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Chief Editor
Borneo Journal of Medical Sciences
Faculty of Medicine and Health Sciences
Universiti Malaysia Sabah
Jalan UMS
88400 Kota Kinabalu
Sabah, Malaysia
Tel: +60 88 320000 Ext 5620
Fax: +60 88 320928
Email: bjms@ums.edu.my

PUBLISHER

Penerbit Universiti Malaysia Sabah (UMS)
Ground Floor, Library
Universiti Malaysia Sabah
Jalan UMS
88400 Kota Kinabalu
Sabah, Malaysia
Tel: +60 88 320 789
+60 88 320 462
Fax: +60 88 320 446
Email: penerbit@ums.edu.my

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EDITORIAL

Paradigm Shift: A Need of the Hour in the Techno Era

Krishna Dilip Murthy

Department of Biomedical Sciences
& Therapeutics
Faculty of Medicine and Health Sciences,
Universiti Malaysia Sabah, Kota Kinabalu,
Sabah, Malaysia

It is time to cogitate as to **"how and what"** we teach in the medical faculties/schools. We are aware that the generation of students is different; called the "Z"-generation. So, in keeping with the trends in the field of globalization, IR 4.0, artificial intelligence and the techno era, there is a need to change and become flexible to meet the demands of the artificial intelligence and the era. The future generations will be the Centennials who will adapt heutagogy (pronounced as: hyoo-tuh-goh-jee) principles to learn what they are passionate about. Heutagogy was first defined by Hase and Kenyon (2000) as a form of "self-determined learning". So, in other words, pedagogy (the art and science of teaching children) and andragogy (the art and science of teaching adults) periods are almost over or take a back seat. In simpler terms, pedagogy is faculty-centred education; andragogy is student-centred education is not enough[1]. Heutagogy is self-directed, transformative and the present thing[2]. We need to be aware and cognizant of this fact in order to cater to our clients of the next generation.

As John Dewey once said: "If we teach today's students as we taught yesterday's, we rob them of tomorrow. This is so, true…

Right now it is
Yesterday's curriculum
Taught by today's teachers
For tomorrow's professionals

We need to change by 'bridging the inter-generational gap'. We need to adapt to the drastic changes taking place in the field of medical education and blend the technology to suit the needs. We have to be aware that there is a plethora of information in the World Wide Web (www) and there are the digital media available to access too. We need to be creative and innovative in developing our lecture plans and delivery methodology. We need to incorporate OER, MOOC, videos, flipped classrooms and other modes to see that our students have more attention span and access to them as and when they need. Not all students learn at the same pace. Therefore, the learning is now "technology-driven" in the techno-era. The present-day generation is "net-centric", where the internet can provide the necessary resources for a self-directed learning experience[3]. There is a process of reflection on the part of the learner which increases the attention and cognitive processes in learning. This also reinforces the catchword of "lifelong learning"[4]. This not the final step as the peer role and technology have a say in what we learn and how we learn to lead to pedagogy and cybergogy which is becoming the in-thing in education. So, let us all teachers make an honest change in our outlook (paradigm-shift) and change for the betterment of tomorrow's generation of doctors.

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REVIEW ARTICLE

A Systematic Literature Review on Technology-Enhanced Learning in Medical Education

May Honey Ohn[1*], Bareth Ravindran[2], Chan Zhi Wei[3], Khin Maung Ohn[4], Ng Pey Luen[5]

[1] Emergency Department, Sandwell & West Birmingham NHS Trust, United Kingdom
[2] Surgical Department, Hospital Tuanku Ja'afar Seremban, Kuala Lumpur, Malaysia
[3] Orthopaedics Department, Hospital Sungai Buloh, Kuala Lumpur, Malaysia
[4] Department of Surgery, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia
[5] Radiology Department, Hospital Queen Elizabeth II, Sabah, Malaysia

*Corresponding author's email: mayhoney.ohn@gmail.com

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blended learning, technology-enhanced learning, medical education, hybrid learning, undergraduate medical students

ABSTRACT

This systematic review was aimed to evaluate the effectiveness of technology-enhanced learning (TEL) used in medical teaching for undergraduate medical students. The objectives are to (a) identify various teaching modalities which are used to enhance TEL; (b) evaluate whether TEL is more effective than traditional learning (TL) in cognitive and affective learning domain outcome. The empirical studies were searched in the following databases: Google Scholar, MEDLINE, ERIC, ProQuest, Cochrane Library and Scopus. All papers published from 2008 to 2018 were included. From eligible studies, the study design, study field, study population, intervention methods, type of assessment and learning achievement were abstracted and summarized the information. The search results were independently reviewed by two authors. From a pool of 1384 articles, 43 eligible articles were identified, enrolling 7292 undergraduate medical students examining comparative study between TEL and traditional learning. The results showed that there was a high degree of heterogeneity seen amongst the included studies in terms of TEL modalities used. The majority of intervention studies favoured online resources, while the rest used various offline multimedia electronic devices, virtual simulations and blended modes. Overall findings showed promising data that TEL is better than TL with regards to knowledge gain and skill acquisition, as well as providing higher student satisfaction. In all, the findings present blended learning in a positive and promising light in time, particularly where systematic reviews on technology-enhanced learning in the field of the undergraduate medical programme have produced mixed result.

INTRODUCTION

Traditionally, the instructional method in medical education has always been in the form of face-to-face teaching[1, 2]. With traditional learning (TL), the majority of the allocated time is devoted to information transfer from a content expert to a novice student. The extent to which students partake with the content is highly variable, although small-group teaching certainly opens the window for direct interaction between the learner and the teacher, permitting immediate feedback and clarification between the two. Nonetheless, large-group sessions such as lectures are often relatively impersonal[3] and students may find this approach is not ideal for their learning[4]and the status of web-based education in Saudi higher education are demonstrated. Three main challenges of applying blended learning in Saudi higher education are addressed. One major challenge to be considered in the implementation of blended learning in Saudi universities is the adaptation of this element in the traditional university culture. Finding the right design of blended learning is another challenge that is discussed in detail. Furthermore, the time issue is considered a crucial challenge facing blended learning faculty. Practical recommendations that would facilitate transition to a blended learning university environment are presented. It is hoped that this study will help to provide insight for the faculties and the decision-makers throughout higher education in Saudi Arabia. Although this investigation is specifically related to the implementation of blended learning in the universities of Saudi Arabia, we are confident that the assumptions and recommendations contained herein will be of great value to other populations facing similar challenges. Introduction The Saudi Ministry of Higher Education has encouraged the use of information tech-nology (IT. In addition, the learning process in the traditional setting also emphasises more on student learning "what" and not "how". The primary focus also tends to be more on completing the required subject matter quota with minimal to no student involvement in inquiry-based education and in solving problems, but rather in tasks set by the teacher. This leads to low motivation and the subject matter is "distant" to the students. Teachers hold an authoritarian role and tend to dictate the structure of the lesson and the division of time. The learning process takes place within a classroom and school in accordance with a designated timetable, resulting in students having no flexibility[5].

Nevertheless, the past two decades have seen a revolutionizing transformation in the innovations of technology and devices, and the field of medical education must evolve accordingly to catch up[6]. Technology-enhanced learning (TEL) which is used synonymously with e-learning, does not have a unique definition. It is typically used to describe the utilization of information technology (IT) to educating and learning students. When TEL is combined systematically with face-to-face teaching to increase communication among students, instructors, and resources, it is regarded as blended learning (BL)[7]. Blended learning, which allows flexibility and creativity, are nowadays popular teaching strategy in medical institutions. Although initially met with scepticism, there has been an increased acceptance of technology-enhanced blended learning in the field of medical education[8, 9]and it is ludicrous that any educational establishment, at any level from school to the higher education institution, would consider withdrawing technology from their curriculum[10, 11]. and it is ludicrous that any educational establishment, at any level from school to the higher education institution, would consider withdrawing technology from their curriculum.

The exact prevalence and beneficial outcome of the usage of TEL in medical institutions are yet determined but it was found that most institutions of higher educations in Malaysia have adequate infrastructure

for e-learning, equipped with broadband internet access and some with wireless mobile computing capabilities[12]. Globally, various modalities of TEL resources are being introduced in medical education, with some success in their implementation[13 – 15]and novice students often experience difficulty grasping the complex three-dimensional (3D. If medical education in Malaysia is to maintain a competitive edge, it needs to keep abreast of contemporary developments. Hence, it is hoped that this systematic review would highlight the impact of TEL on undergraduate medical education, which may justify its consolidation into the local medical curriculum. The aim and objectives of this systematic review are to (i) identify various teaching modalities which are used to enhance TEL among undergraduate medical students, (ii) establish whether TEL achieves better improvement in a cognitive learning outcome, (iii) establish whether TEL achieves better improvement in affective learning outcome. It was hypothesized that overall learning effectiveness would be higher with TEL than TL.

MATERIALS AND METHODS

Search Strategy

The systematic review was carried out using a comprehensive search strategy with selection criteria. Two authors (MHO and KMO) independently searched the empirical studies in the following databases: Google Scholar, MEDLINE, ERIC, ProQuest, CINAHL, Embase, PsycINFO, Cochrane Library, Scopus. It was conducted in accordance with the Cochrane Collaboration guideline[16] to answer the research objectives, risk of bias, appropriateness of outcome measures and generalizability of results. All papers published in English languages from 2008 to 2018 were included in this systematic review. Search criteria used MeSH terms which are refined using keywords of published articles. Search terms are connected using the Boolean Operators 'AND' and 'OR' to capture all relevant article suggestions. A total of 20 synonyms were used to identify key papers relevant to two concepts in the peer-reviewed scientific literature i.e. electronic learning and undergraduate medical education. These phrases are "undergraduate medical education" OR "Undergraduate Medical Students" OR "Clinical-year students" OR "Pre-clinical year students" AND "technology-enhanced learning" OR "e-learning" OR "web-based learning" OR "internet-based learning" OR "m-learning" OR "computer-assisted learning" OR "online learning" AND "Traditional teaching" OR "Face-to-face teaching" AND "learning effectiveness" OR "learning achievement" OR "cognitive learning outcome" OR "knowledge gain" OR "skill acquisition" OR "Affective learning outcome" OR "satisfaction". Cross-references were checked from the selected papers not to miss the hidden papers. Those duplicated papers were excluded from the final analysis.

Ethical Considerations

The ethical consideration was not necessary as this review consisted of a secondary analysis of published articles.

Study Eligibility

Population, Intervention, Comparator, outcome and study design (PICOS) framework for systematic review which has been endorsed by the Cochrane Collaboration, is used in this study[17]. The study considered to include in this systematic review only if it fulfils all inclusion criteria and does not meet any of the exclusion criteria as outlined in Table 1.

Table 1 Criteria to assess the eligibility by using Population, Intervention, Comparison, Outcome and Study design (PICOS) framework to be included in this systematic review

Parameter	Inclusion criteria	Exclusion criteria
Participants	All undergraduate medical students (pre-clinical year and/or clinical-year students)	Postgraduate medical students Non-medical students Nursing students
Intervention	Any technology-enhanced learning	No technology involved
Comparison	Face-to-face or traditional or didactic learning	No comparison or control group
Outcomes	Level 1 & 2 Kirkpatrick evaluation model[18] were used to assess the learning effectiveness or achievement in terms of cognitive learning outcome (knowledge gain and/or skill acquisition) and/or affective learning outcome (learning satisfaction).	
Study design	Quantitative Comparative interventional study design	Non-comparative study Qualitative study

Validity, Reliability and Rigour

This review was conducted in adherence to PRISMA standards of quality of reporting systematic review and meta-analyses[19] (Figure 1).

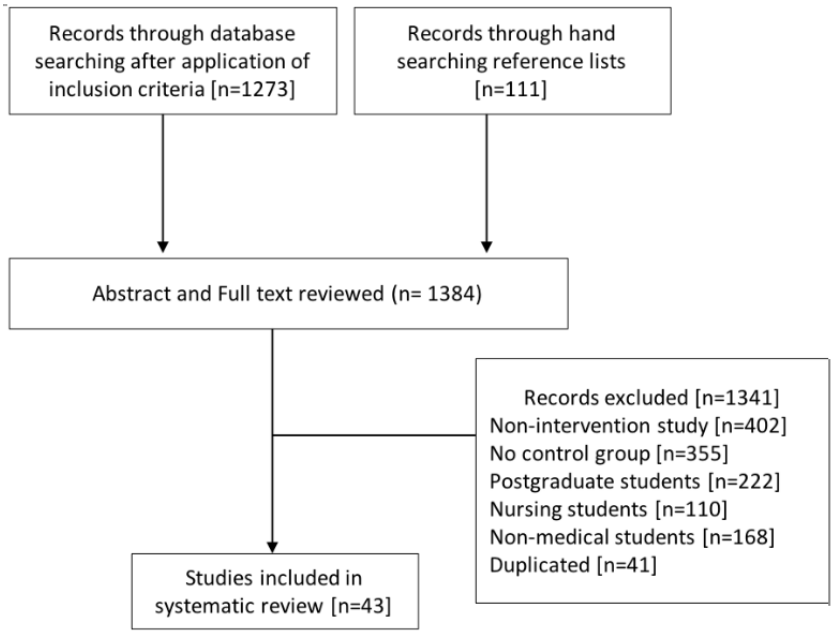

Figure 1 PRISMA flowchart of the systematic review

Data Extraction and Analysis

From eligible studies, the study subject, study population, instructional methods, type of assessment and learning achievement were abstracted and summarized the information. Two authors (CZW and BR) independently reviewed the search results and screened data using pre-defined extraction templates. Another reviewer (NPL) was involved where disagreements arose over the relevancy of the data. The results were downloaded to Mendeley where duplicate citations were removed. Data extraction and analysis were done using Microsoft Excel®. Descriptive statistics were described in terms of frequency. The systematic review was limited by the presence of selection and/or performance bias found in some of the selected studies.

RESULTS

Table 2 shows detail information extracted from this review. There were 44 published studies included in the review, a vast majority of which (33 of them) were Randomized Controlled Trials (RCT), with the rest being 1 comparative study, 3 randomised cross over studies, 2 quasi-experimental studies, 2 cohort studies and 2 mixed methods paper. A total of 7,292 undergraduate students were involved in the systematic review. A high degree of heterogeneity is seen amongst the included studies in terms of TEL modalities used. Twenty-two out of the forty-three studies (51%) utilized online resources, which included online lectures, online courses, e-learning portals, discussion forums and emails. Multimedia or electronic devices, including podcasts, digital game-based learning, CD-ROM, mobile devices and videos, were used by 13 studies (30%). Eight studies of the forty-three (19%) intervened with virtual models, such as augmented reality and virtual reality environment, as well as 3D models. As seen, a wide range of technology was used by the studies, all in different ways to improve and enhance medical student learning. Several individual technologies were mentioned specifically, such as augmented VR for anatomy and histology, Artificial Interface for Clinical Education, Virtual Microscopy, webcast and online 3D anatomy module. However, some studies do not describe their intervention in detail, making replication of these studies in other domains difficult. It is also noted that thirty-nine out of forty-three (91%) studies were done in the developed countries (United States, Canada, Europe, United Kingdom, and Australia); while the remaining four (9%) came from Asia (China and India), with none from South America, Africa, and the Middle East.

Table 2 Summary of the study design, population, intervention, assessment and outcomes of the included studies.

Author (year)	Study design	Study population	Geographic location	Numbers of participants	Study intervention	Study assessment	Study outcome
Ackermann et al. (2010)[20]	RCT	3rd-year medical students	Germany (Europe)	19	Software CD vs traditional learning	Pre and post-test	1. X-ray interpretation skill: Results favour TEL over TL
Allen et al. (2016)[13]	RCT	Undergraduate medical students	Canada	47	Online 3D neuroanatomy interactive module vs traditional laboratory module	Pre and post-test	1. Knowledge: Results favour TEL over TL 2. Satisfaction: Results favour TEL over TL
Amesse (2008)[21]	RCT	3rd-year medical students	USA	36	Computer-based learning tutorial session vs traditional learning	Post-test	1.Knowledge: Results favour TEL over TL
Armstrong et al. (2009)[22]	RCT	4th-year medical students	United Kingdom	21	Interactive slide show vs traditional learning	Post-test	1. Knowledge: No significant difference between TEL and TL

Davidson (2011)[23]	Cohort	1st-year medical students	Canada	300	Blended online team-based learning vs didactic learning	1. Course evaluation survey with Likert scale 2.Examination results	1. Knowledge: Results favour TEL over TL 2. Satisfaction: Results favour TEL over TL
Ferrer-Torregrosa et al. (2015)[24]	RCT	1st-year medical students	Spain (Europe)	211	Augmented reality book vs standard sessions with lectures, slides, and video recordings of cadaveric material	1. Post-test	Knowledge: Results favour TEL over TL
Green et al. (2011)[25]	RCT	2nd-year medical students	USA	121	Interactive computer-based program vs. traditional learning	1. Post-test 2. Questionnaire	1. Knowledge: Results favour TEL over TL
Gunn et al. (2017)[26]	RCT	1st-year medical imaging students	Australia	33	Virtual reality radiology simulation software vs traditional radiology laboratory session	Post-test	1. Knowledge: Results favour TEL over TL 2. Skill: Results favour TEL over TL
Haeur et al. (2009)[27]p = .01	RCT	3rd-year medical students	USA	303	Web-based learning vs control group	1. Checklist 2. 8-item satisfaction survey with responses on a Likert type scale	1. Skills: Results favour TEL over TL 2. Satisfaction: Results favour TEL over TL
Ilic et al. (2015)[28]	Mixed method	1st-year medical students	Australia	147	Blended learning (online plus classroom plus mobile) vs traditional learning	1. Berlin questionnaire- 2. Assessing Competency in EBM (ACE) tool – 15 MCQ 3. Evidence-based Practice Question (EBPQ) , focused group discussion	1. Knowledge: Results favour TEL over TL 2. Satisfaction: Results favour TEL over TL
Ingrassia et al. (2014)[29]	RCT	2nd-year medical students	Italy	524	Blended learning (e-learning plus Problem-based learning) vs. traditional learning	1. Pre-test and post-test, simulation exercises 2. Likert scale to assess satisfaction	1. Knowledge: Results favour TEL over TL 2. Satisfaction: Results favour TEL over TL
Javadian & Shobeiri (2016)[30]	RCT	3rd-year medical students	USA	745	Internet-based (IB) education vs. dissection-based (DB) education on pelvic anatomy	Post-test	Knowledge: Results favour TEL over TL

Jenkins et al. (2008)[31]	RCT	2nd-year medical students	USA	73	Computer-assisted instruction tutorial vs. traditional lecture and group work	Post-test	1. Knowledge: No significant difference between TEL and TL
Kandasamy & Fung (2009)[32]	RCT	2nd-year medical students	Canada	55	Online computer-assisted module vs. review article	1. Post-test 2. Questionnaire	1. Knowledge: Results favour TEL over TL 2. Satisfaction: Results favour TEL over TL
Kanthan (2011)[33]	RCT	1st and 2nd-year medical students	Canada	114	Digital games vs no games	1. Pre-test and post-test 2. Satisfaction survey questionnaire	1. Knowledge: Results favour TEL over TL 2. Satisfaction: Results favour TEL over TL 3. Engagement: Results favour TEL over TL
Kerfoot & Brotschi (2009)[34]	RCT	3rd, 4th and 5th-year medical students	USA	115	Online spaced education vs. traditional classroom	Pre-test and post-test	Knowledge: Results favour TEL over TL
Kleinert et al. (2015)[35]	RCT	3rd-year medical students	Germany	62	Virtual simulator "ALICE" (Artificial Interface for Clinical Education) vs. control group	1. Pre-test and post-test 2. 6-point Likert scale to assess satisfaction	1. Knowledge: Results favour TEL over TL 2. Satisfaction: Results favour TEL over TL
Kong et al. (2009)[36]	RCT	5th-year medical students	China	90	PBL teaching with digital format material vs. traditional learning	1. Theoretical and case analysis examinations 2. Evaluation of students' practice 3. Questionnaire	1. Knowledge: Results favour TEL over TL 2. Skills: Results favour TEL over TL
Langdorf et al. (2018)[37]	Comparative study	4th-year medical students	USA	468	Team-based simulation learning/Flipped classroom vs. didactic lecture for ACLS	1. 50 multiple-choice (MC) format questions 2. 20 rhythm-matching questions 3. 7 fill-in management of simulated cases.	1. Knowledge: Results favour TEL over TL
Lewis et al. (2011)[38]	RCT	2nd-year medical students	Canada	39	Access-to-localization tool exploring cranial nerve lesions vs. control group	1. Final examination scores 2.Questionnaire	1. Knowledge: Results favour TEL over TL 2. Satisfaction: Results favour TEL over TL

Miller (2016)[39]	RCT	1st-year medical students	USA	265	Comparing dissection of donor cadavers (qC), manipulation of digitized 3D holographic renderings (qH) and examination of plastinated specimens (qP)	Class examination results	Knowledge: Results favour TEL over TL
Mione et al. (2013)[40]	Randomised cross over design	Undergraduate medical students	Belgium	199	Virtual microscopy (VM) vs. Light microscopy (LM)	Pre-test and post-test with crossover	Knowledge: No significant difference between TEL and TL
Montassiera et al. (2016)[41]	RCT	5th-year medical students	France	89	ECG online module vs. traditional learning	ECG interpretation score	1. Knowledge: No significant difference between TEL and TL 2. Satisfaction: Results favour TL over TEL
Ochoa & Wludyka (2008)[42]	RCT	3rd-year medical students	USA	38	Web-based interactive programme vs. traditional learning	1. MCQ 2. Likert scale	1. Knowledge: Results favour TEL over TL 2. Satisfaction: No significant difference between TEL over TL
Palmer & Devitt (2008)[43]	RCT	4th-year medical students	Australia	130	Interactive computer-based format with detailed feedback vs. standard lecture material vs. both	1. Post-test 2.Questionnaire	1. Knowledge: No significant difference between TEL and TL
Pickering (2017)[14]	RCT	2nd-year medical students	United Kingdom	49	Anatomy drawing screencast vs. textbooks	Pre-test and post-test	Knowledge: Results favour TEL over TL
Raupach et al. (2009)[44]	RCT	4th-year medical students	Germany	148	Web-based collaborative teaching module vs. traditional learning	1. Pre-test and post-test 2.Questionnaire	1. Knowledge: Results favour TEL over TL
Raupach et al. (2010)[45]	RCT	4th-year medical students	Germany	74	Web-based problem-based learning group vs. traditional group	1. Post-test 2.Questionnaire	1. Knowledge: No significant difference between TEL and TL

Ricks et al. (2008)[46]	RCT	3rd and 4th-year medical students	Canada	23	E-learning (web-based tutorials) vs. traditional learning	Post-test	1. Knowledge: Results favour TEL over TL
Saltarelli et al. (2014)[47]	Quasi-experimental trail	1st and 4th-year medical students	USA	165	Model-based multimedia simulation learning system vs. traditional undergraduate human cadaver laboratory	Post-test	Knowledge: Results favour TL over TEL
Schreiber et al. (2010)[48]	Randomized cross over study	Undergraduate medical students	United Kingdom	100	Video podcast vs. live lectures	1. MCQ 2.Questionnaires to assess satisfaction	1. Knowledge: No significant difference between TEL and TL 2. Satisfaction: Results favour TL over TEL
Smits et al. (2012)[49]	RCT	2nd-year medical students	Netherlands	141	E-learning vs. traditional learning	1. Post-test 2. 5-point Likert scale	1. Knowledge: No significant difference between TEL and TL
Stolz et al. (2012)[50]	RCT	3rd-year medical students	Switzerland	129	E-learning vs. traditional learning	1. Post-test 2. 12-item OSCE	1. Knowledge: No significant difference between TEL and TL 2. Skills: Results favour TL over TEL
Subramanian et al. (2012)[51]	RCT	3rd-year medical students	USA	30	E-learning vs. traditional learning	1. Post-test 2. Long term post-test	1. Knowledge: Results favour TEL over TL
Stirling & Birt 2014)[52]	Randomized cross over study	1st-year medical students	Australia	71	Enriched multimedia eBook vs. traditional anatomy practical session	Pre and post-test	1. Knowledge: Not significant different between TEL and TL 2. Satisfaction: Results favour TL over TEL
Tian et al. (2014)[53]	RCT	2nd-year medical students	China	229	Virtual microscopy (VM) vs. Light microscopy (LM)	1. Post-test 2.Questionnaires to assess students' teaching preference and satisfaction	1. Knowledge: Results favour TEL over TL 2. Satisfaction: Results favour TEL over TL

Thompson & Laurie (2017)[54]	Cohort study	Undergraduate medical students	USA	1171	Virtual histology module with multiple audiovisual modalities and a virtual microscope platform vs. traditional laboratory sessions	1. In-house examination results 2. Evaluation of trends in performance on the histology and cell biology portion of the United States Medical Licensing Examination (USMLE) Step 1 Examination 3.Questionnaire for student feedback	1. Knowledge: Results favour TEL over TL 2. Satisfaction: Results favour TEL over TL
Truncali et al. (2011)[55]	RCT	1st-year medical students	USA	94	Interactive multimedia slides with external resources and videos vs. control group	1. Post-test 2. OSCE 3. Questionnaire	1. Knowledge: Results favour TEL over TL 2. Skills: Results favour TEL over TL 3. Attitude: Difference not tested
Webb & Choi (2014)[56]	Mixed-method study	1st-year medical student	United Kingdom	165	Interactive radiological anatomy e-learning module vs. traditional learning	1. Pre-test and post-test 2. Summative course assessment by Integrated Anatomy Practical Paper (IAPP) 3. Questionnaire to assess satisfaction	1. Knowledge: Results favour TEL over TL 2. Satisfaction: Results favour TEL over TL
Vaccani et al. (2016)[15]	Quasi-experimental trial	3rd-year medical students	Canada	148	Webcast vs. traditional live lectures	1.Post-test 2.Questionnaire on students' responses	1. Knowledge: No significant difference between the two groups 2. Skills: Results favour TEL over TL 3. Satisfaction: Mixed results
Vyas et al. (2010)[57]	RCT	4th-year medical students	India	52	Web-based workshop vs. control group	1. Clinical reasoning problems (CRP) score 2. Questionnaire	1. Knowledge: Results favour TEL over TL 2. Satisfaction: Results favour TEL over TL

Yeung et al. (2012)[58]	RCT	2nd-year medical students	United Kingdom	78	Online module vs. control group	1. Post-test 2. Subjective questionnaire using a 5-point Likert scale	1. Knowledge: No significant difference between TEL and TL 2. Satisfaction: No significant difference between TEL and TL
Zeng Ru et al. (2017)[59]	RCT	Medical students	China	181	ECG online module vs. traditional learning	ECG interpretation score	1. Knowledge: Results favour TEL over TL 2. Satisfaction: Results favour TEL over TL

RCT: randomized controlled trial; TEL: technology-enhanced learning; TL: traditional learning; vs: versus; MCQ: multiple choice question; OSCE: objective structured clinical examination; ECG: electrocardiogram

Forty-two (97%) selected papers have studied knowledge as a learning outcome. Thirty of the forty-two studies (71%) found that usage of technology-enhanced blended learning has resulted in significantly improved knowledge among test subjects. On the other hand, 12 studies (28%) found that there is no significant difference while only 1 study (2%) favoured traditional learning over TEL. Notably, all three studies which used a blended learning method combining online learning and face-to-face teaching showed 100% favourable on knowledge improvement over TL. In addition, a total of 7 papers have studied skills as an outcome where 6 studies (86%) have found that use of TEL resulted in significantly improved skills whereas a single study favours traditional learning. Next, a total of 20 studies have taken learner's satisfaction into consideration as an outcome. In 15 (75%), the results favoured TEL over traditional learning whereas 3 papers (15%) found learners to be more satisfied with traditional learning while another 2 (10%) found no significant difference or mixed results.

DISCUSSION

Overall findings of the included studies show promising data that TEL is better than TL with regards to knowledge gain and skill acquisition, as well as providing higher student satisfaction. A review published in 2012 reported that blended learning in the clinical education of healthcare students shows some measure of improvement in students' competencies, and further suggests that the highly contextual, complex needs of a competent healthcare graduate can potentially be addressed by blended learning[60]. On the other hand, a 2015 WHO review have suggested that in terms of knowledge and skill gain, TEL is "no better and no worse" than traditional learning for undergraduate healthcare profession learning[61]. However, our review cannot be entirely compared to the other presently available reviews, as the reviews lack focus solely on undergraduate medical students, including both clinical and pre-clinical groups. They are either generalized for all fields of healthcare profession students, or for niche groups within medical education.

Amongst the various modalities studied, online resources are favoured and often utilized in medical education, because of its ability to help 'address issues of educational equity and social exclusion, and open up democratic and educational opportunities'[62] and is generally regarded as to provide ease of access and flexibility, portability, improved student-teacher contact, and increased discussions with peers [61]. However, in the midst of convenience of online resources, it is warned that decreased access to teaching physicians, and dependence on the availability of technology, need to be addressed when using this modality[15]. The use of multimedia in medical teaching is also on the rise largely due to its 'special capacity of interactivity and it achieves its greatness through its interaction', as well as being able to provide greater retention of knowledge[14], at the same time that electronic devices are playing a growing role in the academic lives of medical students, especially in Malaysia[63]. Virtual model, another increasingly popular method, is able to provide a 3-dimensional and dynamic view of the structures, and focus on user interaction with the model, thus enhancing understanding of the anatomical structures and physiological mechanisms, and providing an ideal platform for hands-on procedures. es and physiological mechanisms, and providing an ideal platform for hands-on procedures.

It has been noted that a mode of learning's acceptability is likely to influence its effectiveness[61]. This can be seen from our reviews as well as, among the 15 papers that favoured TEL in terms of student satisfaction, all apart from one demonstrated a significant improvement in knowledge or skill. Concurrently, all 3 papers favouring satisfaction with TL found no significant improvement in knowledge or skill, as well as 2 out of 3 paper showing a mixed, or no significant difference in student satisfaction. Moreover, it is crucial to note that all 3 papers that favoured traditional learning, did leave room for TEL as a useful accompanying tool, as it has been described as non-inferior to TL[41], a useful adjunct to traditional methods[52], and have an important role in reinforcing learning and aiding revision[48]. Thus, for TEL interventions to work effectively, policymakers and educators should strive to understand and address specific factors and aspects of TEL that positively influences students' acceptability. It has been noted that student satisfaction does not depend on the TEL format alone, but rather in establishing a strong educator presence in online settings and building online learning communities that foster positive relations[64]. The overwhelming majority of published papers on TEL from developed nations highlights the urgent need for more studies in evaluating and comparing the effectiveness of TEL amongst developing countries for better adaptation to local needs and conditions. In all, while TEL shows promising results, it is fair to note that it will play a hand-in-hand role as traditional learning, as it been expressed by a number of papers, viewing it as a supplementary tool alongside rather than a replacement one [6, 36, 56.]

CONCLUSION

In all, the findings present blended learning in a positive and promising light in time particularly where systematic reviews on technology-enhanced learning in the field of undergraduate medical program have mixed results. Nevertheless, with the advent of technological advances and the fundamental increment of the familiarity, experience and skills of educators in incorporating technology in teaching, it is just a natural phenomenon that increasingly complex tools are developed to support and enhance teaching in the undergraduate medical field. From the review, the authors recognize that there is an urgent need for more TEL evaluation studies to detail the purpose of TEL interventions and the assessment and overall approaches adopted, the economic properties of the interventions, the specific design of learning materials and to describe how has technology enhanced and impacted the students' learning experience.

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ORIGINAL ARTICLE

Prevalence of Obesity and Correlated Hypertension and Hyperglycaemia Status among Participants of a Health Screening Programme in Inanam Sub-district, Kota Kinabalu, Sabah, Malaysia

Khairul Anwar Zarkasi[1], Nur Zuliani Ramli[1*], Vennila Gopal[1], Sadia Choudhury Shimmi[1], Anne Lolita Miranda[2], Wan Salman Wan Saudi[1], Caroline Sunggip[1]

[1] Department of Biomedical Sciences and Therapeutics, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia
[2] Pusat Rawatan Warga UMS, Hospital Universiti Malaysia Sabah, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia

*Corresponding author's email: nurzuliani@ums.edu.my

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ABSTRACT

Obesity is a known risk factor for non-communicable diseases, including hypertension and diabetes mellitus, with Malaysia having the highest prevalence of obesity among Southeast Asian countries. Additionally, the delivery of medical services to the rural communities remains challenging despite efforts to increase accessibilities to the healthcare facilities. Therefore, regular health screening programmes specifically aiming at these communities are necessary for early diagnosis and intervention to prevent complications while improving the patients' quality of life. A health screening programme was conducted in a sub-district of Kota Kinabalu, Sabah, Malaysia, where 50 participants were examined for general obesity based on body mass index (BMI) together with central obesity according to waist circumference (WC) and waist-to-hip ratio (WHR). Bioelectrical impedance analysis was performed to estimate body fat percentage (fat%) and body fat mass, along with the measurement of systolic blood pressure (SBP), diastolic blood pressure (DBP), and capillary blood glucose. The median age of the participants was 39.50 years. The prevalence of general obesity, central obesity based on WC and WHR, hypertension, and hyperglycaemia was 28%, 78%, 74%, 24%, and 20%, respectively. Both fat% and fat mass had positive correlations to the BMI (fat%: $r = 0.656$, $p = 0.001$; fat mass: $r = 0.868$, $p = 0.001$) and WC (fat%: $r = 0.505$, p = 0.001; fat mass: $r = 0.761$, $p = 0.001$). DBP had positive correlations with the BMI ($r = 0.390$, $p = 0.005$), WC ($r = 0.467$, $p = 0.001$), and WHR ($r = 0.331$, p = 0.019), while SBP had a positive correlation only with WC ($r = 0.341$, $p = 0.015$). Conversely, capillary blood glucose had no

significant correlation with either BMI, WC, or WHR. The higher prevalence of central obesity among participants of the health screening program compared to the national level should raise concern among the healthcare providers regarding the future risk for hypertension and hyperglycaemia in this community.

INTRODUCTION

Since the last two decades, obesity has been regarded as a global epidemic[1]. According to the World Health Organization, 650 million or 13% of the total world population is obese in 2019[2]. Among the Southeast Asian countries, Malaysia has the highest prevalence of obesity (15.1%), followed by Brunei (14.1%), and Thailand (10.0%) while the least obese nations include Vietnam, Timor-Leste, and Cambodia (2.1%, 3.8%, and 3.9%, respectively)[3, 4]. Obesity is the result of an imbalance between energy intake and expenditure which is stored as body fats[5]. Increased in adiposity results in low-grade inflammation, insulin resistance, and activation of the sympathetic nervous system that ultimately lead to diabetes mellitus and hypertension[6-8]. Therefore, targeting obesity through weight reduction, active lifestyle, as well as healthier eating habits remain the mainstay of treatment for these diseases[9].

Hypertension and diabetes mellitus, if left undetected, could lead to many complications. They increase the risk for diseases such as myocardial infarction, stroke, retinopathy, and nephropathy[10, 11] that may require hospital admission with prescriptions of multiple types of medications. Since healthcare cost in Malaysia is heavily subsidized, especially in the public sector[12], treating patients with diabetes and hypertension with several complications would increase the economic burden to the nation. Moreover, hospitalization could potentially cause loss of income and reduces the productivity of the individual[13]. Thus, early detection of the diseases by screening programme as secondary prevention and health intervention is imperative not only to reduce the cost of treatment but also to prevent complications and sustain the patients' quality of life.

Delivery of healthcare services to the rural regions remain challenging despite efforts by the authority to increase accessibility to the health facilities[14]. The geographical areas, education level, as well as the socio-economic status of the community, could influence the access to the health facilities. For instance, the health-seeking attitude towards mental health among the rural community in the North-western island of Penang was 85.4% although a majority of the respondents had an education level of only up to secondary school[15]. Additionally, the diabetic patients residing in a rural area of Tanjong Karang, Selangor, had high appropriate health-seeking behaviour reported at 85.9%[16]. This was contrasted with the rural coastal community of Eastern Sabah where a vast majority of the respondents were living in hardcore poverty with almost half having either primary or no formal education at all[17]. A large proportion of this community did not have their blood pressure, blood lipid, and fasting blood glucose checked for the preceding 12 months. As a result, more than three-quarters of the respondents who were incidentally found to have elevated readings of these parameters had never been diagnosed with hypertension, hypercholesterolaemia, or diabetes mellitus by any medical personnel.

These facts delineate the importance of conducting regular health screening in rural regions. Therefore, the program aimed to determine the prevalence of obesity, hypertension, and hyperglycaemia among the Inanam sub-district community of Kota Kinabalu, Sabah, Malaysia.

MATERIALS AND METHODS

The health screening programme took place on 27 April 2019 at the Inanam sub-district of Kota Kinabalu, Sabah, Malaysia. It has a

total population of 3,604 comprising the Bumiputera (71.0%), non-Bumiputera (20.3%), and non-citizen (8.7%)[18]. In this report, all the individuals (n = 50) aged 18 years and above who participated in the health screening activities were included.

Anthropometry

The participants were instructed to stand barefooted on the weighing scale (SECA®, Hamburg, Germany) while on loose, light clothing for the weighing procedure. Height was measured by placing the stadiometer plate (SECA®, Hamburg, Germany) over the participants' heads while they were standing with a straight back. Body mass index (BMI) was calculated using the formula, BMI = weight (kg) ÷ height squared (m^2). By adopting the World Health Organization International Classification for Asian Population, participants were classified either as non-obese or obese based on the cut-off points of ≤27.4 kg/m^2 and ≥27.5 kg/m^2, respectively[19].

Waist circumference (WC) was measured with participants who were at tidal expiration by wrapping a non-extensible measuring tape horizontally around the abdomen between the lowest border of the rib cage and the upper border of iliac crest[20]. Hip circumference (HC) measurement was taken at the widest part of the hip over the femoral greater trochanter[21]. Participants were classified as centrally obese when the WC was ≥90 cm and ≥80 cm for males and females, respectively. Waist-to-hip (WHR) ratio was calculated using the formula, WHR = WC ÷ HC. Participants with WHR >0.9 for males and >0.8 for females were considered as centrally obese. Criteria for central obesity based on measurement of WC and WHR were determined according to the standard set by the Malaysian Clinical Practice Guidelines for the Management of Obesity[22].

Bioelectrical Impedance Analysis

The body fat percentage and body fat mass were estimated by performing bioelectrical impedance analysis (BIA) using Tanita® BC-418 Body Composition Analyzer (Tanita Corporation, Tokyo, Japan)[23]. The instrument is portable, quick, relatively simple, and is used widely as a method to estimate body composition with a very strong correlation with the standard dual-energy X-ray absorptiometry[24, 25]. Additionally, it generates reliable and reproducible results with very minimal intra- and inter-observer variation, along with <1% variation upon repeat measurement[26]. To minimize error, all participants were asked to stand on the metal plate with bare feet and hold onto the metal grip of the device. The limbs were held out and ensured not to be in contact with other body segments during the procedure. Body composition analysis via BIA measures the fat, lean mass, and water content by measuring resistance (or impedance) as electrical signals pass through different tissue types of the body[27].

Blood Pressure and Capillary Blood Glucose Measurement

The participants could rest for at least 5 minutes before blood pressure measurement using Omron® SEM-1 (HEM-7051) electronic blood pressure device (Omron, Kyoto, Japan). The device has a sensitivity of 88.2% and specificity of 98.6% to detect hypertension[28]. An appropriate-sized cuff was applied to the middle part of the supported right arm in the sitting position while the device was ensured to be placed at the participants' heart level. If the first reading were high, the blood pressure would be measured again after the participant rested for another 10 minutes. The blood pressure reading was classified as either non-hypertensive (≤139/89 mmHg) or hypertensive (≥140/90 mmHg) by referring to the criteria from the Malaysian Clinical Practice Guidelines for the Management of Hypertension[29].

For capillary blood glucose measurement, index finger of the left hand was cleaned with 70% isopropyl alcohol swab (Becton, Dickinson and Company, New Jersey,

USA) and allowed to dry for few seconds. Upon pricking, the initial blood drop was wiped out with dry cotton. Subsequent blood was dropped into a glucose strip connected to the Accu-Chek® Performa glucometer device (Roche Diagnostics, Basel, Switzerland). The readings of ≤7 mmol/L and ≥7.1 mmol/L were considered as normal and hyperglycemia, respectively, according to the Malaysian Clinical Practice Guideline for the Management of Type 2 Diabetes Mellitus[30].

Since blood pressure and capillary blood glucose were measured using automated devices, we ensured that the participants were under standard conditions before and during the procedure. Only one trained person was responsible for the measurement of each parameter to reduce inter-observer variation.

Statistical analysis

The data were subjected to the Shapiro-Wilk test to identify the distribution type. Since the data was not normally distributed, each parameter was expressed in the median and interquartile range (IQR). Non-parametric Spearman ρ correlation test was performed to look for correlation among those parameters. Strength of correlation was determined as poor ($0<r<0.3$), fair ($0.3\leq r<0.6$), moderate ($0.6\leq r<0.8$), and very strong ($0.8\leq r<1$)[31], while significance value was set at $p<0.05$. These tests were conducted using IBM® SPSS® Statistics (version 23) software.

RESULTS

The participants in the health screening program had a median age of 39.50 years. For other parameters, their median and interquartile range are listed in Table 1.

Table 1 Characteristics of the participants expressed in median and interquartile range

Parameters	Median	1st centile	3rd centile
Age (years)	39.50	23.00	45.25
Weight (kg)	62.00	51.50	69.25
Height (cm)	157.00	151.75	163.13
BMI (kg/m2)	23.90	21.80	27.89
Waist circumference (cm)	90.50	82.00	97.00
Hip circumference (cm)	100.00	95.50	106.00
Waist-to-hip ratio	0.90	0.85	0.92
Body fat percentage (%)	31.40	24.23	34.10
Body fat mass (kg)	18.95	14.10	24.05
Systolic blood pressure (mmHg)	124.00	111.50	135.25
Diastolic blood pressure (mmHg)	78.50	72.75	85.50
Capillary blood glucose (mmol/L)	6.00	5.40	6.65

As shown in Table 2, a quarter (28%) of the participants were obese according to the BMI classification, with a median of 30.77 kg/m^2. Meanwhile, measurement of WC and WHR showed the contrary, whereby nearly two-thirds (78% and 74%, respectively) of them were classified as centrally obese with a median of 94.00 cm for WC and 0.90 for WHR.

On the other hand, 24% of the participants were hypertensive with median systolic blood pressure (SBP) of 150.50 mmHg and 94.50 mmHg for the diastolic blood pressure (DBP). Lastly, 20% of the participants had hyperglycemia with a median capillary blood glucose reading of 8.60 mmol/L.

Table 2 Prevalence of obesity, hypertension, and hyperglycaemia among the health screening participants

Parameters		n	%	Median (IQR)
BMI (kg/m^2)	Non-obese	36	72	22.63 (20.17 – 24.49)
	Obese	14	28	30.77 (28.30 – 32.93)
WC (cm)	Normal	11	22	78.00 (75.00 – 79.00)
	Centrally obese	39	78	94.00 (87.00 – 100.00)
WHR	Normal	13	26	0.87 (0.81 – 0.90)
	Centrally obese	37	74	0.90 (0.86 – 0.94)
BP (mmHg)	Non-hypertensive	38	76	SBP: 121.00 (109.75 – 127.50)
				DBP: 75.00 (68.75 – 82.00)
	Hypertensive	12	24	SBP: 150.50 (137.50 – 157.25)
				DBP: 94.50 (87.75 – 107.25)
Blood glucose (mmol/L)	Normal	40	80	5.85 (5.40 – 6.08)
	Hyperglycaemia	10	20	8.60 (7.73 – 9.25)

Abbreviations: BMI (body mass index), BP (blood pressure), DBP (diastolic blood pressure), Glu (capillary blood glucose), IQR (interquartile range), SBP (systolic blood pressure), WC (waist circumference), WHR (waist-to-hip ratio).

To look for correlation between all parameters, non-parametric Spearman's ρ correlation coefficient test was performed (Table 3). Body fat percentage had a very strong correlation with body fat mass (r = 0.829, p = 0.001), moderate correlation with BMI (r = 0.656, p = 0.001), and fair correlation with WC (r = 0.505, p = 0.001). Additionally, body fat mass had a very strong correlation with BMI (r = 0.868, p = 0.001), moderate correlation with WC (r = 0.761, p = 0.001), as well as fair correlation with WHR (r = 0.358, p = 0.011). In the meantime, WC was found to have a moderate correlation with both BMI (r = 0.763, p = 0.001) and WHR (r = 0.747, p = 0.001), along with a fair correlation with age (r = 0.427, p = 0.002). In contrast, WHR showed a fair correlation only with age (r = 0.329, p = 0.020) and BMI (r = 0.408, p = 0.003). DBP had a very strong correlation with SBP (r = 0.803, p = 0.001) together with a fair correlation with almost all other parameters including age (r = 0.335, p = 0.017), BMI (r = 0.390, p = 0.005), WC (r = 0.467, p = 0.001), WHR (r = 0.331, p = 0.019), and body fat mass (r = 0.396, p = 0.004). On the contrary, SBP had a fair correlation only with age (r = 0.359, p = 0.011) and WC (r = 0.341, p = 0.015).

Table 3 Spearman's ρ correlation coefficient among age, BMI, WC, WHR, fat%, fat mass, SBP, DBP, and glucose

		Age	BMI	WC	WHR	Fat%	Fat mass	SBP	DBP	Glu
Age	*r*	1.000								
	p-value	–								
BMI	*r*	0.201	1.000							
	p-value	0.161	–							
WC	*r*	0.427†	0.763†	1.000						
	p-value	0.002	0.001	–						
WHR	*r*	0.329*	0.408†	0.747†	1.000					
	p-value	0.020	0.003	0.001	–					
Fat%	*r*	0.092	0.656†	0.505†	0.244	1.000				
	p-value	0.524	0.001	0.001	0.087	–				
Fat mass	*r*	0.167	0.868†	0.761†	0.358*	0.829†	1.000			
	p-value	0.245	0.001	0.001	0.011	0.001	–			
SBP	*r*	0.359*	0.264	0.341*	0.222	0.024	0.260	1.000		
	p-value	0.011	0.064	0.015	0.121	0.871	0.068	–		
DBP	*r*	0.335*	0.390†	0.467†	0.331*	0.171	0.396†	0.803†	1.000	
	p-value	0.017	0.005	0.001	0.019	0.236	0.004	0.001	–	
Glucose	*r*	0.104	0.177	0.139	-0.036	0.192	0.214	0.232	0.214	1.000
	p-value	0.472	0.220	0.335	0.805	0.181	0.135	0.105	0.135	–

*Correlation is significant with $p<0.05$ (2-tailed); †Correlation is significant with $p<0.01$ (2-tailed). Abbreviation: BMI (body mass index), DBP (diastolic blood pressure), Fat% (body fat percentage), Glu (capillary blood glucose), SBP (systolic blood pressure), WC (waist circumference), WHR (waist-to-hip ratio).

DISCUSSION

This paper summarized the findings from a health screening programme conducted in a rural community of Inanam sub-district, Kota Kinabalu, Sabah, Malaysia. It marked the 4th edition of the "Jom Sihat Bah!" programme since its inception in 2016 which incorporated health awareness talks, health educational booths, blood donation drive, house visits, and donations to the underprivileged, as well as health screening initiatives[32].

A total number of 50 participants in the health screening activities comprising both males and females were included in this study. Unlike our previous health-screening findings in a rural community of Kiulu, Tamparuli, Sabah, where the participants were mainly from the older-aged groups[33], participants in the Inanam sub-district were mostly middle-aged. Inanam was located less than 10 km from the Kota Kinabalu downtown as compared to Kiulu, which had almost quintupled the distance. Hence, the work opportunities might be highly available for the younger generations without the necessity to migrate to the urban area.

The prevalence of general obesity based on BMI was identical to the national prevalence (28.0% and 30.6%, respectively) but higher for the prevalence of central obesity based on WC (78.0% vs. 48.6%)[34]. According to the WHR measurement, the prevalence of central obesity among the participants was also higher compared to the earlier reports by Ahmad and colleagues (74.0% vs. 44.8%)[35]. Since the Inanam sub-district was located in the vicinity of the outskirts of Kota Kinabalu, the community lifestyles might closely resemble the urban population than the rural ones. Generally, urbanites had lower physical activities compared to the rural-dwellers[36] that

might explain the higher prevalence of central obesity among the participants.

Although detection of general obesity via BMI and central obesity by WC and WHR yielded different results, all of them were directly correlated to the body fat compositions. Estimation of body fat mass and body fat percentage using BIA revealed that both parameters had a positive association with BMI and WC, with the former having additional positive association with WHR. Furthermore, positive associations were also seen among BMI, WC, and WHR. Traditionally, BMI alone was used to detect obesity as a risk factor for cardiometabolic diseases. However, it could not differentiate between subcutaneous and visceral adiposity, as well as the inability to discriminate between lean and adipose masses in general[37, 38]. As a result, the classification of obesity might be inaccurate especially among individuals with larger muscle mass[39]. Therefore, a combination of all three parameters was often used as a holistic approach to assessing general obesity and central obesity during health screening activities[40].

Hypertension prevalence among the participants of the health screening programme was almost similar to the national prevalence (24.0% and 30.3%, respectively)[34]. A prospective cohort study on Chinese adults found that central obesity predicted future hypertension independent of general obesity with a cumulative hypertension incidence of 25.9% over a period of ten years[41]. Consistently, our findings showed that both SBP and DBP had a positive correlation with central obesity. Thus, the high percentage of central obesity should raise concern among healthcare professionals regarding the risk of impending hypertension in this community. Therefore, a scheduled health screening program must be organized regularly for early diagnosis and commencement of treatment in order to achieve the desired blood pressure control and to prevent sequelae.

In this health screening programme, the hyperglycaemia prevalence among the participants was closely equivalent to the national prevalence (20.0% and 17.5%, respectively). Despite a robust positive association between hyperglycaemia and general obesity/central obesity[42], our findings showed otherwise. This could be due to the small number of participants during the health screening programme. Besides, we only measured random capillary blood glucose to screen for hyperglycaemia which might be influenced by factors such as the time of last meal taken. The most accurate tests to check for hyperglycaemia as well as to diagnose diabetes mellitus are serum HbA_{1c} and oral glucose tolerance test comprising of fasting and 2-hour postprandial blood glucose level measurement[43] which we could not perform due to logistic limitations. However, similar to hypertension, the future risk for hyperglycaemia in this community should still be taken into consideration due to the higher percentage of central obesity found among the health screening participants.

CONCLUSION

The prevalence of general obesity, hypertension, and hyperglycaemia among the participants of the health screening programme in Inanam sub-district community was comparable to the national prevalence. However, central obesity was exceptionally higher than at the national level. It should raise concern among healthcare professionals regarding the future risk of hypertension and hyperglycaemia in this community.

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CONFLICT OF INTEREST

The authors declare that they have no competing interests in publishing this article.

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ORIGINAL ARTICLE

Sonographic Measurement of the Thickness of Subcutaneous Tissue and Hepatic Echo-Intensity Attenuation Rate in Non-alcoholic Fatty Liver Disease

Abdul Sattar Arif Khammas[1, 2*], Hasyma Abu Hassan[1], Sarah Qahtan Mohammed Salih[3], Hayati Kadir Shahar[4], Ramlah Mohamed Ibrahim[1, 5], Nurul Nadiah Mohamed Nasir[1, 5], Rozi Mahmud[6]

[1] Department of Imaging, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Serdang, Selangor, Malaysia
[2] Department of Radiological Techniques, College of Health and Medical Technology, Middle Technical University, Baghdad, Iraq
[3] Computer Center, College of Health and Medical Technology, Middle Technical University, Baghdad, Iraq
[4] Department of Public Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Serdang, Selangor, Malaysia
[5] Department of Nutrition and Dietetics, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Serdang, Selangor, Malaysia
[6] Cancer Resource and Education Centre (CaRE), Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Serdang, Selangor, Malaysia

*Corresponding author's email: abdulsattar.arif@mtu.edu.iq

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ABSTRACT

The most common cause of the chronic liver disease is non-alcoholic fatty liver disease (NAFLD). This study was designed to compare a mean subcutaneous tissue thickness (SCTT) and hepatic echo-intensity attenuation rate (HEIAR) among NAFLD grades. Sonography was carried out on 628 consecutive subjects. The distance between the skin surface and the liver capsule was measured and was labelled the SCTT. Also, the ultrasound of HEIAR was retrospectively quantified on an image archiving. HEIAR was calculated as the difference between mean intensity of echo for two regions of interest (ROIs) in near- and far-fields divided by the distance between these two ROIs multiply by frequency of the probe. Of the 628, 235 subjects were diagnosed with NAFLD. The age range was 45 – 75 years with mean 54.5 ± 6.7 years. There was a significant difference of mean SCTT among NAFLD grades ($p<0.001$), 65.4% of subjects with SCTT measured ≥ 2.1 cm had NAFLD versus 34.6% of subjects had no NAFLD. Similarly, the differences of mean HEIAR among NAFLD grades were reported to be statistically significant ($p<0.001$). All of the subjects with HEIAR of 1. 7dB/cm MHz and over had NAFLD. HEIAR is a useful indicator for non-invasive quantitative assessment of NAFLD where sonographically measured HEIAR equal to or over than 1.7 dB/cm MHz makes identifying NAFLD is probably (sensitivity is 59% and specificity is 89%). HEIAR is a useful indicator for non-invasive quantitative assessment of NAFLD.

INTRODUCTION

Non-alcoholic fatty liver disease (NAFLD) is the most common cause of chronic liver disease worldwide[1]. It is also the most common cause for the chronic elevation of the liver enzymes in United States nowadays[2]. Histologically, NAFLD is defined as excessive fat accumulation in the liver tissues over 5% of the wet liver weight due to causes other than alcohol intake[3, 4]. Dyslipidaemia is the most common condition that can lead to fatty liver disease. An abnormal circulating lipoprotein concentration has reflected the disturbances in the homeostasis of the major lipid components of TG, lipoproteins, TC, and cholesterol esters. Lipids conveyed in the blood plasma are composed of lipoprotein complexes. After eating, fat-food and TC are deposited into the intestine cells and then connected with newly resultant chylomicrons. With energy increases, the glucose is transformed into fatty acids. The latter is further utilized to build up TG. TG is stored in the form of fat droplets in the hepatocytes or merged with VLDL and then excreted into the bloodstream. In this manner, the TG content of these molecules is piecemeal decreased by the action of the lipoprotein lipase that leads to LDL with comparative increases in the cholesterol content. LDL is transported and deposited into the liver by linking the LDL to the LDL receptor. Hence, excess deposition of TG in hepatocytes is considered the hall-mark of NAFLD[5]. It roughly affects 20 – 40 % of Western population[6]. In Asia, it was initially uncommon but with the increase in obesity and diabetes mellitus (DM)[7], it would also be on the increase with affecting 12 – 37 % of general population[8 – 15]. NAFLD encompasses a wide spectrum of liver diseases ranging from simple steatosis to non-alcoholic steatohepatitis (NASH) that leads to fibrosis, cirrhosis and eventually hepatocellular carcinoma (HCC)[16]. Nevertheless, NAFLD is still considered as a benign disease unless it develops into steatohepatitis and fibrosis[17]. Its association with insulin resistance and obesity has been well reported where a previous study showed that NAFLD was strongly correlated with hypertriglyceridaemia, type 2 DM and obesity[18]. Furthermore, fatty liver changes are likely to be as the hepatic manifestation of the metabolic syndrome[13]. Interestingly, Targher, Marra & Marchesini G (2008)[19] indicated that NAFLD is not only a risk factor for chronic liver disease but it is also considered an independent risk factor for developing cardiovascular disease (CVD).

Currently, ultrasound is widely used for detection NAFLD because it is a non-invasive machine, safe (with no radiation hazard), available and less expensive than other radiological modalities such as magnetic resonance imaging and computed tomography[20]. There are sonographic features could indicate to fatty liver changes, two of the idealistic features are an increased hepatic echo-intensity attenuation rate (HEIAR) of the liver parenchyma and also increased subcutaneous tissue thickness (SCTT). Therefore, the present study was designed to define a cut-off value of the hepatic echo-intensity attenuation rate above which NAFLD is likely. We also sought to compare the SCTT in subjects with and without NAFLD.

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MATERIALS AND METHODS

A prospective cross-sectional study was carried out among Malaysian adults with age ranges between 45 to 75 years who underwent screening programme for the period from 15 August 2015 until 15 January 2016 at Golden Horses Health Sanctuary (GHHS) located in Seri Kembangan, Klang Valley, Malaysia. Ethical from Ethics Committee for Research Involving Human Subject (JKEUPM) with number UPM/TNCPI/RMC/1.4.18.1(JKEUPM)/F2 was obtained prior to conducting of this study. Each respondent was informed about the study verbally and in writing according to Good Clinical Practice, after that, informed consent was obtained from all respondents before the commencement of this study.

Males who have drunk alcohol over 140 g/week and females over 70 g/week, were hepatitis B or C viruses carrier, previous liver insults or surgery, pregnancies, taken corticosteroid or lipid-lowering medications were excluded from the study. The subjects were randomly selected using a systematic sampling method. Liver ultrasound was performed on 628 consecutive subjects by a single radiologist with experience over 10 years using Philips (HD 15) medium-range machine with a convex-array probe (3.5 MHz). A standard approach has been used in image acquisition. The subjects have been recommended not to eat any food by mouth for 8 hours prior to the examination; if the fluid is needed, only plain water should be taken. The subject lied in the supine position with his/her right arm elevated above the head. The coupling agent (gel) was applied to the right upper abdomen. The radiologist started the examination with a longitudinal scan. Afterwards, the transverse scan and intercostal scan along the mid-axillary line were achieved. The distance between the skin surface and the liver capsule was measured and labelled as the SCTT. Therefore, an attempt was made to reduce compression of subcutaneous tissue by the probe.

The normal liver parenchyma is homogenous in echotexture with reflectively (echogenicity) equal to or slightly greater than that of the renal cortex and spleen. Therefore, fatty liver changes were qualitatively assessed based on the increase in reflectively of liver parenchyma compared to the right renal cortex and spleen[21, 22]. The determination cut-off value of HEIAR to define fatty liver changes was based on the mean of the hepatic echo-intensity attenuation rate among NAFLD grade I. NAFLD grades were also qualitatively assessed based on reflectively of intrahepatic vessels walls and diaphragm (Figure 1). When there is no increased in reflectively of the liver parenchyma compared to the renal cortex or spleen, it is described as grade 0 or normal. When there is slightly increased in reflectively of the liver parenchyma, it is described as grade I or mild. When there is increased in reflectively of the liver parenchyma with loss visualization of portal vascular walls, it is described as grade II or moderate. When there is markedly increased in reflectively of the liver parenchyma with poor or no visualization of the posterior portion of the diaphragm, it is described as grade III or severe [22-25].

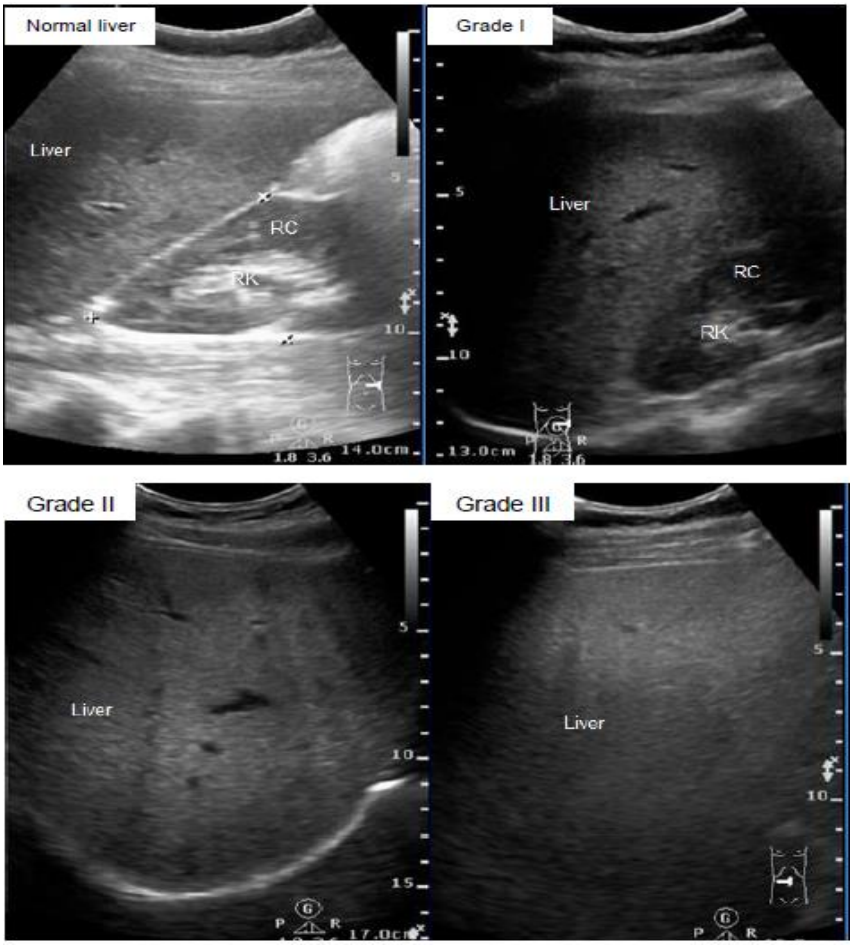

Figure 1 Various grades of diffuse fatty liver disease as compared with the normal liver (the pictures were taken from the study population)

In meanwhile, the ultrasound HEIAR was retrospectively quantified on an image archiving. On the liver image, the observer selected two ROIs of 5 mm square in the liver homogenous area along the ultrasound beam in the near-field (depth 3 – 5 cm) and far-field of the liver, respectively, avoiding vessels and artefacts. The distance between the two ROIs were also measured (Figure 2).

HEIAR was calculated according to the equation below:

HEIAR = $(lnEn\text{-}lnEf)/(\Delta d \times f)$; where

lnEn and *lnEf* are the mean intensity of echo in near-field and far-field of the liver, respectively.

Δd is the distance between two liver ROIs.

f is the ultrasound frequency of transducer and was used 3.5 MHz in this study.

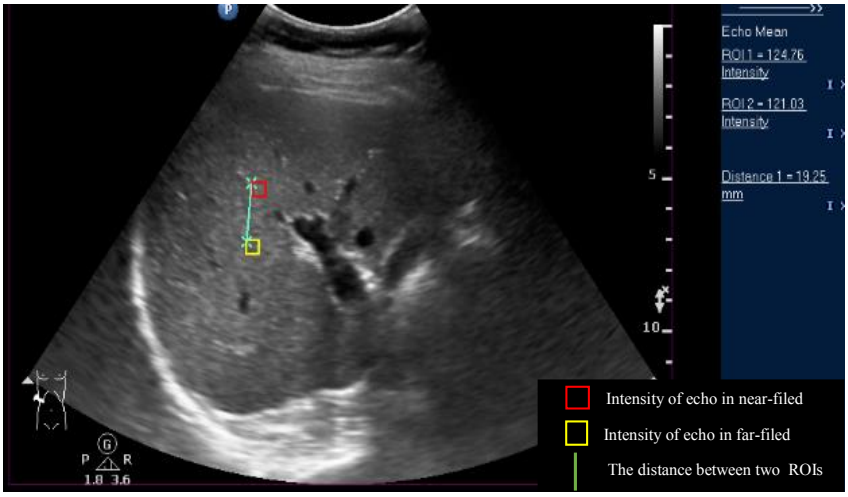

Figure 2 Hepatic echo-intensity attenuation rate on ultrasound. Image shows the liver intercostal view with the drawing of two ROIs in near-field and far-field at the homogenous area in the liver parenchyma. The distance was measured from the top corner of the near-field ROI into the top corner of far-field ROI

Statistical Analysis

Data analysis was performed using Statistical Package for Social Science (SPSS) program version 22.0. First, descriptive analysis was carried out to calculate the percentages of each factor among the study population. Chi-square test was performed to determine the association between categorical variables. In addition, sensitivity and specificity were calculated based on crosstab from the descriptive statistic. Analysis of variance (ANOVA) was achieved to compare a mean among more than three groups with normally distributed data. A p-value of < 0.05 was considered statistically significant.

RESULTS

Of the 628 consecutive subjects with a mean age of 54.5 ± 6.7 years who underwent a screening programme and met the inclusion criteria in this study. Table 1 shows characteristics of the study population based on the distribution of age, gender, ethnicity, presence of disease and its grades. Of 235 (37.4%) subjects diagnosed with NAFLD and 393 (62.6%) subjects were not found to have NAFLD. Of those with NAFLD, there were 9.6% of subjects with a mild grade of fatty liver, 23.7% with a moderate grade and 4.1% with severe grade. The females had a higher percentage than males in our study population and overwhelming Chinese in race reflecting the urban population from which is derived from.

Table 1 Basic socio-demographic characteristics of study population (*n* = 628)

Variables	*n* (%)	mean ± SD
Age	–	54.54 ± 6.69
Gender		
Male	302 (48.1)	–
Female	326 (51.9)	–
Race		
Malay	92 (14.6)	–
Chinese	518 (82.5)	–
Indian	18 (2.9)	–
NAFLD		
Yes	235 (37.4)	–
No	393 (62.6)	–
NAFLD grades		
Grade I (mild)	60 (9.6)	–
Grade II (moderate)	149 (23.7)	–
Grade III (severe)	26 (4.1)	–

NAFLD: Non-alcoholic Fatty Liver Disease

Based on one way ANOVA test, Table 2 shows the differences of means SCTT and HEIAR among NAFLD grades. The mean SCTT was 1.8 ± 0.4 cm in grade 0 (normal), 2.1 ± 0.5 cm in grade I (mild), 2.2 ± 0.5 cm in grade II (moderate) and 2.6 ± 0.7 cm in grade III (severe). This indicates that differences in mean SCTT among NAFLD grades were noted to be significant (p <0.001). According to HEIAR, the results also revealed that mean HEIAR was 0.8 ± 0.7 cm in grade 0 (normal), 1.7 ± 1.3 cm in grade I, 2.2 ± 1.3 in grade II and 3.0 ± 1.5 cm in grade III. This indicates that there are significant differences in mean HEIAR among NAFLD grades (p <0.001)

Table 2 Differences of means HEIAR and SCTT among NAFLD grades (*n* = 628)

variables	NAFLD grades				F-statistics (df)	*p*-value
	Grade 0 (*n* = 393)	Grade I (*n* = 60)	Grade II (*n* = 149)	Grade III (*n* = 26)		
HEIAR (dB/cm.MHz)	0.8 ± 0.7	1.7 ± 1.3	2.2 ± 1.3	3.0 ± 1.5	9.277 (2)	< 0.001
SCTT (cm)	1.8 ± 0.4	2.1 ± 0.5	2.2 ± 0.5	2.6 ± 0.7	9.133 (2)	< 0.001

HEIAR: Hepatic echo intensity attenuation rate; dB: decibel, cm: centimetre; SCTT: Subcutaneous Tissue Thickness

According to the Chi-square test, Table 3 shows an association between SCTT and HEIAR with NAFLD. As grade I is considered initial stage of NAFLD, so that we adopted mean of the SCTT in grade I (2.1 cm) as a cut-off value to likely diagnose NAFLD where there were 65.4% (149/228) of subjects with SCTT measured ≥ 2.1 cm had NAFLD versus 34.6% (79/228) of subjects without NAFLD with sensitivity 52% and specificity 86%. Among subjects with SCTT < 2.1 cm, there were 21.5% (86/400) of subjects with NAFLD versus 78.5% (314/400) with no NAFLD.

Table 3 Chi-Square of HEIAR and SCTT with NAFLD

Variables	NAFLD status		X^2 (df)	*P*-value
	Yes, *n* (%)	No, *n* (%)		
HEIAR			405.7 (1)	<0.001
(≥1.7 dB/cm. MHz), (*n* = 175)	175 (100.0)	0 (0.0)		
(<1.7 dB/cm. MHz), (*n* = 453)	60 (13.2)	393 (86.7)		
SCTT			119.2 (1)	<0.001
(≥2.1 cm), (*n* = 228)	149 (65.4)	79 (34.6)		
(<2.1 cm), (*n* = 400)	86 (21.5)	314 (78.5)		

Thus, Figure 3 illustrates the thinning of SCTT (less than 2.1 cm) in subject with normal liver whereas Figure 4 illustrates the thickening of SCTT (more than 2.1 cm) in a patient with NAFLD. Moreover, the mean HEIAR in grade I (1.7 dB/cm. MHz) has been depended for detecting NAFLD, where 175 out of 175 (100.0%) subjects with HEIAR of 1.7 dB/cm. MHz or above had NAFLD with sensitivity 59% and specificity 89%. In contrast, only 60 out of 453 (13.2%) subjects with NAFLD had HEIAR less than 1.7 dB/cm.MHz.

Figure 3 Normal liver sonography demonstrates a subcutaneous tissue thickness (arrow) of less than 2.1 cm

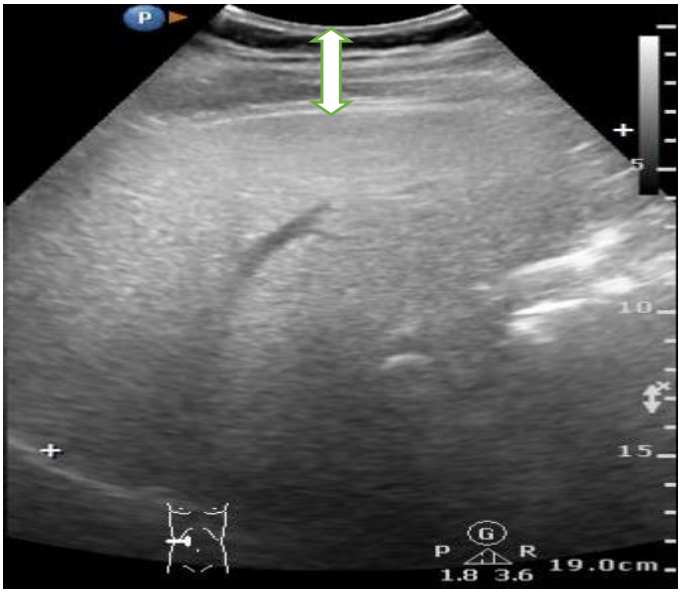

Figure 4 Sonography in of NAFLD patient demonstrates a subcutaneous tissue thickness (arrow) of more than 2.1 cm

DISCUSSION

Although ultrasound is valuable to diagnose NAFLD, the liver biopsy is still considered as the reference tool for the detection, quantifying and grading of NAFLD as well as its ability to differentiate between NAFLD and nonalcoholic steatohepatitis (NASH)[25, 26]. However, sampling error may occur because the fat infiltration is sometimes unequally distributed in hepatocytes[27]. Moreover, the biopsy is an invasive tool and has some risks which lead to serious complications. In this study, qualitative and quantitative ultrasound methods were used for assessment of fatty liver disease. The qualitative method describes the fatty liver disease based on increasing in reflectively of the liver parenchyma compared to the renal cortex[28].

In contrary, the quantitative ultrasound method of HEIAR is an additional method that can be applied to the detection of NAFLD. In the present study, we present a method to quantify fatty infiltration in hepatocytes using ultrasound HEIAR. The ultrasound HEIAR is an objective, computer-calculated index. This idea is not new innovative but it is identical to concepts addressed in previously published studies with some amendments of practical points. Although Fujii et al. (2002)[29] and Itoh et al. (1988)[30] indicated that sonographically measured the attenuation coefficient would be used for ultrasound quantitative assessment of the grading of fatty liver changes. The researchers needed specific systems to quantify the attenuation coefficient and these are hard to use in the factual clinical area. In our study, ultrasound evaluated the hepatic attenuation because it demonstrates a 256-level grayscale brightness on screens which is no highly accurate but could be useful. Although Webb et al. (2009)[26] stated that the hepatorenal index was beneficial for quantification of hepatic steatosis, the various disease processes can, unfortunately, alter the echogenicity of the renal cortex. Moreover, the activated of time-gain compensation (TGC) activated as a default function using by most sonographers is considered a confounding factor to compensate for the echogenicity of deeper attenuated areas. Therefore, in the present study, we thwarted the activation of TGC because it is an inverse objective to measure the ultrasound attenuation.

In light of that, Sonographic quantitative assessment was used to quantify the mean of HEIAR among NAFLD grades as well as adoption these means in grade I as cut-off values to likely identify NAFLD. Our study reported a high difference of HEIAR among NAFLD grades. Importantly, mean HEIAR in grade I was 1.7 dB/cm.MHz, thereby we found that the prevalence of NAFLD was 100% among patients who had HEIAR equal to or greater than 1.7 dB/cm.MHz. Hence, sonographically measured HEIAR equal to or over than 1.7 dB/cm.MHz makes the diagnosis of NAFLD probably. Incompatible with our study, Zhang et al. (2012)[31] confirmed that the difference of HEIAR between NAFLD and non-NAFLD was strongly significant. On equal importance, Kwon et al. (2013)[32] assessed cut-off values of the ultrasound attenuation index for estimation severe hepatic steatosis using two probes 4 MHz and 8 MHz. The researchers reported that optimal ultrasound attenuation index cut-off value of 31.0 at 8 MHz is beneficial to approach for non-invasive diagnosis of severe hepatic steatosis.

Furthermore, this study has also compared the means of SCTT among NAFLD grades where we depend on the mean in grade I as cut-off values to likely identify NAFLD. As expected, our results revealed a close correlation between SCTT and NAFLD grades. In addition, most of the healthy subjects had less than mean SCTT in grade I (less than 2.1 cm). Our study is partially consistent with a study done by Riley & Bruno (2005)[33], which reported that the diagnosis of NAFLD among subjects with SCTT measuring sonographically less than 2.0 cm is unlikely.

CONCLUSION

Sonographically measured SCTT is not strongly approached to diagnose NAFLD. Nevertheless, HEIAR is a useful indicator for non-invasive quantitative assessment of NAFLD.

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CONFLICT OF INTEREST

The authors declare that they have co competing interests in publishing this article.

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CASE REPORT

Early Experience in Surgical Treatment of Adolescence Idiopathic Scoliosis: A Report of Four Cases

Muhammad Wafiuddin[1, 2], Ed Simor Khan[1*], Rajandra Kumar[1], Zamzuri Zakaria[1], Haidar Nusuruddin[1], Ahmad Faizal[2], Luqman Abd Bakar[3], Syafik Yunus[3], Fawwaz Zamri[3]

[1] Department of Orthopaedic and Rehabilitation, International Islamic University Malaysia, Gombak, Selangor, Malaysia
[2] Department of Surgery, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia
[3] Department of Orthopaedic, Hospital Sultan Haji Ahmad Shah, Temerloh, Pahang, Malaysia

*Corresponding author's email: edsimorkhan@gmail.com

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ABSTRACT

Adolescent idiopathic scoliosis (AIS) is the most common spinal deformity among teenager. For those indicated, early surgical intervention allows better surgical correction due to flexibility of the spine during teenage years, hence good functional outcome and better cosmetic can be expected. In this case report, there is the management of four patients surgically using the posterior spinal instrumentation and fusion. Pre-operatively patients were examined at IIUM Medical Centre spine clinic, all necessary investigations were carried out. A thorough explanation was done to patient and parents regarding procedure, risk and benefit. All patients were treated using the same surgical technique. Neuromonitoring was used throughout the whole surgery until skin closure. All patients were hospitalized around one week. Post-operatively patients were followed up at two weeks, six weeks, three months, and every six months thereafter. It is important for clinicians to identify patients with AIS as early detection and timely treatment will change the natural history of curve progression. Surgical intervention when necessary will be easier and with less risk of complications when surgery was carried out during teenage years as the spine is more flexible and the deformity is less severe.

INTRODUCTION

Being described by Greek physicians as early as 460 – 370 BC by Hippocrates, scoliosis is a direct term for crookedness. Scoliosis is defined as a three-dimensional deformity of the spine where the lateral curvature in a coronal plane is more than 10 degrees[1]. Scoliosis is categorised

into three major types which are congenital which is caused by abnormally formed vertebra, syndromic which are part of certain associated disorders or idiopathic where the cause is not known. Idiopathic scoliosis can be further be divided into infantile affecting 0 – 3 years old, juvenile 4 – 10 years of age and adolescent, aged more than 10 years old[1]. Being the most common spinal deformity, adolescent idiopathic scoliosis (AIS) affects 0.47 to 5.2 % of children aged 10 – 16 years old [2].

CASE PRESENTATION

First Case

A 16-year-old female initially presented to the hospital in 2016 with a complaint of back deformity. Her mother noticed the deformity incidentally when she was changing clothes and noticed a hump over her right upper back two years prior. Her Mother also noticed her left shoulder level was higher than her right. The right-sided hump deformity worsened over the period and she complained of occasional mild dull aching pain especially after standing for a long duration. Her pain was partially relieved by rest. The pain does not affect her daily activity or sleep. She has no weakness or numbness. There was no history of bowel or bladder incontinence. She did not notice any skin changes. There was no history of shortness of breath or breathing difficulties. There was no history of trauma or fall. She does not have a complaint of headache, vomiting or seizure. There was no history to suggest an underlying infective cause. There is no similar complaint among family members, no family history of malignancy and no history of a tuberculosis contact. She attained menarche at the age of 14 with regular cycles of menstruation. Upon examination, she was tall with a height of 172 cm and well-nourished. Her vital signs were stable. There were no neurocutaneous stigmata, wasting of muscle, deformity of feet or toes to suggest neuromuscular disease. She was walking with a normal gait. On standing, her head and neck are tilted to the right side. There was no tenderness or swelling over the cervical region. Posteriorly there was the prominence of a right scapular region with left shoulder slightly elevated compared to the right. There was an obvious right-sided thoracic hump which appears more prominent on the Adams forward bending test. There were left-sided thoracic crease and right lumbar crease (Figure 1).

Figure 1 Pre-operatively note the patient left-sided thoracic crease. There was no midline skin defect such as hairy patch, dimples or naevi. Her shoulder was asymmetrical causing cosmetic issues

There was no midline skin defect such as hairy patch, dimples or naevi. Her right hip was tilted to the right side. There was no local rise in temperature, tenderness or paravertebral muscle spasm. Cervical, thoracic and lumbar spine motions were normal. Powers of upper and lower limbs were 5/5, the sensation was intact, and reflexes were normal. There was no limb length discrepancy. Examination of other systems was grossly normal. The routine blood investigation was performed which revealed normal full blood count, coagulation studies, renal and liver profile. The thoracic and lumbar Cobb's angle measured on neutral AP position was 60 degrees and 65 degrees respectively (Figure 2).

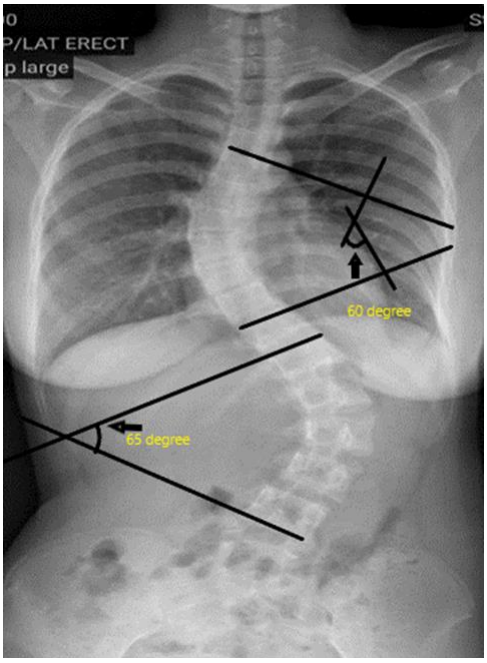

Figure 2 Pre-operative X-ray in one of our patients with thoracic and lumbar Cobb's angle measurement of 60 and 65 degrees respectively

She had successfully undergone posterior spinal instrumentation and post-operative correction for thoracic and lumbar percentage is 64% and 58% (Figure 3, Tables 1 and 2).

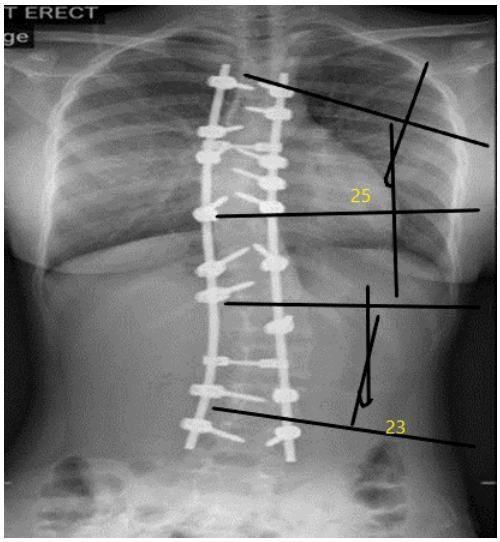

Figure 3 In the same patient, post-operative X-ray showed deformity correction of thoracic and lumbar Cobb's angle of 64% and 58% respectively

Table 1 Correction of thoracic cobbs angle curvature

Thoracic	Pre-operative	Post-operative	Improvement in lateral curvature (%)
Patient 1	60	25	64
Patient 2	64	24	65
Patient 3	63	28	55
Patient 4	57	19	67

Table 2 Correction of lumbar cobbs angle curvature

Lumbar	Pre-operative	Post-operative	Improvement in lateral curvature (%)
Patient 1	65	23	58
Patient 2	33	3	90
Patient 3	30	12	60
Patient 4	10	3	70

Good cosmetic results achieved after the operation (Figure 4). Currently, she is comfortable and living an active lifestyle.

Figure 4 Post-operatively good cosmetic results achieved with surgical correction

Second Case

A 15-year-old female initially presented our centre with an incidental finding of scoliosis during follow up at a community clinic at 13-year-old. In the next 3 years, the scoliosis degree becoming more deformed thus causing her to have back discomfort. It was not associated with neurological problems. There are no skin changes, and she is very active in school. There was no history of trauma headache vomiting and seizure. There was no family history of malignancy or tuberculosis contact. Attained menarche at the age of 12-year-old she has a regular cycle every month. Upon examination, she is a moderate build girl. Her vital signs were stable. There were no neurocutaneous stigmata, wasting of muscle, deformity of feet or toes to suggest neuromuscular disease. She was walking with a normal gait. There was no tenderness or swelling over the cervical region. Posteriorly there was the prominence of a right scapular region with left shoulder slightly elevated

compared to the right. There was an obvious right-sided thoracic hump which appears more prominent on the Adams forward bending test. There was no thoracic crease and lumbar crease. There was no midline skin defect such as hairy patch, dimples or naevi. Her right hip was tilted to the right side. There was a normal motion of the spine with minimal limitations. Powers of upper and lower limbs were 5/5, the sensation was intact, and reflexes were normal. There was no limb length discrepancy. Examination of other systems was grossly normal. The routine blood investigation was performed which revealed normal full blood count, coagulation studies, renal and liver profile. The thoracic and lumbar Cobb's angle measured on neutral AP position was 64 degrees and 33 degrees respectively (Figure 5).

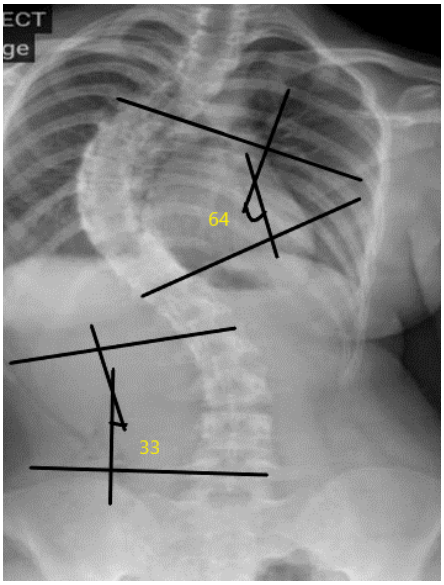

Figure 5 Pre-operative X-ray with thoracic and lumbar Cobb's angle measurement of 64 and 33 degrees respectively

She had successfully undergone posterior spinal instrumentation and post-operative correction for thoracic and lumbar percentage is 65% and 90% (Figure 6).

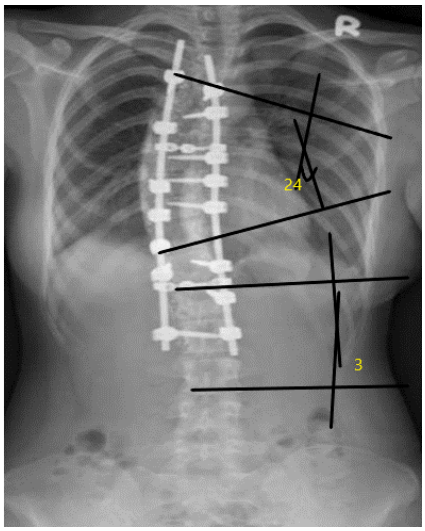

Figure 6 In the same patient, post-operative X-ray showed deformity correction of thoracic and lumbar Cobb's angle of 65% and 90% respectively

The operation was uneventful and she recovered well from the operation.

Third Case

A 25-year-old female defaulted her orthopaedic follow up during her teenage years. Initially diagnosed with scoliosis at 15-year-old. She presented to us at 24 years old due to cosmetic issues. She did not complain of weakness and her urinary and bowel function is normal. There are no skin changes. There was no history of trauma headache vomiting and seizure. There was no family history of malignancy or tuberculosis contact. Attained menarche at the age of 13-year-old she has a regular cycle every month. Upon examination, she is a moderate build woman. Her vital signs were stable. There were no neurocutaneous stigmata, wasting of muscle, deformity of feet or toes to suggest neuromuscular disease. She was walking with a normal gait. There was no tenderness or swelling over the cervical region. The right shoulder was grossly elevated compared to the left. There was an obvious right-sided thoracic hump which appears more prominent on the Adams forward bending test. There is a prominent thoracic crease. There was no midline skin defect such as hairy patch, dimples or naevi. Her right hip was tilted to the left side. There was a normal motion of the spine with minimal limitations. Powers of upper and lower limbs were 5/5, the sensation was intact, and reflexes were normal. There was no limb length discrepancy. Examination of other systems was grossly normal. The routine blood investigation was performed which revealed normal full blood count, coagulation studies, renal and liver profile. The thoracic and lumbar Cobb's angle measured on neutral AP position was 63 degrees and 30 degrees respectively (Figure 7).

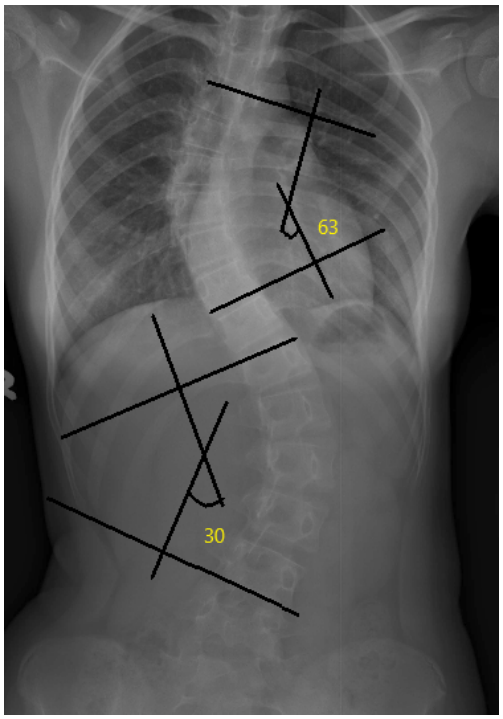

Figure 7 Pre-operative X-ray of the patient with thoracic and lumbar Cobb's angle measurement of 63 and 30 degrees respectively

She had successfully undergone posterior spinal instrumentation and post-operative correction for thoracic and lumbar percentage is 55% and 60% (figure 8)

X-rays showed deformity correction of thoracic and lumbar Cobb's angle of 55% and 60% respectively.

The operation was complicated with surgical site infection and she was treated with antibiotics and recovered well from the operation.

Fourth Case

A 20-year-old male presented at our clinic when her mother noticed her son hump is becoming more prominent at 18-year-old. She detected the problems when he is 14 years old. There was no history of trauma, malignancy, tuberculosis contact or skin disease. Upon examination, he is a well-built man. His vital signs were stable. There were no neurocutaneous stigmata, wasting of muscle, deformity of feet or toes to suggest neuromuscular disease. He was walking with a normal gait. There was no tenderness or swelling over the cervical region. Posteriorly there was the prominence of the left scapular region with left shoulder slightly elevated compared to the right. There was an obvious left-sided thoracic hump which appears more prominent on the Adams forward bending test. There was no thoracic crease and lumbar crease. There was no midline skin defect such as hairy patch, dimples or naevi. his right hip was tilted to the left side. There was a normal motion of the spine with minimal limitations. Powers of upper and lower limbs were 5/5, the sensation was intact, and reflexes were normal. There was no limb length discrepancy. Examination of other systems was grossly normal. The routine blood investigation was performed which revealed normal full blood count, coagulation studies, renal and liver profile. The thoracic and lumbar Cobb's angle measured on neutral AP position was 57 degrees and 10 degrees respectively (Tables 1 and 2). He had successfully undergone posterior spinal instrumentation and post-operative correction for thoracic and lumbar percentage is 67% and 70% respectively (Figure 8).

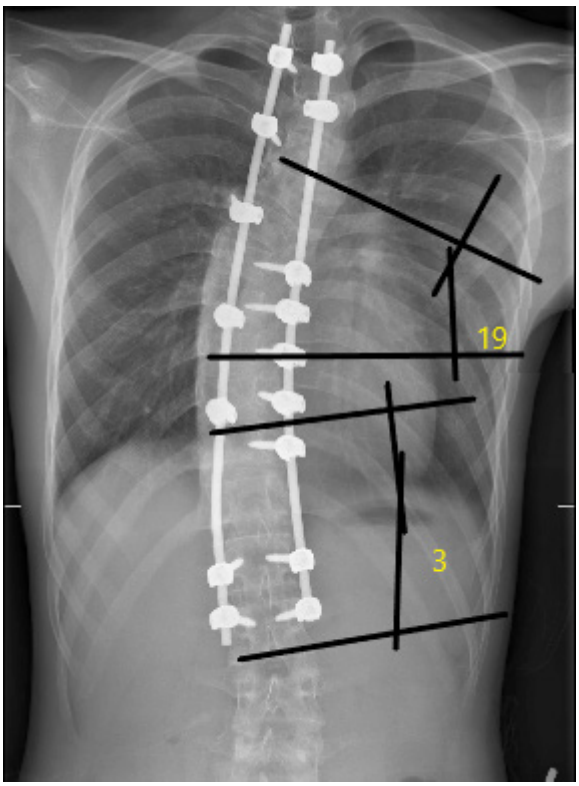

Figure 8 Post-operative X-ray showed deformity correction of thoracic and lumbar Cobb's angle of 67% and 70% respectively

DISCUSSION

The prevalence of gender are equal in the small curve but an increase in female prevalence with larger and progressive curves[3]. The natural course of scoliosis was demonstrated in a study where thoracic curves more than 50 degrees progressed at around 1 degree a year, thoracolumbar curves progressed at 0.5 degrees a year and lumbar curves 0.24 degrees a year while thoracic curves less than 30 degrees was found not to progress[4]. The exact pathogenesis of scoliosis is not known but several abnormalities have been identified as associated factors such as genetics, growth of the skeletal system, metabolism of bone, metabolic pathways, biomechanics, central nervous system and others[5]. Most of the patients with AIS are asymptomatic and are detected during screening exams. Those that seek treatment usually presents with unequal shoulder levels, waistline asymmetry or rib prominence, which are typically identified by close ones. Back pain is a common complaint affecting 26 – 51% of patients[6]. The severity of pain was found to have a direct association with the degree of curvature and lumbar curves significantly more painful than thoracic curves. It is reported that back pain in scoliosis is primarily discogenic in nature but several other factors such as facet joint arthritis, degenerative disc disease, spinal stenosis, nerve root entrapment and muscular causes do contribute to the pain[6]. Physical examination should be thorough to look for neurocutaneous stigmata's that may point to other cause of scoliosis such as café au lait spots in neurofibromatosis, hairy patch or dimples in spinal dysraphism and hyperlaxity in Marfan syndrome. Maturity of the patient is assessed using the Tanner stage to determine remaining skeletal growth. Adam's forward bending test is performed to assess the degree of rotational deformity and rule out postural scoliosis followed by a detailed neurological examination. Asymmetrical reflex including abdominal reflex could point towards an intraspinal disorder[7].

Cobb angle is attained by identifying the angle formed between the intersection of lines perpendicular to tangential lines along superior endplate of the superior-end vertebra and the inferior endplate of the inferior end vertebra. The lateral bending view is important as preoperative evaluation to identify flexible curves. Magnetic resonance imaging is done selectively in presence of left thoracic curve, atypical pain, early-onset scoliosis, thoracic kyphosis greater than 40 degrees or abnormal neurological finding which may identify the presence of tumours or lesions such as syrinx and Arnold-Chiari malformations[8]. Skeletal age using Risser score of iliac apophysis ossification should be done to estimate the curve progression.

Management of AIS primarily involves observation, bracing or surgery. Observation combined with physiotherapy is advocated for mild deformity where Cobb angle is less than 25 degrees[9]. Bracing is advocated for skeletally immature adolescents with Cobb angle of 25 – 40 degrees and goal is to prevent progression of the curve that may require surgery. Milwaukee brace also is known as cervical-thoraco-lumbo-sacral orthosis (CTLSO) can be used in high thoracic and cervicothoracic scoliosis with success rate of up to 77 per cent[10]. Others include thoraco-lumbo-sacral orthoses (TLSO), soft braces and night time braces with varying success rate. Eventually, up to 10 per cent of patients with adolescent idiopathic scoliosis will require surgical consideration[11]. The general objective of surgery is to halt progression, achieve three-dimensional correction of spinal curvature, relieve pain or functional disability due to curvature and correct unacceptable cosmetic problems. Surgery is advocated for Cobb angles more than 30-60 degrees in thoracolumbar region and the thoracic region at end of growth. Posterior instrumentation is the mainstay surgery of most idiopathic curves as done in our patient. Anterior instrumentation is used mainly for thoracolumbar and lumbar curves however

is related to disadvantages such as implant breakage, pseudarthrosis, unfavourable scar and effect on lung function[12].

CONCLUSION

Average operating time was 6 to 8 hours. Estimated blood loss ranges from 800 ml to 1.8 L. All our patient received at least one pint of packed cell intra-operatively. One patient developed a superficial surgical site infection over the proximal wound area but treated successively without complication with oral antibiotics for two weeks. All our patient recovered well. In conclusion, early detection and surgical intervention when indicated for adolescent idiopathic scoliosis will yield good outcome and satisfactory correction can be achieved.

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We would like to acknowledge the patients involved in this study for the cooperation given

CONFLICT OF INTEREST

The authors declare that they have no competing interests in publishing this case.

CONSENTS

Written informed consent was obtained from the patient to publish the case with its related pictures. A copy of the written consent is available for review by the Chief Editor.

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CASE REPORT

"A Double-Edged Sword": A Case Report on Liver Injury Side-Effect of Anti-Tuberculosis Drug on Liver Tuberculosis Patient

Azlina Ibrahim[1], Alvin Oliver Payus[2*]

[1] Department of Medicine, Hospital Kuala Lumpur, Kuala Lumpur, Malaysia
[2] Department of Medicine-Based Discipline, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia

*Corresponding author's email: dralvinpayus@ums.edu.my

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ABSTRACT

Hepatic involvement in extra-pulmonary tuberculosis (TB) is rare, even in the endemic area. It has a high mortality rate as it can easily be misdiagnosed due to its rarity and non-specific presentations, and the treatment can be challenging for its hepatotoxic side-effect. A 55-year old man who was newly diagnosed with AIDS and pulmonary TB which complicated with anti-TB-induced transaminitis, presented with a few weeks history of fever and persistent diarrhoea. It was initially treated as microsporidia infection but the symptoms persisted despite given antiparasitic agent for more than a week. He was subjected to computed tomography (CT) scan of the abdomen and noted multiple hypoechoic lesion at multiple segments of the liver, which later confirmed to be liver TB by liver biopsy. As he could not tolerate Akurit-4 (Rifampicin 150 mg, Isoniazid 75 mg, Pyrazinamide 400 mg and Ethambutol 275 mg), the second-line treatment was given instead. He is currently well on regular clinic appointment. The objective of this case report is to share the rare occurrence of hepatic TB and the difficulty to treat it as the hepatotoxic effect of anti-TB medications complicate the liver damage due to the infection.

INTRODUCTION

Tuberculosis (TB) commonly affects the pulmonary system due to the nature of the organism that favours the high oxygen tension environment. Rarely, it also infects the liver which has lower oxygen concentration. This can occur with or without pulmonary involvement, and can either diffusely be

disseminated over the liver, or locally affect a single lobe[1]. Hepatic TB is relatively a curable disease. However, the delay in diagnosis and treatment can lead to fatal consequences[2]. Furthermore, the treatment has a side effect that causes liver injury which synergized the damage caused by the infection itself. This rare extra-pulmonary TB is the main focus of discussion in this case report.

CASE PRESENTATION

A 55-year old male who is newly diagnosed with AIDS presented with a history of fever and persistent diarrhoea for a few weeks. One month prior to the presentation, he was diagnosed with pulmonary tuberculosis (TB) started on 3 tablets a day of oral Akurit-4 (Rifampicin 150 mg, Isoniazid 75 mg, Pyrazinamide 400 mg and Ethambutol 275 mg), which was appropriate to his body weight. However, he developed drug-induced hepatitis whereby his alanine aminotransferase went up to 100 IU/L, therefore second-line medication was initiated which include intramuscular streptomycin, oral ethambutol and moxifloxacin. At that time, his CD4 counts were 15 cells/μL and the viral load of 127,000 copies/mL. Currently, upon presentation, he was febrile and severely dehydrated requiring aggressive fluid resuscitation and inotropic support. He was empirically treated for microsporidia infection and was planned for 3-weeks of oral albendazole. He was also restarted on oral Akurit-4 as his liver function has normalized. However, he again developed marked transaminitis where his ALT jumped up four times from upper limit of normal after five days of restarting the medication which was then withheld and was changed back to second-line medications. Despite more than a week of oral albendazole, he still has persistent diarrhoea and intermittent fever. Blood cultures were negative. In view of persistent gastrointestinal symptoms with multiple spikes of temperature, CT scan of the abdomen was done and noted hypodense liver lesion in segment IV which suggestive of early liver abscess formation (Figure 1).

Figure 1 CT scan of the liver showed the hypodense area in segment IV likely represent liver abscess

He was then empirically treated for pyogenic liver abscess. A serial abdominal ultrasound showed multiple new hypoechoic lesions on other segments of the liver (Figure 2). As he was radiologically worsened, this raised the possibility of therapeutic failure.

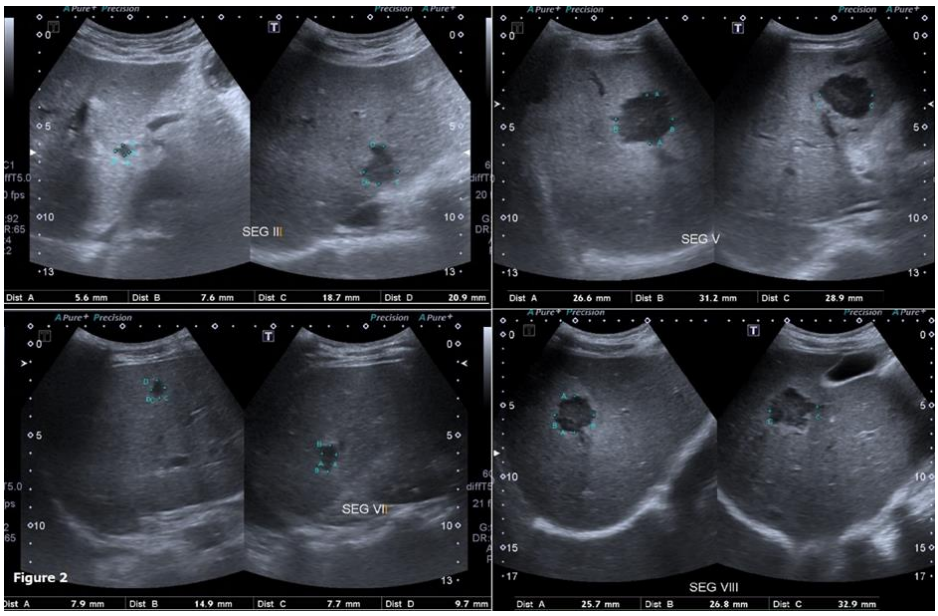

Figure 2 Ultrasound of the hepatobiliary system showed hypoechoic lesion over the segment II (left above), segment V (right above), segment VII (left bottom), segment VIII (right bottom)

He has then proceeded with a liver biopsy and it showed chronic granulomatous inflammations (Figure 3) with scattered acid-fast bacilli organism upon special stain with Ziehl-Neelsen (Figure 4) which suggestive of liver TB. The treatment with second-line anti-TB was continued, and oral isoniazid was added on day 42 of treatment in which he tolerated. He completed the treatment for a total of 1-year with 2-months of intensive phase which consist of all four medications, followed by ethambutol and isoniazid for maintenance. His liver function has been normal and static to date.

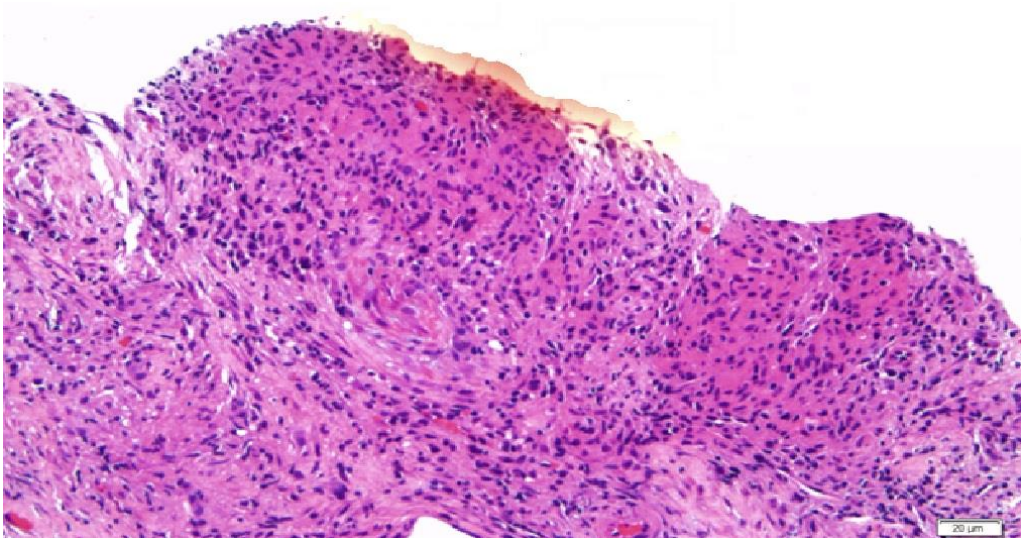

Figure 3 Histopathological examination of the liver tissue biopsy showed scattered granulation tissue with mixed inflammatory cells, predominantly histiocytes and occasional neutrophils.

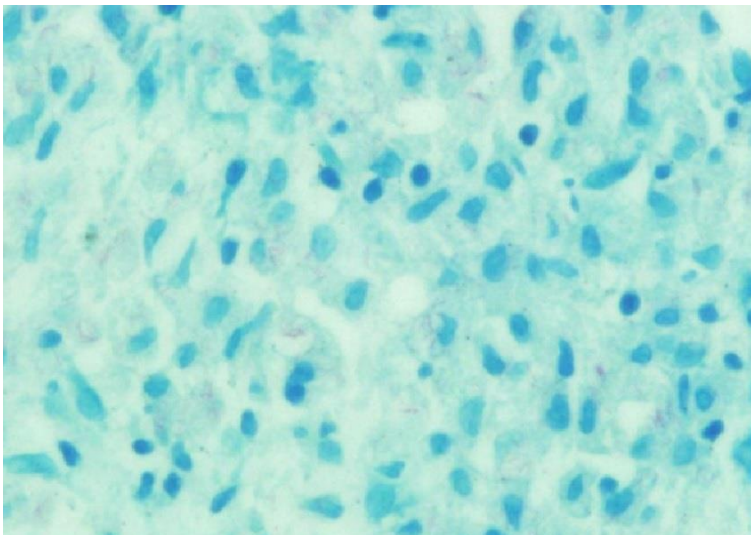

Figure 4 Microscopic examination under special staining showed scattered acid-fast bacilli organism which stained faint pink on Ziehl-Neelsen

DISCUSSION

Hepatic tuberculosis (TB) is rare which accounts only 1% of all TB infections[1] and has a clinical presentation that highly mimics other common liver diseases such as pyogenic abscess, primary tumours and others. Classically it can present in three forms, and the commonest one is diffuse hepatic involvement seen along with pulmonary or miliary infection. This is seen in more than 50% of cases and is due to the haematogenous spread of mycobacteria via the hepatic artery. Patients are often asymptomatic despite the diffuse involvement of the liver. The second form is also known as granulomatous hepatitis, which is a diffuse hepatic infection without recognizable pulmonary involvement. The third and rarest form presents as a local tuberculoma[1]. Although hepatic TB relatively is a curable disease, it is associated with a high mortality rate. This is because hepatic TB lacks typical clinical presentations and diagnostic imaging features that make it easily misdiagnosed and causing delayed in treatment which lead to fatal consequences[2]. Acute liver failure secondary to TB infection was also reported but only in a few cases and most are associated with miliary TB[3].

The common manifestations of hepatic TB are hepatomegaly, fever, abdominal pain and weight loss. Less commonly, it can also present with ascites, jaundice and splenomegaly. Patient with local hepatic TB may present with abdominal pain and jaundice while miliary hepatic TB may present with acute respiratory symptoms such as cough and sputum production[4]. Patient with elevated liver transaminases reflected the involvement of liver parenchyma whereas elevated alkaline phosphatase and gamma-glutamyl transferase suggestive of biliary tree involvement. However, our patient had hepatitis secondary to anti-TB and have cause a delay in the diagnosis of hepatic TB.

Radiological investigations such as ultrasound, computed tomography and magnetic resonance imaging are useful diagnostic tools. Liver tuberculoma appears as a non-enhancing low-density centre, owing to caseation necrosis with a slightly enhancing peripheral rim which corresponded to surrounding granulation tissue[5]. The contrast-enhanced ultrasonography may be helpful in differentiating the diagnosis of hepatic TB from other hepatic focal lesions[6]. However, the most specific test is liver biopsy with mycobacterial culture. The demonstration

of acid-fast bacilli on special staining and caseous necrosis on biopsy can be very useful pathological tools but their absence cannot exclude the diagnosis.

Apart from the diagnostic difficulty, another major challenge in managing hepatic TB is the risk of hepatotoxicity that can be induced by anti-TB drugs. The incidence of anti-TB induced hepatoxicity is about 24.6%, with almost half occur within the first 2 weeks[7]. Chen HC et al. (2003) recommended treating the patient with hepatic TB with standard regimens despite the potential hepatotoxicity of these drugs, provided that the other cause of the liver injury must be excluded[8]. However, our patient developed transaminitis from the first line anti-TB after a few days of intensive phase, which have masked the liver injury caused by the infection. Therefore, he is not a suitable candidate for the first-line anti-TB treatment, especially oral pyrazinamide. But he did tolerate oral isoniazid and manage to take it for 1-year.

CONCLUSION

In conclusion, this case report demonstrates the double-effect of the anti-TB drug in treating hepatic TB where in one hand it has good therapeutic value but in the other hand it also has a hepatotoxic side effect that synergizes the damage caused by the infection. This side effect can mask the liver involvement and results in diagnosis delay. Therefore, one needs to suspect liver infiltration for patients with disseminated TB who had deranged liver function secondary to anti-TB drugs and initiate the proper diagnostic investigations and effective treatment promptly in order to save lives.

ACKNOWLEDGEMENTS

The authors would like to thank the patient for giving his consent and cooperation in relation to the writing of this case report. The author would also like to thank the Director General of Ministry of Health of Malaysia for his permission to publish this article.

CONFLICT OF INTEREST

The authors declare that they have no competing interests in publishing this case.

CONSENTS

Written informed consent was obtained from the patient to publish the case with its related pictures. A copy of the written consent is available for review by the Chief Editor.

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CASE REPORT

Improvement in Quality of Life after Myomectomy

Ehab Helmy Abdel Malek Fahmy[1], Constance Liew Sat Lin[2], Alvin Oliver Payus[2*], Rhanye Mac Guad[3], May Zaw Soe[1], Satishratnam Nagaratnam[4], Symeon Mandrinos[5], Chin Yeung Sing[6], ABM Tofazzal Hossain[7]

[1] Department of Reproductive Health, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia
[2] Department of Medical-Based Discipline, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia
[3] Department of Biomedical Science and Therapeutics, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia
[4] Labuan Hospital, Obstetrics and Gynaecology Department, Labuan, Malaysia
[5] Swinburne University of Technology Sarawak Campus, Kuching, Sarawak, Malaysia
[6] Sabah Women and Child Hospital, Gyn. Oncology Department, Kota Kinabalu, Sabah, Malaysia
[7] Department of Surgery, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia

*Corresponding author's email: dralvinpayus@ums.edu.my

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ABSTRACT

Dysmenorrhea is one of the leading causes of pelvic pain and menstrual disorder among women during childbearing age. The burden of dysmenorrhea is greater than any other gynaecological complaint. Some women have severe dysmenorrhea which renders them incapacitated for days each menstrual cycle requiring absence from study or duty, frequently requiring pain killer, restriction of daily performance, poor sleep, negative moods such as anxiety and depression. A 31-year-old female presented with severe dysmenorrhea and heavy menstrual bleeding (HMB) as a cause of multiple uterine fibroids, underwent surgeries to remove 100 fibroids from her uterus which has improved her quality of life, eliminating her dysmenorrhea and menstrual abnormalities.

INTRODUCTION

The prevalence of dysmenorrhea is 45 to 93% of women during reproductive age. The primary dysmenorrhea is common in young women and remains a good prognosis even though it is associated with low quality of life. The secondary forms of dysmenorrhea are associated with endometriosis and adenomyosis[1]. Recent research suggests that prostaglandin F2α (PGF2α), a potent myometrial stimulant and vasoconstrictor in the secretory endometrium is the main pathogenesis of primary dysmenorrhea. The increase in prostaglandins in the endometrium after the fall in progesterone in the late luteal

phase results in increased myometrial tone and excessive uterine contraction[2].

CASE PRESENTATION

This 31-year-old lady visited a fertility clinic in 2009 due to subfertility for six years during her first and second marriage. Her menarche was at the age of 13 years and had regular menstrual cycles until the age of 20 years. The patient had a myomectomy surgery done in 2007 during which 20 fibroids have been removed. Infertility workout was done and her hysterosalpingogram showed partial bicornuate uterus with no endometrial split as reported in 2010. During her clinic follow-up in February 2011, it was noted that the patient had recurrent multiple uterine fibroids. Hysteroscopy was done in March 2011 and it was noted that she had multiple submucosal fibroids at the fundus and posterior wall. The patient was referred to a tertiary centre for transcervical resection of myoma (TCRM) in July 2011. At the tertiary centre, the patient was opted for conservative treatment after counselling with the doctor at the fertility clinic.

In March 2012, this patient presented with heavy menstrual bleeding for 3 days with symptom and signs of anaemia, her haemoglobin (Hb) level was 5.11 g/dL. Upon admission to a specialist hospital, 4 pints of pack cells (PC) were transfused over 24 hours and her haemoglobin level increased to 11.5 g/dL upon discharge. In June 2012, the patient presented with an episode of heavy menstrual bleed, with 10 – 15 pads fully soaked per day for 3 consecutive days. On admission, her haemoglobin level was 6.79 g/dL and she was transfused 2 pints pack cells and her Hb improved to 9.11 g/dL.

Ultrasound scanning was done on the same day which showed multiple uterine fibroids measuring 3 – 6 cm (Figure 1).

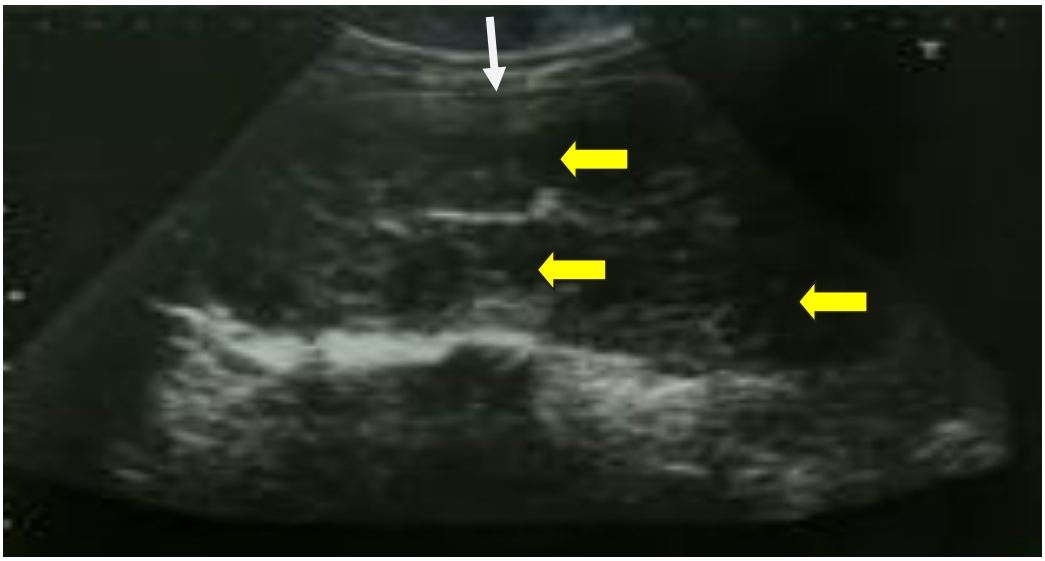
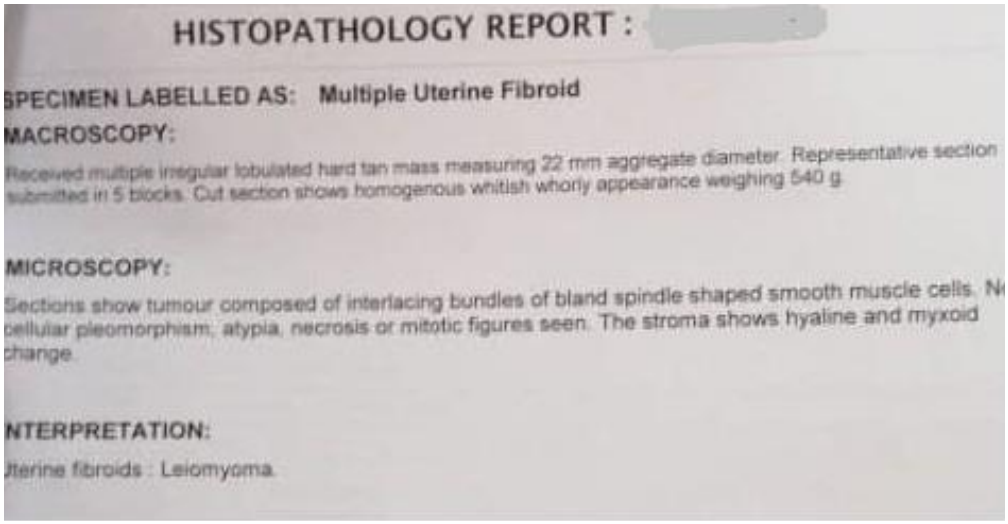


Figure 1 Pre-operative scan. Yellow arrows indicate multiple uterine fibroids measuring 3 – 6 cm and the white arrow indicates uterus. Uterus size was not measured because of huge size uterus

In October 2012, the patient opted for laparotomy myomectomy for recurrent uterine fibroids. A total of 80 intramural uterine fibroids were removed during surgery with total estimated blood loss of 6 litres. The patient required ICU admission with a total of 6 pints pack cells, 4 units of fresh frozen plasma, and 6 units cryoprecipitate were transfused.

The patient recovered well. Histopathology confirmed leiomyomas (Figure 2). After 3 months of post myomectomy, uterus size was 9 × 4 cm (Figure 3).



HISTOPATHOLOGY REPORT :

SPECIMEN LABELLED AS: Multiple Uterine Fibroid

MACROSCOPY:

Received multiple irregular lobulated hard tan mass measuring 22 mm aggregate diameter. Representative section submitted in 5 blocks. Cut section shows homogenous whitish whorly appearance weighing 540 g.

MICROSCOPY:

Sections show tumour composed of interlacing bundles of bland spindle shaped smooth muscle cells. N cellular pleomorphism, atypia, necrosis or mitotic figures seen. The stroma shows hyaline and myxoid change.

NTERPRETATION:

Uterine fibroids : Leiomyoma.

Figure 2 Histopathology report

Figure 3 Three months of post myomectomy. Arrow indicates uterus approximately 9 × 4 cm

In 2013, it was noted asymptomatic small uterine fibroids which might be missed during previous laparotomy myomectomy, however, patient was not keen for any active management as her lifestyle was much improved after myomectomy where she experienced significant improvement of dysmenorrhea, no prolonged or heavy menstrual bleeding, no more hospital admissions for blood transfused, active and can do her duty until last review 2016. The patient has opted for conservative management as she would decide for her fertility workup after she was counselled and opted for conservative treatment by fertility clinic team at a tertiary centre in July 2011. The patient did not turn up during follow-up at the fertility clinic after 2011. After her last myomectomy surgery was done in October 2012, her quality of life has been improved for the following years. She did not have heavy menstrual bleeding while she was able to resume her work without any complaint of anaemia or dysmenorrhea and she did not need to be transfused as before the last myomectomy surgery.

DISCUSSION

Uterine fibroids (also known as leiomyomas or myomas) are the commonest benign uterine tumours, with an estimated incidence of 20 – 40% in women during their reproductive years[3]. Victor Bonney was the pioneer surgeon introduced myomectomy in the history of gynaecological surgery in the 1920s. Most myomas start as asymptomatic and diagnosed during a routine pelvic examination. Myoma starts small and gradually increasing in size until it becomes symptomatic causing heavy menstrual bleeding and dysmenorrhea and might be associated with infertility. Current recommendations include consideration of myomectomy in infertile women after extensive evaluation eliminating other causes of infertility[4]. The uterine fibroid risk factor with the strongest evidence is black race[5]. Active management as myomectomy is the treatment of choice among women with heavy menstrual bleeding as compared to conservative management especially in the terms of preserving fertility during childbearing age. Before the advent of laparoscopic technique in myomectomy procedure most surgeries were done through a laparotomy approach, which is considered an invasive surgery but still one of the conventional techniques for myomectomy procure until today. It is a recommended operation for those cases with contraindication for minimally invasive surgery. When expertise for laparoscopic myomectomy is available, open myomectomy is usually reserved for women who have multiple or extremely large fibroids[6]. Patient's quality of life has been tremendously improved post myomectomy operation in October 2012. She did not complain of heavy menstrual bleeding or symptoms of anaemia. She was able to commence her daily life without needing blood transfusions or complaining of dysmenorrhea as before her last myomectomy operation.

CONCLUSION

Patient with clinical pictures of severe dysmenorrhea, heavy menstrual bleeding and poor quality of life due to multiple uterine fibroids can be improved tremendously after myomectomy operation.

ACKNOWLEDGEMENTS

The authors would like to thank the patient for her cooperation in relation to the writing of this case report. The author would also like to thank the Director of Hospital Labuan.

CONFLICT OF INTEREST

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CASE REPORT

Good Recovery of Prostate Carcinoma with Spine Metastases to T9 Following Laminectomy

Muhammad Wafiuddin[1, 2], Ed Simor Khan[2*], Ahmad Faizal[1], Jasfizal Jasni[3], Loh Li Loong[2]

[1] Surgical-Based Department, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia
[2] Orthopaedic and Rehabilitation Department, Kuliyyah of Medicine, International Islamic University Malaysia, Gombak, Selangor, Malaysia
[3] Orthopaedic Department, National Defence University of Malaysia, Kuala Lumpur, Malaysia

*Corresponding author's email: drwafi1986@gmail.com

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prostate carcinoma metastasis, laminectomy, Frankel Grade A

ABSTRACT

Prostate carcinoma is a common health issue that can metastasise in the spine. A 65-year-old male was diagnosed with prostate carcinoma and two years later he developed a progressive neurological deficit over the bilateral lower limb. He experienced severe back pain, became paraplegic and the quality of life was severely impaired. Radiographic investigations were done and revealed osteoblastic bone metastasis at thoracic vertebrae with spinal cord compression. The patient underwent surgical decompression surgery at the T9 level mainly for pain control. Six months post-surgery not only the pain was well controlled but patient able to ambulate with walking aid. It is a rare post-operative result as the neurological recovery in a patient with complete paralysis is less than 3%. This type of recovery is possible when the cause of the neurological deficit is mainly mechanical compression from tumour rather than cord ischaemia from traumatic injury.

INTRODUCTION

Prostate carcinoma is one of the most common problems in developed countries, 80% of patient will develop spinal metastases and 6.7% complicated with spinal compression. Back pain, weakness, anal and urinary sphincter dysfunction will lead to a decrease in quality of life[1]. Their median overall survival rate is 2 years. The recovery rate of a patient with a complete neurological deficit of lower limb recovered is only around 3%[2]. Usually, a patient is classified using the Frankel Classification[3] either the patient is unable to

walk (Frankel A – C) and Frankel D and E where the patient can walk. Spinal decompression surgery is aimed to relive the pressure compressing the spinal cord by removing either the lamina, ligament, enlarging the foramina or part of the intervertebral disc. Six months after post-surgery if patient gained improvement in the neurological function he or she is further classified according to the Frankel classification. This was a case of advanced prostate cancer where good neurological recovery was achieved following laminectomy of T9 vertebra in a patient with spinal metastases.

CASE PRESENTATION

A 65-year-old male diagnosed with prostate carcinoma 2 years prior to presentation. Initially presented with nocturia and dysuria he was treated for benign prostatic hyperplasia. As time passes by he develops haematuria with significant loss of weight and appetite. He underwent orchidectomy and completed chemotherapy. Seven months later he presented with progressive weakness and numbness of bilateral lower limb weakness associated with back pain. He described the pain as stabbing in nature and located at a lower back area with radiation to the buttock. Bowel and urinary function are impaired. As the disease progress, the patient became bedbound and his quality of life worsens. Visual Analog Score for his back pain was 5/10. General examination showed a moderate build man, he was not pale and no lymph node was palpable. There was local tenderness over the thoracic and lumbar area however there was no deformity. Perianal sensation, deep anal sensation and sphincter function were normal. Neurological examination revealed complete paralysis of the bilateral lower limb, with absent of bilateral knee and ankle jerk reflex and sensation. Plain radiograph and magnetic resonance imaging (MRI) showed osteoblastic bony metastases at the T9 level with the epidural extension (Figures 1, 2, 3, and 4). The diagnosis was made at this point.

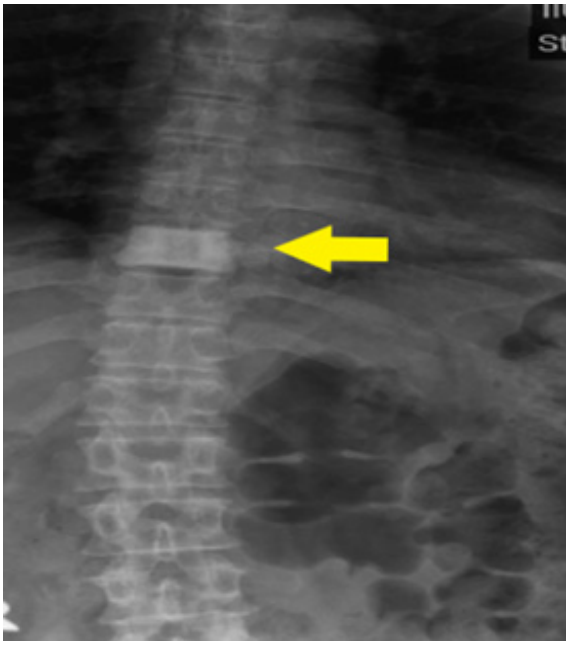

Figure 1 Posterior-anterior plain radiograph showing osteoblastic lesion (yellow arrow) over the T9 thoracic vertebrae

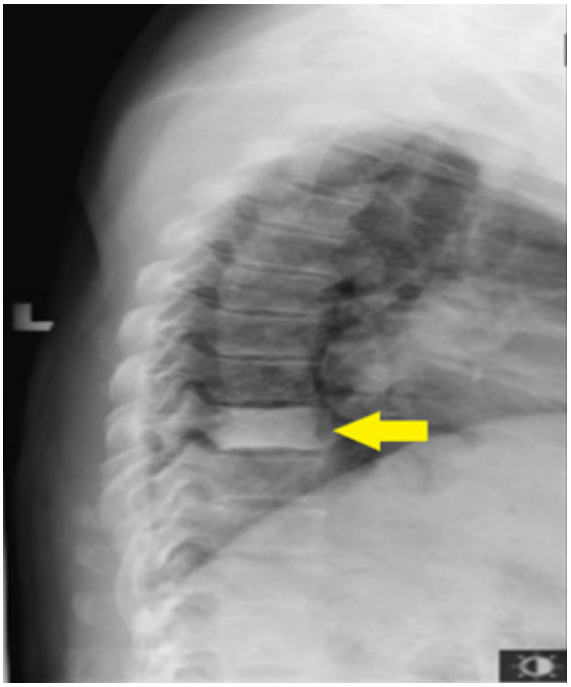

Figure 2 Lateral plain radiograph with the arrow pointing towards osteoblastic lesion over the T9 thoracic vertebrae, there is no obvious kyphosis noted

Figure 3 MRI in the sagittal plane with Osteoblastic bone metastases at T9 level with the arrow pointing towards the epidural extension

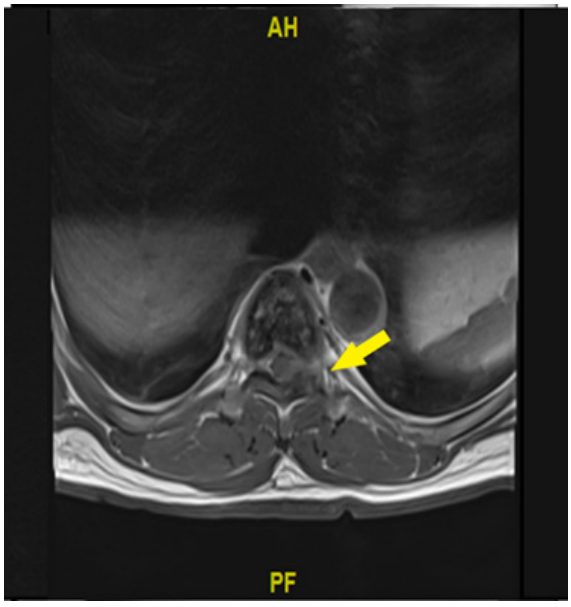

Figure 4 Axial plane MRI cut at T9 level showed osteoblastic bone metastases involving mainly the vertebrae body, with the arrow pointing towards the area where the spinal cord is compressed within the spinal canal

To predict the patient prognosis, we scored the patient based on the revised Tokuhashi score for spinal metastases[4]. The score was calculated taking into account of his general condition which is good during the presentation, no extraspinal metastatic foci, only one number of metastasis to the vertebral body, no metastasis to other organs, non-aggressive type of cancer, and complete paralysis. His total score was less than eight. A score of less than eight predicted that the life expectancy for this patient is less than six months. Still clinical in the dilemma we offered the patient surgery mainly for pain relief. He underwent wide laminectomy of T9 vertebra with preservation of bilateral facet joint. No implant needed as there is no significant vertebral body collapse. Six months after surgery, the patient showed good neurological recovery with motor power MRC grade 4 (Figures 5 and 6) for bilateral lower limb and Visual Analog Score for back pain reduced significantly. The urinary and bowel function slowly improving over time.

Figure 5 Six months after decompressive laminectomy patient can stand erect with MRC power grading at least 4

Figure 6 The patient quadriceps muscle power of at least 4 during the examination

DISCUSSION

Prostate cancer is common cancer with 1.6 million men diagnosed worldwide[5]. Spinal cord compression due to prostate metastases to occur at the thoracic level is the highest with an incidence of 15.7%[1]. Bone metastasis is a debilitating condition and metastasis to the spine can cause cord compression, impaired bowel and urinary function and pain. Clinical management of spinal metastasis patient requires a multi-disciplinary team that includes spine surgeon's, radiation oncologist, medical oncologist rehabilitation team and supporting nurses[6]. In an end-stage cancer patient, the aim is to prolong life expectancy, local tumour control and to improve the overall quality of life. Offering surgery is always a dilemma due to the high rate of postoperative complications[7]. Furthermore, he presented with complete paralysis (Frankel A) and the success rate in regaining neurological function post-operatively is only around 3%[2, 8].

Spine Surgeons used multiple scoring systems to predict patient prognosis and aid in the decision making process. Modified Tokuhashi and Tomita is useful to predict patient survival. Tomita score is based on the primary tumour site, the number of visceral metastases and the number of bone metastases. While the Modified Tokuhashi score considers the general condition of the patient, the number of bone metastasis outside the spine, either metastasis to major organ removable or not, and lower limb neurological function. Modified Tokuhashi had better accuracy compared to Tomita Scoring in predicting patient survival[4]. A lower score means the survival is poorer and vice versa.

In general, in spinal metastasis, there is two mainstay treatment, radiotherapy and surgical decompression with or without stabilization using an implant. A throughout screening is essential to avoid further morbidity to the patient. An advanced cancer patient is immunosuppressed and malnourished making them more prone to surgical site breakdown.

In an advanced cancer patient, the surgical aim is mainly palliative to reduce the pain, control local tumour extension, and to prepare the patient for radiotherapy. Surgical strategies are divided into three parts according to the Global Spine Tumour Study Group (GSTSG)[9]. Surgeons aim to do palliative decompression, tumour debulking and total vebrectomy, and to achieve this method aim is further divided either by removing the tumour piece by piece or *en bloc* removal. The method of removal will influence the tumour margin whether it is intralesional or wide margin[10]. For palliative surgery the tactic is palliative

decompression, piece by piece tumour excision and margin will be intralesional.

Three to four weeks post-operative and provided the wound is healed patient can underwent adjuvant radiotherapy regime. Typically, external beam radiotherapy with a single fraction dose of 8 Gy is used to provide palliative pain relief. The efficacy of external beam radiotherapy in reducing pain is almost up to 60%[11].

CONCLUSION

The aim of surgery and adjuvant radiotherapy is to provide pain relief in a palliative patient. We did not expect neurological recovery after the decompressive spinal surgery. He recovered from MRC power zero to four for bilateral lower limb and regain his urinary and bowel function. As the chance of recovery is only 3%, his post-operative findings are rare. There is a chance of significant neurological recovery following decompression surgery for spine metastases from prostate cancer especially when the cause of the neurological deficit is mainly mechanical compression from tumour rather than cord ischaemia from traumatic injury.

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We would like to acknowledge the patient for his permission in using his clinical history and findings.

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CONSENTS

Written informed consent was obtained from the patient to publish the case with its related pictures. A copy of the written consent is available for review by the Chief Editor.

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BJMS
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SHORT COMMUNICATION

Peer-Led Group Tele-Supervision of Clinical Psychologists: Optimization of Resources – A Malaysian Case Study

Umi Izzatti Saedon[1], Nicholas Pang Tze Ping[2], Loo Jiann Lin[3*]

[1] Department of Psychiatry and Mental Health, Raja Perempuan Zainab II Hospital, Kelantan, Malaysia
[2] Department of Community and Family Medicine, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia
[3] Department of Medical Education, Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia

*Corresponding author's email: jiannlinloo@gmail.com

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ABSTRACT

Inaccessibility to clinical supervision is an issue faced by solo clinical psychologist practitioners. Combination use of web-based instant messaging and video call application were tried by 28 clinical psychologists in conducting a peer-led group tele-supervision to address ethical dilemmas, discuss case management, provide technical instruction, explore resistance and analyse countertransference, provide emotional support, and share knowledge and updated guidelines. Despite facing challenges including difficulty in face-to-face session scheduling, limited time for in-depth discussion, internet connection issues, and documentation dilemma, we believe it has potential to influence supervision practice for clinicians working in isolation in rural or remote locations.

INTRODUCTION

Clinical supervision is a meeting where supervisees discuss, review and reflect on their work with a supervisor. This results in experiential learning and improvement in practice[1]. For supervision to be beneficial, close monitoring, opportunities to model competence, specific instructions, clear goals, and feedback on performance are essential[2]. Conventional face-to-face supervision may not be readily accessible for isolated clinical psychologists if travelling distances are far. This problem is shared by clinical psychologists in the Malaysian public healthcare setting, as most state tertiary hospitals have only one clinical psychologist.

With the advancement of information technology, a variety of applications are available to assist this process, including web-based instant messaging[3,4]. Incorporation of technology into clinical supervision has significantly removed geographical barriers[5]. Different tele-supervision efforts have been tried in different regions of the world with largely positive response although larger prospective studies are still required, including the cost-effectiveness[6].

In this article, the authors describe a case study from Malaysia, considering their personal experience of using a combination of web-based instant messaging applications and video call applications in conducting peer-led group tele-supervision among clinical psychologists.

The Initiative of Peer-led Tele-Supervision Platform

WhatsApp™ (instant messenger), Zoom™ (video or audioconference call) and Skype™ (video or audioconference call) were used by 28 clinical psychologists from Malaysia for the purpose of organizing peer-group tele-supervision. First, a core WhatsApp™ group was set up in October 2017 for text-based discussion while online face-to-face sessions were conducted using either Skype™ or Zoom™ every three months. Each session lasted around three hours with at least four participants. Case summaries and issues for discussion would be submitted a week prior to the online meeting with specific caution taken to maintain patient confidentiality.

Discussions during the tele-supervision covered the following areas:

1. Ethical dilemmas
2. Case assessment and management
3. Technical support
4. Resistance and countertransference analysis
5. Emotional support
6. Knowledge sharing and update of guidelines

Ethical Dilemmas

Common ethical dilemmas brought for discussion included the conflict between the duty of care and confidentiality as well as law-related concerns, e.g. issues related risk of self-harm or harming others, rape, underage sex, and domestic violence. The discussion in WhatsApp™ to get others' opinion has significantly reduced the anxiety faced by solo clinical psychologists as there is a collective opinion on such pressing issues. While discussing these clinical cases with ethical dilemmas on the virtual platform, the similar principle of confidentiality needed to be upheld[7, 8].

Case Assessment and Management

Clinical psychologists with limited numbers of psychological tools feel overwhelmed when more comprehensive psychological assessment is needed. Such cases were discussed in tele-supervision and referral to the nearest clinical psychological services which had the needed psychological tools could be made, which inculcates a collaborative spirit.

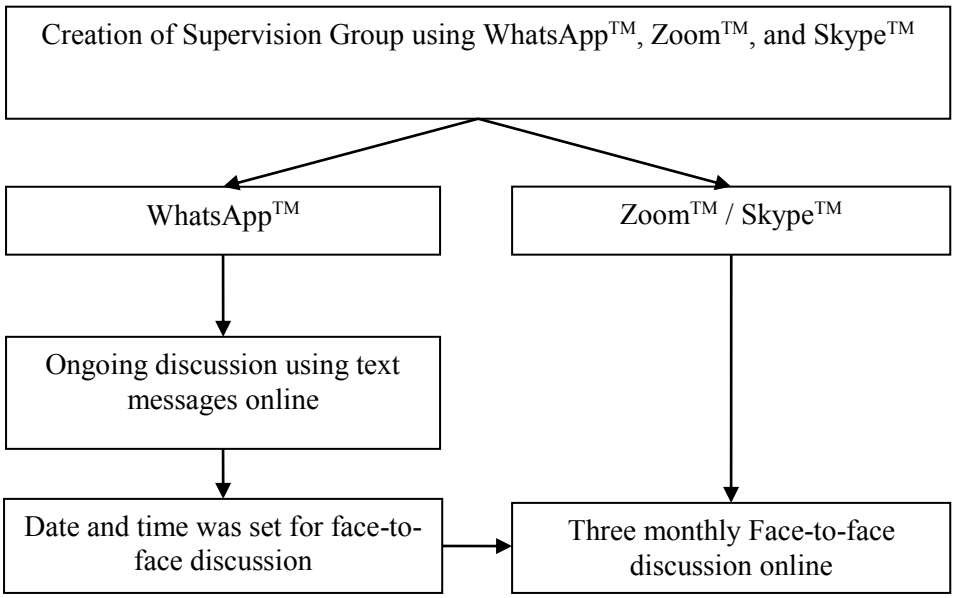

Figure 1 Flowchart of tele-supervision group using different virtual platforms

Technical Support

As familiarity with specific assessment procedures or therapy protocols depends on the exposure during training, this tele-supervision group provides additional accessible and supportive guidance and technical support for a range of assessment and therapeutic methods, which help in competency improvement and monitoring.

Resistance and Countertransference Analysis

Resistance and countertransference can happen while dealing with complicated cases, including borderline personality disorder[9]. The WhatsApp™ group allows cases to be dissected from different angles and perspectives. By having input from peers through different platforms, a solo clinical psychologist can share his or her thoughts.

Emotional Support

One of the most daunting parts of being a solo clinical psychologist is the feeling of fighting the war alone as described by some of the practitioners. Having an active WhatsApp™ message and regular face-to-face meeting helps the solo clinical psychologist feel more supported.

Knowledge Sharing and Update of Guidelines

The up-to-date practice is recommended to ensure the best outcome for patients although it is difficult for a solo clinical psychologist to keep abreast with all the latest developments. With different participants being delegated to different learning topics, new and updated guidelines can be summarised and shared among group members.

The Benefit of the Approach

This tele-supervision shared the benefit of group supervision, including multiple feedback sources, chances for networking, different perspectives for one issue, learning through observation, learning how to lead a discussion, and improvement of presentation skills[10]. Removal of temporal and geographical restrictions was one of the strengths of this approach. No extra cost was incurred other than the mobile network package.

Challenges Faced

It can be challenging to get suitable time for face-to-face discussions during office hours. Hence, some of the online teleconference meetings took place after office hours.

A high number of cases that required input limited the depth of the discussion. Balancing the breadth and depth of input given for each case was a challenging job. Fortunately, some relatively less complicated case could be discussed through WhatsApp™ text messages and discussion of one case also provided solutions for other cases.

The flow of discussion relies on the quality of the internet connection too. The sudden disappearance of a participant from the face-to-face discussion was not an uncommon phenomenon. In addition to that, the sound quality was another important factor that disturbed the flow of the supervision process.

As there is no existing policy in Malaysia regulating this form of clinical tele-supervision, documentation of the conclusion of discussion in the patient's note can be a dilemma. The medicolegal standing of the results of discussions is still uncertain until a legal framework is implemented. Nevertheless, documentation of clinical supervision is encouraged as it has several important values, such as helping in tracking the progress of professional development[11].

CONCLUSION

Peer-led group tele-supervision is an additional platform for work resources and psychosocial support among clinical psychologists, which promotes collaborative practice and improves the quality of service. Its low-cost nature makes it feasible to be expanded to rural and remote places or resource deprived region. More structured and larger prospective studies need to be conducted to evaluate the efficiency of this model of peer-led group tele-supervision.

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CONFLICT OF INTEREST

The authors declare that they have no competing interests in publishing this case.

ETHICAL APPROVAL

Ethical approval was obtained from the Ethical Review Committee of Universiti Malaysia Sabah on 15 December 2017 (Reference number UMS/FPSK6.9/100-6/1/95). A copy of the approval is available for review by the Chief Editor.

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STUDENT'S SECTION

Palmaris Longus Tendon Absence in Pre-Clinical Medical Students of Universiti Malaysia Sabah

Navin Ravi[1], Elvira Effie Juis[1], Michelle Maria Vincent[1], Rasyidah Shokri[1], Vinooshana R. Kannan[1], Izzudin Madin[1], Khairun Nadzihah[1], Khairul Azman[1], Aye Mya Thidar[1*]

[1] Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia

*Corresponding author's email: amtdteacher@gmail.com

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ABSTRACT

Palmaris longus (PL) tendon is regularly used in reconstructive surgeries as a donor tendon because it is observed as an accessory muscle and has little practical use to the human hands. It is only found in mammals. For example, the orangutan has PL but it is absent variable in the higher class of apes such as gorillas and chimpanzees. The absence of PL in humans appears to be hereditary, but the genetic transmission is unclear. The main objective of this study is to determine the prevalence of PL tendon absence in pre-clinical medical students of UMS and to compare the lack between gender and ethnic groups. By using standard Schaffer's test, we examined the presence or absence of PL tendon among the first and second-year medical students of UMS. Four additional tests, Thompson's test, Mishra's test I, and II, Pushpakumar's tests were used to determine whether PL present or not. A total of 134 volunteers were examined, and 91.8% were right-handed, and 8.2% were left-handed. The overall absence (bilateral and unilateral) of PL tendon was 23.9%, whereas unilateral absent was 17.9%, and bilateral absent was 6.0%. The high prevalence of absence of PL tendon among females 25.5% compared to males 20.0%. Chinese and Indian have a higher incidence of PL tendon absence followed by Kadazandusun and Malay. In this study, there were different figures for each ethnic group. The prevalence of absence of PL varies depending on the populations.

INTRODUCTION

The prevalence of the absence of the Palmaris longus (PL) reported by Colombos in De Re Anatomica Libri in 1559[1]. It described that there is a wide variation of the prevalence of PL absence in different ethnic groups. Gender and ethnicity are the factors for the absence of PL. Eric et al. (2010) reported the comparison of PL absence concerning hand dominance[2].

Among the flexor muscles of the forearm, PL is the most superficial flexor muscles. The muscle is slender and fusiform shaped. It is located between flexor carpi radialis and flexor carpi ulnaris muscles. It consists of a long tendon with short muscle belly. It originates from the medial epicondyle of the humerus. Weak flexion of the wrist and anchors the skin and fascia of the hand are the action of PL muscle[3]. Its principal function is to act as an anchor of the skin and fascia of the hand. It has been investigated that the PL tendon phylogenetically degenerates in flexion of the metacarpophalangeal joint. The median nerve lies partly under cover of the PL tendon at the wrist, and partially between the flexor carpi radialis and the PL tendon. Therefore, the median nerve is protected by the tendon. The median nerve becomes the most superficial structure in the wrist due to the absence of PL. So during surgical incision and trauma, this nerve will be vulnerable to injury.

PL muscle is an accessory muscle with little function in the human upper limb. Therefore, often used in reconstructive surgeries[1]. For reconstruction surgery, PL tendon is the tendon of choice because of its long tendon and without producing any functional defect in the upper limb. By preoperative examination, the presence of PL tendon can be easily examined. At the time of birth, it is completely developed while fascia lata is not so well developed at that age. In reconstruction surgery by a hand surgeon, all these factors support it to become a commonly used donor tendon. For the repair of chin and lip defects, correction of ptosis as well as management of facial paralysis, plastic surgeons utilize the PL muscle[3].

PL muscle is one of the most variable muscles in both number and form in the human body. This well-developed muscle is only found in mammals, mainly during weight-bearing and ambulation where the forearm is used. For example, PL is always present in the orangutan but it is absent variable in the higher class of apes such as gorillas and chimpanzees. It has been found that the PL tendon is rapidly degenerating in humans[2].

The objective of this research is to identify the prevalence of PL tendon absence in pre-clinical medical students of UMS and to compare the lack between gender and ethnic groups.

MATERIALS AND METHODS

This research included 134 students from first and second-year medical students of UMS which involved 40 males and 94 females from 18 to 20 years old. The respondents received a thorough and comprehensive briefing on the procedures of the study and had given informed written consent. They were also treated with professional courtesy and fairness as well as having their confidentiality protected as was agreed upon in the terms and agreement of the consent form. The subjects who had previous surgeries of the upper limb or who had any abnormalities of the upper limb were excluded. A general demographic questionnaire with hand dominance was followed by an examination of absence of the PL tendon. The investigators were using the standard Schaffer's test[4] (thumb is opposed to the little finger while the wrist is flexed) to examine the presence or absence of PL tendon. The presence of PL tendon is determined by the protuberance under the skin at the wrist. It can be palpated and seen on inspection. Otherwise, the other four added tests, namely

Thompson'stest[5], Pushpakumar's test[6], Mishra's 1st, and 2nd tests[7] were done to confirm the absence. If the PL tendon is still not visualised after performing the additional test, they are concluded to have an absence of PL tendon.

Schaeffer's Test

Subjects need to steady their forearm at 90°, then opposing the thumb to the little finger with the wrist partially flexed in Schaeffer's test (Figure1).

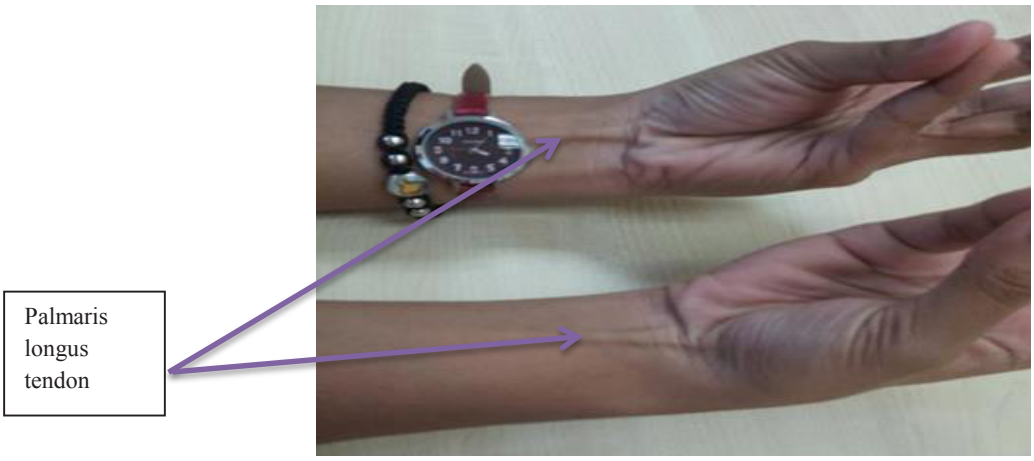

Figure 1 The arrows show the bilateral presence of PL (Schaeffer's test)

Thompson's Test

A fist needs to be made, followed by flexing the wrist against resistance with the thumb flexed over the fingers in Thompson's test (Figure 2).

Figure 2 Unilateral absence of PL (Thompson's test)

Pushpakumar's "Two-Finger Sign" Method

The subjects need to fully extend the index and middle fingers, the wrist and other fingers were fully flexed with the thumb opposed and flexed in "two-finger sign" method of Pushpakumar's (Figure 3).

Figure 3 Unilateral absence of PL (Pushpakumar's test). The arrow shows the presence of PL only in the right hand

Mishra's 1st Test

Mild active flexion of the wrist with passive hyperextension of the metacarpophalangeal joints.

Mishra's 2nd Test

Abduct the thumb against resistance with the wrist partially flexed.

SPSS version 22.0 software was used to analyse the data and to test the association between gender, ethnic and hand dominance with the absence of PL tendon by using a chi-square test.

RESULTS

Overall Absence of PL Tendon

Several 134 volunteers consisting of first and second-year medical students, 40 male students (29.9%), and 94 female students (70.1%) were examined in this study. In our research, there were 25 Malays (18.7%), 42 Chinese (31.3%), 34 Indians (25.4%), 19 Kadazandusun (14.2%), and 14 others (Bajau and Suluk) of 10.4%. There were 123 right-handed students (91.8%), whereas only 11 students were left-handed (8.2%). The overall absence (bilateral and unilateral) of PL tendon was in 32 students (23.9%).

Gender and PL Tendon Absence

The prevalence of the lack of PL (both bilateral and unilateral) among females (25.5%) compared to males (20.0%). Out of 134 subjects, 40 subjects were male (29.9%), and 94 were female (70.1%). The bilateral absence of PL is 7.4% in females but 2.5 % in males. Unilateral absence on the left side was more common in females (12.8%) than males (7.5%). The one-sided absence of PL on the right side was higher among males (10.0%) than females (5.3%) (Tables 1 and 2).

Table 1 Absence of PL between gender

Gender	PL tendon absent	PL tendon present
Male	**8 (20.0%)**	**32 (80.0%)**
Female	**24 (25.5%)**	**70 (74.5%)**

Pearson Chi-Square = 0.472, $p > 0.05$

Table 2 Bilateral and unilateral absence of PL between gender

Gender	Unilateral right absent	Unilateral left absent	Bilateral absent	Bilateral present
Male	**4 (10.0%)**	**3 (7.5%)**	**1 (2.5%)**	**32 (80.0%)**
Female	**5 (5.3%)**	**12 (12.8%)**	**7 (7.4%)**	**70 (74.5%)**

Pearson Chi-Square = 2.873, $p > 0.05$

Ethnic Groups and PL Tendon Absence

Only 7 (16.7%), Chinese students had unilateral absent of PL tendon on the left side, whereas one in single absent on right side and bilateral absent in one subject.

There were four students (11.8%) who had a one-sided absence of PL tendon on their right hand, three students (8.8%) had bilateral absence (8.8%) and two students (5.9%) from the Indian ethnic group had unilateral absence on their left side. Among the Malays, the unilateral right absence is 2 (8.0%) while

unilateral remaining lack and bilateral absence take place at one student each (4.0%). For the Kadazandusun ethnic group, 4 had unilateral absence on the left side (21.1%), and 3 (15.8%) had bilateral absence (Table 3).

Table 3 PL absence and ethnic groups

Gender	Unilateral right absent	Unilateral left absent	Bilateral absent	Bilateral present
Malay	**2 (8.0%)**	**1 (4.0%)**	**1 (4.0%)**	**21 (84.0%)**
Chinese	**1 (2.4%)**	**7 (16.7%)**	**1 (2.4%)**	**33 (78.6%)**
Indian	**4 (11.8%)**	**2 (5.9%)**	**3 (8.8%)**	**25 (73.5%)**
Kadazan-Dusun	**0 (0.0%)**	**4 (21.1%)**	**3 (15.8%)**	**12 (63.2%)**
Others	**2 (14.3%)**	**1 (7.1%)**	**0 (0.0%)**	**11 (78.6%)**

Pearson Chi-Square = 16.123, $p > 0.05$

Hand Dominance and PL Absence

Out of the 134 students, 123 were right-handed (91.8%), and 11 were left-handed (8.2%). Among the right-handed students, 14 of them had a unilateral left absence of tendon (11.4%), nine students had unilateral right absence (7.3%). Seven right-handed students (5.7%) had the bilateral absence of PL tendon. As for the left-handed students, the bilateral lack and one-sided absence of tendon on the left side were found in 1 student (9.1%). Thus, the prevalence of PL tendon absence was higher among right-handed students (24.4%) compared to the left-handed students (18.2%) (Table 4).

Table 4 PL absence and hand dominance

	Unilateral right absent	Unilateral left absent	Bilateral absent	Bilateral present
Right-handed	**9 (7.3%)**	**14 (11.4%)**	**7 (5.7%)**	**93 (75.6%)**
Left-handed	**0 (0%)**	**1 (9.1%)**	**1 (9.1%)**	**9 (81.8%)**

DISCUSSION

PL belongs to the anterior compartment of the forearm. Proximally the muscle is attached to the medial epicondyle of the humerus, and distally to the distal half of the flexor retinaculum and apex of the palmar aponeurosis. The tendon passes over the flexor retinaculum to break into four ligamentous fibrous slips for all the digits except the thumb and form the palmar aponeurosis[3]. Hence, there is a strong reason to believe that palmar aponeurosis exists as the degenerated tendon of PL. As the human hand can perform normal functions without this muscle, the muscle becomes less important results in disuse atrophy[8].

A recent study was done by Holzgrefe et al. (2019) where the comparison between the sensitivity, specificity, and accuracy of physical examination with high-resolution sonography for the detection of the PL tendon in 136 wrists. In contrast with sonography, the

results showed the sensitivity and specificity of the physical examination were 94% and 86% respectively[9].

PL muscle is frequently described as variable muscles in both numbers and form[9]. The presence or absence of PL tendon should be sought out early because of its potential use for surgical procedures. For reconstructive and aesthetic surgeries such as recurrent injuries of the flexor tendons, ligament reconstructions, pulley reconstruction, reconstructions and ligaments of the thumb and elbow, ocular defects, blepharoptosis and other surgical reconstructions need the knowledge of the prevalence of PL absence among particular population that will assist the surgeons in their choice of donor tendon[10].

This study found that both-sided absence was more common in females than males. Left-sided absence was less common in males than in females. These findings were supported by the survey among ethnic groups of Sabah, which shows PL absence is more common in females and on the left side[11].

It is understandable that the prevalence of the absence of PL varies depending on the different ethnicities in populations. Some investigators described that the highest rate of the lack of the PL muscle was among the Egyptians[12]. Surprisingly, Caucasians had a high prevalence of absence of the PL than the African Americans and Asians[13]. In Universiti Kebangsaan Malaysia study, Malays had a higher prevalence of PL absence, followed by the Indians and lowest rate had in Chinese[14]. Whereas, in this study, Chinese (31.5%) and Indian (26.5%) ethnic groups have a higher prevalence of PL tendon absent than Malay and Kadazandusun ethnic group.

This study also showed the prevalence of PL absence related to hand-dominance. From this study, right-handed people have a higher incidence of PL absence than left-handed people. Unilateral absence is higher among right-handed people than left-handed people. Bilateral absence is higher among left-handed people.

Some inventors executed studies to ascertain the clinical implications. They observed that the grip strength of the hand was unaffected but the pinch strength of the fourth and fifth digit decreased in the absence of the PL in both sexes[15]. The PL may be considered as a useful anatomical landmark for grafting in hand surgeries. Carpal tunnel syndrome or compartment syndrome can be produced by anomalous PL in the carpal tunnel[16]. According to the Anatomists, absence or anomalous PL is also important in day-to-day clinical practice[17].

The absence of PL tendon by clinical examinations would not confirm the total agenesis of the muscle, as in some studies conducted on human cadavers is one of the limitations of this study. Although this study highlighted that the PL absence prevalence was much higher in the female population and more commonly absent on the left side. Most of the studies concluded that the absence of PL is more common in women and on the left side, although the differences were usually not significant when analysed statistically. This study found similar findings, but the differences were not significant. So, although this research between gender, ethnicity and hand dominance with PL absence is not substantial, it corresponded to previous studies.

CONCLUSION

This study finding concluded that the PL absence is more common in female, on the left side with a higher prevalence in the right-handed people. Palmaris longus tendon is unilaterally absent in 17.9% and both sides in 6.0% of its population, with an overall absence of 23.9%. In relation to ethnic groups, Chinese (31.5%) and Indian (26.5%) had a higher prevalence of PL tendon absent than Malay

and Kadazandusun ethnic group. Further study is required among the ethnic population of Sabah to determine the anatomical variations associated with PL absence.

CONFLICT OF INTEREST

The authors declare that they have no competing interests in publishing this article.

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