowledge will help to further students' understanding of the evolving mindset of society, both past and present, regarding anatomical dissection and voluntary body donation. Through the study of the history of procuring cadavers, students are better positioned to appreciate the determination, generosity, and altruism of donors who have bequeathed their bodies for the educational needs of others. This, in turn, enables the students to consider the cadaver as their teacher, first patient or at best body of a fellow human being; not only to ensure that the body is treated in an ethically acceptable manner, but also to provide an empathetic foundation in students to provide the utmost care to their patients with kindness and due respect in their future medical practice. Thus the willed body donation plays a significant role in producing not only a competent but also a compassionate medical practitioner. In this manuscript, the body donation practices of Sri Lanka are reviewed along with the Taiwanese-originated silent mentor programme.

Running title: Body donation in Sri Lanka

Donation of body for Anatomical Dissection in Sri Lanka: A Review

Anatomy remains central for medical education; ample knowledge in this discipline is fundamental for an efficient and safe medical practice. The macroscopic anatomy is an integral part of the anatomy curriculum in the allopathic medical study programme. Dissection of a cadaver is regarded as an essential and valuable tool in teaching macroscopic anatomy for medical students. Evidence of the practice of dissection has its roots in the school of Alexandria ~ 300 B C where dissection was used as the main tool to learn anatomy through a regular and systematic approach (1).

Cadavers are regarded as "great teachers" (2) and / or "first patients" (3) on different perspectives, and dissection of which enable students to comprehend the complex, three - dimensional human anatomy which is mandatory for their future role as a medical practitioner. In addition, cadavers also contribute to clinical training, for example in surgical simulation training (4).

Knowledge on the source of cadavers and the manner by which they were obtained for anatomical studies in the past is fundamental for medical students to appreciate the evolutionary changes that occurred through many centuries in the scientific, ethical and legal perspectives of society towards procurement of bodies for dissection. Understanding the history of body procurement helps the present medical students to appreciate the determination, generosity, and altruism of donors who have bequeathed their bodies to medical institutions for educational purposes and scientific advancement.

The earliest records of the dissection of human bodies indicate that they were performed in public, including the ones that were performed in the Middle Ages. Later in the 17th and 18th centuries, anatomy theatres were established in many cities of Europe (5) to perform dissections for which the dead bodies of executed persons was the only legal source of cadavers, as at the time, society viewed dissection as a great dishonor for the person being dissected (6) both in terms of loss of personhood and the social identity.

As the procurement of bodies from executions alone was unable to fulfil the requirement of medical schools, body snatching (the "digging up of newly buried bodies" illegally) became the additional source of bodies in the United States (6, 7) and in Britain during the 18th and early 19th centuries (8). The grave robbers were given specific names by the public such as ''body snatchers'', ''sack-em-up men'', and / or ''night doctors'' whereas anatomy professors referred to them as ''resurrectionists'' (6, 7, 8). In order to prevent grave robbing, new devices like iron cages ("mortsafes") were erected over new graves and / or guards were assigned to watch over the burial ground for a certain period of time after the burial of a fresh corpse (often family members took on the responsibility of being a guard)(7). The watch houses and watch towers, built to guard new graves, still exist in Scotland (8). Legislation preventing grave robbing was passed in 1789 in the United States in response to a mob riot referred to as the "Doctors' Riot" held in New York in the previous year (6, 7).

Use of unclaimed bodies was deliberated as an alternate source of cadavers for anatomy teaching. The laws that permit usage of unclaimed bodies for dissection were first enacted in the United States in Massachusetts in 1830 and 1833 (6), and in the United Kingdom in 1832 (Anatomy Act of 1832) (8).

In the 19th and 20th centuries, body donation programmes were developed and capital punishment was eliminated in many countries in view of the rights and dignity of human beings (9). Body donation can be described as an act of providing one's own intact body for

medical education and / or research upon demise by his/her informed consent given prior to death. At the turn of the 20th century, though opinion of most citizens of the United States disapproved of dissection, a few exceptional Americans were in view of donating their bodies to the science upon death; this was noteworthy and peculiar enough that it was mentioned in newspapers. As such, in 1889, newspapers highlighted that a wealthy Maryland horse dealer, Thomas Orne, had made the decision to bequeath his body. In addition, in 1912, two hundred physicians in New York pledged in public to bequeath their bodies upon death for dissection with the intension of overcoming the stigma against this teaching tool (10).

Gosh (11) indicated that body donation serves as the sole source of cadavers for dissection purposes in the medical institutions located in most parts of the globe. Among the 68 countries where cadavers were used for anatomy education, body donation (obtained through bequest made by the "deceased person during his or her lifetime") was the exclusive source of cadavers in 22 countries (12).

The allopathic medical education system in Sri Lanka has its roots in the 19th Century in Jaffna where the training of doctors was carried out by American Missionary practitioners (13). Establishment of the Colombo Medical School in 1870 can be considered as a milestone in the path of allopathic medical education of the country (14). Subasinghe and Jones (15) highlighted that the practice of donating bodies for medical education commenced in the early 20th century or early post-colonial days. However it is not known when the cadavers were first utilized for dissection purposes in the country. Available information indicates that preserved cadavers from Colombo were brought to the University of Peradeniya to commence its first batch of medical education in 1962. Subsequently, unclaimed bodies obtained from a hospital and those resulting from execution were used for dissection (16). However, from the 1970's onwards, body donation became the sole source of cadavers for medical education in Sri Lanka (15).

In Sri Lanka, the Transplantation of Human Tissues Act (No. 48 of 1987) governs the donation of human bodies and tissues for educational, scientific, therapeutic, and research purposes (17). This legislation permits the procurement of cadavers for dissection with the consent of the donor which was given prior to his or her demise in the presence of competent witnesses. In the absence of such consent, the next of kin is legally empowered to donate the body if no contrary intention had been expressed by the deceased during his or her life time. Donation of the body of a child (child is defined as someone who is "under twenty-one years of age") for anatomical dissection can be made by the parents, or guardian (in the absence of parents). As it stands, Sri Lankan law permits the usage of unclaimed bodies for anatomical research.

In general, body donation should be governed by highly transparent, non-commercial, professionally supervised 'willed body programmes' (5). The International Federation of Associations of Anatomists (IFAA) in 2012 provided "recommendations of good practice

for the donation and study of human bodies and tissues for anatomical examination" (18). Medical institutions in Sri Lanka have their own criteria for body donation (referred to as "body donation programme") in accordance with the legislation of the country.

The body donation programme in Sri Lanka encompasses fundamental information regarding body donation including, but not limited to; Essential documentation (e.g. application / consent form, identification proof of next - of - kin, Certificate of Death or Notice of Death); Institutional policies and practices (e.g. prior registration, embalming method, age of the deceased, time of acceptance, transportation arrangements, handling of remains subsequent to dissection, maintaining the dignity and anonymity of the donors); Rejection criteria (e.g. unsuitability of a dead body due to medical reasons [e.g. history of certain infectious diseases] and scientific reasons (e.g. poor physical condition, having had postmortem examination); and Legal rights of the body upon it's transfer to a medical institution (19, 20, 21, 22). Medical institutions typically accept both unpreserved and embalmed bodies for medical education and research.

Subasinghe and Jones (15) reported that most medical institutions in Sri Lanka obtain more donated bodies than their requirements. However, when an institution has no or limited cadaver resources (making it impossible to conduct the dissection session according to the stipulated curriculum) dead bodies can be obtained from another institution (19) through legal procedures.

The scarcity of cadavers for dissection is one of the major challenges faced by many medical schools in the world, especially the ones located amongst the more developed countries. Procurement of human bodies and body parts through importation has also been adversely affected due to restrictions and prohibitions made by the countries that permit exportation of cadaveric materials (23). Inadequacy of cadavers leads medical institutions to consider the incorporation of alternate methods such as pro-section, human body models prepared using plastination technology, 3-dimentional computer programmes, body painting, interactive tables that can be used to learn full-body anatomy, etc. A medical school in the United Kingdom has introduced a curriculum which requires no cadavers for teaching anatomy (24, 25) due to disadvantages in, and surrounding the usage of, cadavers.

A novel approach (referred to as "silent mentor programme"), that was successful in overcoming the deficit of cadavers, was introduced in Taiwan at Tzu Chi University in 1996. The body donation system and the educational approach of this programme were successful in generating excess of donations (26). Since then, this program has expanded to Malaysia (2012); it was commenced by a collaboration between the University of Malaya and Tzu Chi University (23, 27). In addition, the model of the silent mentor programme has been followed in the development of body bequest programmes of some educational institutions located in Hong Kong, Myanmar, and Singapore (23). A successful implementation of this approach was at the Yong Loo Lin School of Medicine,

National University of Singapore. Before the introduction of the silent mentors programme in 2012, dissections were paused for almost a decade due to a shortage of cadavers; after the development of the program, dissections could once again be carried out (28).

This approach differs from traditional body donation programmes, both in Sri Lanka and Western countries, where anonymity of the donor (name, family background, etc.) is usually preserved. Conversely, in the newer approach, the students perform home visits and meet the other members of the family of the donor to learn about the donor's life (e.g. personal, medical, social history, etc.) prior to the official commencement of the course (4, 23, 26, 27). Occasionally, the students may even have the opportunity to meet living donors who are at a terminally ill stage (26).

Historically, many medical institutions in Sri Lanka have had the practice of organizing religious memorial blessings to the donors in the presence of staff, students, and relatives of the donor, albeit in the absence of the cadaver (15). Conversely, in the novel body donation programme, the religious ceremony occurs in the presence of cadavers, with the students, and donor's family members in attendance (26).

Traditionally in Sri Lanka, arrangement for disposal of cadaveric remains, upon completion of dissection, is made by the relevant institution without the involvement of relatives or students; no remains, including ashes, are provided to relatives. In contrast, the students and relatives of the donor participate in the cremation ceremony and serve as coffin bearers in the newer approach (26). In this approach, ashes are either kept in urns and placed in the institution (26), or are returned to the family members (27, 28).

In Thailand, the cadavers attain the status of ajarn yai (great teacher) and treated accordingly. Anonymity is not preserved, and students participate in both the dedication as well as cremation ceremonies (2).

It is rational and logical to consider that an ideal body donation programme should incorporate sufficient information regarding the handling of cadavers upon its acceptance by the institutions, particularly in the procedures related, including but not limited, to; Storage (e.g. whether a separate space is provided for each cadaver); Teaching (e.g. importance of cadavers/cadaveric dissection in teaching anatomy, how cadavers are presented to students [i.e. exposure of required region only]); Research (e.g. what is the role of cadavers or body parts in research, whether/how images could be published in research papers); Maintaining the anonymity and dignity of the donor (e.g. whether cadavers/body parts are transferred to other institutions, display of cadavers/body parts in public exhibitions, restricting access to dissection halls); and the Fate of the remains (e.g. retention of body parts to be used as museum-mounted specimens or for other purposes, how/when cadavers are disposed of). In order to protect and preserve trust from the general public, there needs to be transparency regarding the policies and procedures of body donation programs, especially ones that address the issues mentioned above.

Reflective Remarks

The first exposure to a cadaver may trigger many questions to medical students concerning the purpose of the cadaver in teaching anatomy and how it was obtained by the medical institution. Answering the latter question, along with historical context, enables medical students to understand the evolution and importance of body donation, as well as recognize the generosity of donors and their family members. In addition, this guides medical students to handle cadavers in a moral, ethical, and legal manner, with respect and graciousness throughout their learning period.

By bequeathing their bodies (upon death) donors set an example for altruism and establish a social bond with the medical students dissecting them; it reminds students of the privilege of their profession, and it encourages them to provide the utmost care to their patients, with kindness and due respect, in their future medical practice.

Both body donation programmes and silent mentor programmes have inherent similarities and differences. Regardless, in order to support anatomical education and protect public support, a vivid transparency of all procedures must be maintained in the donation process from the moment of acceptance of a dead body, up until the respectful disposal of its remains.

The selfless gift of donors significantly contributes in producing a competent and compassionate medical practitioner and is viewed as an invaluable contribution to society.

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Conflict of interest

None

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Anatomy Education Re-imagined

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The SARS-CoV-2 (COVID-19) pandemic led to a seismic shift in learning and teaching. There was an abrupt halt to in-person teaching and a rapid pivot towards online solutions (1) including in the field of Anatomy education (2,3) where teaching and learning previously usually involved human cadaveric laboratory sessions. With lab access halted, institutions deployed contingency measures (4) and used online Anatomy resources including 3D, virtual reality and videos to bridge the gap (5).

One year on, vaccines raise hopes of return to normalcy. But having successfully integrated innovative techniques into the anatomy educators' toolkit, we can reimagine how Anatomy education is delivered. Here we describe some teaching modalities we successfully used during the pandemic that we will embed into our future Anatomy teaching and review literature that underpins the pedagogic principles of these teaching techniques.

Section 1: The Context

1.1 Anatomy education at Aberdeen

At the University of Aberdeen Anatomy is taught to healthcare students (Medicine, Dentistry, Physicians' Associate) and some groups of BSc students. The majority of gross anatomy teaching is prosection-based. There are strict guidelines about use and upkeep of cadaveric materials in Scotland namely the Anatomy Act 1984 (6), as modified by the Human Tissue Act (Scotland) 2006 (7). Hitherto an issue we have been cautious about was the capture, storage and use of cadaveric images. Even with appropriately consented cadavers, images were only captured and used for specific projects and publications, not for regular teaching and never uploaded online for teaching including to our password protected Virtual Learning Environments (VLE). Students undertake a lecture about the Anatomy Act and sign a Code of Conduct at the start of the academic year agreeing to abide by our regulations.

1.2 Student learning preferences and learning materials

Anatomy is a visual subject and learning gross anatomy is best achieved by engaging with cadaveric specimens or models. It appeals to students with visual and kinaesthetic learning preferences. Additional learning activities such as lectures, interactive tutorials, workbooks, lab manuals or online resources supplement practical learning. In designing and using a wide range of teaching modalities our aim as educators is to engage students of different learning preferences. There are various theories about student learning preferences, here we refer to the VARK theory (8) which proposes that learners prefer one or more of Visual, Auditory, Read-Write or Kinaesthetic modalities.

Section 2: COVID adaptations to Anatomy teaching at Aberdeen

At the start of the pandemic our immediate response was to put together online synchronous (live) lectures and tutorials or asynchronous lecture recordings. Later we began to modify and incorporate other teaching adaptations to improve student engagement and learning. Below are six such adaptations that we will continue after pandemic restrictions end.

2.1 The electronic workbook:

At Aberdeen, we provide Anatomy students with bespoke printed workbooks aligned to local learning outcomes. Workbooks offer a framework for students through questions and tasks that promote learner engagement with lab material. Hoadley and Galant (9) believe that workbooks function as curricular tools providing tasks "to help students master concepts".

Unable to run lab sessions, we produced electronic workbooks that embedded links to subscribed commercially available anatomy packages (dissection videos and 3D rotatable layered illustrations). This helped compensate for the loss of lab-based study and engaged students by asking them questions relating to the video or online resource. Students appreciated being guided through all subscribed resources (previously listed as recommended reading).

We intend to continue using such all-inclusive electronic workbooks but complement them with shorter physical worksheets for use in the lab.

2.2 Live from the Lab:

Demonstration as a method of teaching Anatomy is not new. Anatomy lecture theatres in the 1600s were often built like an amphitheatre to accommodate vast audiences (10). At Aberdeen demonstrations were used within the Anatomy labs to demonstrate tricky or intricate Anatomy using a visualiser (WolfVision VZ-C6 Ceiling Visualizer, GmbH) that allowed magnification of intricate structures. A Live from the Lab session was such a demonstration beamed online from the lab to students in remote locations.

Ethical and safety considerations: We modified our Anatomy Code of Conduct to prohibit download of online cadaveric images onto personal devices. Our local IT team built a secure folder on our VLE to store recordings, accessible only by registered students signing in with university credentials. Conditions for viewing live events and their recordings were made explicit. Specifically, these sessions were to be viewed in privacy and not shared with friends or family. There are disciplinary processes if students break these conditions, but we found that explaining the importance of following the code (to avoid negative publicity which would undermine trust amongst public and thereby affect future cadaver donations) students demonstrate good citizenship and abide by it.

Student feedback suggests they found Live from the Lab a valuable resource and exposed some unexpected benefits; "access" to cadaveric teaching outside of class times and equity of experience for the class as the following comment suggests.

"Live from the lab is better than anatomy last year because we all get to see the structures instead of crowding around [specimens] where people who were not at the front of the specimen…don't see anything" (2nd year medical student)

DiLullo et al's (11) study found that live streaming dissection videos improved student satisfaction and self-perceived performance. Langfield et al (12) however warn that it promotes passive learning. To incorporate active learning, Live from the Lab tutors ask questions during the demonstration and students reply using the online platform's chat function. An observation we made is that through the chat function in online lessons students are more likely to engage in discussions than when face to face.

The success of these sessions including students' adherence to the Code of Conduct means that going forward we will continue to use such online demonstration especially in areas that students struggle.

2.3 3D rotatable cadaveric models:

The technique of photogrammetry (13) has been used to reconstruct 3D rotatable cadaveric models. At Aberdeen a dedicated team have developed a bank of 3D cadaveric images (14) Compared to commercially available 3D resources they are authentic, made from departmental specimens and show more information including normal variations and pathology. Some models have step-by-step layered 'dissection' and labelling that familiarises students with spatial relationships. These resources appeal to visual and kinaesthetic learners. The use of our 3D models increased during the pandemic and adds value to the anatomists' toolkit.

2.4 Interactive case-based discussions:

Case based learning is thought to work by increasing motivation through group work, encouraging critical reflection (15) and also by integrating knowledge and practice (16). At Aberdeen we have used this format, getting students to work in small groups to solve clinical problems using relevant histology, histopathology and radiology. It was ideally suited to deliver online with minimal change. Students work in break-out groups and then feed back to the larger class discussion.

An additional benefit of this small-group format during COVID was that it allowed some student-to-student social interaction. There is growing concern that students' mental health has been impacted negatively during the pandemic partly because of their social isolation with very little face to face teaching. One study (17) found that 86% of participants thought that decreased social interactions led to build up of stress. We would like to believe that our case-based sessions alleviated this to a small degree.

2.5 Online discussion forums:

Discussion forums are an established tool in online courses and can promote higher level thinking (18). To create a community of learners, we asked students to use the discussion forum to discuss curricular queries with each other and faculty. While this was used with variable success, students

themselves produced a live document for asynchronous discussion between students and tutors. We found it an efficient tool to get a feel for student learning and addressed their queries at a subsequent Live from the Lab or Q&A session and we will continue using this going forwards.

2.6 Online assessments:

Our practical exam previously consisted of students undertaking a circuit of timed stations answering questions related to specimens, models or images which were then hand-marked and totalled and collated manually. Most universities moved to online assessments during the pandemic. We moved our Anatomy exam to a secure online platform and physical specimens were replaced by images.

The advantage was the ability to look at exam statistics and question performance whereas previously the hand-marked format did not allow this. This is advantageous and post-covid we intend returning to in-person exams using specimens in the lab but with students answering on the online platform using a hand-held device such as a tablet.

Conclusion

The pandemic opened the doors to exciting new teaching techniques and incorporation of technology. Going forwards we are excitedly looking to return to our labs to teach and assess Anatomy but will hold on to these innovations thus improving our Anatomy teaching toolkit.

The techniques described here are low-cost and easy to set up. We hope that sharing our practice will encourage other departments world-wide to adopt what suits their circumstances and share their own good practice, thus building a global community of practice.

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RESEARCH PAPERS

Intensity of neck pain and its association with anthropometric measurements

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Abstract

Objective

This study was conducted to determine the association between intensity of pain (PI) and anthropometric measurements among patients with chronic neck pain.

Material and methods

This cross-sectional study was conducted among 321 patients with chronic neck pain aged 20-69 years. PI was measured by a visual analog scale (0 to 100). The following anthropometric measurements were taken; weight (Wt), standing height (StHt), sitting height (SiHt), neck circumference (NC) and absolute neck length (ANL). The body mass index (BMI) and relative neck length (RNL) were calculated. Independent sample t-test was used to compare the mean difference between groups ('mild or moderate' and 'severe or worst' pain). Pearson correlation was used to determine the correlation between PI and anthropometric measurements and $p<0.05$ was taken as statistically significant.

Results

A significant low positive correlation was obtained between PI and BMI of the patients with the majority being overweight or obese individuals experiencing 'severe or worst possible pain' ($r=0.14$, ($p=0.03$). Statistically significant low positive correlation between PI and SiHt was observed in females ($r=0.16$, $p=0.03$), but not in males ($p=0.79$). The means of NC, ANL and RNL were not significantly different between patients with 'mild or moderate' and 'severe or worst possible' pain among both male and female. There were no significant gender differences in PI.

Conclusion

Overweight and obese were more likely to have high intensity of neck pain. The SiHt of the females was significantly associated with intensity of neck pain.

Key words: Body mass index, Chronic neck pain, Neck circumference, Neck length, Sitting height

Introduction

Neck pain is a public health problem worldwide, common among the adult population, with one in two people suffering neck pain during their lives [1,2]. Chronic neck pain is significantly associated with their day-to-day life. It has an impact on their families, as well as on the communities and health-care systems of a country [3,4]. Economically, it is a burden to a country considering the cost of the health system, the reduced work efficiency, work absenteeism and insurance coverage [5]. It is a common issue for early retirement, sick leave, and disability [6]. The National Institute for occupational Safety and Health, estimated that the annual cost for work related Musculoskeletal Disorder was $ 13 billion a decade ago and very recently it was between $ 45-54 billion [7]. Neck pain is defined as "a pain originating from musculoskeletal tissue in the region from the occiput to the first thoracic vertebrae" [8]. It is a complex physiological, psychological, and behavioral phenomenon [8,9]. Improper posture, lower intensity stress and strain for longer periods are foremost causative factors for neck pain [10-12]. The cause of neck pain can vary from degeneration, trauma and mechanical causes and depends on factors such as age, gender, anthropometric measurements, physical activity, occupation, genetics, psychopathology (depression, anxiety, somatization), smoking and alcohol consumption, sleeping disorders, poor posture [13,14].

The presence of chronic neck pain may vary depending on the anatomy of the neck and anthropometric measurements of the individuals. The aim of this study was to determine the association between neck pain and the anthropometric measurements of the patients with chronic neck pain. This may provide a clearer understanding of the etiology of neck pain and a more effective management of this problem.

Running title*:* Intensity of neck pain and anthropometric measurements among chronic neck pain patients in Sri Lanka

Materials and Methods

The study was conducted at the Colombo South Teaching Hospital (CSTH) after obtaining ethical approval from the Ethics Review Committee (ERC) of the Faculty of Medical Sciences, University of Sri Jayewardenepura, and ERC of Colombo South Teaching Hospital. It was a cross sectional study among a convenient sample of 325 patients presented with neck pain to the rheumatology clinic at CSTH. Patients between the ages of 20 and 69 years, who had undergone radiological investigations (X-ray cervical spine- Anteroposterior and lateral) of the neck were included. Excluded from this study were, patients who had a past history of neck surgery or surgery of the cervical spine, cervical tumors or cervical ribs, patients diagnosed with metabolic bone disease (eg. osteoporosis, osteomalacia), neoplasia (eg. metastases, multiple myeloma), or bone infections (TB, osteomyelitis, abscess in the vertebral column) and pregnant females. Written informed consent was obtained from the patients. Neck pain was defined as "pain

originating from musculoskeletal tissue in the region from the occiput to the first thoracic vertebrae" [8]. Chronic neck pain was defined as neck pain that lasted for more than three months [13]. A pretested interviewer administered questionnaire was used to collect the socio-demographic data and intensity of pain. Anthropometric measurements (weight, standing height, sitting height, neck circumference, absolute neck length) were recorded by the principal investigator using standard calibrated scales. The visual analogue scale 101 (0 to 100) was used to measure the intensity of pain. Patients were asked to get the average of the intensity of pain suffered during the past 7 days and record the value out of 100 [15]. Pain intensity was categorized as mild (1-25), moderate (26-50), severe (51-75) and worst possible (76-100). For purposes of calculation, mild and moderate pain was considered together as 'mild or moderate' (<50), and severe and worst possible pain was considered as one category 'severe or worst possible' (≥ 50).

Weight (kg) and standing height (cm) of the patients were recorded with light clothing and without shoes to the nearest 0.1cm and 0.1kg, respectively, and BMI was calculated as weight in kilograms divided by the square of the height in meters (kg/m^2) [16]. It was categorized into four groups as underweight (<18.5 kg/m^2), normal weight (18.5-22.9 kg/m^2), overweight (23-24.9 kg/m^2) and obese (≥25 kg/m^2) according to the Asia-Pacific cutoff points [16]. For purposes of calculation, overweight and obese considered as one category 'overweight or obese' (≥23kg/m^2).

The sitting height of the patients was measured with light clothing, without shoes and hair accessories. The patient was asked to sit on a stool looking straight a head, feet hanging down and back in contact with an upright surface. The head was kept straight having the lower border of the orbital cavities in the same horizontal plane as the external auditory meatuses. Measurements were recorded to the nearest millimeter [17].

The non-stretchable plastic tape was used to measure the neck circumference. The measurement was taken, with the patient standing upright, looking straight ahead, with shoulders down but not hunched. The measurement was taken just below the level of laryngeal prominence (Adam's apple) midway between mid-cervical spine and mid anterior neck, to within 1 mm [18].

The absolute neck length was measured as the perpendicular distance between external occipital protuberance and seventh cervical vertebra spinous process (A-B) in the lateral cervical x-ray [19] (Figure 1). The relative neck length was calculated by dividing the absolute neck length with height of an individual and multiplying it by 100 [19].

Figure 1: Absolute neck length

The following formula was used to calculate the relative neck length.

$$\text{Relative neck length} = \frac{\text{Absolute neck length x 100}}{\text{Total height of individual}}$$

Statistical Analysis

Data entry and analysis was done by using the Statistical Package of Social Sciences (SPSS). Quantitative data were presented using frequency distribution and mean values. Qualitative data were presented using percentages.

Intensity of pain was defined as continuous dependent variable as well as categorical variable. Age, BMI, standing height, siting height, neck length, absolute neck length, relative neck length and neck circumference were considered as continuous variables.

Continuous variables were checked for normality, and all found to be normally distributed, therefore independent samples t-test was used to compare the mean difference between two groups. Pearson correlation was used to determine the correlation between pain intensity and anthropometric measurements. P value of < 0.05 was taken as statistically significant.

Results

Of the 325 patients who presented to the clinic with chronic neck pain, 321 patients were selected for this study according to eligibility criteria. The characteristics of the participants are summarized in Table 1 and the correlation between the anthropometric measurements and the intensity of the pain are tabulated in Table 2.

Table 1: Summary of sample characteristics

Characteristic		**Descriptive statistic**
Age (Years)	Mean ±SD	53.08 ±12.04
	20-29	16 (5%)
	30-39	29 (9%)
	40-49	70 (21.8%)
	50-59	86 (26.8%)
	60-69	120 (37.4%)
Gender	Female	254 (79.12%)
	Male	67 (20.88%)
Weight (Mean±SD)	Male	59.46±9.09
	Female	57.89±10.38
Standing height (cm) (Mean±SD)	Male	162.62±6.22
	Female	153.13 ±9.11
Intensity of pain (Mean ±SD)	Male	74.69±11.25
	Female	73.55±11.98
	Sample	73.81±11.86

Body mass index (kg/m2)	Underweight (<18.5 kg/m2)	29 (9.04%)
	Normal (18.5-22.9 kg/m2)	41 (12.77%)
	Overweight or obese (≥23kg/m2)	251 (78.19%)
	(Mean ±SD)	24.32±4.05
Sitting height (Mean ±SD)	Male	83.89±4.49
	Female	79.08±4.62
Neck circumference	Male	364.14±36.13
(Mean ±SD)	Female	339.08±29.37
Absolute neck length (Mean ±SD)	Male	99.28±12.37
	Female	92.02±10.93
Relative neck length (Mean ±SD)	Male	6.12 ±0.79
	Female	6.03±0.84

Table 2: Comparison of anthropometric measurements of patients having 'mild or moderate pain' and 'severe or worst possible pain'

Characteristic	**Mild or moderate pain**	**Severe or worst possible pain**	**P value**	**t value**
Body mass index	21.57± 3.49	24.46 ±3.98	0.00	t=3.34
Standing Height				
Male	167.67±0.58	162.95±6.45	0.21	t=1.25
Female	153.24±6.22	153.16±9.53	0.97	t=0.03
Sitting Height				
Male	80.33±2.52	83.79±4.91	0.23	t=1.19
Female	76.71±4.49	79.01±4.72	0.04	t=1.93
Neck circumference				
Male	347.33±14.18	357.60±33.47	0.60	t=0.52
Female	332.59±24.72	340.99±29.83	0.26	t=1.12
Absolute neck length				
Male	108.33±1.53	103.29±9.66	0.37	t=0.89
Female	93.71±4.93	92.37±11.04	0.35	t=0.93
Relative neck length				
Male	6.46±0.08	6.355±0.68	0.36	t=0.92
Female	6.10±1.64	6.06±0.86	0.85	t=0.17

The patients mean age ± SD was 53.08 ±12.04. Of the 321 patients studied, 254 (79.12%) were females. The mean weight was 59.46±9.09 kg in males and 57.89±10.38 kg in females. The mean standing height was 162.62±6.22cm and 153.13 ±9.11cm in males and females respectively. The mean intensity of pain was 73.81±11.86 in the sample. Mean

intensity of pain in males was 74.69±11.25 and in females 73.55±11.98. There was no significant difference between the mean intensity of pain in male and female (p=0.49, t=0.68).

Mean BMI±SD was 24.32±4.05 in this sample. The mean BMI of patients in the category of 'severe or worst possible pain' (≥ 50) (24.46±3.98) was significantly higher than the mean BMI of patients in the category of 'mild or moderate pain' (< 50) (21.57±3.49) (p=0.00, t=3.34) (Table 2). A significant low positive correlation (r=0.14, p=0.03), was seen between intensity of pain and BMI. Out of 321 patients with chronic neck pain, 251 (78.19%) belonged to overweight or obese group, of whom 225 (89.6%) had 'severe or worst possible pain'.

Mean standing height (cm) of patients with 'severe or worst possible pain' was not significantly higher than mean standing height (cm) of patients with 'mild or moderate pain' in both males (p=0.21, t=1.25) and females (p=0.97, t=0.03) (Table 2). There was no correlation between intensity of pain and standing height in both males (p=0.62) and females (p=0.94).

Mean sitting height of female patients with 'severe or worst possible pain' (79.01±4.72) was significantly higher than those with 'mild or moderate pain' (76.71±4.49) (p=0.04, t=1.93). This difference was not observed in male patients (p=0.23, t=1.19) (Table 2). Statistically significant (p=0.03), low positive correlation (r=0.16) was found in the intensity of pain and siting height in female but not in male (p=0.79). Out of the total females studied, 40% were sewing machine operators. In an analysis of the other 60% of female who were not sewing machine operators no significant correlation between the intensity of pain and sitting height was observed (p=0.64, r=0.46).

Mean neck circumference (male: p=0.60,t=0.523; female: p=0.26, t=1.12) , absolute neck length (male: p=0.37, t=0.89; female: p=0.35, t= 0.93), and relative neck length (male: p=0.36, t=0.92; female: p=0.85,t=0.17) of patients with 'mild or moderate pain' were not significantly different from patients with 'severe or worst possible pain' in both males and females (Table 2). A statistically significant association was not seen between the intensity of neck pain and neck circumference or absolute neck length or relative neck length in both males and females.

Discussions

The etiology of neck pain is still not clear. There are several factors that could be responsible for neck pain, its etiology, and its impact on individuals. The present study was to determine the association between intensity of pain in patients with chronic neck pain and their anthropometric measurements.

There was a statistically significant, positive correlation between BMI of the patients with chronic neck pain and intensity of the pain. The majority of the patients studied were overweight or obese (Table 1). Of these, almost 90% had 'severe or worst possible pain'. Previous studies have demonstrated an association between obesity and neck pain. A

relatively strong association between obesity and the prevalence of chronic pain in the neck, shoulders, and low back were demonstrated especially among women [20]. Another study has shown that the association of overweight and obesity with an increased risk of chronic pain in the neck/shoulders among both women and men was significant [21]. These findings could indicate that obesity may be a factor responsible for chronic neck pain.

No single cause could be attributed to justify the association of chronic neck pain with obesity; the link may be multifactorial. Addressing the known causes of obesity, such as a sedentary lifestyle, incorrect eating habits, mental depression, mental stress, could reduce the incidence and intensity of neck pain in individuals. Studies have recommended as preventive measures regular physical activity and healthy nutrition.

A statistically significant positive correlation between intensity of pain and sitting height was observed in females. Of the female patients studied, 40% were sewing machine operators. A subsequent analysis of the non sewing machine operators (who form 60% of females studied), did not show this positive correlation. The positive correlation between the intensity of pain and sitting height in this study, could be occupation related and be attributed to the working conditions of sewing machine operators, whose work involve long hours in a sitting position. The sewing machine operation is characterized by a static sitting posture with forward incline head and trunk [22]. Little work has been done to associate chronic neck pain with occupational factors (the posture, working conditions and the sitting height of individuals). A task analysis has shown that posture problems as a result of a poor workstation layout such as incorrect table, chair height, and non-adjustable equipment contributes to the high incidence of muscular skeletal disorders in sewing machine operators [23]. A Sri Lankan study has demonstrated an association between neck pain and chair height in sewing machine operators [24].

It is known that the height of the chair as well as the height of the sewing machine used by these workers are fixed and cannot be adjusted to suit the individual worker's needs. A better understanding of their association is required to appropriately manage this group. Future studies with larger sample size and different working setups may provide a basis for recommendations for height adjustable equipment in workplaces that would contribute to a lower incidence of neck pain.

Although there was no positive correlation between intensity of pain and sitting height in males a probable association cannot be excluded as in this sample, only about 20% of the patients are male. Further studies using larger samples are required.

The association of neck circumference, absolute neck length and relative neck length with the intensity of neck pain were not statistically significant in both male and female. Previous studies have shown, that, there is no significant relationship between neck length and cervical spondylosis [19].

A significant association between intensity of pain and gender was not observed in the present study. This observation is not

compatible with the existing evidence, that females are more prone to have greater intensity of pain [15,25].

Few limitations should be acknowledged. This is a cross sectional study conducted among a specific group of patients with chronic neck pain, at a single centre. We have not assessed other factors which may be responsible for chronic neck pain such as: depression, engaging physical activity, hours spend for reading and watching television, smoking and alcohol consumption. Future studies should be multicentered and other confounding factors should be analyzed with the intensity of pain and anthropometric measurements.

Conclusion

Overweight or obese were more likely to have high intensity of neck pain ('severe or worst possible pain'). The sitting height of the females was significantly associated with intensity of neck pain.

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Bifurcation of the mandibular canal- Radiological appreciation of a rare anatomical variation - Report of 3 cases and review of the literature

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Abstract

The mandibular canal is a single canal that runs in the mandible carrying inferior alveolar neuro vascular bundle and splitting of the mandibular canal into in its course is rare occurrence. With the advent of 3-dimensional imaging modalities like computed tomography or cone-beam computed tomography better visualization becomes possible. As a result, more cases of this nature are being reported in the recent past giving rise to increased prevalence than in the past where two-dimensional imaging like digital panoramic tomography were dominating. This article also appreciates the radiological anatomy of three cases with bifurcation of the mandibular canal incidentally diagnosed in the cone-beam computed tomography and also discusses the clinical significance of this rare anatomical entity.

Introduction

The mandible is a unique piece of anatomy that had amazed both the anatomists and clinicians due to its structure and multitude of functions it performs. The mandible being the second bone to begin ossification in the body ossifies approximately in the 6-7th week of intrauterine development.[1] Cartilage formation tends to occur as clusters from the Meckel's cartilage and then unify to form a single bone. In both humans and primates, this ossification process completes in the first year after birth. [2] Mandibular canal is formed by the encapsulation of bone during embryogenesis. [2]

The mandibular canal originates from the mandibular foramen in the posterior aspect of mandible and terminates at the mental foramen in the anterior aspect of mandible and it carries the inferior dental nerve, artery, and vein. .[1] It is a single canal, running anteriorly, through the trabecular bone, to the level of the alveolus of the mandibular central incisor, near the mental foramen.[1] The canal is wide and narrows towards the medial side. [1,2] It is known that the mandibular foramen can have variations, but rare in nature.[3] It can be in the form of the bifid, trifid, double mandibular canal, and pseudo bifid/double mandibular canal. [3] The reason for these variations in the mandibular canal is related to the embryological formation of the inferior dental nerve (IDN) in the mandible.[4] Radiologically, the mandibular canal is characterized by a radiolucent strip in between two radio-opaque lines, generally, it is a single structure observed in different positions of the mandible and around the mandibular third molar. [3]

The incidence of a bifid mandibular canal is dependent on the method of radiological investigation such as Dental panoramic

tomography (DPT) and Cone-beam Computed Tomography (CBCT). There are several classifications describing the bifurcation of mandibular canal (BMC). BMC was first described in 1973 by Pattierson [7].

The presence of BMC has many clinical implications and such as knowledge of variations in the course of the mandibular canal is important in lower impacted third molar removal surgery, implant placement in the posterior mandible, orthognathic surgery, when managing the failure of IDN block and as a differential diagnosis in pain in posteriorly resorbed alveolar ridges caused by the pressure exerted by dentures [5].[6][8].[9].

Here, we report three cases of BMC which was identified incidentally to appreciate its radiological anatomy and literature to understand this entity.

Case history

In all 3 cases, the bifurcation of the mandibular canal was diagnosed from the referrals for evaluating the risk of Inferior dental canal damage in lower mandibular third molar removal surgery by evaluating the Cone Beam Computed Tomography (CBCT) images.

Details of the 3 cases are summarized in table 1.

Table 1 - Clinical and radiological summary of the cases

Case Number	Age	Gender	Presenting complaint	Radiological interpretation of the mandibular canal (CBCT)
1	24	M	Pain from a left side wisdom tooth.	The left inferior alveolar canal (IAC) appears to be bifid. It divides into two, posterior to the Left side lower third molar and gives out a lingual branch. The said lingual branch crosses the mandible immediately posterior to the Left side lower third molar. (figure 1 & 2)
2	25	F	Impacted right side wisdom tooth	The right IDN canal has a buccal path away from the roots of the right-side lower third molar. An accessory canal is given out apically in relation to the 48 and travels lingually (figure 3 & 4)
3	55	M	Pain on right side lower jaw.	The right IDN canal has a buccal path away from the roots of the right-side lower third molar. An accessory canal divides from the main canal posterior to the 48, and travels lingually. (figure 5 & 6)

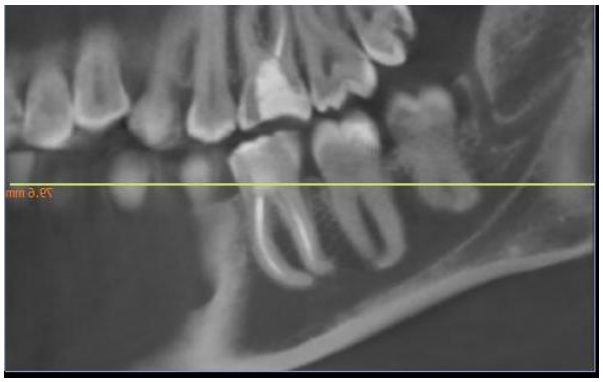

Figure 1 - Pseudo Panoramic section of CBCT showing the pathway the IDN of case number 1

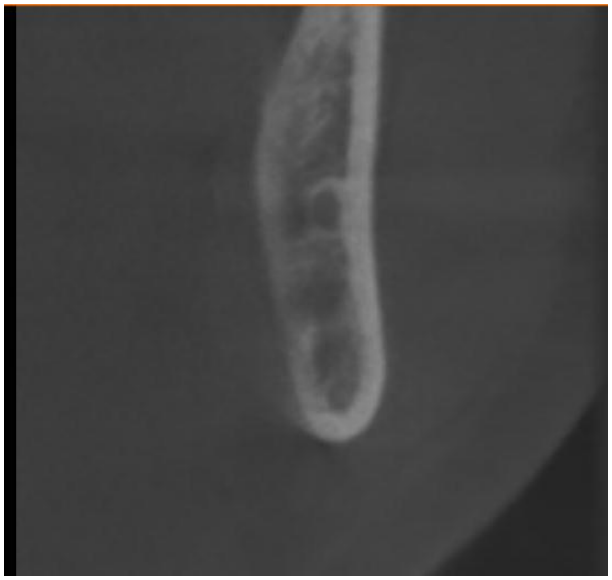

Figure 2 - Coronal view of CBCT showing the pathway the IDN of case number 1

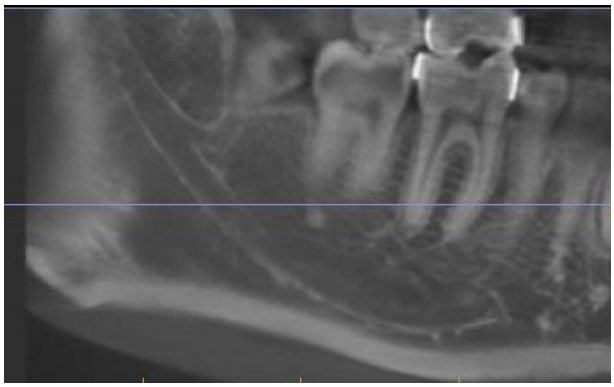

Figure 3 - Pseudo Panoramic section of CBCT showing the pathway the IDN of case number 2

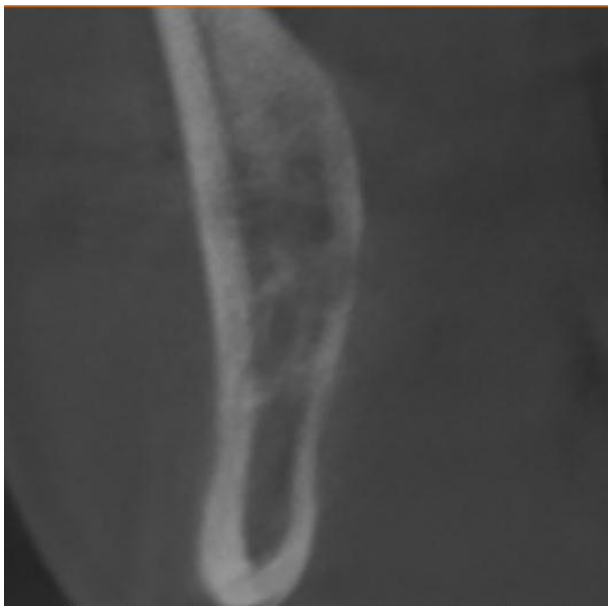

Figure 4 - Coronal view of CBCT showing the pathway the IDN of case number 2

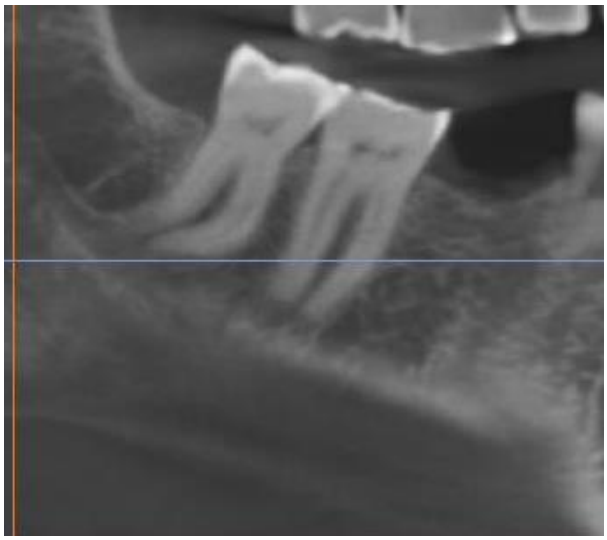

Figure 5 - Pseudo Panoramic section of CBCT showing the pathway the of case number 3

Figure 6 - Coronal view of CBCT showing the pathway the IDN of case number 3

Discussion

The origins of the bifid mandibular canal can be comprehended by understanding its embryology. There are 3 IDN canals that form in the course of embryonic development to innervate each of the groups of teeth in one half of the mandible. This development is followed in time by the fusion of the nerves. This theory would explain the as existence of double mandibular canals in some patients, secondary to incomplete fusion of these 3 nerves. This was discussed by Chavez et al. [4]

CBCTs provide 3-dimensional images where multiple cut sections could be analyzed, further details can be obtained and superimposition can be avoided.[8] Many authors say that CBCT is a better imaging modality than DPT for spotting BMC in the mandible. Normal anatomical structures have been reported to be superimposed, under or falsely reported, or not clearly seen in panoramic radiographs.[8] Kuribayashi et al. show that due to the narrow nature of the accessory canal of the BMC could be missed in OPG but not in CBCT so the prevalence could be more which was 15.6%.[10] Bogdán et al and Klinge et al provide more information on this through a cadaveric study. [11] Freitas et al had found a 30% prevalence of bifid mandibular canals in a sample of 300 in a CBCT study.[8] This raises a concern about its rare nature of the bifid mandibular canal. This sheds light on a gap of knowledge that is worth exploring.

Carter and Keen, Nortje and Langlais et al are the classification methods used in the classification of BMC.[12] Langlais et al classification is most commonly used as it was based on large sample numbers. [3] (table 2) According to this classification, our 3 cases belong to type 1, which is the more prevalent type as the division occurs before the root of the impacted mandibular third molar.

Table 2 - Describes Langlais et al bifurcation of the mandibular canal.[3]

Type	**Description**
Type I	Single foramen Duplicated canal to third molar region
Type II	To the ramus of the mandible
Type III	Combination of I and II
Type IV	Separate foramina Duplicated canal

Understanding the anatomical variations of the mandibular canal is important for a dental surgeon. A possible cause for local anesthesia

failure during inferior dental nerve block is the existence of accessory nerve supply due to bifid or trifid mandibular canal.[5] If this occurs, it should be radiologically investigated and confirmed. The same can be said during the exodontia of the impacted mandibular third molar, the relationship of the impacted tooth and IDN canal should be evaluated and the presence of bifid canal should be looked upon and also its relationship with the root of the impacted tooth. [5] With this understanding, the surgical technique for the removal of the impacted mandibular third molar should be planned, so that IDN canal damage may be avoided. Also, the same can be stated in the placements of dental implants in the posterior mandible. A gradual alveolar ridge resorption in the posterior aspect of the of the mandible by denture wearing caused compression of an accessory branch of the mandibular canal can cause pain. [13]

The identification and understanding of this variation of the mandibular canal is important for a maxillofacial surgeon or plastic surgeon as well, especially when performing bilateral sagittal split osteotomy in the orthognathic surgical correction of the defects of the mandible.[14]

Complications such as traumatic neuroma, paresthesia, and bleeding can occur due to the ignorance of this variation. [15]

The prevalence of bifid mandibular canal is rare but with the advent of better three-dimensional modalities, this premise may be questionable. Further investigations are warranted. The appreciation of the anatomy of this entity is important for the management of the IDN block failures. Also, for performing extraction of impacted lower third molars, placement of posterior implants, and performing bilateral sagittal split osteotomy in orthognathic surgery to prevent IDN canal damage.

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Conflicts of interest

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Online Anatomy education during COVID 19 pandemic period among pre-clinical Medical Students: An Experience of University of Peradeniya

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Abstract

Objective

The objective of this study was to evaluate the perception, attitudes, and barriers faced by students during the online anatomy course.

Materials and methods

A descriptive cross-sectional study was carried using a questionnaire, based on available feedback questionnaires from the faculty and published questionnaires, pilot tested and finalized. It was distributed via Google-forms to 185 second-year students who had undergone 2 semesters of online teaching.

Results

A total of 115 Google-forms were received. Females represented 50.9%, with a mean age of 21.9±1.022 years. Smartphones (86%) were mainly used to access online material while mobile data (79.8%) was the commonest method of internet access. Online learning tool usage was: Moodle-98.2% Zoom-94.7% and Youtube-66.7%. Attitudes towards online learning were positive (77.2%) with prior preparation for teaching sessions as high as 97.4% and active participation in the online sessions (81.6%). Majority preferred Moodle for online lectures (81.74%), histology practical sessions (89.57%) and slide projections (82.74%) while for gross practical sessions it was Moodle (80.87%) and Youtube (41.74%). For tutorials (70.44%) and discussions (76.52%) majority preferred Zoom sessions. Of the respondents 57.9% feared lack of direct anatomy learning might have an impact on their clinical skills in future. The major problems of online learning were identified as lack of self-motivation, lack of onsite practicals, and increased screen time.

Conclusion

Though majority of participants agreed that onsite anatomy teaching and learning cannot be replaced by the online course, the attitude towards it appears to be mostly positive during the COVID-19 pandemic.

Key words: COVID-19, Anatomy, Pre-clinical, Online, Medical education

Introduction

The COVID 19 infection is a serious global health threat, continuing its spread across the world. It has caused a pandemic with a growing number of cases and considerable mortality rate, infecting more than 90 million

people worldwide from the end of 2019 going into 2021.

This situation has changed the day to day life of individuals throughout the world. Schools and universities had to be closed and education activities were discontinued as a part of health guidelines to prevent the spread of the disease.

However, education is a must for the betterment of a country and a society and prolonged periods without education will have a bad impact on the future. Therefore, educators and teachers had to use alternative methods of teaching and learning to overcome this issue and as a result internet and web-based teaching and learning came to play a major role in continuing education during the pandemic.

Online teaching is characterized as the use of computer technology to provide technology-based learning. Even though this type of teaching has been there ever since the discovery of the web it always placed a less important role to onsite teaching. However, with the closure of universities and schools around the world, learning management systems and conference platforms quickly became the main method of imparting knowledge to millions of students around the world. Online learning modalities encourage student-centered learning and they are more easily manageable during this Pandemic situation (1). Further, transition to complete online program may be a learning experience for both students and faculty (2).

In Sri Lanka the situation is similar and online learning system has become a compulsory part of the teaching and learning process for higher education. After the sudden closure of universities in the country with the spread of COVID -19, the government of Sri Lanka promoted online and other distance education methods as an alternative solution for continuing higher education.

Unlike developed countries, this was a big challenge for most government universities where mostly education concepts were delivered through onsite teaching methods. For some subjects online platforms were ideal and maybe even better. However, for medical education where they have to take decisions based on experience it was a bigger challenge. In situations where conclusions are arrived at based on observations, guidance of a lecturer seems essential.

However, Faculty of Medicine, University of Peradeniya has continued the academic program shifting quickly to online teaching preventing major disruption of educating medical graduates. Almost all the batches in the faculty are involved in the online academic program including pre-clinical batches.

Pre-clinical years form the base of the entire medical career of undergraduates and therefore any deficiency in delivering knowledge during this initial period can affect their entire future. First year students with fresh minds and a high degree of enthusiasm are energetic learners and need proper guidance for laying the foundation to their medical careers.

When it comes to pre-clinical years anatomy is one of the main subjects. It is a highly practically oriented subject which requires students to learn by dissecting cadavers, handling bones and looking at microscopic

slides. Therefore, the anatomy teachers face a huge challenge in delivering the practical aspects of anatomy to students through online education tools.

Teaching sessions have covered theory, discussions and tutorials via conference platforms and learning management systems (LMS). Recorded lectures were uploaded to LMS with pdf version of handouts. While some lectures were delivered live via conference platforms. Gross Anatomy practicals were done by making video clips and uploading them to the LMS. However, the students have missed the opportunity of doing dissections step by step and couldn't feel the beauty and the depth of this very interesting subject.

Despite all these efforts there are obvious deficiencies and issues in delivering this subject via online platform compared to traditional anatomy education. Department of Anatomy, Faculty of Medicine, University of Peradeniya has decided to conduct this questionnaire-based survey to identify these problems.

The aim of this study is to assess the student perception of the current online teaching program, to understand the attitudes of students, their preferences and the barriers faced in learning anatomy via the online platform, with a view to improving the delivery of subject matter to preclinical medical students.

Methodology

This descriptive cross-sectional questionnaire based online survey was conducted from January 20th to February 15th 2021, among second year students in the Faculty of Medicine, University of Peradeniya. Participation was completely voluntary and informed consent was taken from each participant.

This survey was conducted to assess the perception, attitudes, and barriers faced by students during the online anatomy course conducted during the pandemic period. A questionnaire was designed using available feedback questionnaires from the faculty and published questionnaires.

The questionnaire included 65 questions, and was divided into two sections. First section consisted of questions regarding the demographic characteristics of the participants. Second section was further divided in to 7 parts. The first part was based on accessibility of necessary facilities. The second part included 16 questions to evaluate the attitudes towards the online anatomy course. It consisted of questions using 5-point Likert scale (5-Strongly agree, 4-Agree for the most part,3-Undiceded, 2-Disagree for the most part, 1-Disagree entirely.). The other parts consisted of questions regarding preparation for online teaching activities, questions regarding active participation during online teaching activities, students view on methods of delivering anatomy content via online platforms and problems related to online learning.

The questionnaire was pilot tested on 5 final year students and edited accordingly. The finalized questionnaire was built into Google-forms. The consent form and the questionnaire were emailed to 185 second-year students who had undergone 2 semesters of online teaching.

Statistical data analysis was performed by using Microsoft excel and Minitab 17 statistical software.

Results

Out of the 185 questionnaires distributed a total of 115 were received. Age ranged from 19-25 years with a mean age of 21.9±1.022 years. Gender distribution was male- 49.1% and female 50.9%. Smartphones (86%) tablets (68.4%) and laptops (41.2%) were used to access online material. Of the participants 79.8% used personal mobile data and 56.5% accessed personal Wi-Fi connections to connect to the net. Almost all students had their own devices and a good internet connection to access online content. The faculty LMS (Moodle) (98.2%), conference platform (zoom) (94.7%) and YouTube (66.7%) were the commoner online tools used for learning.

Attitude and Perception towards online learning/ teaching in Anatomy.

Most of the participants (77.2%) had positive attitudes towards the online anatomy course, while 19.3% had neutral attitudes. Most of the student found learning anatomy online to be comfortable (70.1%) and their LMS to be well organized and user friendly (87.7%). Of the participants, 47.45% felt that online learning in Anatomy should play a complementary role in the future while 35.1% were neutral to the idea. Most students (82.45%) felt that online learning gave them more time to spend with their families. Most students (85.9%) felt that the online anatomy course was used effectively during the COVID 19 pandemic and 57.9% mentioned that the online content and teaching sessions had improved the standard of anatomy teaching. Only 32.5% felt that their motivation for online learning was higher compared to onsite learning. Most (62.3%) felt that they could manage their time better with online teaching. However, 57.9% participants feared that the lack of direct onsite face to face anatomy learning might have an impact on their clinical knowledge in the future. Many of the participants (62.6%) agreed that onsite anatomy teaching and learning cannot be replaced by the online course. Table 1 shows the statements used to assess the attitude towards online learning/ teaching in Anatomy.

Table 1: Statements used to assess the attitude towards online learning/ teaching in Anatomy.

1)	I comfortable in learning Anatomy via online platforms.
2)	I feel that online learning in Anatomy should play a complementary role in the future.
3)	I feel that Moodle (LMS) is well organized and user friendly for teaching Anatomy.
4)	I feel less stressed for online teaching in anatomy compared to onsite teaching.
5)	I feel that I have got more time to be with my family because of online teaching.
6)	I feel that online teaching is efficient for Anatomy compared to onsite teaching.
7)	I feel that online teaching is used effectively for Anatomy during COVID 19 pandemic period.
8)	I feel that increased use of online platforms for Anatomy improves standards of Anatomy education.
9)	My motivation is high for online teaching in Anatomy compared to onsite teaching.
10)	I feel independent during online learning compared to face to face Anatomy learning.
11)	I am able to manage my time effectively and easily because of online teaching compared to onsite teaching.
12)	I prefer online learning anatomy to onsite methods.
13)	I believe that I could reduce my expenses spent on study materials because of online teaching.
14)	I have a fear of getting low marks for anatomy because of online learning.
15)	I feel that lack of direct anatomy learning will have an impact on my clinical knowledge in future.
16)	I feel that onsite learning in anatomy cannot be replaced by online learning.

The percentage of students that mentioned they had prior preparation for teaching sessions was as high as 97.4% and active participation in the online sessions was 81.6%. Student preferences on the delivery mode of different anatomy teaching components are given in table 2.

Table 2: Student preferences on methods of delivery of anatomy components via online platforms.

	Conference platform (Zoom)	**LMS (Moodle)**	**Social media (Facebook)**	**Social media (WhatsApp)**	**YouTube**
Anatomy Lectures	55.6% (64)	81.74% (94)	1.74% (2)	5.22% (6)	22.61% (26)
Gross Anatomy practical's	20.0% (23)	80.87% (93)	N/A	2.61% (3)	41.74% (48)
Microscopy Practical's	10.43% (12)	89.57% (103)	N/A	4.35% (5)	25.22% (29)
Tutorials	70.44% (81)	51.30% (59)	2.61% (3)	6.96% (8)	4.35% (5)
Practice Slide Projections	37.39% (43)	82.74% (94)	N/A	N/A	16.52% (19)
Question and answer discussions	76.52% (88)	43.48% (50)	5.22% (6)	15.65% (18)	6.09% (7)

With regard to lectures most participants preferred the uploading of a video recording (42.1%) or narrated PowerPoint (38.6%) of the lectures with a PDF version of the lecture handout to the LMS.

Student perceptions on the mode of delivery of practical components in anatomy are given in figure 1.

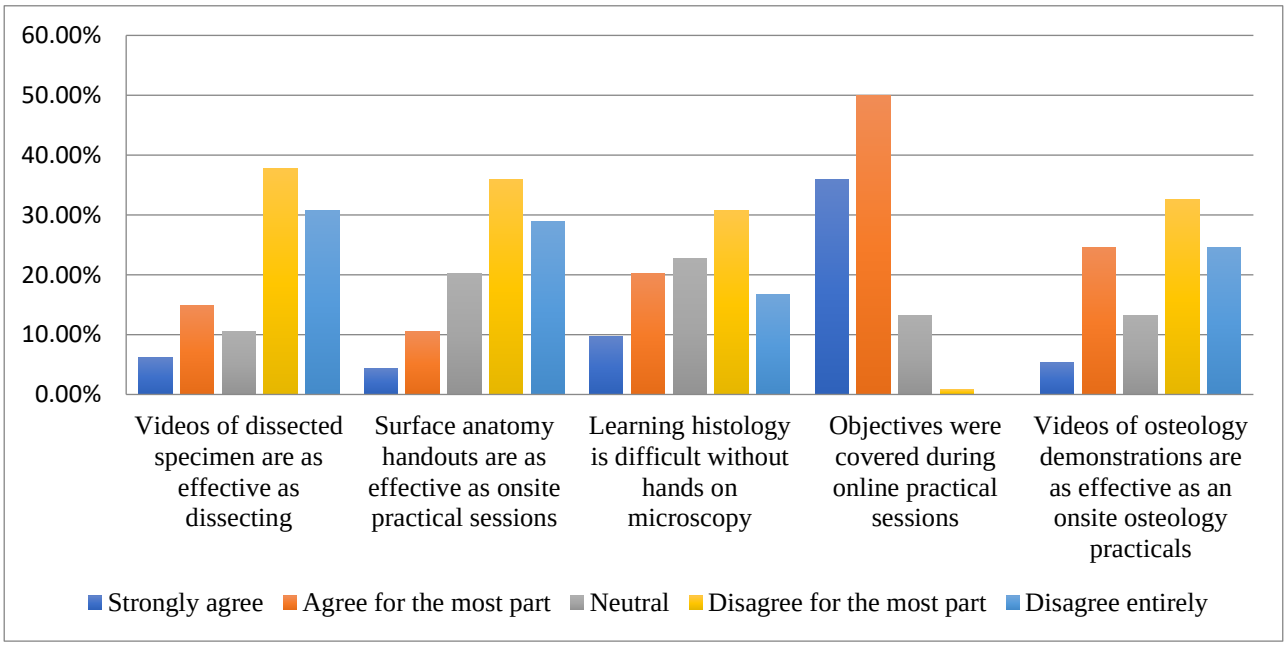

Figure 1: Student perceptions on the mode of delivery of practical components.

Issues/ Barriers faced during the online Anatomy course.

With regard to problems faced during the online course, 21.1% complained about the screen size of their device. Only 24.6% of the participants complained of poor internet connection. Respectively 15.8% and 13.2% complained about uncomfortable home environment and diminished freedom at home due to online learning. The time spent on learning via online platforms has significantly increased as expected. Previously only 10.5% engaged more than 4 hours per day to learn via online modes. However, during the pandemic time, it has increased up to 70.2%.

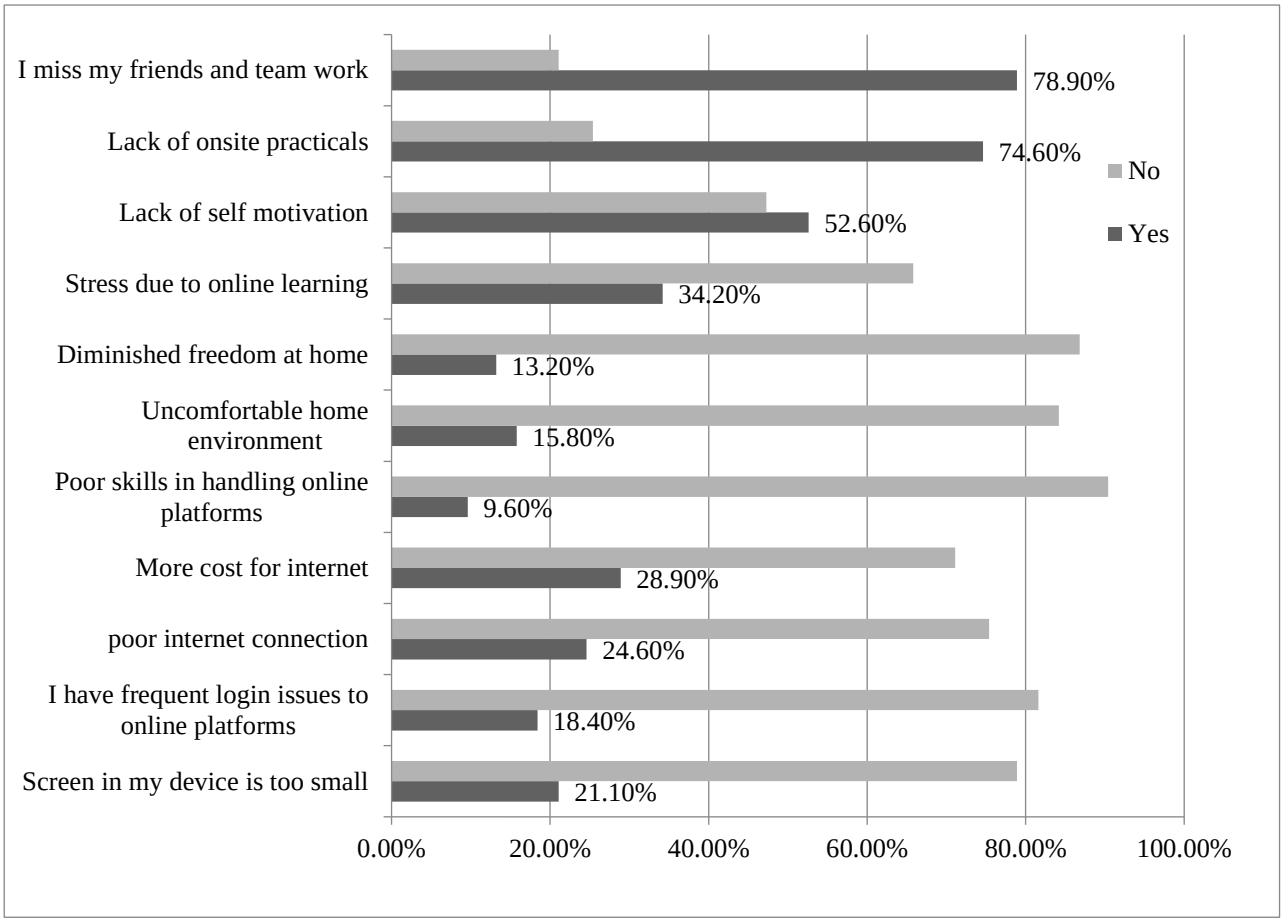

Figure 2: Main Problems faced during online learning.

Of the participants 49.1% faced health problems or discomfort due to prolonged screen time. Visual symptoms were more common among the respondents (83.9%). According to respondents sleeping difficulties were complained by 36.2% and musculoskeletal related pain by 41.1% of the participants.

Discussion

Due to the COVID 19 infection, physical classroom sessions were suspended by different government regulations and universities had to assume an online based course. This transition was more difficult for disciplines such as anatomy due to its practical

nature of delivering content. Cadaver dissections, microscopy practical sessions, osteology demonstrations and practical sessions on surface anatomy play an integral part of anatomy teaching. Developing an online course to cover these practical aspects, while delivering lecture-based content was a daunting task for most anatomy teachers. The online anatomy course at Peradeniya was designed to deliver the lecture component as well as to imbibe at least a percentage of practical knowledge to students.

The main purpose of this study was to assess the perception, attitudes, and barriers faced by students during the period of online anatomy teaching. Although this area has been evaluated in other countries, researchers consider this the first exploration of the topic in Sri Lanka.

Most of the participants in the current study had positive attitudes towards online learning during the pandemic (77.2%). However, 62.6% of the participants perceived that onsite teaching cannot be replaced by online teaching. Similar findings were reflected by other studies which reveal that although distance anatomy education proves valuable during the pandemic, it is less efficient than traditional methods especially with regard to practical lessons (3, 4, 5). This demonstrates that hands on experience in understanding the anatomical three-dimensional structure and relations cannot be completely replaced by virtual methods.

Students felt that video demonstrations of prosected specimens or dissections were not as effective as cadaveric dissections at the laboratory. They preferred onsite surface anatomy and osteology practical sessions to video demonstrations or practicing on one's self at home. However, it appeared as if they preferred video demonstrations of histology slides to actual microscopic examination of slides. Even though the majority preferred onsite practical sessions they agreed that all objectives for the practical sessions were covered by the online course.

Findings of our study revealed a significant increase in the time spent on online platforms for learning before and during the pandemic time as expected. A similar study among UK medical students revealed that the percentage of students using online platforms for more than 15 hours per week increased from 7.35% prior vs 23.56% during the pandemic (6). Prolonged screen time could be a cause of health problems such as visual symptoms, sleep disturbances and musculoskeletal pain as reported by the students. Research studies have found evidence between prolonged screen time and visual health problems (7). Awareness of these issues could be considered as the first step in remedial actions such as regular breaks from screen time and stretching exercises in between online sessions.

Our study reveals an overall positive attitude towards online learning among the pre-clinical students. The online delivery of lectures, gross anatomy practicals and microscopy practicals were well received by most even though the majority agreed that onsite lessons cannot be replaced by online methods of teaching. The lack of hands-on experience in learning anatomy may have a disadvantage in the deep understanding of the subject when applying

knowledge in the clinical setting. A study in Saudi Arabia reported that videos and images would not substitute practical sessions (68.4%) (8).

COVID-19 pandemic has disrupted face-to-face teaching in medical schools all over the world. This study reflects that the Department of Anatomy has successfully transitioned their educational environment to online teaching and assessments. One of the main implications was identified as preclinical students missing the hand on experience during their preclinical years (57.9%). Similar results were reflected by a study by Gaur et al., 2020 (9).

The major problems of online learning were identified as lack of self-motivation (52.6%), loss of peer learning (78.9%) and lack of onsite practicals (74.6%). In a study carried out among medical students in Libya the main problems faced by the participants were financial issues and poor quality of internet connection which were not reported by the majority in our study (10).

As the response rate was 62.16%, the attitudes and perceptions of all students could not be accurately assessed, which can be considered as a limitation of this study. It is further questionable whether this was due to issues with regard to online communication.

Even though online education has proven to be well perceived by the students during the pandemic period educators must be vigilant in identifying problems related to online learning and addressing them when designing and implementing new online anatomy courses for effective online education.

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Conflict of interest

None

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Morphological Diversity of Peroneus Tertius: A Cadaveric Study

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Abstract

Objective

The objective of this study was to demonstrate morphological anatomical variations of the peroneus tertius muscle which may have important clinical and surgical implications.

Materials and methods

Fifty four specimens of anterior compartment of the leg which were dissected routinely according to the undergraduate course were examined for variations of the above muscles and the anatomy was further defined using appropriate dissection methods.

Results

A wide variation was found with regard to the morphology of peroneus tertius and the extensor digitorum longus muscles with considerable differences between the legs of the same cadaver.

When considering important variations deviating considerably from the normal structure, a variation of the distal attachment of peroneus tertius muscle in two specimens revealed that in addition to the normal attachment to the shaft of the fifth metatarsal, an additional slip inserted to the extensor expansion of the fifth toe. It apparently replaced the fourth tendon of extensor digitorum longus, which only had three divisions in these specimens.

Seventeen of the specimens had a single muscle belly giving rise to 5 tendons which had the usual distal attachments of the peroneus tertius and the extensor digitorum longus muscle as stated below. Absence of peroneus tertius was noted in one specimen.

Conclusion

The anatomical structure of the peroneus tertius vary substantially from individual to individual, inclusive of differences existing between the left and the right lower limbs of the same cadaver.

Key words: peroneus tertius, extensor digitorum longus, anatomical variations, Jones fracture.

Introduction

Peroneus tertius or fibularis tertius and extensor digitorum longus are muscles in the anterior compartment of the leg. Although the peroneus tertius was once thought to be a muscle unique to humans (1) it has also been found in certain anthropoid apes (2,3).

The earliest recorded description of these muscles is by Vesalius (6). Some contemporaries of Vesalius rejected peroneus tertius as a separate muscle and described it as a part of extensor digitorum longus.

Proximal insertion of the muscle is on the distal third or more of the fibula as well as on the interosseus membrane and anterior intermuscular septum (5, 6, 7). The distal attachment is classically described as to the base of fifth metatarsal bone (6, 7). Evidence of variations of this insertion are described to be to shaft of the fifth metatarsal, fascia covering fourth interosseous space and base of fourth metatarsal (6, 7, 8, 9). Though the tendon of peroneus tertius is described as usually one, work of Ericikt et al (8) has found that there can be 2 tendons with a slip. Although interconnections between extensor digitorum longus muscle and peroneus tertius is mentioned in textbooks the precise manner of connection is not well documented. Stevens et al (9) however has documented intertendinous connections between peroneus tertius and extensor digitorum longus tendon.

Considering the action of this muscle, work of (15) has found that the muscle is important in the swing phase of the gait to level the foot and help toes clear the ground along with extensor digitorum longus and tibialis anterior. This muscle is implicated in the occurrence and management of Jones fracture (17). The muscle is additionally used in filling soft tissue defects in the limbs (16).

The extensor digitorum longus muscle arises from the inferior surface of the lateral condyle of tibia, proximal three quarters or upper half of the medial surface of fibula, adjacent anterior surface of interosseous membrane, deep fascia, anterior crural intermuscular septum and the fascial septum between itself and tibialis anterior. It descends to form a tendon which divides in to four on the dorsum of the foot each joined by a slip from the extensor digitorum brevis to form dorsal digital expansions through which they finally insert to the bases of distal and middle phalanges of lateral four toes. (6, 7) The action of this muscle is to dorsiflex the foot and extend the toes.

Method

Fifty four specimens received by the Department of Anatomy, Faculty of Medicine, University of Peradeniya for studying purpose of students were used for this study. Initially medical students dissected the specimens under the guidance of the academic staff members. Following completion of the relevant dissections, the lower limbs were thoroughly observed for variations of peroneus tertius muscle and its tendons and subsequent dissections carried out to clearly define the anatomy.

Results

Results showed a wide variation of morphology with remarkable differences noted between the legs of the same cadaver. Here are described five variations that significantly deviated from the normal text book description.

In the right leg of a female cadaver (figure 2) the peroneus tertius muscle gave rise to two tendons. The lateral tendon inserted into the base of the fifth metatarsal. The medial slip continued to the fifth toe beyond the fifth metatarsal, apparently replacing the fourth tendon of extensor digitorum longus. Extensor digitorum longus muscle gave rise to three tendons rather than the usual four, each heading towards second, third and fourth toes. In the left leg of the same cadaver both extensor digitorum longus and peroneus tertius originated as a single muscle with 2 muscle bellies splitting high in the leg. Extensor digitorum longus showed no variation on insertion. Peroneus tertius split in to 2 slips with the lateral slip attaching to fifth metatarsal head and medial slip joining the fascia over fourth interosseus space (figure 3).

A similar variation to figure 2 was noted in another female cadaver on the left leg with two tendons arising from peroneus tertius and 3 tendons arising from extensor digitorum longus. Additionally there was a prominent intertendinous slip extending from the tendon of peroneus tertius attached to the fifth toe to the tendon of extensor digitorum longus attached to the fourth toe (figure 4).

In two male specimens on the left leg the two muscles had extensive intermuscular connections proximally apparently forming a single muscle which separated in to two muscle bellies distally. In both specimens the medial muscle belly representing the extensor digitorum longus gave rise to 3 tendons and the lateral muscle belly representing the peroneus tertius gave rise to 2 tendons as above (figure 5).

Seventeen of the specimens showed a single muscle belly arising from the anterior surface of the tibia giving rise to five tendons which had distal attachments to the usual distal attachments of the peroneus tertius and the extensor digitorum longus (figure 6).

Absence of Peroneus tertius was noted in one specimen, which was the left leg of a male cadaver (figure 7).

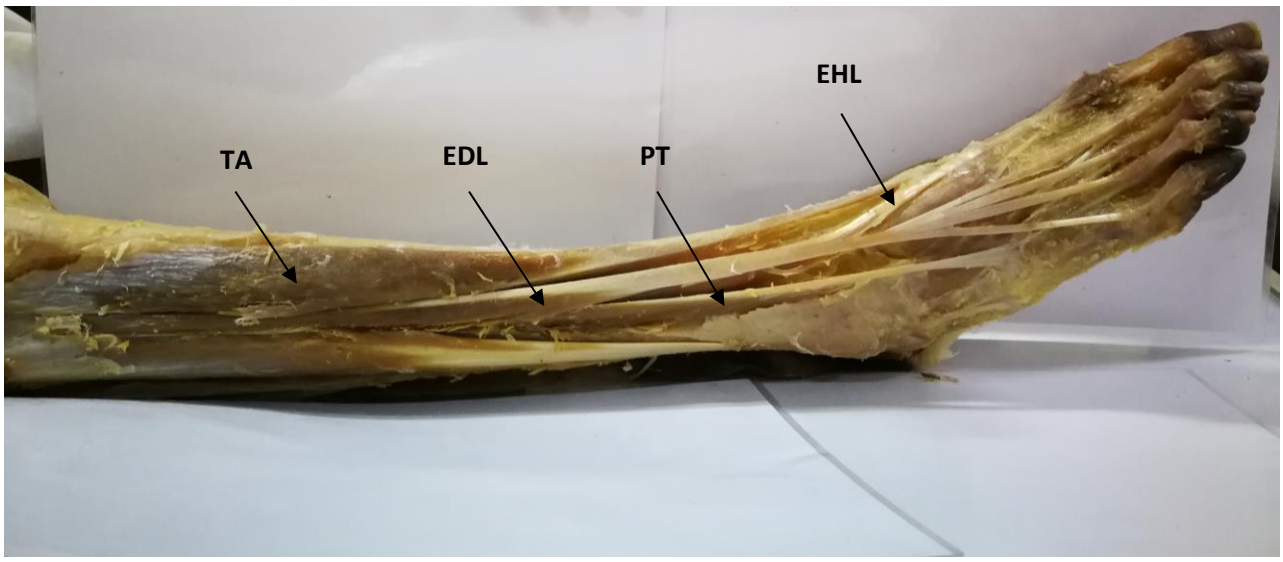

Figure 1. Normal morphology of peroneus tertius and extensor digitorum longus.

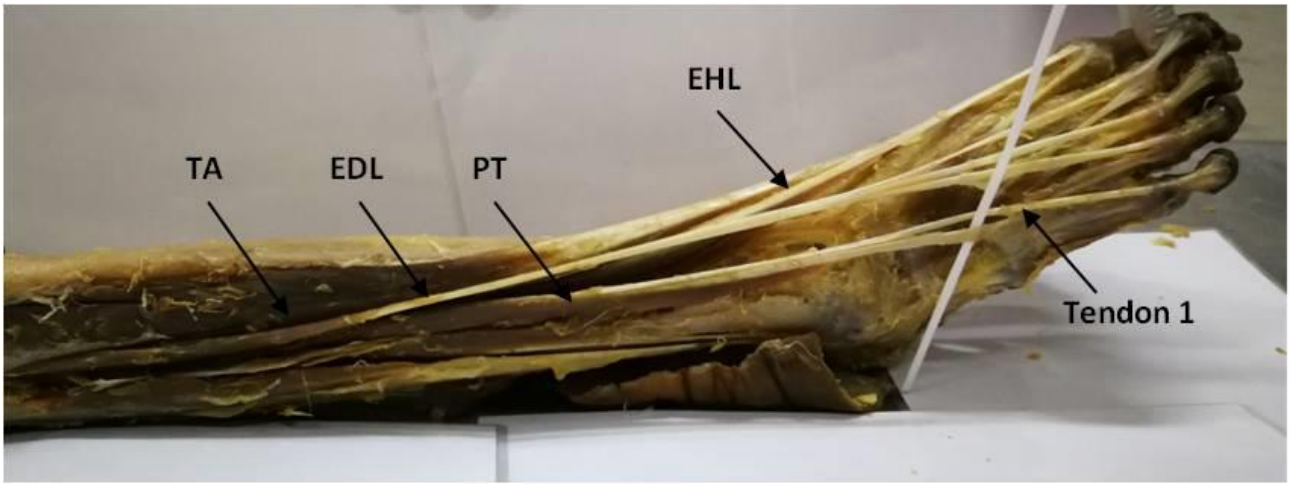

Figure 2. Fourth tendon of extensor digitorum longus replaced by a tendon of peroneus tertius (Tendon 1)

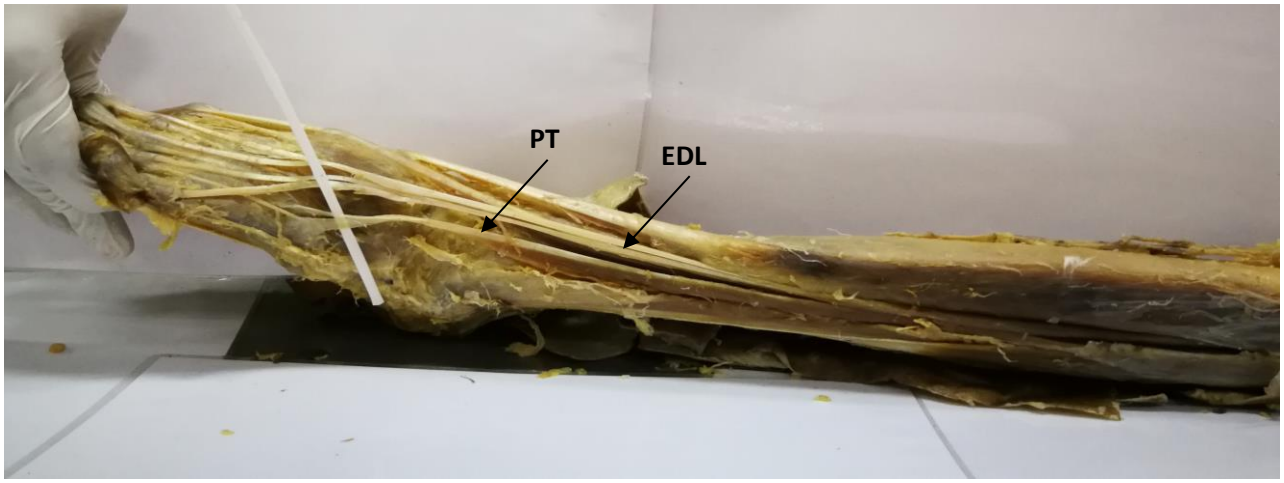

Figure 3. Peroneus tertius split in to 2 slips with the lateral slip attaching to fifth metatarsal head and medial slip joining the fascia over fourth interosseus space.

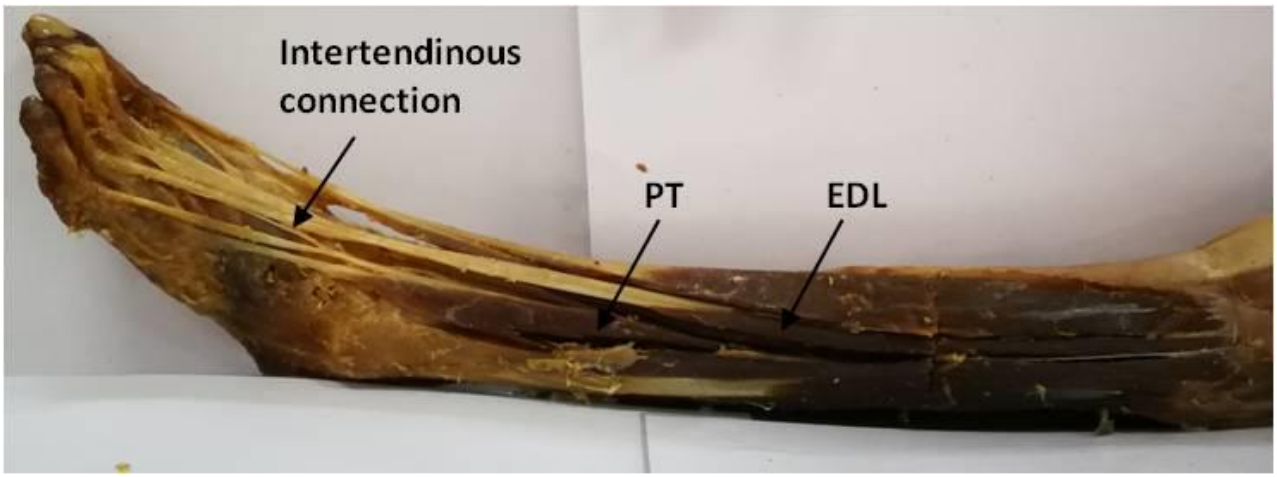

Figure 4. Fourth tendon of extensor digitorum longus replaced by a tendon of peroneus tertius with the addition of an intertendinous slip between tendons of peroneus tertius and extensor digitorum.

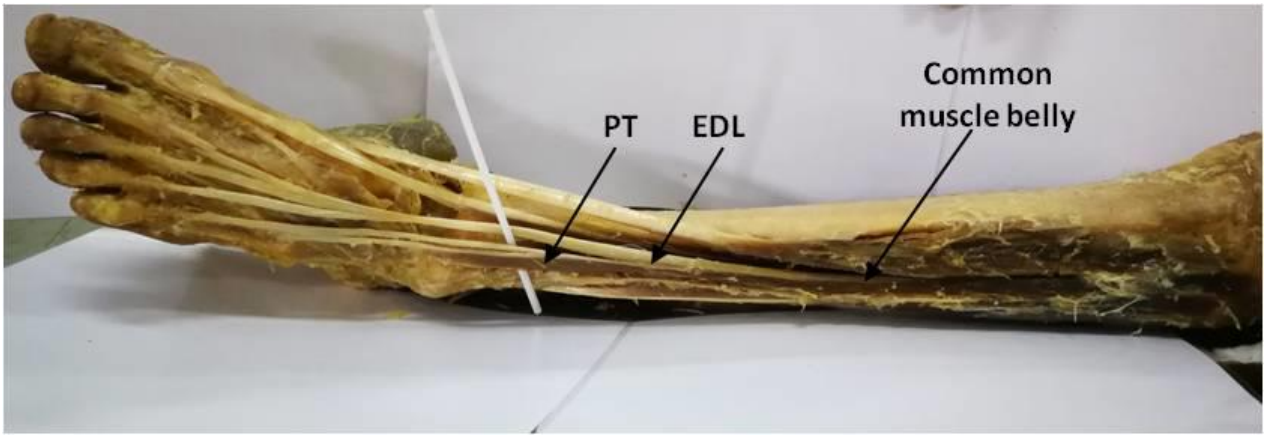

Figure 5. Proximally single muscle giving rise to two muscles representing peroneus tertius and extensor digitorum longus giving rise to two tendons and three tendons respectively.

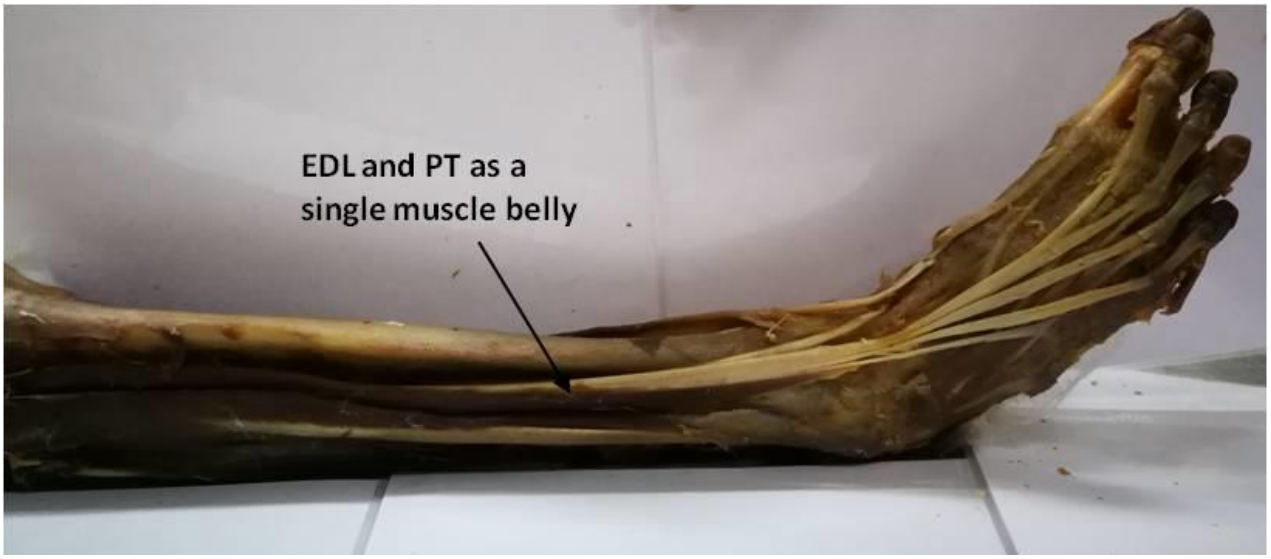

Figure 6. A single muscle replacing the peroneus tertius and extensor digitorum longus giving rise to five tendons.

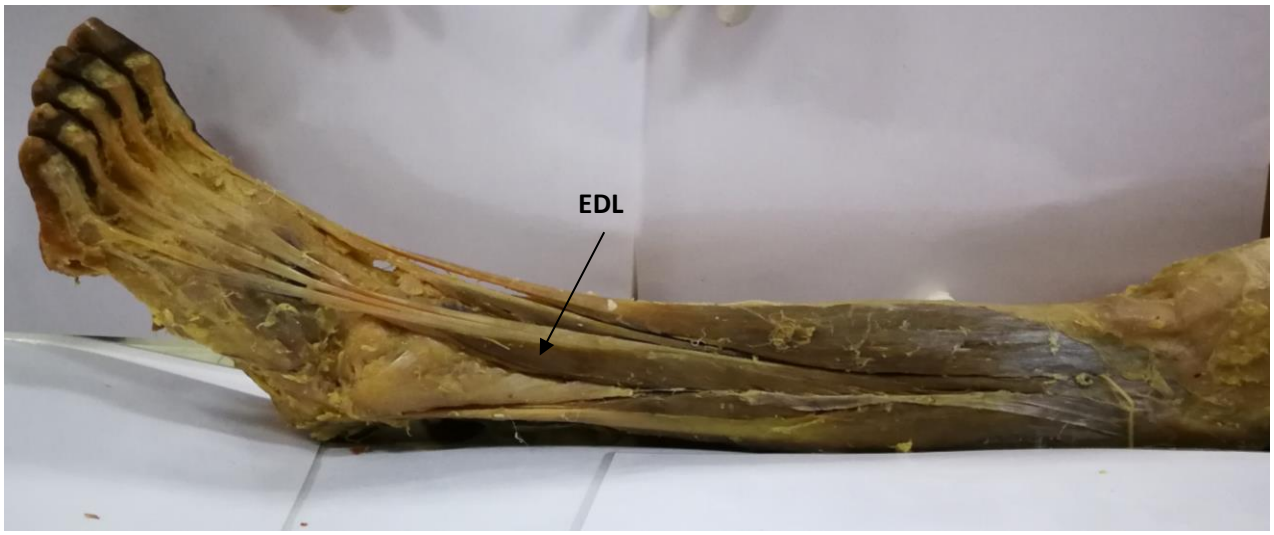

Figure 7. Absent Peroneus Tertius.

Discussion

A few variations involving peroneus tertius muscle and extensor digitorum longus muscle have been reported earlier. Absence of peroneus tertius tendon has been reported by many (5), (9), (13), (14), (18) with the percentage ranging from 1.5 upto 10.45% of the studied samples. Absence of peroneus tertius was noted in one of the fifty four (1.85%) of the specimens used in our study. Yildiz and Yalcin, 2012 (11) reported on a peroneus tertius muscle arising from extensor hallucis longus muscle. Rao et al., 2014 (21) as well as Bhatt, Modi and Mehta, 2010 (22) have reported of cases where extensor digitorum longus tendon has divided into 3 slips which inserted into 2^{nd},3^{rd} and 4^{th} toes and a slip from Peroneus tertius tendon supplying the 5^{th} toe which is one of the variations we have found in our study.

The anatomy of peroneus tertius and extensor digitorum longus tendons are important in surgical reconstructions relevant to trauma to the dorsal aspect of foot. Additionally peroneus tertius is used as a free flap to treat soft tissue defects and osteomyelitis of lower limbs (10), (19). Gaulrapp and Heimkes, 1997 (20) mentions a case where peroneus tertius tendon was used to repair ruptured tibialis anterior tendon. The variation of figure 2 and 3 might hinder the use of peroneus tertius tendon for above mentioned purposes as extension of 5^{th} toe might be affected with the removal of peroneus tertius muscle/tendon.

Proneus tertius is an important anatomical boundary used in the placement of arthroscopy portals (23). Individual variability of this muscle may necessitate use of imaging techniques prior to such procedures. In the cases with increased muscle bulk as well as the replacement of the fourth tendon of the extensor digitorum longus by a slip from peroneus tertius may depict a more important role of peroneus tertius in its function. The implication of such a variation in the occurrence and treatment of Jone's fracture is also unsure.

The evolutionary origin of the peroneus tertius has been of controversies since its first description in the 16^{th} century. It was considered a part of extensor digitorum longus by some anatomists (5). Joshi, Joshi and Athavale, 2006 mentions that extensor digitorum brevis of the foot has migrated upwards to give rise to the peroneus tertius (13). In our study as seventeen out of the fifty four specimens had a common muscle belly representing both muscles, origin of peroneus tertius by extensor digitorum longus may be more suggestive.

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Conflict of interest

None

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CASE REPORTS

Congenital Diaphragmatic hernia presenting in adult life: A study of two cases

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Running title: congenital diaphragmatic hernia diagnosed in adults

Abstract

Congenital Diaphragmatic hernia (CDH) usually presents in the newborn and rarely present as undetected cases in adult life. Defects in the diaphragm can cause abdominal organs to herniate into the thoracic cavity resulting in respiratory distress or strangulation of abdominal organs. Reported here are 3 cases of congenital CDH presenting in adult life.

A 59-year-old male presenting with epigastric pain, bilious vomiting and constipation demonstrated an air-fluid level in the anterior mediastinum on chest radiograph. Surgery revealed an anterior Morgagni defect with a loop of terminal ileum herniated and strangulated into the pericardial sac.

A15-year-old girl presenting with abdominal pain and pyrexia for 2 days, on CT chest and abdomen revealed right lobe of liver and transverse colon in the right hemithorax with the pericardium pushed to the opposite side. Surgery revealed a large right sided Bochdelaks type hernia. A strangulated gangrenous transverse colon was removed from within the thoracic cavity.

In these cases the body had adapted by maintaining total lung volume by compensatory hyperplasia of the contralateral lung allowing the patients to survive with no symptoms for a long duration of time. Even though rare, the possibility of CDH presenting as acute abdomen is important to remember.

Key words: congenital diaphragamatic hernia, bowel loops in the thorax, fluid levels in thorax

Introduction

Congenital diaphragmatic herniae (CDH) are a relatively rare group of disorders occurring in 1-5: 10000 births [1]. CDH is usually diagnosed soon after birth or during childhood mostly because its association with lung hypoplasia which leading to dyspnoea early in life. However cases have been reported where patients have lived with such defects without any complications to adult life[2,3]. Here we report the clinical findings and outcomes in two such cases of CHD which survived to adult life undiagnosed.

The diaphragm develops from four main structures: septum transversum, pleuroperitoneal membrane, dorsal

oesophageal mesentry and the body wall. The final closure of these parts occurs at 8 to 10 weeks of gestation at the Bochdaleks foramen. Defective closure allows abdominal organs to herniate into the developing thoracic cavity compressing and causing malformation of the lungs and sometimes the heart. Lung hypoplasia is a common associated defect. Left sided defects are commoner with the liver being protective and preventing right sided ones. Anterior defects are through the Morgagni's foramen, between the diaphragm and sternum.

Etiology of CHD is multifactorial with a majority of cases being syndromic. However isolated cases of CHD which are non-syndromic are reported. Less than 2% are familial with autosomal and X-linked varieties being reported.

Three basic types of CDH are described: the posterolateral Bochdalek hernia, the anterior Morgagni hernia, and the hiatus hernia. The Bochdalek hernia occurs in approximately 85% of cases. Left-sided hernias allow herniation of both the small and large bowel and intra-abdominal organs into the thoracic cavity. In right-sided hernias which account for 13% of cases, the liver and parts of the colon herniate into the thoracic cavity.

Case 1

A 59 year old male was admitted to the surgical casualty with burning epigastric pain and bilious vomiting that had developed over the preceding 4 hours. He had not opened bowel for three days. On examination he had a distended abdomen. A diagnosis of acute intestinal obstruction was made. Postero-anterior and lateral chest radiographs demonstrated an air-fluid level in the anterior mediastinum (Figure 1). The patient rapidly became septic despite nasogastric decompression and intravenous fluid therapy. An urgent exploratory laparotomy was performed, which revealed an anterior Morgagni defect in the diaphragm through which a loop of terminal ileum had herniated to lie within the pericardial sac. The sharp edge of the diaphragmatic defect was seen to have strangulated the intestinal loop. The loop of affected bowel and the iscahemic tuft of omentum were resected and a double barrel ileostomy was exteriorised in the right iliac fossa. The diaphragmatic defect was repaired in two layers using an interrupted non-absorbable suture. The patient made an uneventful recovery and underwent reversal of ileostomy eight weeks later.

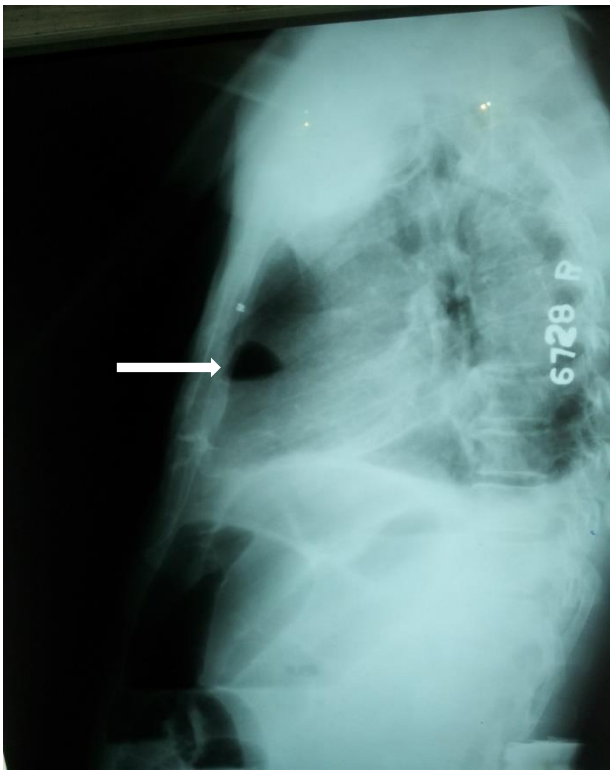

Figure 1: air fluid level in lateral chest radiograph

Case 2

A 15 year old girl presented to surgical casualty with severe abdominal pain and difficulty in breathing that had developed rapidly over the preceding 8 Hrs. She had been having on-off abdominal pain related to meals over the past several years. Previously she had been investigated for eventration of the right hermidiaphragm in a specialist thoracic unit conservatively. On admission she was ill febrile tachycardic and tahypnoic. Right sided air entry was reduced and percussion note dull. The abdomen was soft and non-tender. Chest X ray PA revealed a large loop of large bowl in the right hemithorax and a diffuse opacity in the right lower zone (Figure 2). CT scan confirmed the presence of bowel in the right hemithorax and the lower zone opacity was found to be the right hemi liver (Figure 3).

Following resuscitation, emergency laparotomy was performed. A modified rooftop incision was employed to gain access to the upper abdomen. A Bochdalek type posterior defect was found in the right hemidiaphragm. Through this defect the right hemi liver had hermiated into the right hemithorax along with the entire transverse colon, which was gangrenous. The right hemiliver was adapted to fit the cavity of the right hemithorax indicating that this anatomy may have been present for a long time. The diaphragmatic defect was enlarged. The right hemi-liver was delivered into the abdomen after division of its anchoring ligaments whilst safeguarding the vascular architecture. The gangrenous loop of bowel was delivered to the abdomen and excised. The diaphragm was repaired in 2 layers. The presence of the large right hemi-liver precluded any attempt at abdominal closure. Following a temporary closure the patient made a gradual recovery.

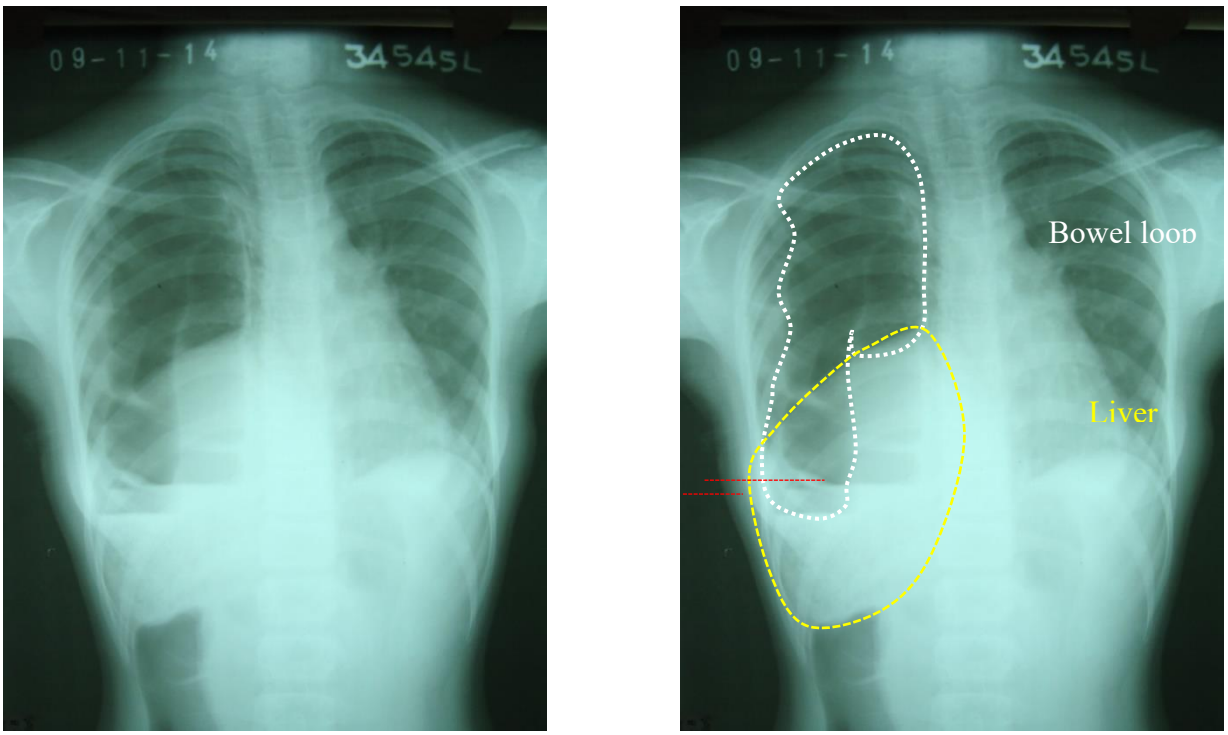

Figure 2: Antero-posterior chest radiograph showing bowel loop (white) with fluid levels (red) and the right hemi liver (yellow) in the right hemi thorax

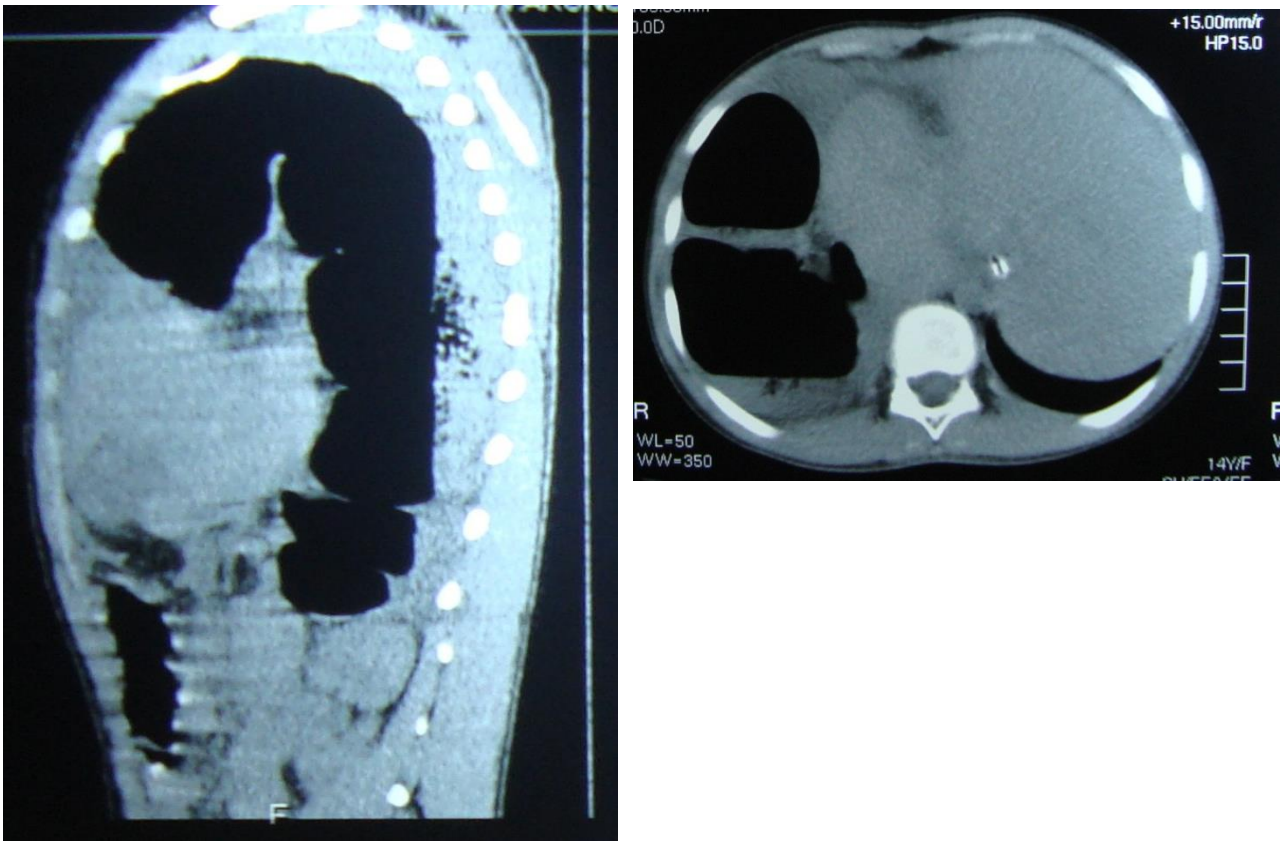

Figure 3: Axial and sagittal CT abdomen showing the bowel loop in the thorax

Discussion

CHD tends to be diagnosed at birth or infancy due to features related to lung hypoplasia and other congenital defects. However isolated CHD may go undiagnosed in rare cases with the patients surviving into adulthood with minimal or no syptoms. In the two cases discussed here one patient had gone undiagnosed till the age of 59 and the other until 14 years.

In the first case an anterior Morgagnis diaphragmatic hernia has caused loops of small intestine to herniate into the thoracic cavity giving rise to intestinal obstruction. Morgagni's defect is a congenital defect in the anterior diaphragm due to incomplete fusing of the septum transversum with the sternum and/or ribs. Giovanni-Battista Morgagni first described this type of hernia in 1761 [4]. This type of CDH represents approximately 1-3% of surgically treated diaphragmatic hernias [5]. This defect may go unnoticed or cause respiratory distress in infancy or as reported here features of strangulated bowel in adulthood. Small bowel and omentum being the most mobile parts of the gut have a chance of herniating through such defects. Herniation of the terminal ileum into the thorax is extremely rare. The presence of an air fluid level denoting bowel in the anterior mediastinum is highlighted as a rare finding on chest radiography.

In the second case which was a Bochdalek type hernia where the liver and the small bowel had herniated into the thorax, the body had adapted by maintaining total lung volume by compensatory hyperplasia of the contralateral lung. Bochdalek hernia occurs due to incomplete fusion of the pleuroperitoneal membrane posterolaterally. This type of hernia in invariably diagnosed at birth or infancy due to respiratory symptoms. Since the left side of the pleuroperitoneal membrane closes last left sided defects are commoner. However in the case described here the defect was right sided and was diagnosed at the age of 15 years. It was fascinating to find the liver molded to the shape of the thoracic cavity. It appeared that the herniation of bowel loops had occurred as an acute event giving rise to symptoms.

Even though rare, the possibility of CDH presenting as acute abdomen in later life is important to remember.

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Conflict of interest

None

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Abnormal origin of left ovarian artery from the inferior renal polar artery - A rare anatomical variation

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Abstract

Anatomical variations of the renal arteries and gonadal arteries are not uncommon owing to their embryological origin. Awareness of possible anatomical variations of the renal artery and gonadal artery is essential for surgeons who perform open and minimally invasive procedures of the kidneys and retroperitoneal region to prevent disastrous haemorrhagic complications during those procedures and for radiologists to prevent misinterpretations of imaging and to prevent vascular complications during interventional procedures.

The present report describes an unusual variation of the left ovarian artery arising from the inferior renal polar artery which originated from the abdominal aorta superior to the main renal artery.

Key words: Ovarian artery, inferior renal polar artery

Introduction

The renal arteries are a set of paired branches of the abdominal aorta arising just below the origin of the superior mesenteric artery[1]. Both renal arteries cross the corresponding crus of the diaphragm at right angles to the aorta and enter the renal hilum in between the renal vein and the ureter at the level of the first lumbar vertebra. The right renal artery is longer and often higher than the left. Although a single renal artery supplying each kidney is classically described, it is subject to anatomical variations frequently[2]. Knowledge of these anatomical variations of the renal vasculature is of great importance with the advent of vascular reconstructive surgeries, renal transplants, and various radiological and urological procedures carried out in this region[2].

The renal arteries themselves may vary in their level of origin, calibre and obliquity. They give off branches to suprarenal gland, ureter, renal capsule, perinephric tissue and the renal pelvis in their extrarenal course[1]. Near the renal hilum, each renal artery divides into anterior and posterior divisions, which in turn divide into segmental arteries supplying the renal segments. Accessory renal arteries which are believed to be derived from persistent embryonic lateral splanchnic arteries are not uncommon findings[1,2]. They can be found in more than 30% of the population and usually arise from the aorta below (less commonly above) the main renal artery and follow it to the renal hilum[1].

The gonadal arteries arise from the abdominal aorta a just inferior to the renal arteries at the level of the second lumbar vertebra. Then they pass inferolaterally under the parietal

peritoneum on psoas major muscle[1]. However, anomalous origins, course and numerical variations of the gonadal arteries are reported in the literature. Gonadal arteries are reported to be originated from renal arteries, accessory renal arteries, suprarenal artery, lumbar arteries, common iliac artery and superior epigastric artery[3]. Gonadal arterial anatomy and its anomalies are widely being studied because of their importance in testicular and renal surgeries. M Shoja et al have reported that aberrant gonadal arteries are associated with accessory renal arteries[4]. Although these variations can be attributed to its embryonic development, the exact embryonic signals which govern the formation of accessory renal arteries or aberrant gonadal arteries remain unknown[4].

Case report

We have encountered an anomalous origin of a left ovarian artery from an inferior renal polar artery during routine educational dissections of the cadavers in the Department of Anatomy, Faculty of Medicine, University of Ruhuna, Sri Lanka.

We observed an accessory renal artery which originates 1 cm above the origin of the left renal artery passing to the inferior pole of the left kidney during dissection of the abdomen of a 70-year-old female cadaver. This artery was identified as the inferior renal polar artery. The artery passes downwards towards the left renal pole crossing the left suprarenal vein, left renal vein, branches of the left renal artery and the left ureter anteriorly. The left ovarian artery was observed to originate from the inferior renal polar artery about 3cm proximal to its entry to the renal substance. Two tributaries of the left renal vein were observed draining blood from the renal hilum and the left ovarian vein was found to be draining to the inferior of the two (Fig 1).

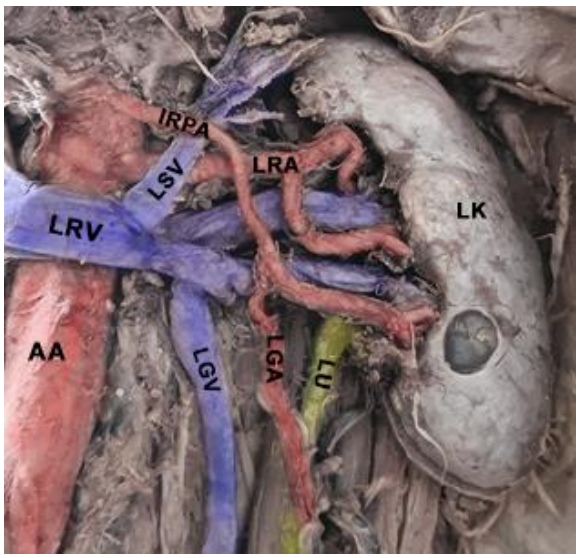

Figure 1 - Left retroperitoneal space showing, inferior renal polar artery with a high origin associated with an anomalous origin of ovarian artery from it.

(LK - left kidney, LU - left ureter, AA- abdominal aorta, LRA - left renal artery, IRPA - Inferior renal polar artery, LGV - left gonadal artery, LRV - left renal vein, LSV - left suprarenal vein, LGV - left gonadal vein)

On the right side, the normal distribution of the renal artery was observed and the ovarian artery had its usual origin from the abdominal aorta below it. Four venous tributaries were found at a distance of 2.5 cm from the renal hilum on the right side and the right ovarian vein was observed to be draining to the inferior vena cava.

Discussion

Although variations of the renal arteries are not uncommon, a high origin inferior renal polar artery from the abdominal aorta associated with anomalous origin of a gonadal artery is rarely reported in literature5,6. Awareness of these potential anatomical variations is of great importance for interventional radiologists, urologists, vascular and transplant surgeons who carryout open and minimal access surgical procedures in this region.

Accessory renal arteries to the inferior pole of the kidney crossing anterior to the ureter as in our case, may cause ureteric obstruction leading to hydronephrosis5. Awareness of these variations in the origin of these vessels highlights a potential importance for preprocedural imaging of the vasculature of the renal hilum to avoid complications during the surgery.

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Conflict of interest

None

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A unique Anatomical variation of flexor digitorum superficialis muscle: a cadaveric case report

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Running title: Variation of flexor digitorum superficialis

Abstract

Anatomical variations of the flexor digitorum superficialis (FDS) muscle are uncommon and is related to evolution of muscle from amphibians to human. These variations are of academic interest and should be considered when facing variations in clinical examination, interpreting radiological images and in surgical procedures such as tendon graft.

We report a case of unilateral variation of FDS muscle in the forearm with two muscle bellies: superficial and deep which has not been reported before. The humeroulnar and radial origins of the superficial belly united to form a single muscle belly, which divided in the upper part of forearm into two tendons, that passed through carpal tunnel and inserted into the middle phalanges of third and fourth digits. The deep belly originated from medial epicondyle of the humerus next to flexor carpi ulnaris, continued as a short tendon in the upper part of forearm and then formed a second muscle belly in the middle third of the forearm (two muscle bellies separated by an intermediate tendon). In the lower part of forearm deep muscle belly divided into two tendons which traversed the carpal tunnel and was inserted into middle phalanx of second and fifth digits.

The report enhances the knowledge on variation of FDS and add a note to understand atypical findings on physical examination and during surgery.

Key words: Anatomical variation, forearm flexors, Flexor digitorum superficialis, carpal tunnel

Introduction

The flexor digitorum superficialis (FDS) is an extrinsic muscle of the hand. It arises from two heads – humeroulnar and radial, which unite to form a singular muscle belly in the forearm between the superficial and deep muscle groups. In the lower part of antebrachium, it splits into four tendon. The tendons pass deep to the flexor retinaculum within the carpal tunnel in 2 rows, with the tendons for middle and ring finger being superficial to that of index and little finger. The tendons diverge towards the medial four digits and enters the digital flexor sheath. At the base of the proximal phalanx each tendon splits into 2 slips to allow the passage of flexor digitorum profundus (FDP) and are inserted into the sides of the shaft of middle phalanx of the

corresponding digit. The FDS is a prime flexor of proximal interphalangeal joint (PIPJ) (1).

Anatomical discrepancy of FDS muscle belly, abnormal connections of muscle and tendon and absence of the tendinous part have been described in anatomical and clinical studies. Most of them are cadaveric findings (2, 3, 4, 5, 6, 7, 8). Some are incidental asymptomatic finding during surgery (9, 10, 11). Palm muscle mass resembling soft tissue tumor (10, 12, 13, 14) and carpal tunnel syndrome due to undetermined aetiology 10, 12, 13) are rare symptomatic findings. Elliot et al (10) classified variations of FDS in human into type 1 – V and claimed "evolution of this muscle from amphibians to higher primates is the prime reason for the variations".

The present case describes a unique type V variant observed during cadaveric dissection and this finding will add to note to our knowledge of FDS muscle disparity

Case report

During undergraduate dissection of a 65-year-old male preserved cadaver by medical students of Faculty of Medicine, University of Jaffna, morphological variation in the FDS was observed on left upper limb. All other forearm muscles were anatomically normal. The FDS had 2 bellies, superficial and deep. The superficial belly had the usual humeroulnar and radial origins, which united to form a single muscle belly. It bifurcated at the region of the upper and middle third of forearm, passed below the flexor retinaculum (Fig 1) and inserted into middle phalanx of 3rd and 4th finger (Fig 3). The deep belly originated from medial epicondyle of the humerus (common flexor origin), next to flexor carpi ulnaris muscle. It had double belly appearance (digastric) in upper part of forearm; two muscle bellies connected by an intermediate tendon (Fig 2). The deep belly bifurcated at middle and lower third of forearm. These tendons passed deep to the tendons of superficial belly through carpal tunnel and insert into 2nd and 5th fingers (Fig 3). The contralateral forearm does not show any anatomical variation. The median nerve was found deep to the deep belly of FDS.

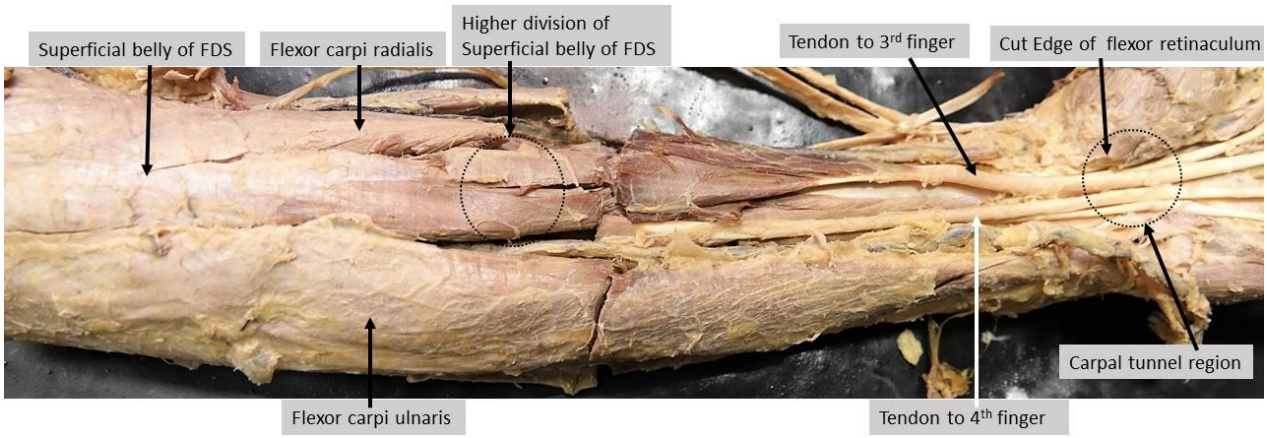

Figure 1: Dissection of the anterior flexor aspect of the forearm showing the superficial belly of FDS dividing again into two bellies nearly at upper and middle third of forearm and tendons of them passing below flexor retinaculam.

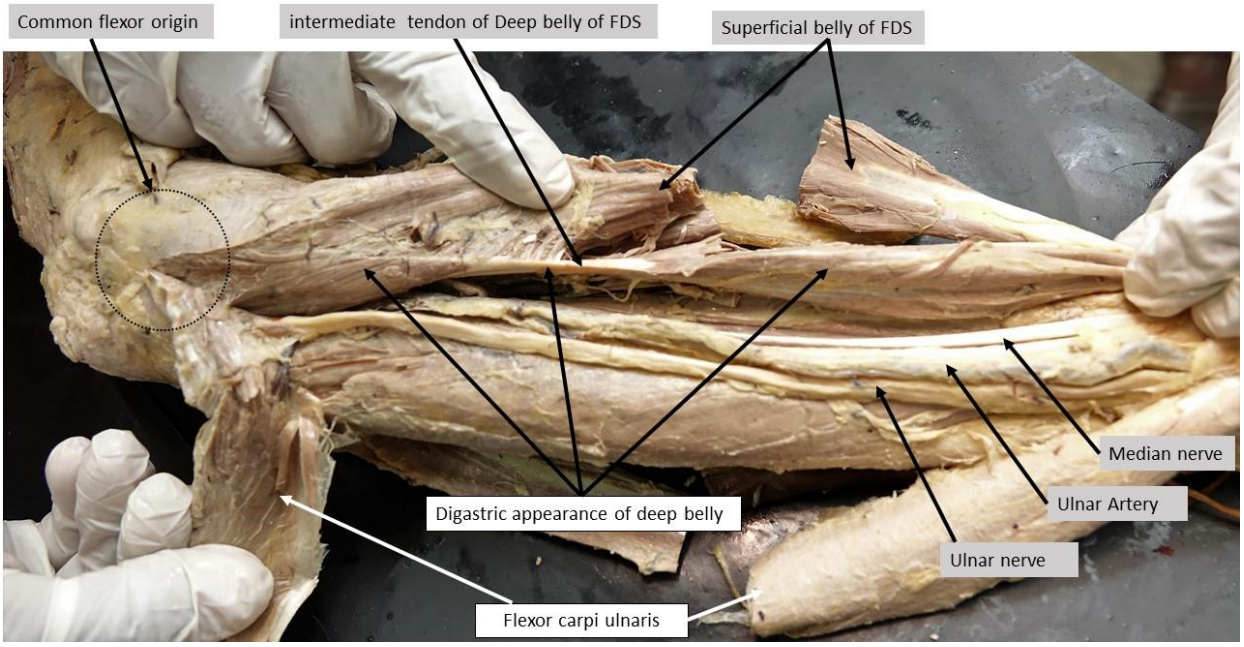

Figure 2: Dissection showing deep belly originating from the common flexor origin and the digastric appearance (double belly appearance) of deep belly in the upper third of forearm

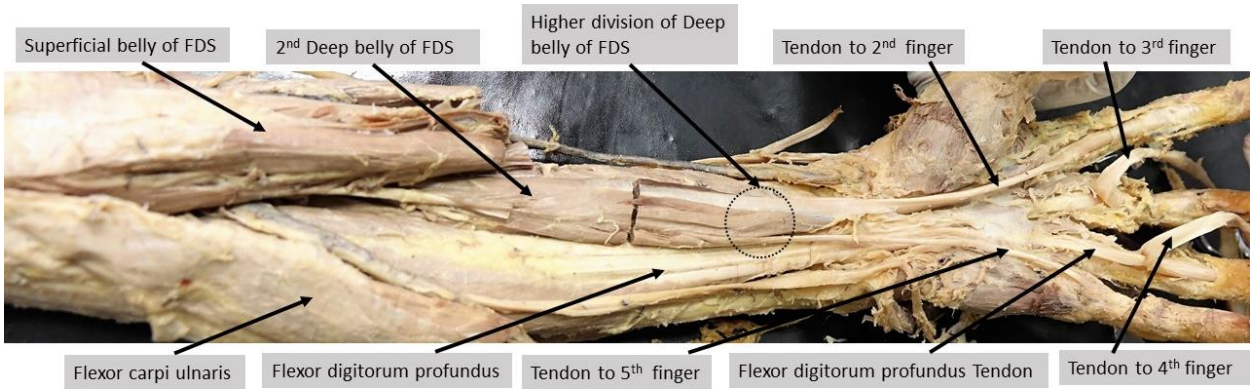

Figure 3: Dissection showing bifurcation of deep belly in the junction of middle and lower third of forearm and insertion of its tendons into 2nd and 5th digits. Insertion of tendons of superficial belly into 3rd and 4th digit can be seen.

Discussion

Elliot el al (10) reviewed the articles reporting the variations of FDS and they classified the variations of FDS into 5 types. 'Type1 - connection between the tendons of the muscle itself; type II - additional muscle belly connection between the FDS tendons and the flexor retinaculum within hand; type III - digastric additional muscle connected to tendon of FDS within hand; type IV - distal extension of muscle belly of forearm towards carpal tunnel and type V - anatomical variation of FDS muscle in the forearm'. They discuss the development and evolution of FDS. In amphibians flexor muscles of forearm act as wrist flexors and digits are flexed by brevis

muscles originating within the hand. In mammals these brevis muscles attach with the extrinsic flexor muscle mass evolve from forearm and the digits are flexed by forearm flexor muscles. The brevis muscles become tendons of FDS and FDP passing through the carpal tunnel into the palm. Therefore the abnormal or additional muscle bellies of the FDS in man represent the derangement in the normal process of development or intermediate stages in the development process (3, 10).

Tan et al (9) introduced another classification for variations of FDS. The variations are classified into two major categorizes: variation of muscle belly and tendon arrangement. They claimed muscle belly anomalies are mostly incidental findings. When the muscle belly extends to carpal tunnel, it may cause carpal tunnel syndrome. Additional muscle belly in palm may present as a palmar mass. They further added that abnormalities of muscle belly can in the form of brevis type muscle present in the palm or muscle belly extend into carpal tunnel or digastric muscle, where muscle bellies are separated by a tendon in palm. This classification does not take variations in muscle bellies in the forearm into account.

Literature reveal variation of FDS frequently occur in palm of the hand; Type 1I& III according to Elliot el (10) classification and most frequently anomalies occur in the FDS that serves the index finger (10, 13, 14). This variant have been reported during surgery as a small mass attached to the middle phalanx of index finger or to the tendon of FDS to index finger proximally and distally (digastric) in the palm. These masses may or may not be painful. Elias and Schulter-Ellis (13) stated that preoperative differential diagnoses of those masses included tendon sheath tumors, lipoma, palmar ganglion, vascular malformations and haematoma. However, Stephens et al (14) emphasized the possibility of an additional muscle belly of FDS should be brought into mind if the mass is soft and becomes firm when proximal interphalangeal joint is flexed against resistance.

Tan et al (9) observed connections between musculotendinous units during clinical examination of 500 subjects. They stated that tendon abnormalities do not produce noticeable symptoms, but they affect evaluation and interpretation of FDS function clinically, especially in a patient with a FDS tendon injury.

Type IV variant, extension of muscular part distally into the carpal tunnel has been observed during carpal tunnel decompression (10, 13). Yesilado et al (11) noticed a fleshy muscle belly extending to flexor compartment of wrist without a tendon during forearm surgery. Traction on the muscle caused flexion of proximal interphalangeal joints of medial four fingers.

Type V variation observed in our study is less common and incompletely described when it is identified in surgery because their dissection is limited to the incision made to treat clinical needs of the case (10). The first case presented by Mainland (2) during cadaveric dissection showed a variant of the FDS where the tendons of the ring and small fingers were connected to three muscles of which two

additional muscles were in the forearm. In an operation on the flexor aspect of the forearm to remove a lipoma Figueiredo and Hooper (3) identified an anomalous muscle belly lying deep to median nerve in distal forearm and on traction it caused flexion of proximal interphalangeal joint of index finger. But due to limited incision, they couldn't explore the origin of the anomalous muscle belly. Elliot et al (10) identified a variant while performing a surgery, where a small muscle belly originated from deep surface of transverse carpal ligament and attached by a tendon to FDS muscle of middle finger 8 cm proximal to wrist fold. Nayak et al (4) reported unilateral 2 additional muscle bellies in anterior forearm deep to FDS, originating from it. Radial side one was a Gantzer's muscle ("muscle arises as small belly from forearm flexors and insert either into flexor pollicis longus or FDP") inserting into flexor pollicis longus tendon and the ulnar side belly forming an independent tendon in the forearm, passing through the carpal tunnel. Passive traction on it caused flexion of distal and middle phalanx of middle finger. Rao et al (6) reported a variant during cadaveric dissection, where a separate muscle belly originated from medial epicondyle of humerus and formed a tendon in middle of forearm. The tendon passed deep to the transverse carpal ligament and inserted into middle phalanx of fifth digit. In a series of 100 dissected cadavers Caetano et al (8) presented unilateral variation of FDS in a cadaver, where an accessory digastric muscle belly connected to the FDS in the middle of forearm on its deeper aspect and proximally attached to the common flexor origin. This finding mimic the proximal aspect of the deep belly reported in the present study. Another finding similar to the present report was documented by Shoja et al (5). They observed superficial and two separate fusiform deep muscle bellies. The medial belly originated from common flexor origin and coursed through the distal forearm as a slender and inserted onto the little finger. The radial side belly merged proximally with the deep surface of the superficial part of the FDS and continued distally as a tendon to get inserted onto the index finger. In the present study deep belly wholly originated from medial epicondyle and had a unique morphology in the upper part, 2 bellies and an intermediate tendon.

Morphological variation of muscles of forearm are not common and most of the time they are incidental findings during surgical interventions. These anomalous muscles can produce soft tissue masses and can compress vessels and nerves leading to compression symptoms. Therefore, knowledge of these variation helps the clinicians to detect he etiology, interpret symptoms and to manage the patients with such anomalous presentation.

Brandsma et al (15) pointed out another importance of knowing the FDS variant. Following injury to ulnar and radial nerve, flexor digitorum superficialis tendons are used in tendon transfer to correct claw hand deformity and loss of opposition of the thumb respectively. Variations in the origin and course of the tendon may cause difficulty in identifying these tendons during surgical procedures, especially when window incisions are made over the normal orientation of these tendons.

Identifying these variations will add knowledge on morphological variation of FDS and knowledge of the anatomical variations help to understand atypical findings on physical examination and during surgery and help to interpret abnormal radiological findings.

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Anatomy of laparoscopic splenectomy; case report

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Abstract

Splenectomy when performed by laparoscopy is associated with less morbidity compared to open surgery. It also has a cosmetic advantage due to smaller wounds. The case discussion illustrates the anatomical landmarks and relationships during a laparoscopic splenectomy.

Key words: laparoscopy, splenectomy, anatomy

Introduction

Splenectomy is done electively for benign and malignant haematological conditions. It is well established that splenectomy is curative for benign hematological conditions especially immune thrombocytopenic purpura where excessive destruction of platelet occur. When performed by laparoscopy the morbidity is reduced. Understanding the attachments, blood supply and anatomical relationships is the key for port placement and dissection. One should appreciate that dissection happens in retroperitoneal and peritoneal compartments.

We present a patient who has undergone laparoscopic splenectomy for immune thrombocytopenic purpura, discussing the anatomical landmarks.

Case report

A 19 year old female, diagnosed patient with immune thrombocytopenic purpura was referred from haematology clinic for splenectomy. Ultrasound scan of the abdomen revealed a normal size spleen. Laparoscopic splenectomy was planned. Preoperative vaccination was arranged 2 weeks prior to surgery.

Positioning of patient

Patient was placed in right lateral decubitus position after general anesthesia with endotracheal intubation. Nasogastric tube was inserted to decompress the stomach. This positioning helps to push away the transverse colon, splenic flexure from the field of dissection.

Port position

5 ports were used. 10 mm camera port inserted just above and lateral to the umblicus after creating pneumoperitoneum with veress needle. 2 more ports were inserted in epigastric area and another 2 ports were inserted in left sub costal area.

The surgery began with identification of spleen, stomach, transverse colon, splenic flexure and gastrocolic omentum. (Figure 1)

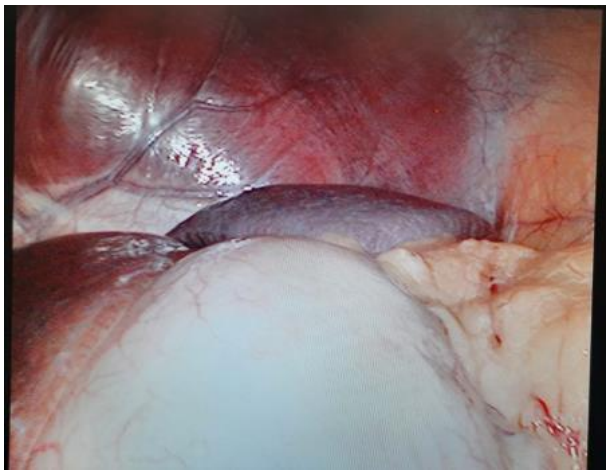

Figure 1

Spleno-colic ligament divided and lower pole of spleen released. Gastrocolic omentum divided and entered into lesser sac. splenunculi noted at splenic hilum.

Gastrosplenic ligament dissected and short gastric vessels divided. (Figure 2)

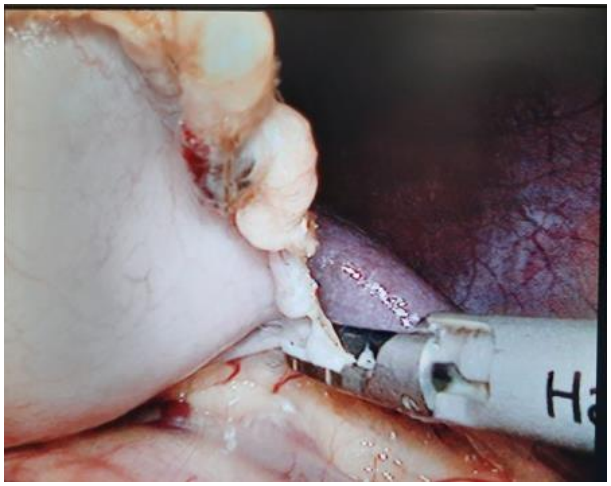

Figure 2

Splenic artery was identified at the upper border of pancreas and ligated and divided between clips. (Figure 3) The tail of the pancreas was lifted up to identify the splenic vein which is posterior to the pancreas. This two was divided between clips. (Figure 3)

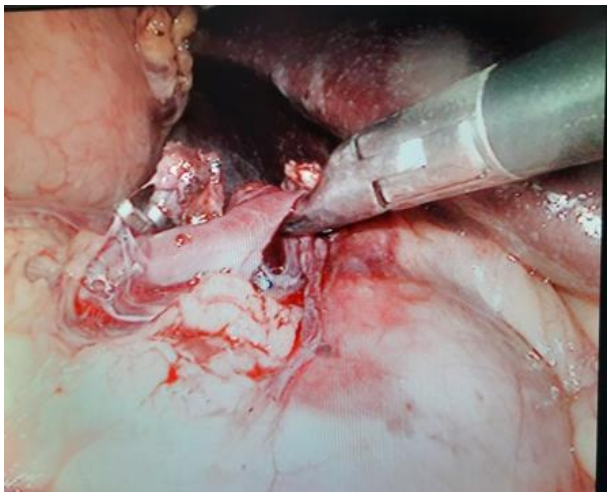

Figure 3

Splenic hilum approached and pancreatic tail was preserved with care.

Spleen dissected out from all the attachments and delivered through a pfannenstiel incision. (Figure 4) This allows the scar to be hidden under cloths.

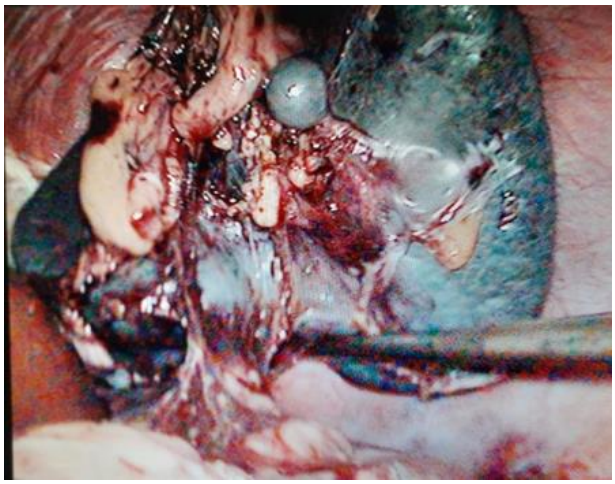

Figure 4 - Splenictomy specimen

Splenic bed relooked to exclude bleeding. Tube drain was inserted after achieving hemostasis. Layered closure of pfannenstiel incision was done.

Post operative care

Patient was managed in the acute side bed in the ward. She had minimal analgesic requirements. She was discharged on the 3rd post-operative day.

Discussion

During laparoscopic splenectomy exposure of the spleen on the left upper quadrant can be technically difficulty especially in obese patients. Also, advanced technical skills and equipment are needed to control the splenic blood supply. Injury to the tail of the pancreas during dissection of the splenic hilum may result in pancreatitis. Therefore, the knowledge on anatomical landmarks are essential for the surgeon, especially because laparoscopic splenectomy has several advantages over open splenectomy[1–4]. The studies comparing open and laparoscopic approaches in the literature shows that laparoscopic approach results in less pain, shorter hospital stay, less morbidity and mortality, earlier return to job, and earlier start to diet. The indication for two approaches are similar in literature but laparoscopic splenectomy is widely used in patients with hematologic diseases like idiopathic thrombocytopenic purpura (ITP). These patients are more prone to wound infections and dehiscence as they use corticosteroids1. Therefore having smaller incisions is a big advantage reducing the incidence of wound complications.

Conclusion

Appreciating the attachments of spleen, it's blood supply and related organs as discussed under method is the key for successful and safe surgery.

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Conflict of interest

None

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LETTER TO THE EDITOR

Teaching Anatomy in Sri Lanka: Past, Present and Future

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Running title: Anatomy Teaching in Sri Lanka

Sri Lanka is expanding its wings on allopathic medical education by commencing the academic activities of a novel medical faculty at the University of Moratuwa in the current year (1). Each medical faculty in Sri Lanka is attached to a state university, which is governed by the university grants commission (UGC) of Sri Lanka. Anatomy is an integral component of allopathic medical education which forms the basis for competent and safe medical practice. All - except one - medical faculties have a dedicated department to teach anatomy to undergraduate medical students. A shortage of anatomy teachers and an overall reduction in teaching hours, are two important concerns that may impair the quality of anatomy education.

Time devoted to teaching human anatomy has experienced a considerable reduction in the medical curriculum for undergraduate medical students (2, 3). In fact, a recent curricular revision of one of the medical faculties in Sri Lanka resulted in 25.5% reduction in the time spent in the anatomy curriculum (4). However, development of a national core curriculum would overcome this issue by recommending minimum student contact hours for anatomical study.

Shortage of qualified academic staff to teach anatomy, on a full time basis, for undergraduate medical students is a global apprehension to contemporary medical education, and Sri Lanka is likely not an exception. A web - based short review on the anatomy department of the earliest ten medical faculties in Sri Lanka revealed that about 50% of them had only four or less teaching staff (Senior Professor, Professor, Associate Professor, Senior Lecturer, Lecturer, and Probationary Lecturer) in the department (5–14). However, nineteen teachers in the anatomy departments had obtained their doctorates in the relevant field and each institution – except two – had at least one teaching staff with a doctoral degree.

In the absence of any regulations that stipulate the teacher to student ratio for medical faculties in the country, the prescribed norms of the UGC for the allocation of Cadre of teaching staff (Senior Professor / Professor [Chair], Senior Professor, Professor, Associate Professor, Senior Lecturer, Lecturer [Grade I, and II], and Probationary Lecturer) could be considered as the national standard where one teacher is assigned per seven undergraduate medical students (15).

According to the recently published statistics of UGC pertaining to the year 2019, the teacher: student ratio observed for allopathic

medical course was 1: 8.85 (16). When other staff namely Temporary Lecturer, Instructor, Demonstrator, and Temporary Tutor were also considered for calculation, the ratio became 1: 6.86. The proportion of probationary and unconfirmed lecturers in comparison with the remaining teaching staff (i.e. Professors and Senior lecturers) in medical faculties and universities in Sri Lanka was 0.37 and 0.48 respectively (16). It is instructive to consider that recent medical graduates show comparably less interest in joining medical faculties.

According to the present review, considering the proposed student admissions to individual medical faculties (1) and the available teaching staff at the department of anatomy (excluding Temporary Lecturer, Instructor, Demonstrator, and Temporary Tutor)(5–14), the teacher to student ratio greatly varied between the institutions and the lowest ratio observed was 1: 13.57. It appears that academic careers in anatomy are not amongst the first choices of many recent medical graduates. One of the possible reasons for this observation is lack of opportunity to practice learnt medicine upon choosing an academic position as an anatomy teacher. Needless to say, anatomy is a basic medical science which traditionally involves class room- based teaching (which is currently taking place online due to the COVID-19 pandemic), therefore the opportunity for clinical practice is limited. It was also observed that consultants / experts in the field of general surgery, radiology, hematology, ophthalmology, otolaryngology, and urology were among the anatomy teachers in Sri Lanka. Nevertheless, it was also evident that their services, on a full time basis, were not available in 50% of the institutions. At present, the shortage of academic staff is overcome by appointing visiting lecturers from another department of the same institution or from hospitals and other medical faculties in the country.

Scarcity of qualified anatomists is an important global concern (17) as it may greatly affect the knowledge and skills of medical graduates. Efforts have to be taken to encourage qualified candidates to choose the anatomy field by adopting appropriate strategies in accordance with regulations and institutional practices. One strategy could be integrated ward classes where an anatomist can be invited to discuss the anatomical basis of fractures, nerve injuries, trauma, surgical, and other procedures in the patient. In addition, if permissible and practically feasible, anatomists can be accommodated in the professorial unit of teaching hospitals or other government hospitals where their services are required and welcomed. This will help anatomy teachers to retain their knowledge and skills in their field of expertise.

Obtaining a stipulated postgraduate qualification within a certain period of time is a requirement for junior lecturers (“Probationary Lecturers”) to be fully granted their post in the Sri Lankan university system. An inevitable component for career advancement in academia is the research and scientific publications necessary for promotion to professorial positions (18). Thus a potential candidate who is not interested either in post-graduate qualifications or research may not pursue becoming a university-level teacher. It is noteworthy that neither postgraduate

qualification nor research are mandatory for a medical officer to obtain confirmation and/or grade promotion in the state health sector.

University teaching is a full time appointment thus overtime benefits, which is a privilege of the state health sector, is not provided, and not considered in calculating the equalization allowance to medically and dentally qualified teachers in the University system (19). However, academic staff are entitled to financial benefits related to University examinations.

These reasons along with others such as higher teaching load compared to other basic medical sciences (17), lack of interest in teaching, avoiding exposure to unpleasant working environments (handling cadaveric materials, exposure to preservatives, etc.), looking for challenging opportunities rather than dealing with routine academic activities, and other reasons, may prevent potential candidates from choosing an academic career.

Since this subject forms the foundation for learning many other disciplines in medical education, shortage of staff in the anatomy department impacts the teaching of anatomy and in turn, may impair the quality of graduates.

Apart from inimitable contribution to society by producing competent and compassionate medical graduates, an academic career in a state university has other advantages such as stable (not required to relocate) employment, later retirement age, provision for probationary study leave, sabbatical leave, longer periods of vacation leave, and membership in the University Provident Fund, Employees' Trust Fund as well as the National Pension Scheme. This information should be made available to prospective candidates, and the Anatomical Society of Sri Lanka (ASSL) can play a pivotal role in this area to attract qualified candidates by planning strategic approaches and promoting the profession.

Increased academic responsibilities due to higher teaching loads coupled with a shortage of teaching staff in anatomy departments, may limit the time an academic teacher has for career development (time that would have otherwise been spent on research and writing papers). In this context, the dedication of contemporary anatomists in the country who work for the betterment of society deserves greater appreciation.

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None

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BRIEF COMMUNICATION

Morphometric evaluation and quantification using Fiji

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Abstract

Fiji is a free software which can be used for image analysis in anatomical studies which allows obtaining accurate measurements of fine structures for morphometric evaluation. Fiji has a user-friendly interface with no requirement of programming skills, hence it has gained a wide interest among basic scientists. Here, we describe a protocol for obtaining basic measurements in gross anatomical and radiological studies using Fiji.

Key words: Fiji, ImageJ, quantification, measurements, anatomy

Article

Introduction

A myriad of studies in gross anatomy, radiological anatomy and developmental biology utilize measurements such as distance, angle, area, volume and curvature to describe morphology of different structures. The classical approach of obtaining these measurements was to use instruments such as calipers (1), measuring tapes (2), set squares (3) and goniometers (4). Often magnifying glasses were used to aid measurements since fine structures could not be accurately resolved by the naked eye (5). This approach had several limitations when measuring curvilinear distances, angles and areas which necessitated indirect measuring strategies such as using threads (3). Moreover, since the measurements were obtained real-time, it was laborious to revisit the specimens and obtain new measurements for subsequent analyses and revisions of the studies.

These shortcomings could be easily overcome by utilizing image analysis software for morphometric evaluation in anatomical studies. Fiji (previously known as ImageJ) is one such popular software used by the basic scientists worldwide for image analysis. Fiji was originally developed by the National Institute of Health (NIH) for analysis of histological images (6). It is an open source (free) software which is constantly being modified and enhanced by the users and universally accepted by high impact journals inclusive of Nature, Cell and Science (6). Fiji has a user-friendly interface with no need of knowledge in programming languages and coding. It allows obtaining a wide array of measurements to analyze structural morphology encompassing linear and curvilinear distances (7), angles (7), area (8), and volume (9). Measurements can be obtained accurately after magnifying images (10) which increases reproducibility. Large

scale image analyses such as detection and counting of vascular (11) and neural (12) networks can be conducted using automated 'macros' and freely available extensions of Fiji. Moreover, there is a growing interest in analyzing 3-dimensional datasets based on cadaveric and radiological cross-sections, which could be easily achieved by using this software (10, 13).

The objective of this paper is to introduce Fiji for anatomical and radiological studies. Here, we describe a protocol for obtaining basic measurements such as distance, angle and area.

Protocol

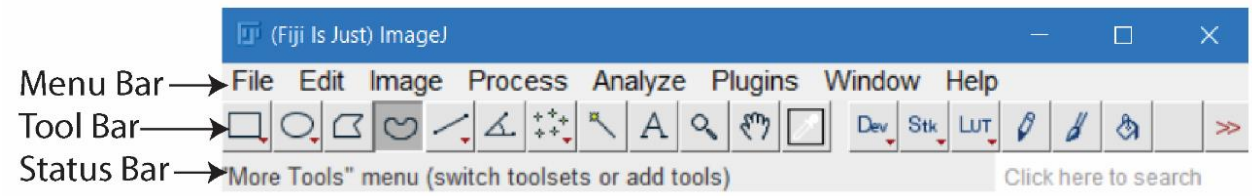
Setting up Fiji environment

Fiji can be downloaded from the site (https://imagej.net/Fiji/Downloads). Once extracted, Fiji can be launched by clicking on the Fiji/ImageJ.exe icon. Figure 1 shows the Fiji interface. The software can be updated by selecting Help → Update.

Getting sources of data

The structures which need to be measured are required to be photographed with a scale (ruler or a caliper) kept at the same plane of the specimen (Figure 2A). Having a fixed distance between the camera and the specimen will make image analysis faster. Care should be taken to orient the specimen perpendicular to the camera lens.

A)



B)

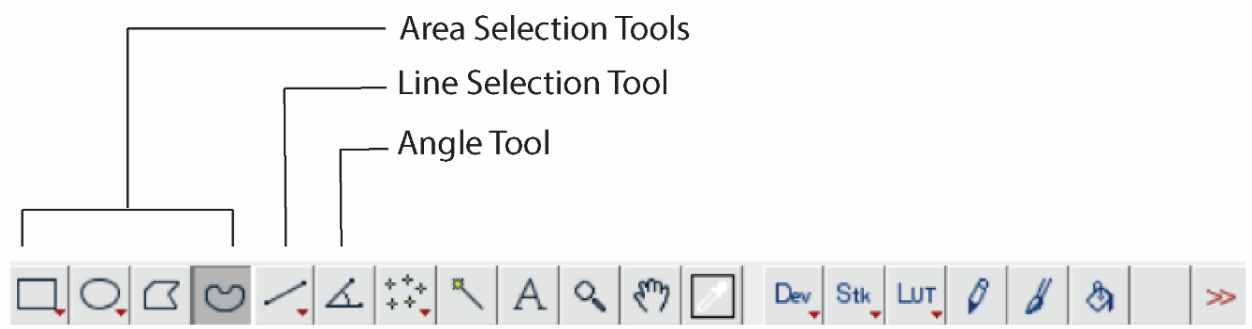


Figure 1: Fiji interface. A) Menu Bar, Tool Bar and the Status Bar of Fiji. **B)** Inset of Tool Bar showing tools that are used for various measurements.

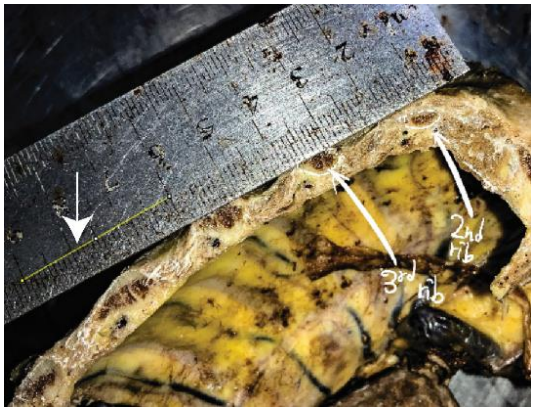
Importing images to Fiji

Fiji supports a variety of file formats inclusive of JPEG, PNG, GIF, TIFF, BMP, DICOM. They can be imported by selecting File → Open. Alternatively, the images can be dragged and dropped on to the interface.

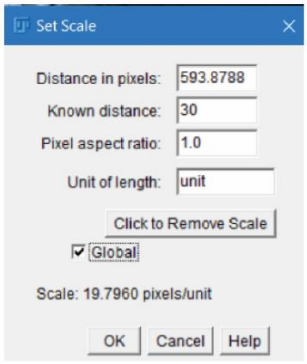
Calibration

If the images have been obtained at a fixed distance, the images can be calibrated to obtain the subsequent measurements. First, a line should be drawn across the scale (Figure 2A) using the Line Selection tool (Figure 1B). Then the scale should be set up by selecting Analyze → Set Scale. In the dialog box (Figure 2B) the "known distance" should be entered. The calibration is applied to all the opened images if the "global" option is selected. The settings can be applied by clicking OK.

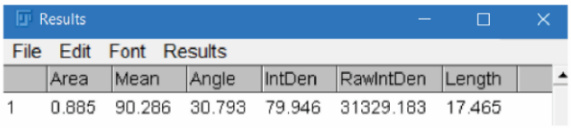
A)



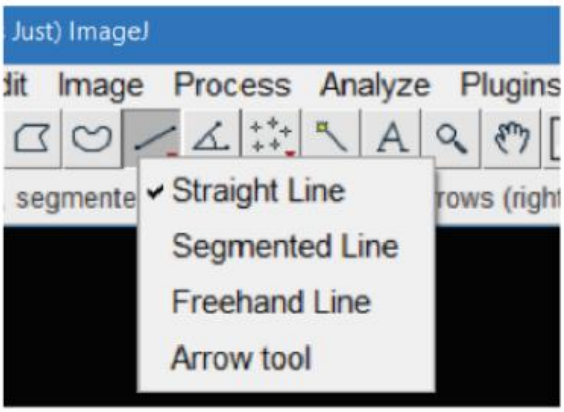
B)



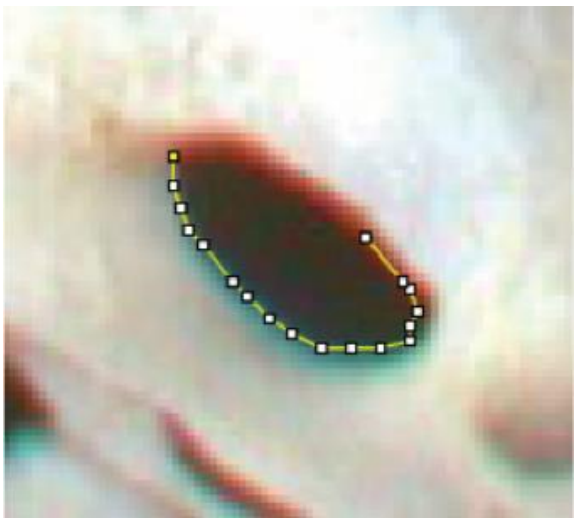
C)



D)



E)



F)

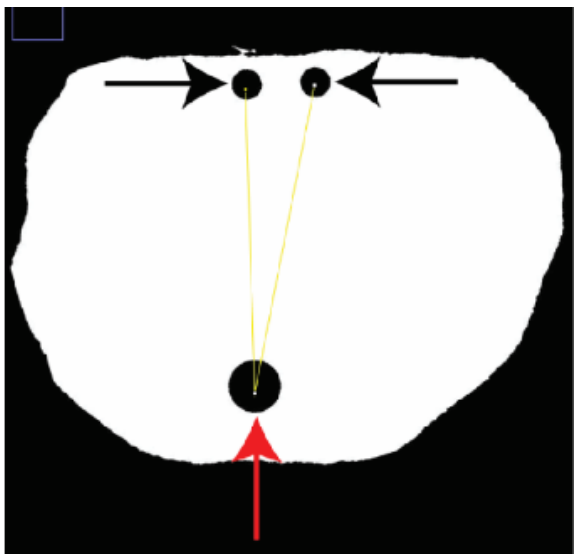


Figure 2: Image analysis using Fiji. A) Calibration of the images. The arrow indicates the line drawn on the ruler to set the scale. **B)** Dialog box for setting scale. **C)** Output of the measurements. **D)** Different line selection tools. E) Measuring the circumference of the foramen ovale of the skull using the Segmented Line tool. F) Measuring the angle between two ejaculatory ducts (black arrowheads) relative to the prostatic urethra (red arrowhead) on a cross section of the human prostate using Angle tool.

Obtaining measurements

Distance – linear and curvilinear

Once the scales are set (see under calibration), the distances can be measured by drawing a line between the structures of interest using the Line Selection tool (Figure 1B). The actual distance is now displayed in the status bar as the "length". The measurement can also be obtained by clicking Analyze → Measure (or Ctrl+M) and scrolling to the "length" tab (Figure 2C), which can be subsequently copied to a database (eg: Excel, SPSS). The curvilinear distances can be measured in a similar way using the "segmented line selection" tool (Figures 2D and 2E). The segmented line tool can be selected by right clicking on the line selection tool and selecting the segmented line option (Figure 2D).

Angle

Angle tool (Figure 1B) is used for measuring angles. The intended angle needs to be indicated by selecting three points (Figure 2F). The measurement can be obtained by clicking Analyze → Measure, and scrolling to the "angle" tab.

Area

The region of the structure can be first selected using area selection tools (Figure 1B). The measurement can subsequently be obtained by selecting Analyze Measure and scrolling to the "area" tab.

Advanced analyses and image editing

A variety of other measurements in biological image analysis such as curvature, skewness, kurtosis, center of mass, perimeter, shape descriptors can be obtained by Fiji, which is beyond the scope of this article. A scale bar can be added to the images using Fiji for publication purposes. Fiji also allows a variety of options for image editing such as sharpening, smoothening, contrast enhancement. However, care should be taken to apply the same parameters/modifications for the entire dataset in order to prevent "image manipulations".

Conclusions

Fiji is an open source software which allows a variety of image analysis options for anatomical research which is widely accepted by the scientific community.

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None

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TRIBUTES

A tribute to an esteemed and distinguished personality in the academic and scientific world who passed away on the 10th December 2020 - Professor Eugene Ramya Wikramanayake (nee Jayasekara) - "Anatomy and Human Genetics Educator"

My association with Eugene Wikramanayake dates back to almost 70 years - a chance meeting of two teenagers at the Peradeniya railway station, strangers to one another but heading to the same destination, the University of Colombo to commence our undergraduate career in medicine. We shared our student days leading to our graduation. Our professional lives ran parallel as we followed the same appointments as interns, and later joined as academics to pursue a career in anatomy. We remained good friends throughout these years sharing our experiences, our achievements and interacting socially with our batchmates till the very end.

Emeritus Prof Eugene Wickramanayake in 2016

We were the batch of 1952 -1958, comprising 110 from all parts of the country. Eugene was one of the brighter students of what was believed to be an exceptional batch. She was Intelligent, quick to absorb facts, clear in her thinking, critical and precise, qualities we saw as images of a future academic. She also displayed an intellectual maturity and a philosophical attitude which was well above of what was expected of one her age. May be it was these qualities that guided her in the choice of her life partner, Tommy Wikramanayake, someone more mature than her who could match her in her intellect and thoughts.

She joined the Department of Anatomy, Faculty of Medicine, University of Peradeniya at its inception in 1962 and walked through all levels expected of an academic ending up as Senior Professor of Anatomy in 1988; after 38 years of dedicated service she retired in 2000.

1965 was a significant milestone in her academic career when she commenced her postgraduate training at the Institute of Genetics of the Faculty of Science, University of Glasgow UK, where she read for PHD in Genetics under the supervision of Professor Guido "Ponte" Pontecorvo, an outstanding researcher in genetics. Ponte (his nickname), was the University's first Professor of Genetics (1955 to 1968), and has been described as "one of the founding fathers of modern genetics". Working with "Ponto" was a stimulating experience for it is here that she understood the fundamentals of genetics, the concept of

life in its entirety while unravelling its secrets down to a molecular level. Her thesis for her PhD in Human Genetics in 1968 was titled "Localisation of Autosomal genes in Man using Chromosomal aberrations"

Prof. Eugene Wickramanayake at the IVth International Congress in Human Genetics, Paris 1971

Realising the scope and future of this up and coming discipline and the importance of introducing the basic understanding of genetics into the minds of young scientist, on her return to Sri Lanka she introduced the course in genetics into the undergraduate and postgraduate curriculum. She also initiated research in Human Cytogenetics, Population Genetics and Physical Anthropology.

Professor Eugene always felt the need to move away from the traditional preclinical curriculum. Anatomy had to be viewed in a wider perspective, as a basic science to be integrated with other disciplines to give a comprehensive and in depth understanding of the human body. She designed and implemented courses in the Neurosciences, Human Reproduction, Genetics, Molecular Biology, Embryogenesis, Histogenesis and Human Evolution into the medical curriculum Later when the Peradeniya Medical School introduced the concept of "Study of Man in Health and Disease" she reoriented the curriculum integrating Anatomy with the clinical disciplines.

Being an avid, continuing learner, her thirst for knowledge was phenomenal. Her learning was built on fundamentals, translating them in her mind to facts. This gave her a clear and succinct understanding of the subject and the ability to retain this knowledge and to precisely transfer it to others.

One of her students and later a colleague aptly demonstrated this by saying

"That is the time I realized the true picture of Prof. Eugene Wickramanayake.

If I am to be very honest with myself I would say she is the best Anatomist I have seen in my life.

She was highly intellectual and had a holistic idea about the human body. She remembered the anatomical facts as concepts and grasps the three dimensional aspect with its evolutionary aspects as well. I know very well- it just registers for life.". He adds – "Now, that is pure wisdom" (Professor DJ Anthony)

Her vast knowledge and the volumes of information that she collected from subjects ranging from medicine, anatomy and science,

to arts, philosophy literature had to be stored in her mind for later use. How else could she have done it!

Her vocation for teaching was to aid the learning of others. Dedicated to student learning and their success, generations of students now professionals (doctors, scientists, academics) have benefitted from her teaching and remember her with gratitude and affection. She was a mentor par excellence to them all and would always find the time to offer valued and valuable advise.

Her research interests centred around Human Cytogenetics, Population Genetics and Physical Anthropology were later extended into biometry, male Infertility and human sociality. One of her main fields of interest was" Veddhas of Sri Lanka". A review of twenty five years of research on the Veddhas of Uva-Bintenna was published in the Journal of the Royal Asiatic Society of Sri Lanka. in 2002. Her studies on analysis of morphological variation in Sri Lankan communities were presented at archaelogical seminars in Peradeniya and Ruhuna

Professor Eugene always kept abreast with recent advances in Genetics, Molecular Biology, Human Reproduction and Anthropology. She often presented papers and participated at international and national conferences. As an active member of the SriLankan scientific and medical associations she never failed to attend any of the annual academic sessions whether they be in Kandy, Colombo, or any other part of the country. Public transport was always available if there was no other means of travel. It is said that young scientists would virtually "shiver in their boots" when they made a presentation at a conference where she was present. Question would be hurled at them with abject criticism sometimes literally tearing their presentation to bits - but there was nothing personal. Criticisms were constructive, accurate, helpful, appreciated and accepted by the presenter

Professor Eugene Wikramayake had many achievements and received many honours throughout her illustrious career, yet was always an epitome of simplicity with her modest, engaging and generous nature. Her slight frame always draped in a simple cotton sari, her countenance a symbol of inquiry and her sometimes rough exterior - masked a vibrant personality with a fount of wisdom and knowledge that has touched the minds and lives of many generations.

She was indeed an amazing lady who will be sorely missed not only by the academic community but by all who knew her.

May she attain the supreme bliss of Nibbana

Professor Shanti Goonewardene (nee Gautamadasa)

Anatomist,

Faculty of Medicine,

University of Colombo (1962 to 2000)

Faculty of Medicine SAITM (2009 to 2018)

INSTRUCTIONS TO AUTHORS

Instructions to Authors

The Sri Lanka Journal Anatomy publishes the following categories of articles which have relevance to Anatomy and allied sciences.

1. Leading articles - One article per issue. It may be solicited by the Editor. Authors are welcome to submit leading articles on current topics of interest. One's expertise or commentaries on general experiences etc. They should be approximately 1500 words in length. References should be 20 or less.

2. Reviews - Reviews are detailed surveys of published research pertinent to anatomy and associated sciences. They should be critical in nature and should not normally exceed 3000 words and 30 references.

3. Research articles - Articles resulting from research work belong to this group. Results from routine clinical examinations or laboratory investigations will not be considered under this category. They should not exceed 3000 words and 30 references. A reasonable number of tables and illustrations will be accepted.

4. Short reports - These include reports on current topics, modified techniques, new materials, practice management etc. Interesting results from routine work or laboratory investigations also may be accepted.

5. Case reports - Reports such as of rare anatomy related conditions.

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Submission of manuscripts

Authors submitting a paper do so on the understanding that no part has been published before, that it is not being considered for publication elsewhere and that it has been read and approved by all the authors. Manuscripts including Tables and Figures should be sent in triplicate (hard copies) as the work will be reviewed by two or more referees. While papers are subject to editing the journal does not hold it responsible for statements made by the contributor. The author alone is responsible for the statements made in his paper. Submission of a manuscript means that authors automatically agree to assign exclusive copyright to the Anatomical Society of Sri Lanka if and when the manuscript is accepted for publication.

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Once an article has been accepted for publication, the author will be asked to supply a copy of the final manuscript on disk (DVD) together with three hard copies of the complete 62 manuscript. Every disk must be clearly labeled with the name of the author, title, software and program version number.

Manuscript style

The manuscripts should be typed, double-spaced: on A4 (212x297 mm) paper and submitted in correct English: both British English and American spelling are acceptable, provided this is consistent throughout the manuscript. Manuscripts not submitted in proper format or in poor English may be returned without review. The format of a manuscript should be as follows: Title page, Abstract, Introduction, Material and Methods, Results, Discussion, Acknowledgements, References, Figure Legends and Tables arranged in that order.

Title Page –

The title page should contain the following information in the order given:

1. A concise but informative title
2. Author's full names (without degrees and titles)
3. Author's institutional affiliations
4. A running title not exceeding 40 letters and spaces
5. Name, address, telephone, telefax and electronic mail address of the author responsible for correspondence.

Abstract page –

Original and review articles must contain an abstract of approximately 250 words with four specified subtitles:

1. Objective: An introductory sentence indicating the objective and purpose of the study.
2. Material and methods: A description of experimental procedure including applicable statistical evaluation.
3. Results: A summary of the new; previous unpublished data and results.
4. Conclusion: A statement of the study's conclusion 3-5 key words according to Index Medicus should be provided.

Introduction –

The introduction should carry sufficient background information on the subject of study.

Material and methods –

Procedures should be described in such detail as to make it possible to repeat the work. Subheadings may be used to improve clearness. Correct unit abbreviations should be used (e.g. "h", "min", "s" and "Fm" rather than "hr", "minutes", "sec" and "FI"

respectively). The authors should consider the ethical aspects of their research and ensure that the work has been approved by an appropriate Ethical Committee. Where applicable, a copy of the ethical clearance certificate should be attached. In human experimentation informed consent from individuals should be obtained and this should preferable be stated.

Statistical Analysis –

Since many scientific investigations rely on statistical treatment, authors are strongly urged to consult a person with in-depth statistical knowledge. Manuscripts with a clear element of statistics are regularly refereed by the Journal's statistics consultant.

Results –

The results section should clearly and concisely present the findings of the research, as a rule in the past tense without subjective comments and reference to previous literature. The results should be supported by statistical or illustrative validation. For the sake of clarity this section may have subheadings.

Tables –

The tables should be numbered in the order of appearance in Arabic numerals. Each table should have a brief explanatory title. Each table should be typed on a separate sheet, with due regard to the proportion of the printed column/page.

Figures –

All graphs, drawings, and photographs are considered figures and should be numbered in the order of appearance in Arabic numerals. Each figure should have a brief and specific legend, and all legends should be typed together on a separate sheet of paper. Photographs should be glossy prints and the reverse should give the figure number, title of paper, principal author's name and have a mark indicating the top. Colour illustrations may be submitted in instances where their use may contribute significantly to the scientific value of the article. Colour illustrations may be printed free of charge at the Editor's discretion, whereas others may be printed at the author's expense.

References –

References are listed double-spaced in a separate reference section immediately following the text. References are numbered consecutively in the order in which they appear in the text; do not alphabetize. Identify references in texts, tables and legends by Arabic numerals (within parenthesis).

Congress abstracts should not be used as references nor may "unpublished observations" and "personal communications" be placed in the reference list. References cited as "in press" must have been accepted for publication and not merely in preparation or submitted for publication.

Examples of correct forms of references are given below. These are based on the format used in the Index Medicus. Abbreviate journal

names according to the /list of Journals Indexed, printed annually in the January issue of Index Medicus. List all authors; do not use et al in the reference list.

Journals

Standard journal article

Bartlett IG, O'Keefe P. The bacteriology of the perimandibular space infections. JOral Surg 1979; 37: 407-409. 64

Corporate (collective) author

WHO COLLABORATING CENTRE FOR ORAL PRECANCEROUS LESIONS. Definition of Leukoplakia and related lesions: an aid to studies on oral pre cancer. Oral Surg Oral Med Oral Pathol 1978; 46: 518-539.

Unpublished article Barker DS. Lucas RB. Localized fibrous growth of the oral mucosa. J Dent? Res 1965: in press.

Books and other monographs Pindborg JJ. Atlas of diseases of oral mucosa. 5th edition. Copenhagen: Munksguard, 1992: 50-66.

Chapter in book Boyde A. Amelogenesis and the structure of enamel. In: Cohen B. Kramer KH(eds). Scientific Foundations of Dentistry. William Heinemann Medical Books Ltd. London. 1976: 335-352.

No author given International statistical classification of diseases and related health problems, 10th revision, vol 1. Geneva: World Health Organization, 1992; 550-564.