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EDITORIAL

Curriculum for Undergraduate Medical Sciences: Traditional, Integrated or Both

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The traditional curriculum for undergraduate medical students ensures discipline-based learning. In a traditional curriculum, students get ample time to get a detailed understanding and undergraduate-level knowledge which is elaborative and sufficient for each subject. Although the students gain ample knowledge of the subject, they lack in correlating the gained information with other subjects. This is not the students' fault; instead, it is due to the lack of scope of correlation in the traditional curriculum. In this curriculum, students are not taught about the applicability of the gained information. Consequently, basic science or pre-clinical subjects seem irrelevant to the students as if the clinical subjects are independent of these subjects, whereas the reality is the opposite (Watmough et al., 2009). The knowledge of the basic subjects serves as the targeted goal of clinical manoeuvre. Traditional curriculum receives criticism for demotivating students to learn basic subjects to practice as a doctor. Moreover, the traditional curriculum is a more lecture-dependent one-way teaching method devoid of a student-oriented approach (Christianson et al., 2007). There is no scope for problem-solving or critical thinking rather than pedagogical learning. Another disadvantage of the traditional curriculum is that students need to wait until clinical years to have experience with patients. Therefore, there is no opportunity for clinical skill development earlier in this curriculum (Rahman, 2022).

However, to improve the situation of the traditional curriculum, the integrated system is introduced where there are interconnections within the disciplines and has no bars between the subjects. Today's education is outcome-based. To fulfil those requirements, reasonable and systematic learning is a crucial concept. Therefore, teaching methods and strategies hold a significant part of the curriculum. Through integrated learning, the autonomy of the learning by the students, experiencing experiential learning, early and systemic exposure to clinical cases, learning collaboration, and continuous learning, build professionalism and skills and correlate the essential science importance in clinical practice (Hassan, 2013). There are three planes of an integrated curriculum, horizontal, vertical, and spiral. Horizontal integration is the connections and correlations between the disciplines or subjects in the same phase, which means basic sciences subjects are related and clinical sciences subjects are interconnected. However, vertical integration connects basic and clinical sciences across the phase. So, basic sciences application in clinical practice experience by the students. Therefore, horizontal and vertical integrations allow students to learn meaningful and relevant learning for effective clinical practice (Patel & Shah, 2020). In the spiral integration, basic science subject is revisited into different phases and steps of the curriculum with increasing complexity. So, there is an opportunity to correlate basic science subjects with clinical subjects, and critical thinking and problem-solving are emphasised (Fraser et al., 2019).

For example, medical colleges of Bangladesh have a traditional curriculum where in phase one, students learn about anatomy, physiology and biochemistry in detail. Furthermore, in phase two, other para-clinical subjects like pathology, microbiology, pharmacology, community medicine and forensic medicine teach, and phase three is the clinical phase. There is detailed learning about each subject, but within the curriculum, there

is no scope for correlation between the pre- or para-clinical subjects and clinical subjects. Therefore, students need to correlate by themselves. However, the Faculty of Medicine and Health Sciences, Universiti Malaysia Sabah, has horizontal, vertical, and spiral integration in the curriculum. Therefore, students learn the basic sciences and are exposed to clinical skills from year one, so horizontal and vertical integration is experienced. Furthermore, in year five, there is a revisit of basic subjects and discuss the cases so that it facilitates students to learn the correlation between basic and clinical subjects and clear the overall conception through spiral integration. However, there is a lack of details knowledge and learning about each subject. Therefore, students face difficulties in correlating basic science with clinical subjects.

From the experience of teaching traditional and integrated curricula, it is better to follow a curriculum which combines both traditional and integrated curricula. This is because the base of the students will be concrete which would facilitate the correlation even better. This can be achieved through teaching the subjects individually and mentioning the application of the learnt knowledge. Moreover, it combines knowledge through problem-based learning, small group discussion, case discussion, seminar presentation, etc. Therefore, there will be a balance between the traditional and integrated curricula that help the students gain sufficient undergraduate knowledge and apply and integrate basic science knowledge with clinical subjects.

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ORIGINAL ARTICLE

Exploring the Needs for Developing MOOC Module on Risk Communication in Global Health Emergencies for Continuing Nursing Education Programme: A Qualitative Study

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ABSTRACT

To support the learning process, it is essential to conduct a needs analysis to identify appropriate instructional materials that fit the learners' characteristics and learning environment. This study aimed to identify the need for developing a MOOC module on risk communication in global health emergencies to use as a teaching tool for continuing nursing education programmes. Following the principles of a qualitative research design, a total of 14 participants, including two nursing lecturers from Kulliyah of Nursing, International Islamic University Malaysia (IIUM), two nurse managers (matrons), two emergency physicians, and eight registered nurses (RN) from SASMEC @ IIUM, were selected through purposive sampling method and interviewed using semi-structured interview-guided questions. The interview data were analysed using thematic analysis. The participants stated that continuing nursing education (CNE) was essential for professional development (PD) and a resource for enhancing existing skills and knowledge. Risk communication skills were crucial for nurses in emergency healthcare contexts. The majority of this study's participants were unfamiliar with MOOC courses and stated that support and motivation from their institution, as well as monitoring of participation and course completion, were needed to implement MOOC courses successfully. To sum

up, understanding of continuing education, current risk communication knowledge and literacy, and awareness of MOOCs were explored. These realities will support the development of the risk communication MOOC module that will help improve nurses' risk communication skills and better prepare them for future global health emergencies.

INTRODUCTION

Innovative technologies are a critical component of the healthcare system and they raise the standard of the healthcare education process. Recently, technology has been rapidly penetrating healthcare education as well as nursing education (Safana & Nat, 2017). Continuing education could be a lifelong professional development process, and it constitutes planned learning experiences aimed at enhancing the knowledge, skills, and attitudes of registered nurses in developing nursing practice to improve patient care, education, management, and research (Agyepong & Okyere, 2018). Although nurses have an innate desire to pursue continuing education, several nurses are deterred from it due to high tuition fees, tight job schedules, exhaustion from shift work, and a shortage of replacement staff. Therefore, e-learning is an emerging approach to overcome these limitations and it enables easy access and flexible learning. E-learning is promoted as a host of affordable, convenient, and growing lifelong learning opportunities (Bahrambeygi et al., 2018). Technology-enhanced teaching poses an enormous challenge for lifelong learning. Educational media could be a solution to this impact, and e-learning and Massive Open Online Courses (MOOCs) have made significant contributions to the integration of teaching and learning (Daradoumis et al., 2013). MOOCs are web-based tools for distance learning and low-cost e-learning. Developing a MOOC-based module can be a lifelong learning resource that develops learners' critical thinking, problem-solving, and interpersonal skills (Lase, 2019).

During global health emergencies, risk communication should help people to stay safe, and risk communication means that the right message given at the right time by the right person can also save their lives (Raina, 2018). Effective risk communication skills and practices are crucial for people's health and safety, particularly in times of health crises, epidemics, or natural disasters. Risk communication aims to assist individuals in making informed decisions about whether and how to address the risks they face (Heydari et al., 2021). Effective communication is important in emergency responses and an essential tool in risk management decisions (Reddy & Gupta, 2020).

Among healthcare personnel, nurses play an important role in sorting information and communicating potential risks to the public. Nurses must be excellent communicators and collaborators. Harvard's Risk Management Foundation found that over 30% of medical errors were due to nurses' poor communication (Hughes & Blegen, 2008). To improve the quality of nursing care, Zangeneh et al. (2021) recommended that communication skills training be incorporated into nurses' continuing education and on-the-job training. According to their study, nurses had a moderate understanding of communication skills. Similarly, the findings of the study titled "Nurses Communicating Risk: Strategies from the Literature" by Anderko et al. (2021) indicated that nurses should learn more about risk communication and be better prepared for situations requiring these skills. More than ever, there is an ongoing need to improve risk communication skills in health emergencies.

In Malaysia, most nursing programmes emphasise communication skills in clinical and community settings. However, communication skills in health emergencies and global health emergencies such as pandemic viral infection, outbreaks of bacterial infection, natural disasters, etc., receive very little attention.

Simultaneously, little to nothing is known about the use of MOOCs on continuing nursing education (CNE), the transfer of learning into practice, and lifelong learning for professional development (PD), regardless of whether technology-enhanced learning could assist nursing professional growth.

On the other hand, modules are teaching-learning tools that are designed systematically and interestingly to achieve the learners' expected competencies (Lindsey et al., 2022). A needs analysis initiates the phase in which an effective instructional design for delivering teaching and learning experiences is designed and developed (Desi Rizma Yanti, 2019). Beyond that, it is an important means of conducting research before designing the teaching material to gather the information that will serve as the basis for developing suitable teaching material according to the learners' needs in that particular area. The main aim of this study was to identify the need for developing a MOOC module on risk communication in global health emergencies for nurses.

MATERIALS AND METHODS

Study Design and Sampling

A qualitative descriptive study was conducted through semi-structured interviews using an interview guide that included four sections: own understanding of PD and CNE, current learning methods and online learning methods in CNE, background knowledge on risk communication in global health emergencies, and awareness of MOOC courses among nurses. The participants were selected through purposive sampling with inclusion criteria such as lecturers who had at least a master's degree in nursing science with a specialization in emergency care and also had at least three years of teaching experience, a nurse manager (matron) who had at least one year of experience in the current position, and registered nurses (RN) and emergency physicians (ED) who had at least one year of experience in the clinical setting.

Data Collection Procedure

The eligible tentative participants were invited through email. Upon their reply, the participant's information sheet and informed consent form were sent to the voluntary participants along with the date and time for the interview. After confirmation, these participants were invited via Google Calendar and the interview was conducted using semi-structured interview questions. Fourteen participants were involved. During the interview sessions, the details of participants' verbal and non-verbal responses such as body language, tone of voice, facial expressions, atmosphere, and special occasions encountered were also recorded as they might have affected the validity of the results. During the interview session, participants were allowed flexibility for dialogue. The interview session lasted 30 to 45 minutes for each participant, and all data was recorded and used in the English language during the conversation. Ethical approval was obtained from the IIUM Research Ethics Committee (Reference: ID No: IREC 2021-172) and SASMEC@IIUM (Research Grant: IIUM/413/DEaR/14/3/1/2021-01-SRG21-051-0051).

Data Analysis

Thematic analysis was used in data analysis (Braun & Clarke, 2006). First, the transcript of the interview recordings, followed by reading and re-reading of the entire dataset. Then, open coding and naming were done. During coding, the researcher addressed the research questions and mentally analysed the data to discover potential themes and then a group of sub-themes. The themes were then synthesized according to the sections of the semi-structured interview guide and then cross-checked with NVivo 12 Plus software to confirm the themes and their sub-themes. Subsequently, the evaluation of trustworthiness, which included credibility, dependability and transferability, and the authenticity of the findings were verified. To ensure the credibility (internal validity) of the

research, the study findings were confirmed by the participants. The data presented were discussed with the experts, and the related literature was also studied for the dependability of this study. For the transferability (external validity) of the findings, interviews were recorded (audio) and listened to, and the content of the recorded audio was transcribed and re-interviewed until data saturation. To ensure authenticity, the researcher first established a trusting relationship with the participants, ensuring they were aware of the nature of the research and able to express their feelings and emotions in the context of the phenomenon.

RESULTS

Socio-Demographic Profiles

A total of 14 participants, including two EDs, two nursing managers (matrons), eight RNs in SASMEC@IIUM, and two nursing lecturers from Kulliyyah of Nursing, IIUM, participated in the study. Many of them were female (72%) with an average working experience of ten years.

To identify the need for developing risk communication in the global health emergencies MOOC module for nurses, the interview was conducted using semi-structured interview-guided questions. The interview data were analysed using thematic analysis, and the themes were synthesised to address the following: (i) understanding of PD and CNE, (ii) current learning methods and practices in CNE, (iii) learning needs of nurses on risk communication in global health emergencies, and (iv) awareness of the MOOC course among nurses.

(i) Understanding of PD and CNE

Regarding professional growth and CNE, the participants' understanding in this study encompassed three main themes: (a) importance for professional life, (b) enhancing PD, and (c) updating knowledge.

(a) Importance for Professional Life

Regarding the first theme, the importance of professional life, the participants emphasised that PD and CNE were essential throughout one's career and to develop current skills. The participants explored their interpretations of PD and continuing education in this theme. Participants one (P1) and three (P3) highlighted the need for PD to earn CPD points and updates.

"My understanding: PD is important. Anything new we need to inform the practitioners. Because they are not commonly aware of what the new things and responsible bodies are, the CPD units, academicians and managerial units. Therefore, it is important to have a branch to inform the practitioners what are the news and updates." (P1:18/3/2021)

"Of course. Very important. Nurses need to update their knowledge from time to time. If we don't do that, nurses just do their jobs without any indication, and don't know what the effects and consequences are." (P3:20/3/2021)

Participant Two (P2) and Participant Seven (P7) stated that CNE was vital for enhancing professional skills and knowledge.

"CNE's purpose is important to make sure that they have confidence and feel enough in their field by further study or something takes speciality. So that, they improve their skills or in terms of knowledge." (P2:18/1/2021)

"CNE is important that the PD is given important too because the instructor has to develop and improve their skill before teaching or importing knowledge to their target group." (P7:30/6/2021)

(b) Enhancing PD

Concerning the second theme, enhancing PD, participants mentioned that PD and CNE

must be maintained to ensure competence in knowledge, skills, and behaviours. In this theme, Participant Six (P6) stated that PD was a process and there was a connection between continuing education and PD, as continuous education would improve PD and career accomplishments.

"PD is basically a process where we will try to acquire knowledge or anything that can improve the effectiveness of our jobs. Certainly, there is a relationship between continuing education and PD because participating or by doing continuous education, somehow will help you to improve your PD." (P6: 27/6/2021)

(c) Updating Knowledge

Regarding the third theme, updating knowledge, the participants mentioned that PD and CNE were necessary and valuable resources for enhancing and expanding existing knowledge and skills. Participant Two (P2) and Participant Four (P4) indicated that each nurse should attend a workshop or seminar to acquire CPD points for licence renewal and updating knowledge and skills.

"Last time, for CNE, they attend conferences, and face-to-face classes when duty free time. After we know the updated knowledge, share it among us." (P2:18/1/2021)

"Every nurse needs to attend a workshop or seminar to renew their licence annually because each CNE either workshop or seminar, they get point to renew their licence. Indirectly, when they attend this kind of talk, they can refresh their skills and get updates and the latest information related to their nursing skills." (P4:19/6/2021)

(ii) Current Learning Methods and Practices in CNE

It was determined that there were three major themes or modes: (a) face-to-face, (b) online, and (c) hybrid modes. In addition, two strategies, including (d) a demonstration video and (e) an objective structured clinical exam (OSCE), were utilised to improve skills.

(a) Face-to-face Classes

Regarding the first current teaching/learning mode, face-to-face teaching, participants indicated that it was common and preferred by nurses. Participants P2, P4 and P12 reported that nurses attended a conference and a face-to-face workshop to exchange ideas and upgrade their knowledge. The participants determined that this approach was the most prevalent and well-known among nurses among the various strategies for PD in capturing CPD points for PD.

"Current teaching strategies, right now, we are in the pandemic, so most of the current teaching strategies are more to online learning strategies, for us very love like face-to-face, we can get easily CPD points and PD." (P12:10/7/21)

"Last time, for CNE, they attend conferences, and face-to-face classes when duty free time. After we know updated knowledge, share it among us." (P2: 18/1/21)

"There are so many forms to enhance our professional development. One of them is CNE which include in terms of seminar, workshop, conference and so on." (P4:19/6/2021)

(b) Online Mode

Regarding the second current teaching/learning method, the online mode, participants reported that it was gaining popularity in continuing education due to the COVID-19 pandemic. Using this method, participants

investigated the implementation of regular CNE using the Google Meet and Zoom platforms. Due to the pandemic, Participants P3, P9, P10 and P12 noted that online learning was utilised for CNE and annual CPD points, despite their preference for face-to-face classes. In addition, CNE has been required in their workplaces on a consistent schedule.

"During the pandemic, one-to-one follow SOP and online learning to get annual CPD points." (P3:20/3/21)

"Like SASMEC, we do have CNE online, every Wednesday, all staff nurses must participate so there is no cheating among staff nurses. All the attendance was recorded. When we got topics, we prepare slides and give them, so they can get new information and they can give new information to all nurses." (P9:2/7/21)

"We do CNE every Wednesday, and also CNE online, we discuss among nurses, paramedics and doctors, so now the current strategy is CNE for CE but the difference is it is not face-to-face, we use online, Google Meet or Zoom." (P10:2/7/21)

"Current teaching strategies, right now, we are in the pandemic, so most of the current teaching strategies are more to online learning strategies, for us very love face-to-face, we can get easily CPD points and PD." (P12:10/7/21)

According to the COVID-19 standard operation procedure (SOP) guidelines for continuing education in nursing, Participant Five (P5) reported that both online and semi-online courses and physical classes with limited participants had been implemented.

"What I can see during the pandemic, for nurses, their continuing education is online, semi-online or course but we follow SOP." (P5:19/6/21)

(c) Hybrid Mode

Regarding the third current teaching/learning method, a hybrid mode, the participants explored that the theory classes were taught via an online platform and the hands-on classes were delivered in a classroom with a limited number of nurses and per the COVID-19 SOP guidelines. Participant 13 (P13) stated that the hybrid mode was currently used for continuing education.

"Currently, webinars, Zoom meetings, and Google Meet for teaching strategies due to the pandemic, before we practice, use a small seminar room allow 10 persons, online we called hybrid mode." (P13: 11/7/21)

(d) Demonstration Video

Demonstration videos and OSCE were being employed in their workplaces to increase clinical skills and maintain skill proficiency. P13 stated that CNE was for knowledge acquisition and skill competence. Therefore, skill videos were used for skill improvement.

"Skills, during CE, not only do they get the knowledge, they can share skill videos on how to maintain catheter care. Because now, difficult for us to do physical hands-on, so only can see the video, which is the correct one. Then, senior staff or nurse managers do an audit or access their staff, whether they have the right technique or not." (P13: 11/7/21)

Participant 11 (P11) also mentioned that watching skill videos and responding to questions relating to the video viewed was one of the ways to gain CPD points through training at the workplace.

"Video simulation practice currently in SASMEC. See video, analyse the video and sit an exam and get a certificate." (P11:10/7/21)

(e) OSCE

As a result of the nature of nursing and its education, each area's core competencies are crucial for providing high-quality nursing care. P7 mentioned that the current method for theory classes was online, whereas practical classes were physical, such as OSCE for PD and CNE.

"The current strategies for CNE are online classes, sometimes physical classes, and OSCE station for skills."
(P7:30/6/21)

(iii) Learning Needs of Nurses on Risk Communication in Global Health Emergencies

Two main themes were identified: (a) the importance for nurses and (b) barriers and challenges in improving risk communication skills.

(a) Importance for Nurses

Regarding the first theme, the participant mentioned that communication and risk communication skills were essential for nurses because they interact with people and care for their lives.

"Very important for nurses because nurses take care human life. In health emergencies, it is important, for me."
(P10:2/7/21)

In addition, the participants highlighted the importance of communication and risk communication skills for patient safety and reducing risks such as medication errors. These skills are also essential to the patient's survival in medical emergencies, particularly during resuscitation.

"Communication is very important because we need to apply the types of communication to avoid harm to our patients. In health emergencies, we are going to about resuscitation, resuscitation communication is very important." (P11:10/7/21)

"Very important because nurses need to have good communication, especially in the management of patients, if they have poor communication, may be errors in medication. During an emergency, communication skills are very important because of the life of patients." (P14:11/7/21).

"Communication is important about we don't want any error to occur for the patient. In health emergencies, of course, communication is important for client safety." (P5:19/6/21)

During emergencies, communication is crucial, and individuals must be able to communicate effectively. The participants considered both verbal and nonverbal modes of communication. In the present pandemic crisis, everyone converses while wearing a mask. Therefore, it appears to be nonverbal communication, and the message is misunderstood. In addition, they highlighted that opinions and prior knowledge also influenced how information was communicated.

"Really important. Because usually, we know that, suppose two ways, we deliver the message, other parties understand or not. So, communication is very important to understand what is the main message, we have verbal and nonverbal now wear the mask, like nonverbal, so can misunderstand information. So, communication is very important." (P12:10/7/21)

"Communication skill is very important because there is the only way how you want to relate your opinions or knowledge or your information. In health emergencies, communication skill is very important because especially in emergencies, you need to communicate well."
(P6:27/6/21)

Although communication skills are essential for nurses in their daily patient care and health emergencies, P3 reported that

nurses still lacked competency in this area and were careless about it.

"Communication is just normal practice for nurses but they don't know how and they didn't take communication seriously but they should know communication is very important." (P3:20/3/21)

Risk communication plays a crucial role in public health emergencies, according to P8 and P9. Information conveyed should be clear and concise; the patient's report is essential and serves communication as a tool for patients' continuing treatment.

"Communication plays a very big role in nursing because we carry the patient forward to another staff to get continuing treatment. As I told the above, communication also plays a big role in health emergencies, so we can use our nursing report as a main communication method." (P8:26/6/21)

"Communication is very important, you know, the information that we provide it must be short and also it must be precise." (P9:2/7/21)

(b) Barriers and Challenges in Improving Risk Communication Skill

Risk communication is one of the eight core principles of pandemic preparedness outlined in International Health Regulations, which are essential to prepare for, respond to and recover from serious public health situations such as new infectious illnesses. Regarding the second theme, barriers and challenges in improving risk communication skills, the participants mentioned that there were still barriers and challenges due to the complexity of emergency circumstances, the shortage of staff in pandemic situations, and their attitudes.

"Communication for nurses is most challenging, communication skills are always a barrier. Because we know that emergency is a really hard

situation in the hospital because we know that so many barriers exist." (P12:10/7/21)

"So, during the pandemic COVID-19, we limit the staff. So, the task should distribute wisely. At the moment, difficult, it comes from nurses' attitudes. Nurses have to check and double confirm with the staff which one is done, required, and informed." (P14:11/7/21)

(iv) Awareness of the MOOC Course Among Nurses

MOOCs are online learning experiences that incorporate traditional teaching techniques such as video lectures, interactive components, assignments, discussion boards, quizzes, and tests. MOOCs are offered for free or at a low cost as a supplement to classroom instruction and for personal and professional development. Participants' knowledge about MOOC courses should also be explored in the needs analysis phase before the training module's design. Regarding this, four major themes were identified based on participants' feedback. These were (a) never heard about MOOC courses, (b) own meaning for the MOOC course, (c) obstacles in implementing the MOOC course and (d) suggestions for the success of the MOOC course.

(a) Never Heard About MOOC Courses

Regarding the theme, namely, never heard about MOOC courses, participants found that MOOCs were not widely known among nurses.

"I don't know about MOOC." (P3:20/3/21, P4:19/6/21, P10:2/7/21)

Although MOOC has been introduced in various settings to accelerate the continuation of education into professional careers, the participants responded that nursing education and CNE had not yet adopted it, and this was the first time MOOC was heard.

"So far no. This is the first time I heard MOOC." (P2:18/1/21)

"I think, it's about great idea if implement MOOC. For now, there is no. Our first experience MOOC." (P9:2/7/21)

(a) Own Meaning for the MOOC Course

Regarding the theme, which was its meaning for the MOOC course, participants declared that the MOOC course was a free and accessible platform for everyone and that it was beneficial for learners with tight shift schedules, such as nurses.

"MOOC is free for all participants." (P10:2/7/21)

"MOOC is one of the accessible platforms for everyone. Every nurse can access. They enrol and they can study at their own pace of time. This is very good for a person who is working." (P1:18/3/21)

In addition, participants explored that MOOC was open, which was appropriate for the current pandemic situation, and that learners could obtain a great deal of knowledge in a short period due to the availability of several MOOC courses in various e-learning platforms.

"It's really good because you can access a lot of free online courses, and you can get multidimensional and variety of knowledge in a short time." (P6:27/6/21)

"MOOC is needed at the current situation, and they can learn openly." (P2:18/1/21)

Regarding the application of the MOOC course, participants stated that it could be used to improve existing knowledge and skills and earn CPD points for PD.

"It is good to do MOOC, because one of the points, we can collect CPD points and also, we can get knowledge. There are a lot of advantages there." (P10:2/7/21)

"MOOC is one method to improve knowledge and skill." (P14:11/7/21)

(b) Obstacles in Implementing the MOOC Course

Regarding the theme of obstacles in implementing the MOOC course, the participants mentioned that there could be challenges in implementing the MOOC course as they were unfamiliar with the MOOC course and how to use it.

"Barriers to MOOC: We are not familiar with MOOC, so we don't know how to use MOOC." (P10:2/7/21)

"Barriers, definitely first is regarding the knowledge of MOOC course itself. I think, a lot of people still don't know about MOOC." (P6:27/6/21)

As MOOC is a form of technology-based learning, participants stated that old-aged nurses might experience significant challenges in this area.

"But young people don't have a problem, but old learners may have quite challenged online in technology." (P12:10/7/21)

"Technology barriers for senior staff." (P4:19/6/21)

Apart from this, other participants mentioned that internet connectivity was one of the challenges in implementing MOOC courses.

"Internet connection will be a problem." (P11:10/7/21)

"The barrier may be Internet accessibility." (P2:18/1/21)

"Usually Internet connection, the main barrier might be." (P7:30/6/21)

The participant also stated that the nursing profession was stressful and exhausting. When nurses desire to learn through MOOCs, their time management skills could be an issue.

"Barrier, I think, time management.
Clinical working may be tiring."
(P14:11/7/21)

One of the participants investigated professional organisations and policies that impacted MOOC course participation. Participants in a MOOC course should be monitored and encouraged by authorised personnel.

"Barriers are professional bodies and policies." (P1:18/3/21)

In addition, participants indicated that learners' prior knowledge and learning needs could pose hurdles to the delivery of MOOC courses.

"Barrier may be topics depends on audience needs. For example, different background knowledge of the audience. Sometimes difficult to understand for nurses and others if topics are related with MO."
(P5:19/6/21)

"Barrier may be a different level of background knowledge." (P9:2/7/21)

In addition, two participants said that learners' motivation, desire, and attitude also served as obstacles to their learning.

"Actually, it is good but one side, what we call – pros and cons. Only one thing we do online is our desire to learn." (P3:20/3/21)

"My personal experience, if you introduce communication module, is their attitude to learn." (P4:19/6/21)

(c) Suggestions for the Success of the MOOC Course

Regarding the theme, suggestions for the success of the MOOC course, the participants indicated that institutional support and encouragement, as well as monitoring of participation and course completion, were necessary.

"The support from an expert can improve it. To increase course completion, make follow up, reminder. Give completion certificate." (P2:18/1/21)

"If they give some points like CPD, they will participate." (P4:19/6/21)

"For future, E-learning, we can continue all disciplines, for nurses, we have to monitor how many e-learning courses they attended. I have to draw one more checklist of how many E-learning courses attended." (P3:20/3/21)

In addition, one participant suggested that assessments, active participation, and live sessions with instructors be incorporated into the MOOC course design to increase learner engagement.

"Assessment and synchronous can enhance participant engagement."
(P1:18/3/21)

Generally, in this semi-structured interview, participants stated that CNE was essential for PD and a source for enhancing existing skills and knowledge. In addition, nurses earn CPD points for licence renewal and career development through participation in CNE programmes and courses. Nurses were more experienced with and preferred face-to-face programmes such as seminars, workshops, and short courses to receive CPD points for professional development, among the several CNE approaches provided. However, in the context of the COVID-19 epidemic, online approaches such as Google Meet and Zoom are popular and currently utilised in CNE activities. Social media platforms such as Instagram and Facebook could be used for educational purposes.

Risk communication skills are important for nurses both in routine and emergency healthcare settings. However, most nurses lack a clear understanding of risk communication and face many challenges and hurdles in

strengthening their risk communication skills due to the nature of real emergencies, the shortage of healthcare personnel, and their attitudes. Regarding familiarity with MOOC courses, the majority of study participants were unaware. Participants suggested that support and motivation from one's institution and monitoring of participation and course completion were required for a successful MOOC course.

DISCUSSION

Understandings of PD and CNE

PD is crucial in every profession as it is an essential aspect of advancing knowledge and skills in professional life. In this study, participants indicated that PD and continuing education were important in professional life and enhanced their knowledge and skills to date. This finding was similarly noted in Price and Reichert's (2017) study, in which nurses expected opportunities for their continuing education throughout their careers and understood that continuous learning was important to maintain their competency skills and quality patient care. It was an expressed need and expectation for nurses in their career stages. These nurses also understood that continuous learning was essential to the maintenance of their competency skills and the delivery of high-quality patient care (Price & Reichert, 2017). Furthermore, the results of the survey conducted by Lera et al. (2020) showed that the majority of participants strongly agreed on the requirement of continuing education and stated two reasons for mandatory continuing education, which were to improve the quality of nursing care provided and to upgrade of the nursing profession. These findings are quite comparable to others that have been discovered in the past. Therefore, continuing education, in general, is essential for enhancing PD and future careers.

Current Learning Methods and Practices in Continuing Education of Nurses

The purpose of CNE is to upgrade the nursing profession and improve the quality of nursing care. In the present study, participants stated that the CNE strategies were face-to-face (physical class), online and hybrid modes, particularly in theory classes and they watched and learned from a demonstration video and then practised themselves and sat the OSCE exam to improve skills. This is similar to the study of modern lifelong teaching strategies in nursing education conducted by Tachtsoglou et al. (2021), which explored that the various training programs like lectures, courses, interactive workshops, or demonstrations in the workplace were conducted during the orientation and training of new staff as well as the updating of knowledge for old staff in the changes of protocols in the workplace.

Learning Needs of Nurses on Risk Communication in Global Health Emergencies

Risk communication focuses on the dissemination of information and the perception of risks. Especially in times of health crises, epidemics, or natural disasters, effective risk communication skills are necessary for the health and well-being of the population. In this study, participants stated that risk communication skills were important for nurses in their daily work life, which is similar to the findings of the literature reviewed by Anderko et al. (2021), which found that nurses were open and willing to learn more about risk communication and believed that they needed to be better prepared for encounters that required these skills and that the basics of risk communication and the implications of these efforts needed to be educated to nurses. On the other hand, participants in the present study also explored that there were some barriers and challenges in improving nurses' risk communication skills, such as the natural hardness of emergency, shortage of

manpower in pandemic situations, and the attitude of the staff.

Awareness of the MOOC Course Among Nurses

In the present study, participants stated that the MOOC course was a free and accessible platform for everyone, it was also good for learners with busy and shift schedules, and it could be used to improve existing knowledge and skills and to earn CPD points for PD; however, MOOC was not well known among nurses. Similar to the study conducted by Purkayastha and Sinha (2021) found that the study participants were interested in pursuing a Massive Open Online Course but were less aware of how to register for a Massive Open Online Course. Therefore, they need proper guidance and more awareness of MOOC courses. The participants of the present study also mentioned that there might be some barriers to using MOOC courses as nurses were unfamiliar, and there were also internet connection problems. Moreover, they also declared that old-aged nurses might face quite a challenge when it comes to technology-based learning, such as MOOC courses. Finally, study participants highlighted that the learners' drive, desire, and attitude also became barriers to their learning. These findings are similar to those of Ma and Lee's (2017) study examining barriers underlying MOOC acceptance by college students. They explored that the individual factors, such as self-control and attitude, as well as the environmental factors, such as motivation and economic circumstances, represented barriers to the use of MOOCs. Accordingly, the participants in this study proposed some suggestions for the success of the MOOC course, such as the support and motivation from an institution as well as the monitoring of participation and course completion. In addition, participants recommended that the MOOC course

design, MOOC course assessment activities, active participation, and live sessions with instructors should be designed to improve learner engagement. Furthermore, the study on the development of medical MOOCs in China: Current Situation and Challenges conducted by Gong (2018) found that using network information required a certain level of digital literacy and strong self-motivation, self-management, and willingness to commit to free online courses.

CONCLUSION

In conclusion, based on the findings of the study, continuing education is a crucial component of professional growth, the existing risk communication knowledge and literacy of nurses, as well as some challenges and suggestions for enhancing nurses' risk communication skills, were investigated. This information assists in developing the MOOC module on risk communication in global health emergencies. This MOOC module will strengthen the risk communication skills of nurses, therefore assuring the delivery of excellent healthcare, particularly during health crises.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest in publishing this article.

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ORIGINAL ARTICLE

Medication Compliance of Patients Attending a Pain Clinic at a Tertiary Hospital in Malaysia

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ABSTRACT

Pain is a public health problem with profound physical, emotional, and societal costs. Conventional oral analgaesics are usually the first treatment, which is cost-effective and relatively safe. However, medication noncompliance is a serious healthcare concern. Medication noncompliance has remained a significant challenge despite considerable efforts to improve patient compliance. Therefore, a study was done to assess medication compliance at a Pain Clinic in a tertiary hospital in Malaysia. The study period was from December 2019 to January 2020. A total of 180 patients participated in the study. The study showed that pain clinic patients' medication compliance was 65%. With the improvement of medication compliance, the quality of life of patients with pain can be improved.

INTRODUCTION

Pain is associated with tissue damage, inflammation, or a relatively straightforward disease process and is usually referred to as acute pain. However, if the pain persists for longer than three months, either as an accompaniment to a disease process or following the usual amount of time expected for an injury to heal, it would be referred to as chronic pain (Turk & Melzack, 2011). In addition, the International Association for the

Study of Pain (IASP) has defined pain as an unpleasant sensory and emotional experience associated with or resembling that associated with actual or potential tissue damage (Raja et al., 2020).

The experience of chronic pain is a significant health problem. Pain can cause profound physical limitations, emotional stress, and increased societal costs (Institute of Medicine (US) Committee on Advancing Pain Research, Care, and Education, 2011). Oral or intravenous analgesics are always the first treatment, which is cheap and relatively safe. Intravenous analgesics are usually given in the hospital setting. However, these oral analgesics will be escalated if necessary. The selection of analgesic therapy is based on the intensity of the pain, according to the World Health Organization (WHO) (1996). These analgesics should be given regularly based on their pharmacological recommendation. In addition, additional doses may be provided for breakthrough pain when needed.

Health providers must ensure that patients with pain must develop a treatment plan. The focus should be optimising the patient's daily function, quality of life, and productivity while minimising analgesic side effects. One of the requirements to achieve this goal is for the patient to be compliant with their medication. Medication compliance is the extent to which a patient correctly follows medical advice (Preedy, 2017). With good compliance, the treatment plan will be achievable.

However, medication noncompliance is a severe worldwide healthcare concern (Berg et al., 1993). Despite considerable efforts to improve patient compliance, more should be done for noncompliance with medication (Miller et al., 1997). These reasons should be addressed as soon as possible for the sake of the patients.

If the compliance issue is not addressed well, the patient's pain will be more challenging. In addition, this will eventually cause a financial strain on health management (DiMatteo et al., 1992; Hammond & Lambert, 1994; Hayes et al., 1979). Authors can divide and talk about what happens if this problem is not addressed well from the point of view of the patient, patient's family, employer, and healthcare system. This would make the introduction organised and understandable. This paragraph is a repeat of what has been stated before.

Until this point in the Introduction, I still do not understand the authors' objectives. The objective of this study is to assess compliance with medication among patients with chronic pain in a tertiary hospital in Malaysia and to identify the possible reasons for the noncompliance of these patients.

MATERIALS AND METHODS

This study was done at a Pain Clinic in a hospital located in Penang, Malaysia, which is a tertiary hospital in Malaysia. The study period was from December 2019 to January 2020. Convenient sampling was done. The patients attending this clinic were screened based on their medical records. The inclusion criteria included patients with chronic pain who was on analgesics for at least three months. Patients will be excluded if they are pregnant or refuse to participate in the study. Patients who agreed to participate in this study were asked to sign consent forms. This study has been approved by the Ethical Committee (NMRR-19289248404).

Participants were given validated Medication Compliance Questionnaires (MCQ). This Medication Compliance Questionnaire (MCQ) was developed by Hassan et al. in 2006 to assess medication adherence. The patients were given the questionnaire while waiting to see the doctor. The questionnaire typically took 30 – 45 minutes to complete. There were two sections in the questionnaire. The first section

was about the socio-demographic data of the patients. These include sex, race, employment status, educational status, visitation to physiotherapy, pain score, and compliance with medication. The second section of the questionnaire was about the MCQ. It comprised ten questions in two domains: a drug-taking behaviour domain, which contained seven items, and a drug-stopping behaviour domain, which included three items. The internal consistency reliabilities of this study (Cronbach's alpha values) were 0.67 and 0.84. The test-retest single-measure intra-class correlation co-efficient were 0.78 and 0.93. The study scores were calculated using the Likert scale ranging from 1 to 5, with five indicating 'never' and one meaning 'very frequently'. All negatively worded scores were reversed, and all scores were converted to a 0 – 100 score. Patients with good compliance or adherence, with a score of 75 or more, answered 'frequently' or 'very frequently' to all items in the questionnaire. Patients who scored less than 75 were considered to be in the non-adherence group. The full-adherence group was patients who scored 100.

Descriptive statistics were used to analyse the sociodemographic and clinical data. The results were presented as means and frequencies. The association between adherence, sociodemographic and clinical factors was analysed using the Chi-square test. The significance level was set at a $p < 0.05$, with a 95% confidence interval. Analyses were performed with the Statistical Package for Social Sciences (SPSS), Version 23.

RESULTS

A total of 180 patients participated in the study based on convenience sampling. The response rate was 100%. The socio-demographic characteristics of the respondents are shown in Table 1. The mean age of the respondents was

50.49 and 13 years old. There was almost an equal number of males and females in this study. There were more Malay and Indian respondents compared to Chinese respondents.

Table 1 Demographic profile of patients (n = 180)

Variable	Mean (SD)	Frequency (%)
Age (Years \pm SD)	50.49 (13)	
Gender		
• Male		93 (51.7)
• Female		87 (48.3)
Race		
• Malay		68 (37.8)
• Indian		67 (37.2)
• Chinese		45 (25)
Employment status		
• Employed		85 (47.2)
• Unemployed		95 (52.8)
Educational level		
• None		17 (9.4)
• School		74 (41.1)
• College		60 (33.3)
• University		29 (16.1)
Physiotherapy		
• Yes		95 (52.8)
• No		85 (47.2)
Pain Score		
• Mild (0 – 3)		71 (39.4)
• Moderate (4 – 6)		64 (35.6)
• Severe (7 – 10)		45 (25)
Compliance		
• Yes		117 (65)
• No		63 (35)

*SD: Standard deviation

Our study showed that pain clinic patients' medication compliance was 65%. However, overall the patient's mean pain score was 4.53 ± 2.3 .

The Pearson correlation coefficient was computed to assess the relationship between the pain score and compliance level, which showed that $r(178) = -0.30$, $p = 0.00$. This explains that patients with good compliance with pain medications tend to report lower pain scores and better pain control.

Table 2 Compliance level among the sub variables

Variables	Compliance (N)		X ²	P
	Yes	No		
Gender				
• Male	65	28	2.02	0.15
• Female	52	35		
Employment status				
• Employed	54	31	0.15	0.70
• Unemployed	63	32		
Pain severity				
• Mild	51	20	4.74	0.09
• Moderate	43	21		
• Severe	23	21		
Attending physiotherapy				
• Yes	65	30	1.04	0.31
• No	52	33		

Table 2 shows no significant difference between groups (gender, employment status, pain severity, and physiotherapy visit) and their compliance level, $p > 0.05$.

The main reason for noncompliance in our study population is patients who tend to take medication only when they feel unwell rather than taking it regularly as prescribed. Besides that, the patients also tend to stop taking medication once they feel better. The third reason patients tend to stop taking medication is if they experience any side effects after taking the drug.

Table 3 Descriptive statistics of each question

Item	Questions	Mean score (SD)
Q1	Taking medication as prescribed	1.69 (0.79)
Q2	Taking medication only if feeling unwell	3.29 (1.34)
Q3	Having difficulty taking medication every day	4.09 (1.27)
Q4	Forgets to take medication	4.08 (1.17)
Q5	Takes double dosing subsequently if missed dose	4.22 (1.18)
Q6	Changes timing of medication without doctors' advice	4.11 (1.21)
Q7	Reduces medication intake once feeling better	3.73 (1.25)
Q8	Stops taking medication when it feels not effective	3.84 (1.38)
Q9	Stops taking medication when gets any side effects	3.67 (1.45)
Q10	Stops taking medication once feeling well/better	3.48 (1.53)

The mean score of individual questions (1 = Very frequent, 2 = Frequent, 3 = Occasionally, 4 = Rarely, 5 = Never).

DISCUSSION

There are several reasons for the under-treatment of pain. One of the factors is poor compliance with pain medications. A study showed that only 21% of cancer patients were adherent to pain medication therapy (Valeberg et al., 2008). This was much lower than the adherence to anti-hypertensives and medications used for hyperlipidaemia,

which were 43% and 36.7%, respectively. (Morisky et al., 1998; Sung et al., 1998). This low compliance to pain medication will eventually decrease patients' quality of life (Graziottin et al., 2011). Our study showed that patients with better medication compliance have significantly lower pain severity. To investigate the reasons behind the low compliance level, a proper understanding of the factors that affect compliance with medication needs to be reviewed.

Several factors affect compliance with medication. This includes age, sex, the severity of disease, lower socioeconomic status, and many others. This is summarised in Table 4.

Table 4 Factors associated with compliance (Hassan et al., 2006)

Factors
<ul style="list-style-type: none"> • Age • Sex • Severity of disease • Lower socioeconomic status • Satisfaction with healthcare • Physician-patient relationship • Drug of choice • The number of medications prescribed • Symptoms of Depression • Drug tolerability with the patient • Intension to comply • Co-morbid medical conditions among the patients • Family support for the patients • Self-efficacy

Many misbeliefs affect their medication-taking behaviour (Gunnarsdottir et al., 2003). For example, most patients taking opioids for pain control have a severe fear of addiction. The patients were also concerned about tolerance, which they fear will cause a bigger problem if their pain progressed shortly. Tolerance is the diminished response to medication during repeated or prolonged exposure. The possible side effects of the drug may also deter the patient from being compliant (Meuser et al., 2001).

There are several steps to improve medication compliance. It can be broadly divided into four methods: patient education, enhanced dosing schedules, increased clinic opening hours, and improved communication between physicians and patients (Osterberg & Blaschke, 2005). The methods are summarised in Table 5.

Education regarding medication usage is critical. The patient, relatives, and health care providers should be informed regarding the medication given, especially the side

effects after taking the drug. Patients must be aware that side effects may be present, but the medication can be continued if pain control is good with a tolerable side effect.

Improving dosing schedules is also an effective way to improve medication compliance. Dosing schedules can be improved with reduced frequency of dosing and the use of pill boxes. Another step that could help to improve medication compliance is for patients to avoid missing their clinic appointment. This can be accomplished by reminding the patient regarding their appointment. Increasing the clinic opening hours may also help, but this involves increasing the number of staff in the clinic. Physician training is also an essential step in improving compliance. With proper training, communication between physicians and patients can be improved. With good communication between doctors and patients, medication compliance can be improved.

Table 5 Steps to improve medication compliance among chronic pain patients

Principles	Suggested methods
Patient Education	<ul style="list-style-type: none"> • Education of the patient • Education of relatives • Education of healthcare providers
Improved dosing schedules	<ul style="list-style-type: none"> • Reduced frequency of dosing • Pill-boxes
Avoid miss clinic appointments	<ul style="list-style-type: none"> • Increased clinic open hours • Patient reminders days before the clinic
Improved communication between physicians and patients	<ul style="list-style-type: none"> • Physician training

Although these suggestions appear simple, they involve a lot of planning and implementation. A standard printed guideline should also be available to patients to improve their compliance. This guideline should include the medication's possible side effects and emphasise the need to continue if the side effects are tolerable. The policy given to the patient should also have a phone number for patients to contact if further information is needed.

CONCLUSION

Pharmacological management remains the cornerstone of pain management. However, poor compliance remains a barrier to achieving this. Among the steps that may help to improve adherence are patient education, improved dosing schedules, avoiding missing clinic appointments, and improving communication between doctors and patients. More efforts are needed to achieve these steps. However, proper planning and exemplary implementation of these steps will significantly enhance patients' quality of life in pain.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest in publishing this article.

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ORIGINAL ARTICLE

The Effect of Mometasone Furoate Nasal Spray on Blood Oxygenation in Allergic Rhinitis Patients

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ABSTRACT

Allergic rhinitis (AR) is a disease that presents with symptoms like nasal discharge, blockage, and itchiness, which impair the quality of life of most patients depending on its severity. The most common symptom in AR patients is a persistent bilateral nasal blockage, which may indirectly and potentially affect the airflow into the lung. However, the symptoms can be controlled using intranasal steroid spray (INS). This study investigated the role of nasal obstruction in lowering blood oxygenation and how INS improved blood oxygenation. This study included 33 patients with AR. Subjects with moderate-to-severe nasal obstruction were recruited based on the Visual Analogue Scale (VAS), and mometasone furoate nasal spray (MFNS) – two puffs twice a day for two weeks was given. Pre- and post-medication parameters compared included nasal obstruction VAS, partial oxygen arterial pressure (PaO₂), partial arterial carbon dioxide pressure (PaCO₂), and oxygen saturation (O₂ saturation). All parameters were substantially different between pre- and post-medication. VAS, PaO₂, PaCO₂, and O₂ saturation were significantly different before and after medicine ($p < 0.01$). A comprehensive treatment of nasal obstruction using MFNS helps improve blood oxygenation and nasal obstruction in AR patients.

INTRODUCTION

Rhinitis is defined as inflammation of the nasal cavity and can be divided into allergic rhinitis (AR) and nonallergic rhinitis (NAR). AR is a combination of two or more nasal symptoms, such as rhinorrhoea, nasal congestion, nasal itchiness, and excessive sneezing. Signs of AR include hypertrophy of the turbinates, pale overlying nasal mucosa, especially over the turbinates, allergic shiners, the Dennie-Morgan line, and the nasal crease. AR is a symptom that results from IgE-mediated inflammation following exposure to allergens. AR can be classified into four types according to Allergic Rhinitis and its Impact on Asthma (ARIA) Guidelines (Hellings et al., 2019): mild AR, intermittent AR, persistent AR, and moderate to severe AR.

AR is a widespread condition affecting millions of people and is a known global health problem. The incidence of AR is steadily increasing within the general population, including adult and paediatric populations. According to the Allergies in Asia Pacific Survey (Katelaris et al. 2011), AR is common across the Asia Pacific population, affecting approximately 10% of the population. In Malaysia, a study in the paediatric community showed the overall incidence of rhinitis symptoms at 27%, with a significantly higher prevalence in the 12 – 14 years age group (38.2%) than in the five to seven years age group (18.2%) (Asha'ari et al., 2010).

Among the most common troublesome symptoms for AR patients is a nasal blockage (DeShazo&Kemp,2021).Theallergenresponses in the nasal mucosa, mediated by the various complex interactions among inflammatory markers, initiate the cascades of inflammatory mediator release (Passalacqua et al., 2007. As a result, it causes mucus gland stimulation and increases vascular permeability, resulting in nasal obstruction from increased secretions, oedema, and exudate formation (Chhabra & Houser, 2011). The enlargement of the nasal turbinates can also be due to mucosal or bony hypertrophy (Leong et al., 2010).

In AR patients, the duration of nasal obstruction symptoms is variable, but most commonly they occur in the morning and at night (Aoyagi et al., 1999). In severe AR, this symptom disturbs daily activities as well as causes the patient to mouth-breathe. Mouth breathing affects adults and children with chronic nasal obstruction by causing dry mouth and throat, eventually leading to sore throat and foreign body sensations, as well as hoarseness and postnasal drip due to the inability of nasal discharge to drain anteriorly (Chhabra & Houser, 2011; Leong et al., 2010). Apart from that, chronic nasal obstruction is believed to be related to chronic headaches, which occur more frequently in children with nasal obstruction and persistent rhinorrhea as compared to a normal child (Schoustra et al., 2022). Chronic nasal obstruction also has a role in determining the severity of sleep-disordered breathing (Passali et al., 2004; Kim et al., 2013). Mclean et al. showed that by eliminating nasal obstruction and therefore reducing mouth breathing, a reduction in the severity of OSA might be achieved, if not totally resolving it (McLean et al., 2005; An et al., 2019).

Airway obstruction via nasal congestion can reduce arterial oxygen and induce hypoxia in tissues, especially if it is not properly compensated by mouth breathing (Bayrak et al., 2010). Studies have also shown that by creating nasal obstruction through nasal packing, which eliminates nasal breathing, the patient may suffer from pulmonary and cardiac problems along with complications such as hypoxia, myocardial infarction, cerebrovascular accident (CVA), and sudden death (Bayrak et al., 2010). The study also showed evidence of changes in blood gas values caused by alveolar hypoventilation, airflow obstruction, and a reduction in alveolar gas diffusion and ventilation/perfusion ratios (Bayrak et al., 2010). An experiment on dogs by Cavo et al., demonstrated that posterior nasal packing also induced arterial hypoxia and hypercapnia, which later returned to normal after packing removal (Cavo et al., 1975; Lin et al., 1979). In a study done by Zayyan et al.,

patients with total nasal obstruction showed no changes in partial arterial oxygen pressure (PaO_2) or oxygen saturation (O_2 saturation), but their partial arterial carbon dioxide pressure (PaCO_2) values decreased due to mouth breathing and increased breathing rate (Zayyan et al., 2010; Banglawala et al., 2013; Banglawala et al., 2014).

Clinically, there are two ways to measure the degree of nasal obstruction, which can be divided into subjective and objective measurements (Mohan, 2018). The subjective measurement includes the use of a visual analogue scale (VAS) and the physician's assessment of nasal obstruction following anterior rhinoscopy. Its measurement will determine the effect of treatment on nasal symptoms via scores given by the patient. VAS is one of the subjective methods for determining the degree of nasal obstruction. VAS is calculated using a 10-point scale or a 100-mm scale (Mora et al., 2009). Mora et al. concluded that clinically, VAS had good reliability to quantify nasal obstruction symptoms in the absence of rhinomanometry (Mora et al., 2009).

The use of objective measurement for nasal obstruction allows the physician to identify the location of the blockage and to evaluate the post-treatment effect on nasal airflow, volume, and physiology. Objective measurements include methods such as acoustic rhinometry, rhinomanometry, nasal inspiratory peak flow, rhinostereometry, radiographic techniques, and videoendoscopic documentation (Meltzer et al., 1998; Bernstein et al., 2012).

Medical treatment is the main option to treat AR. For temporary relief of nasal congestion symptoms, a nasal decongestant significantly reduced the nasal mucosal oedema associated with AR (Zicari et al., 2012). In their study, Zicari et al. discovered that after administering a nasal decongestant to patients with nasal obstruction, upper airway resistance decreased (Zicari et al., 2012).

Aside from the temporary effect of a nasal decongestant, nasal steroid spray is more effective and long-lasting in reducing nasal obstruction in AR patients. Studies by Meltzer et al. and Bernstein et al. showed that MNS had an anti-inflammatory effect thus reducing the allergen's ability to cause an influx of basophils and mast cells into the airways. The dosage was according to the standard dosing in the treatment of AR practised in Hospital Universiti Sains Malaysia. (Meltzer et al., 1998; Bernstein et al., 2012). Apart from that, mometasone furoate is proven safe to be administered through the nose despite being highly potent, it is almost undetectable in plasma samples obtained after oral or intranasal administration in an adult due to its rapid and extensive metabolism. Meltzer et al. (1998) concluded that a daily dose of 50, 100, or 200 $\mu\text{g}/\text{dL}$ did not affect the hypothalamus pituitary adrenal (HPA) axis in 96 paediatric patients (Brannan et al., 1997; Ow et al., 2022).

To determine the effect of nasal obstruction on blood oxygenation, arterial blood gases (ABG) were taken from the artery and analysed clinically. ABG is a useful parameter in assessing blood oxygen levels because it measures the partial pressure of oxygen (PaO_2) in arterial blood, which indicates how well the lungs are oxygenating the blood. ABG analysis can detect four major categories of acid-base disorders i.e., acidosis and alkalosis in respiratory and metabolic. Respiratory acidosis is an acid-base imbalance that can occur when the upper airway is obstructed. This kind of obstruction, if not compensated for by the body, will result in an acidotic pH, high carbon dioxide partial arterial pressure, and low partial oxygen pressure.

This study looked at nasal obstruction in AR patients and its impact on ABG. Even though nasal obstruction does not cause life-threatening acute airway obstruction in adults, the symptoms of nasal obstruction in AR patients are sometimes severe enough to disturb patients' daily activities. However, the literature available looking into the effect

of blood oxygenation in nasal obstruction patients is a study that showed patients with nasal packing had mild hypoxemia and decreased oxygen saturation. The study showed that elimination of nasal obstruction improved pulmonary functions and oxygenation was significantly improved one-week postoperative following removal of the nasal pack (Sobh et al., 2021). The intranasal steroid nasal spray (INS) used in this study was mometasone furoate nasal spray (MFNS), which is widely available throughout Malaysia. One of the aims of this study was to find out the effect of MFNS on blood oxygenation in a patient using the maximum daily dose of 400 mcg per day. The authors hope that the improvement in blood oxygenation through reducing the symptoms of nasal obstruction may provide long-term medical benefits for AR patients.

MATERIALS AND METHODS

This was a prospective cross-sectional study of AR patients who attended the otorhinolaryngology clinic at HUSM in Kubang Kerian, Kelantan. Patients aged 18 to 35 were chosen as sample populations. The inclusion criteria included nasal obstruction symptoms with a VAS ranging from four to ten (the persistent group of AR) and recent use of INS for more than one month. The exclusion criteria were chronic medical disorders of the respiratory system, cardiac disease, haematological disorders, and neurological disorders. Subjects with a severely deviated nasal septum, an intranasal tumour, obstructive sleep apnoea, or who had undergone intranasal surgery were also excluded. The study was approved by the Universiti Sains Malaysia ethical research committee, and written consent was obtained from all the subjects.

A thorough history was taken for each subject, and the patient was subjected to a visual analogue scoring system to determine the severity of nasal obstruction symptoms. It ranges from zero (no obstruction) to ten

(complete obstruction). The patient was asked to tick over the line corresponding to their perception of nasal obstruction. A physical examination involving anterior rhinoscopy and rigid nasoendoscopy was performed on patients with a visual analogue score of four or higher for nasal obstruction to rule out the presence of severe septal deviation, synechiae, nasal tumours, polyps, and adenoid hypertrophy.

ABG was taken from the patient prior to prescribing the INS. The ABG was taken from the patient's radial artery (the area was applied with a topical anaesthetic cream that contained a combination of lidocaine and prilocaine i.e., EMLA) using a pre-heparinized 23-gauge, 25 mm (1 inch) 2 ml syringe. The main parameters obtained from ABG were PaO_2 , PaCO_2 , and O_2 saturation. The patient was instructed to apply MFNS – two puffs per nostril, twice a day for two weeks. During the patient's follow-up, two weeks later, they were assessed again using the VAS regarding the nasal obstruction symptoms, and a repeat ABG sampling was taken. The chosen statistical method was the paired t-test, and the data analysis was performed using Statistical Package for Social Sciences (SPSS) version 20.

RESULTS

This study recruited a total of 33 subjects which included 28 Malays, two Chinese, two Indians and one Siamese (classified as others). There were 13 male (39.4%) and 20 female (60.6%) subjects involved and the patient's mean age was 28.21 years. The VAS post-medication showed marked improvement (Table 1). All the subjects showed improvement in their rhinitis symptoms including nasal obstruction. This also indicated that all the subjects were compliant with their treatment. The mean parameters obtained from the ABG in both premedication and post-medication showed a decrease in the mean except for PaCO_2 (Table 2).

Table 1 Premedication and post-medication VAS mean

Variables	n	Mean (SD)
Premedication VAS	33	7.15 (1.25)
Post-medication VAS	33	2.85 (1.12)

SD = Standard deviation, VAS = Visual Analogue Scale

Table 2 Premedication and post-medication mean of PaO₂, PaCO₂ and O₂ saturation

Variables	n	Mean (SD)
Premedication PaO ₂	33	123.16 (15.13)
Post-medication PaO ₂	33	111.89 (15.18)
Premedication PaCO ₂	33	31.52 (3.53)
Post-medication PaCO ₂	33	33.02 (3.36)
Premedication O ₂ Saturation	33	97.90 (0.65)
Post-medication O ₂ Saturation	33	97.46 (0.76)

SD = Standard deviation, PaO₂ = Partial pressure of Oxygen, PaCO₂ = Partial pressure of Carbon Dioxide, O₂ = Oxygen

A t-test was used to compare the premedication and post-medication differences between VAS, PaO₂, PaCO₂, and O₂ saturation. There were significant differences ($p < 0.01$) between all the variables in the premedication and post-medication except for PaCO₂ (Table 3). It showed that only subjectively did the nasal symptoms improve, as all the variables and measures showed a significant difference.

Table 3 Comparison between premedication and post-medication results

Variables	Premedication mean (SD)	Post-medication mean (SD)	Mean difference (95% CI)	t-statistic (df)	p-value
VAS	7.15 (1.25)	2.85 (1.12)	4.30 (3.84, 4.77)	18.86 (32)	$p < 0.01$
PaO ₂	123.16 (15.13)	111.89 (15.18)	11.26 (6.38, 16.15)	4.697 (32)	$p < 0.01$
PaCO ₂	31.52 (3.53)	33.02 (3.36)	-1.50 (-2.83, -0.16)	-2.283 (32)	0.029
O ₂ Saturation	97.90 (0.65)	97.46 (0.76)	0.44 (0.18, 0.70)	3.441 (32)	$p < 0.01$

SD = Standard deviation, CI = Confidence interval, df = Degrees of freedom, VAS = Visual Analogue scale, PaO₂ = Partial pressure of Oxygen, PaCO₂ = Partial pressure of Carbon Dioxide, O₂ = Oxygen

DISCUSSION

In AR patients, nasal obstruction is one of the hallmark symptoms that may determine the severity of AR itself. Looking back at the pathogenesis of nasal obstruction in AR, which consists of three events; inflammation of the mucosa, congestion of nasal blood flow, and excessive secretions of mucous, these events do cause significant obstruction to the upper airway (Bousquet et al., 2020). This obstruction will reflect the respiration process. Theoretically, the arterial oxygen and carbon dioxide composition in the blood will

be affected by any airway obstruction, alveolar hypoventilation, and reduced gas diffusion (Zayyan et al., 2010; Banglawala et al., 2013; Banglawala et al., 2014).

To maintain blood oxygenation, individuals with nasal obstructions prefer to breathe through their mouths. This is a physiologic compensatory mechanism in response to hypoxia due to nasal obstruction. The change of route of respiration from nasal to oral supposedly may or may not affect the blood gas parameters, which include PaO₂, PaCO₂, and O₂ saturation, as shown in a study

by Zayyan et al. (2010) who evaluated the effects of nasal packing post-septoplasty and septorhinoplasty on cardiac function and blood arterial gases and found that there was no significant difference in pH, PaO₂, or O₂ saturation. However, he noted that there was a reduction in PaCO₂, and he later concluded that it was due to oral breathing because of nasal obstruction (Zayyan et al. 2010). Similarly, a study by Lin et al. (2015) and Yildirim et al. (2016) found that although nasal obstruction caused a decrease in oxygen saturation levels in the blood, the decrease was not significant enough to cause hypoxia or other adverse effects, and both studies concluded that these findings may vary depending on the severity and duration of the obstruction, as well as other individual factors such as rate of breathing, current lung function status, current metabolic status, and health condition (Lin et al., 2015, Yildirim et al., 2016). Our study also showed significant changes in the variables except for PaCO₂, which may indicate that the patient is breathing orally due to an obstructed nose.

The evaluation of nasal obstruction can be done subjectively and objectively. Rhinomanometry, acoustic rhinomanometry, nasal peak flowmeters, and rhinostereometry are the objective measurements for nasal obstruction. These types of measurements will help the surgeon determine the severity of the obstruction (Moubayed & Most, 2022). The objective instrument requires a measurement instrument. In Malaysia, not all otorhinolaryngology clinics have this form of facility. This equipment is expensive, and the cost of maintenance is high. A subjective measurement of nasal obstruction includes patient-reported symptoms such as nasal congestion, stuffiness, and difficulty breathing through the nose (Baraniuk, 2011). The advantage of subjective measurement is that it provides insight into how the patient is feeling and how their symptoms are affecting their quality of life. However, it is subjective and can be influenced by factors such as anxiety, depression, and other psychological factors (Keeler & Most, 2016). A surgeon will

rely on the patient to describe the severity of nasal obstruction symptoms in the subjective measurement, and it is more cost-effective. In this study, we used a subjective measurement via VAS to classify the severity of the nasal obstruction symptom due to the unavailability of the instruments mentioned above.

There are a few studies that verify the suitability of VAS results in conjunction with objective assessment i.e., rhinomanometry or acoustic rhinometry findings. Among others is a study by Mora et al. that utilised the VAS to quantify the subjective feeling of the nasal obstruction symptom in patients following turbinectomy, and in their study, they found that there was a significant and strong relationship between the VAS for nasal obstruction and nasal airflow resistance (measured by rhinomanometry) pre and post turbinectomy (Mora et al., 2009).

Another study, that aimed to investigate the correlation between VAS and acoustic rhinometry in children with no nasal symptoms, found a significant correlation between VAS and minimal cross-sectional area at baseline, but no correlation was found between VAS and acoustic values after decongestion and concluded that VAS showed potential as a subjective tool to investigate nasal obstruction in children over seven years of age (Haavisto et al., 2011). VAS may also be used as a surrogate for rhinomanometry, with adequate reliability. The study aimed to evaluate the relationship between VAS and nasal obstruction in patients with persistent allergic rhinitis and concluded that it was a reliable tool (Ciprandi et al., 2009).

Our study also investigated the effect of MFNS on nasal obstruction symptoms via three blood gas parameters: PaO₂, PaCO₂, and O₂ saturation. Zayyan et al. (2010) evaluated the effects of nasal packing post-septoplasty and septorhinoplasty on cardiac function and blood arterial gases and found that there was no significant difference in pH, PaO₂, or O₂ saturation. However, he noted that there was a reduction in PaCO₂, and he later

concluded that it was due to oral breathing because of nasal obstruction. (Zayyan et al., 2010; Banglawala et al., 2013; Banglawala et al., 2014). These findings were similar to ours, which also noted that only the PaCO_2 had a significant difference ($p > 0.01$). Our study had control subjects that compared whether the changes in arterial blood gases were significant or not, therefore allowing us to establish any intranasal anomalies or patients already experiencing nasal blockage symptoms. Based on this study, we conclude that some arterial blood gas parameters, especially the PaO_2 and O_2 saturation, may remain the same even in a patient with chronic nasal obstruction.

Premedication

Our study showed that during the premedication period, the PaO_2 was higher than normal (mean $\text{PaO}_2 = 123.16$ mm Hg). The PaCO_2 mean was low at 31.52 mm Hg, and the oxygen saturation means stood at 97.9%, which was within the normal range. During this period, the results suggest that the patients were having hyperventilated ABG results due to a high oxygen intake and high carbon dioxide washout. The mean value of the VAS for the nasal obstruction symptom was high at 7.15, which suggests that patients were having nasal obstruction and breathing orally during this premedication period.

Nasal obstruction does contribute to low oxygen intake, which may cause hypoxia. This hypoxia will be compensated by the physiological response of the body to facilitate more air intake through oral breathing. A large volume of air intake explains why, during the premedication phase, patients have a higher PaO_2 value than normal. The same compensatory mechanism through oral breathing is also responsible for causing hypocapnia. In hyperventilation, more oxygen will be inspired, and at the same time, more carbon dioxide will be exhaled. This results in hypocapnia or carbon dioxide washout, which will cause a low reading of PaCO_2 .

In oral breathing, the breathing rate is maintained in the normal range of 15 to 18 times per minute. However, the amount of inspired oxygen is increased, and less inspired air is trapped in the anatomical dead space because an oral breather bypasses the nasal cavity and nasopharynx. Oral breathing allows a greater amount of carbon dioxide to be washed out of the lungs as less restriction of airflow is encountered due to reduced nasal resistance.

Blood oxygen saturation, by definition, is a relative measure of dissolved oxygen that is carried in the blood. The oxygen percentage indicates that all available heme-binding sites in the blood haemoglobin level have been saturated with oxygen. This is why oxygen saturation levels never exceed 100%, and the normal range of oxygen saturation is around 96 to 100%. In our study, the mean premedication oxygen saturation was 97.9%, which was within the normal range.

Post-medication

After two weeks of using MFNS, we found that our patient demonstrated a lower VAS score with a mean of 2.85. The difference between pre- and post-medication VAS was significant. This indicates that our patient was experiencing a reduction in nasal obstruction symptoms, suggesting that MFNS did improve the subjective nasal obstruction symptom. This could be because there is less mucosal oedema on the nasal cavity surface, particularly along the lateral walls, allowing for a better laminar flow of air during inspiration. Vaidyanathan et al. (2021) noted that mometasone nasal spray effectively reduced nasal mucosal oedema and therefore nasal obstruction. The authors found that mometasone nasal spray significantly improved nasal obstruction compared to placebo or other intranasal corticosteroids, as measured by various symptom scores and objective measures of nasal airflow.

On assessing the post-medication arterial blood gases, we found that there was a reduction in the PaO_2 reading. The reading

was still above normal, but there was still a significant difference between pre- and post-medication arterial pressure. It proves that by breathing through the nose, adequate oxygen can be inspired for normal respiration. We also noted that our patient had an improvement in PaCO₂ post-medication, where the mean was 33.02 mm Hg. This may be explained by the fact that when patients start to breathe through the nose, less carbon dioxide is expelled into the atmosphere due to the presence of nasal resistance. This will cause slight carbon dioxide retention in the lung. Apart from that, the slow release of air during expiration allows the lungs to maintain compliance and reduce the risk of lung atelectasis.

The post-medication oxygen saturation result showed that our patients had a normal oxygen saturation mean of 97.46%, which was within the normal range. Although the t-test analysis showed a significant difference between pre- and post-medication results, we believe that the oxygen saturation difference was not directly influenced by the transition from oral to nasal breathing. It is because it only measures how much the heme-binding sites of haemoglobin are saturated with oxygen. This value is under the influence of haemoglobin level, which was not measured during this study.

It appears that most of our patients were having less inspired oxygen and lower expired carbon dioxide washout from the lungs after two weeks of treatment with MFNS. Based on the VAS after medication, our patients started to breathe normally through the nose. This study showed that with an intensive course of MFNS treatment lasting two weeks, there was a reduction in the nasal obstruction symptom. Furthermore, this study showed a significant difference between pre- and post-medication parameters of PaO₂, PaCO₂, and VAS, demonstrating that nasal breathing had been achieved.

The usage of objective measurements such as acoustic rhinometry and rhinomanometry can further improve the data outcome. A larger sample size can increase statistical power and reflect more representative results in this study. Other modes of treatment, whether it be a single mode or in combination, can also be used to optimise the effect and therefore show a more reliable result.

CONCLUSION

The treatment with MFNS alleviates symptoms of nasal obstruction in AR patients by reducing mucosal oedema and therefore improving blood oxygenation. The parameters measured initially showed an adaptation of the AR patient to their current symptoms, which later showed significant improvement at a later stage of the treatment. These improvements in blood oxygenation showed a positive effect that would provide long-term medical benefits for AR patients.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest in publishing this article.

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CASE REPORT

An Unusual Case of *Corynebacterium simulans* causes Infective Endocarditis with Embolic Events

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ABSTRACT

Corynebacterium species are often treated as contaminants. However, there were several recent outbreaks involving *Corynebacterium* species reported across the globe. We report a rare case of *Corynebacterium simulans* causes infective endocarditis which led to debilitating embolic events. A 39-year-old lady presented with a prolonged fever for three weeks. She was in septic shock and had dense right hemiplegia, a pansystolic murmur at the mitral area and hepatosplenomegaly. There were no peripheral stigmata of infective endocarditis. An urgent computed tomography (CT) of the brain showed an infarct at the left corona radiata extending to the left parietal, left basal ganglia and left temporal lobe. She deteriorated and required mechanical ventilation and intensive care. Echocardiogram showed vegetation at both her anterior and posterior mitral valve leaflets leading to severe mitral regurgitation. Splenic infarction was seen in her contrasted computed tomography (CECT) of her abdomen. Her three samples of blood culture were positive for *Corynebacterium simulans*. She deteriorated rapidly and went into multi-organ failure and succumbed. *Corynebacterium* species should be taken seriously and should not be neglected as a contaminant as it can cause potentially fatal complications as described in this case report.

INTRODUCTION

Invasive diseases caused by *Corynebacterium* have been increasingly described (Ogasawara et al., 2021). *Corynebacterium* species is only found in 0.4% of all infective endocarditis (Liesman et al., 2017). Ogasawara et al. (2020), Zheng et al. (2019) and Seng et al. (2015) published several case reports regarding infective endocarditis, pyogenic spondylitis, atopic dermatitis and breast implant infections due to *Corynebacterium simulans* (*C. simulans*) over the past decade. The rest includes *Corynebacterium striatum*, *Corynebacterium jeikeium*, *Corynebacterium amycolatum*, *Corynebacterium propinquum*, *Corynebacterium simulans* and others. For *Corynebacterium simulans*, its specific epidemiological data is not available and reports were saying that many laboratories misidentified *Corynebacterium simulans* as *Corynebacterium striatum* (McMullen et al., 2017). McMullen et al. (2017) reported that *Corynebacterium striatum* is most commonly found in wound and respiratory specimens from patients aged 50 to 69 years. *C. simulans* was first reported in 2000 in which was mainly detected in the skin and infrequently in specimens associated with mucous membranes (Liesman et al., 2017). Ogasawara et al. (2021) stated that the frequencies of isolation of *C. simulans* and *C. striatum* were 3.9% and 96%, respectively. *C. simulans* is prone to infections that require long-term treatment, such as pyogenic spondylitis, infections of

prosthetic joints, and infective endocarditis (Ogasawara et al., 2021). However, there were only a few cases of pyogenic spondylitis and skin infections reported ever since the discovery of *C. simulans* in 2000 (Liesman et al., 2017). Here we report a rare case of *C. simulans* infective endocarditis.

CASE REPORT

A 39-year-old lady with underlying iron deficiency anaemia presented to the emergency department with sudden onset of right-sided body weakness with a background history of prolonged fever for three weeks associated with dyspnoea, lethargy, arthralgia and headache. Otherwise, there were no fitting episodes. On arrival at the emergency department, she was lethargic, febrile and septic looking. Physical examination revealed a dense right hemiparesis with MRC grade 1 power over the right upper and lower limbs. A Grade 3 pansystolic murmur at the mitral area radiating to the left axilla was noticed on cardiovascular examination while abdominal examination showed hepatosplenomegaly. There were no peripheral stigmata of infective endocarditis. Chest radiograph showed no consolidation while electrocardiogram revealed sinus tachycardia. An urgent computed tomography (CT) brain (Figure 1A) showed a recent infarct at the left corona radiata extending to the left parietal, left basal ganglia and left temporal lobe which was consistent with her neurological findings.

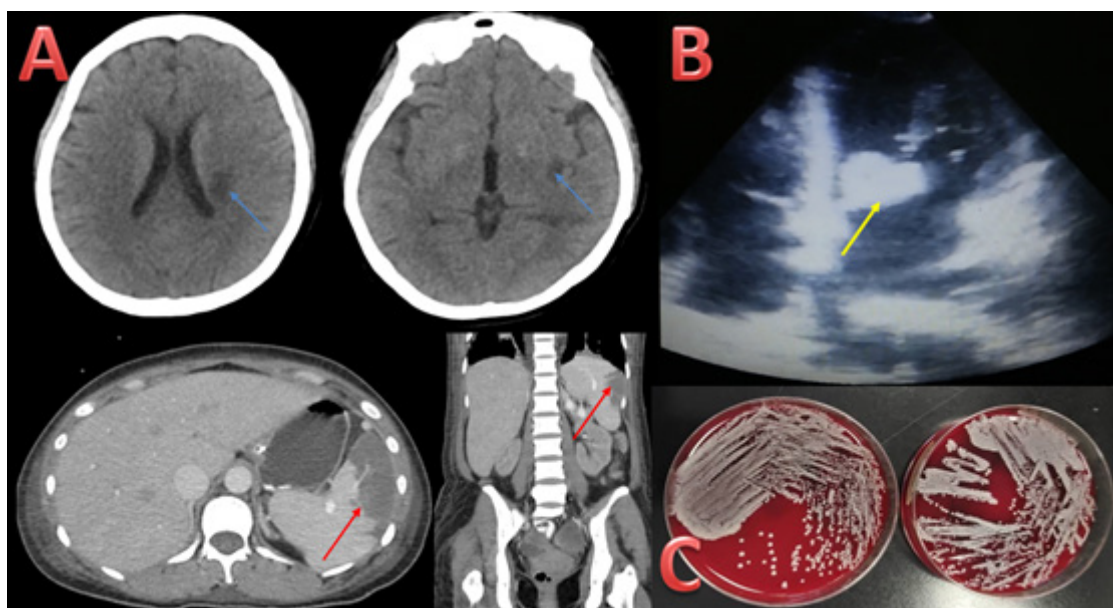


Figure 1 (A) CT brain shows ill-defined hypodensities (blue arrows) at the left corona radiata and left external capsule (blue arrow) in keeping recent infarcts. Differential diagnosis includes septic emboli to the brain. CT abdomen shows well-defined wedge shape hypodensity (red arrows) at the peripheral aspect of the mid-pole spleen (blue arrow) in keeping with splenic infarct. (B) Transthoracic echocardiogram shows large vegetation on the mitral valve (red arrow). (C) Greyish-white non-haemolytic colonies of *Corynebacterium simulans* on blood agar (using Vitek 2 Automated System)

Her condition deteriorated on the first day of admission with impending respiratory collapse and severe arterial hypotension requiring orotracheal intubation, mechanical ventilation, inotropes and intensive care unit admission. The clinical suspicion of acute infective endocarditis was confirmed by an urgent transthoracic echocardiogram (Figure 1B) which revealed 1.4 cm² and 4.7 cm² vegetations at anterior and posterior mitral valve leaflets respectively causing severe mitral regurgitation with preserved left ventricular ejection fraction (55%). Contrast-enhanced CT abdomen and pelvis (Figure 1A) noted splenic infarct. *C. simulans* were identified on all 3 sets of blood cultures using Vitek 2 Automated System (Figure 1C). She was treated aggressively with IV Vancomycin based on blood culture sensitivity. Therapeutic drug monitoring (TDM) showed vancomycin level was within the therapeutic range. However, her condition further deteriorated with acute

renal impairment and coagulopathy. She was subjected to continuous renal replacement therapy (CRRT) due to oliguric acute kidney injury with metabolic acidosis. Since she had a severe septic shock with sustained fever, the cardiothoracic and anaesthetic team feels she was unstable for operation for a valve surgery at that junction. Other broad-spectrum antibiotics such as IV C-penicillin, IV ceftriaxone and IV meropenem were added in an escalating manner to treat the invasive organisms. Despite aggressive antibiotics treatment and haemodialysis, her condition continued to worsen with persistently raised inflammatory markers and leukocytosis (Table 1) despite repeated blood cultures yielding no growth. Since then, she requires increasing ventilation settings and inotropic support. Eventually, she succumbed to death from severe *Corynebacterium* infective endocarditis with embolic events and multiorgan failure after two weeks of intensive therapy.

Table 1 Laboratory investigations

Blood parameters	Reference range	On arrival	2 weeks after treatment
Haemoglobin	12 – 18g/dL	7.1	10.1
Platelets	$150 \times 10^3 - 450 \times 10^3/\text{microlitre}$	154	111
White Cell Counts	$4 \times 10^3 - 9 \times 10^3/\text{microlitre}$	27	30
Sodium	135 – 145 mmol/L	122	145
Potassium	3.5 – 5.1mmol/L	4	4.3
Urea	2.8 – 7.2 mmol/L	16	23
Creatinine	59 – 104 micromol/L	148	106
Total protein	66 – 83 g/L	60	57
Albumin	35 – 52 g/L	23	21
Globulin	28 – 36 g/L	37	37
Total Bilirubin	5 – 21 micromol/L	15	13
Alanine Transferase	0 – 50 U/L	22	11
Alkaline Phosphatase	30 – 120 U/L	325	159
Erythrocyte Sedimentation Rate	0 – 20 mm/hour	69	63
Prothrombin time	9.9 – 11.9 seconds	38.8	12.4
International normalized ratio (INR)	0.9 – 1.10	4.26	1.18
Activated Partial Thromboplastin Time (aPTT)	25.4 – 35.2 seconds	71.8	33
C-Reactive protein	Less than 5	263	260
pH	7.35 – 7.45	7.25	7.28
HCO ₃	22 – 26 mmol/L	14	16
Peripheral Blood cultures (MIC, mcg)	Left arm, right arm, right femoral: Sensitive to:	C. simulans Clindamycin (2) Gentamicin (10) Penicillin (10) Rifampicin (5) Vancomycin (3)	No growth
TDM Vancomycin	Pre-dose: 15 – 25 mcg/ml Post dose: 25 – 40 mcg/ml	20 30	22 35

DISCUSSION

Corynebacterium is a 'club-shaped' Gram-positive bacilli or coccobacilli. It was historically nearly always dismissed as contaminants when isolated from patients but increasingly has been implicated as the cause of significant infections. The increasing number of opportunistic infections of elderly

and immunocompromised patients caused by *Corynebacterium* indicates that effective treatment is crucial (Ogasawara et al., 2021).

Identification of *C. simulans* is often obscured as it is not included in the usual conventional tests database; therefore, it has been easily misclassified as *C. striatum* (Ogasawara et al., 2021). Several identification

systems based on biochemical tests have been developed to aid the laboratory diagnosis of *Corynebacterium* infections, such as API Coryne (BioMerieux, Lyon, France), RapID CB Plus (Remel/ThermoFisher Scientific, Waltham, MA, USA), BBL Crystal Gram Positive ID System (Becton Dickinson, Franklin Lakes, NJ, USA), MICRONAUT-RPO (Merlin Diagnostics, Bomheim, Germany) (Zasada & Mosiej, 2018). Our laboratory uses Vitek 2 Automated system to identify *C. simulans*. Rennie et al. (2008) conducted a multicentre evaluation of Vitek 2 for anaerobe and *Corynebacterium* identification which revealed a 95% confidence interval was met for quality control and reproducibility. In a more recent paper, Xu et al. (2021) published on the direct detection of *Corynebacterium striatum*, *Corynebacterium propinquum*, and *Corynebacterium simulans* in sputum samples by high-resolution melt curve analysis which can detect 22 additional positive specimens, reflecting a 23.9% relative increase in detection rate.

C. simulans is generally more susceptible to antibiotics such as anti-methicillin-resistant *Staphylococcus aureus* (MRSA), β -lactams, and cepheems, especially those that can be served via the oral route compared to *C. striatum* (Ogasawara et al., 2021). This is consistent with our patient's blood culture and sensitivity (shown in Table 1). *C. simulans* is sensitive to vancomycin (anti-MRSA). However, our patient failed to respond to the appropriate antibiotics which may be attributed to the late presentations with massive septic emboli and hospital-acquired infections.

This is to the author's best knowledge the first case of *C. simulans* infective endocarditis, fulfilling the two major clinical criteria of the Modified Duke diagnostic scheme as evidenced by three sets of blood cultures from different sites and timing yielded *C. simulans*

combining with findings of vegetation causing mitral regurgitation on echocardiogram. She presented with right hemiplegia as a late presentation of septic embolism from the infective endocarditis. The comprehensive clinical assessment successfully identified the cause of the hemiparesis and appropriate treatment was administered. The present case stands out for the clinical aggressiveness of the disease.

Arterial embolism of valvular vegetation is frequent and diverse which urges the need for immediate intervention. Arterial embolisms of the lower limbs are reported in 20 to 30% of cases (Pessinaba et al., 2012). The peak incidence of these phenomena is usually in the first 2 weeks of antimicrobial treatment and is influenced by the size and mobility of vegetation (Pessinaba et al., 2012). Our patient transthoracic echocardiography demonstrated large vegetations (1.4 cm² and 4.7 cm²) and certainly a major risk factor for the multiple related embolic complications.

Even with appropriate antimicrobial therapy, our patient remained hemodynamically unstable with persistently elevated inflammatory markers, indicating a failure of medical treatment with the need for valve replacement surgery. The lack of standardized procedures for antibiotic testing is a limiting factor, although the community strains of *C. simulans* are usually susceptible to anti-MRSA (Ogasawara et al., 2021).

CONCLUSIONS

This case highlights an uncommon cause of infective endocarditis. Clinicians should consider *C. simulans* as a possible pathogen based on the clinical context. Although *C. simulans* bacteremia is rare, it is fairly treatable with prompt initiation of antibiotics.

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CASE REPORT

We Didn't See That Coming: Right Eye Blindness Post-Cardiac Surgery

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retinal artery occlusion, post-operative
visual loss

ABSTRACT

Postoperative visual loss (POVL) is a very rare but devastating event that can occur post-cardiac surgery. The most common cause of POVL is vascular occlusion. We present a case of a 39-year-old male with severe mixed aortic valve disease, who had to undergo double valve replacement (mechanical) due to extensive calcification. On postoperative day 7, he complained of sudden painless loss of vision in the right eye. He was diagnosed with right eye central retinal artery occlusion and was discharged home with permanent right eye blindness. Neuro-ophthalmologic complications following non-ocular surgery occur rarely. POVL occurs more likely when there are calcified heart valvular lesions, higher perioperative blood loss, hypotension, low systolic blood pressure, anaemia, hypothermia, prolonged surgery time and age >50 years old. In our case report we have encountered a couple of risk factors for ischaemia which are heavily calcified aortic and mitral valves, lower mean arterial pressure and bypass time >5 hours. Postoperative blindness can be a very serious and devastating problem with no known or established treatment. Stroke is a well-known and established complication of cardiac surgery, but central retinal artery occlusion causing loss of vision is rarely covered and explained.

INTRODUCTION

Postoperative visual loss (POVL) is a very rare but devastating event that can occur post-surgery whether it be an ocular or non-ocular surgery (Lee et al., 2006). The incidence of postoperative visual loss ranges from 0.0012 – 1% in non-ocular and non-cardiac surgery (Berg et al., 2010; Nuttall et al., 2001; Roth et al., 1996; Shen et al., 2009; Williams et al., 1995) to 0.06 – 4.5% in cardiopulmonary bypass (CPB) series (Nenekidis et al., 2012; Nuttall et al., 2001). The most common causes of POVL are vascular occlusion (65.16%), ischaemic optic neuropathies (18.48%), and cortical blindness (16.21%) (Nuzzi & Lavia, 2015). Many factors have been discussed regarding its pathogenesis for the development of POVL such as type of surgery and anaesthesia, comorbidities of a patient and intraoperative conditions but to date, its exact pathogenesis remains elusive (Berg et al., 2010; Buono et al., 2005). Here we present a rare case of POVL post-cardiac surgery.

CASE REPORT

We present a case of a 39-year-old male, ex-smoker with a body mass index (BMI) of 25 kg/m², diagnosed with severe mixed aortic valve disease, who was initially planned for elective aortic valve replacement but unfortunately had to undergo double valve replacement (mechanical). The decision to the conversion of a single valve to a double valve replacement was made in the operating theatre due to extensive calcification. He was extubated on postoperative day 1 with modest inotropes but unfortunately, he was pacing dependent with HR ranging from 30 – 40 bpm in which he required a permanent pacemaker insertion. On postoperative day 7, the patient complained of sudden painless loss of vision in the right eye upon waking up in the morning with visual acuity of only perception to light in the right eye. No history of trauma preceded the event. He was immediately referred to the ophthalmology team, and an

ophthalmic assessment revealed right eye central retinal artery occlusion (CRAO) with fundus findings as in Figure 1. Unfortunately, the visual acuity did not improve with ocular massage and acetazolamide. He had no other forms of neurological deficit. Postoperatively his recovery was complicated by a complete heart block. He was discharged home on postoperative day 21 with permanent right eye loss of vision.

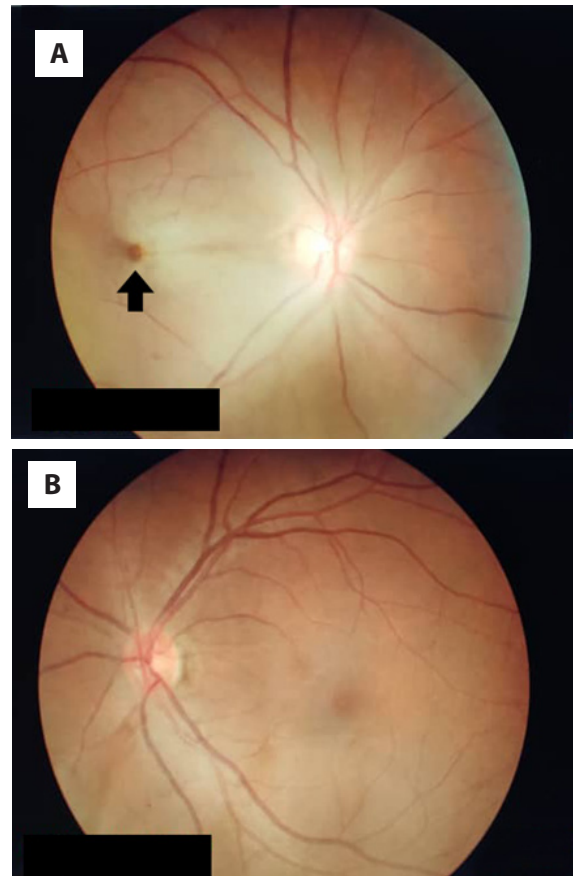


Figure 1 Fundoscopy examination of the patient's bilateral eyes, showing a cherry red spot on the macula of the right eye (A) suggestive of CRAO (black arrow). The right eye retina appears paler compared to the left eye (B), suggestive of retinal oedema of the right eye.

With a bypass time of 351 minutes and a cross-clamp time of 319 minutes, he underwent double valve replacement (mechanical) successfully despite initially being only planned for a single valve replacement (aortic). Intra-operatively his surgery was complicated

with calcification extending from the non-coronary aortic leaflet to the aorto-mitral valve curtain, all the way to the anterior mitral valve leaflet. Hence aortic and mitral valves had to be replaced (mechanical). This decision was made intra-operatively by the cardiothoracic surgeon. During cardiopulmonary bypass (CPB) an aggravated clotting time (ACT) of 488 – 629 seconds was maintained with mean arterial pressure (MAP) kept ranging from 50 – 75 mm Hg all the time with a mean MAP of 64.5 mm Hg. The patient also had his cerebral oximetry monitored as a routine monitoring which recorded a baseline reading of 66% (left) and 70% (right) with the lowest recorded reading of 50% (left) and 53% (right) for approximately 8 minutes. The estimated blood loss was 1 litre. Haematocrit (HCT) was maintained between 28 – 40% preoperatively, intraoperatively and postoperatively. The temperature was kept at 32°C during the bypass and was rewarmed back to 36°C upon coming off the bypass. The patient received 6 units of cryoprecipitate, 4 units of fresh frozen plasma, and 4 units of platelets. The total duration of operation on the bypass was 5 hours 51 minutes. He was able to wean off bypass with modest inotropic support and was transferred to the cardiothoracic intensive care unit. He was operated in a supine position throughout.

DISCUSSION

Potential neuro-ophthalmologic complications following non-ocular surgery include anterior ischaemic optic neuropathy (AION), posterior ischaemic optic neuropathy (PION), CRAO, pituitary apoplexy, and cortical blindness (Berg et al., 2010). Reports have attempted to connect anaemia, hypotension, blood loss, and other haemodynamic variables to the pathophysiology of AION and PION (Buono et al., 2005; Dilger et al., 1998; Lee et al., 2006; Myers et al., 1997; Nuzzi & Lavia, 2015). These variables occur in nearly all cases of cardiac and spine surgery and yet, AION and PION occur rarely (Shen et al., 2009). POVL occurs more

likely when there is higher perioperative blood loss (>1L) (Warner, 2006), hypotension (MAP <70, systolic blood pressure <90 mm Hg) (Berg et al., 2010), anaemia, hypothermia, prolonged surgery time (>5 hours) and patient's age >50 years old (Shen et al., 2009). Perioperative anaemia has also been discussed as a cause (Hb <10 g/dL or HCT <30%) (Berg et al., 2010) with or without hypotension may precipitate the release of endogenous vasoconstrictors by the activation of the sympathetic nervous system, leading to the optic nerve and choroid ischaemia. In our case report the predisposing factors for higher risk of ischaemia are lower MAP and bypass time >5 hours.

A retrospective comparative case series in Seoul identified calcific emboli as a cause for CRAO, comprising 8% of the total emboli identified (Cho et al., 2016). There are also case reports that have identified calcified mitral and aortic valve stenosis as the primary cause of CRAO (Rumelt et al., 1999; Brockmeier et al., 1981). In the past, calcific microemboli have been shown rather conclusively to be the cause of focal retinal ischemia and infarction (Brockmeier et al., 1981; Penner & Font, 1969). In our case report, the most likely cause for postoperative blindness is a calcific embolus from either the aortic or mitral valves. This is supported by the intraoperative finding of heavily calcified valve leaflets involving both the aortic and mitral valves.

During CPB, the HCT level should be optimized and never below <25%, it should be kept as close to 35% as this would ensure enough blood flow and adequate tissue oxygenation (Nenekidis et al., 2012). Hypothermia can cause an increase in the viscosity of blood and may lead to watershed infarct of the optic nerve and this in turn also can reduce the cerebral blood flow by 6 – 7% for every degree centigrade drop in body temperature (Reuler et al., 1978). For our case report, the HCT was maintained between 28 – 40% and the temperature was kept between 32 – 36°C, and thus are not considered factors contributing to the development of CRAO.

Development of CRAO can occur in response to elevation of intraocular pressure (IOP). Elevated IOP causes reduced blood flow to the eye and in turn leads to optic nerve ischaemia (Williams et al., 1995). Perfusion pressure to the eye is determined by MAP-IOP and thus any sudden and drastic changes to the perfusion to the eye may disturb/alter the autoregulation of blood flow to the eye (Hayreh, 1997).

There may be an individual predisposition of certain patients or multiple factors that lead to a “perfect storm” of events resulting in AION or PION such as advanced age, lower minimum post-operative haemoglobin, longer bypass time, angiogram performed less than 48 hr, red blood cell (RBC) transfusion and non-RBC component transfusion (Berg et al., 2010; Nuttall et al., 2001). In this case, the combined factor of lower MAP, prolonged CPB and heavily calcified valves may have compounded to be the “perfect storm” leading to the event of CRAO.

While there are currently no established treatments available for AION, PION, CRAO, or cortical blindness, patients with pituitary apoplexy may benefit from urgent transsphenoidal decompression surgery and corticosteroid administration, and visual acuity may improve with corticosteroid administration (Berg et al., 2010).

CONCLUSION

Postoperative blindness can be a very serious and devastating problem. Stroke is a well-known and established complication of cardiac surgery and is being counselled preoperatively during consent taking. This explanation usually includes stroke involving limbs as well as poor Glasgow coma scale recovery but rarely includes total permanent blindness. Even though this incident is extremely rare but when it happens, it's very deliberating and devastating to the

patient's mental as well as physical recovery post-operatively. Not only that but from the point of medico-legal aspect also there be an implication. A more detailed consent pamphlet for patients to read in detail during their ward admission and stay for better understanding prior to actual operative consent-taking day may be beneficial in helping patients better understand the risks of POVL.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest to publish this case report or sponsorship to declare.

CONSENT

Written consent was obtained from the patient prior to the commencement of this case study. A copy of the written consent is available for review by the Chief Editor.

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CASE REPORT

Ortner's Syndrome: Aortic Aneurysm as a Cause of Unilateral Vocal Cord Paralysis

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ABSTRACT

Hoarseness is a symptom of Ortner's syndrome, a rare disorder caused by mechanical left recurrent laryngeal nerve compression by enlarged cardiovascular structures. This is a case of Ortner's syndrome in an elderly 74-year-old male with an aortic arch aneurysm presenting with hoarseness. We believe the aneurysm causes the left recurrent laryngeal nerve compression, resulting in unilateral vocal cord paralysis. We emphasise the significance of Ortner's syndrome as hoarseness of voice, a significant differential diagnosis in an elderly patient despite the absence of cardiac symptoms.

INTRODUCTION

Both benign and malignant aetiologies can result in recurrent laryngeal nerve paralysis. Vocal cord paralysis is easily detected by laryngoscopy; however, determining the cause can be difficult. Neoplasia is the leading cause of vocal cord paralysis, followed by iatrogenic surgical intervention and aortic and intracranial diseases (Madhuraj et al., 2021; Mulpuru et al., 2008).

Ortner's syndrome is not a common cause of left recurrent laryngeal nerve (RLN) palsy due to inflammatory or mechanical strain caused by enlarged cardiovascular structures. The three initial cases recorded by

Ortner in 1897 involved individuals with mitral valve stenosis and dilated left atrium causing left RLN compression cases were attributed to aortic aneurysm, dilated left ventricle and dilated left pulmonary artery (Ortner, 1897).

A thoracic aortic aneurysm (TAA) is a rare cause of vocal cord paralysis, occurring in less than 5% of individuals with this vascular disorder, and involvement of the ascending aorta and aortic arch is equally infrequent (Madhuraj et al., 2021). In addition, the left RLN is more susceptible to compression than its right counterpart due to its long, winding route and proximity to major mediastinal vessels, the oesophagus, the trachea, and the lung apex (Leoce et al., 2021; Subramaniam et al., 2011).

There is a strong correlation between the rising incidence of TAA and the elderly population (Isselbacher et al., 2022). Asymptomatic patients may benefit from conservative therapy to reduce aortic stress and slow the progression of aortic dilation. Primary interventions for symptomatic patients include stent graft repair and open surgery with aorta replacement (Ismazizi et al., 2016; Isselbacher et al., 2022). TAA should be considered when other common causes of hoarseness of the voice have been ruled out.

CASE PRESENTATION

This is a case of a 74-year-old male who presented for investigation of hoarseness for the past month. He denies upper respiratory tract infection symptoms, hemoptysis, dysphagia, chest pain, or shortness of breath. There are no associated constitutional symptoms. He is a chronic smoker with underlying ischemic heart disease, chronic kidney disease and hypertension. He denies any allergies, history of trauma or surgery to the neck or upper thorax, gastroesophageal reflux, or underlying malignancy. On physical examination, he was malnourished and thin-structured. The oral cavity was normal. A laryngoscope examination showed left vocal cord paralysis

with no evidence of laryngeal inflammation, infection, ulceration, or neoplasm. There is no cervical lymphadenopathy or other neurological deficit. His blood pressure, pulses, respiratory rate, and oxygen saturation were normal. His lung and heart sounds were unremarkable.

Patient first proceeded with a contrast-enhanced computed tomography (CECT) scan of the neck, which showed an anteromedial rotation of the arytenoid cartilage and air distention of the left laryngeal ventricle demonstrating 'sail sign' compatible with left vocal cord paralysis (Figure 1). No enhancing lesion was seen at the glottic region to suggest laryngeal malignancy or cervical lymphadenopathy. An aortic arch aneurysm was detected. However, the image was suboptimal as its extension and relations were not included in a neck scan's limited field of view. Subsequently, a computed tomography angiography (CTA) of the thorax was performed, which shows a wide neck 3.2 x 3.6 x 1.5cm saccular aneurysm arising from the aortic arch with peripheral mural thrombus, protruding into the aortopulmonary window and mildly compressing the left proximal main pulmonary artery (Figure 2). There are no direct or indirect signs of impending aortic aneurysmal rupture. There was no other pathology along the course of left RLN. There was no mediastinal lymphadenopathy or features of lung malignancy.

This led us to conclude that the hoarseness the patient was experiencing was caused by Ortner's syndrome, which is caused by saccular aneurysmal dilatation of the aortic arch compressing on the left recurrent laryngeal nerve. As a result, the patient was recommended for endovascular aortic repair. However, he declined surgical intervention because of financial constraints and the considerable risk associated with the procedure.



Figure 1 Axial image of CECT Neck at the glottis level shows paralysis of the left vocal cord evident by unilateral dilatation of the laryngeal ventricle demonstrating a 'sail sign' (red arrow)

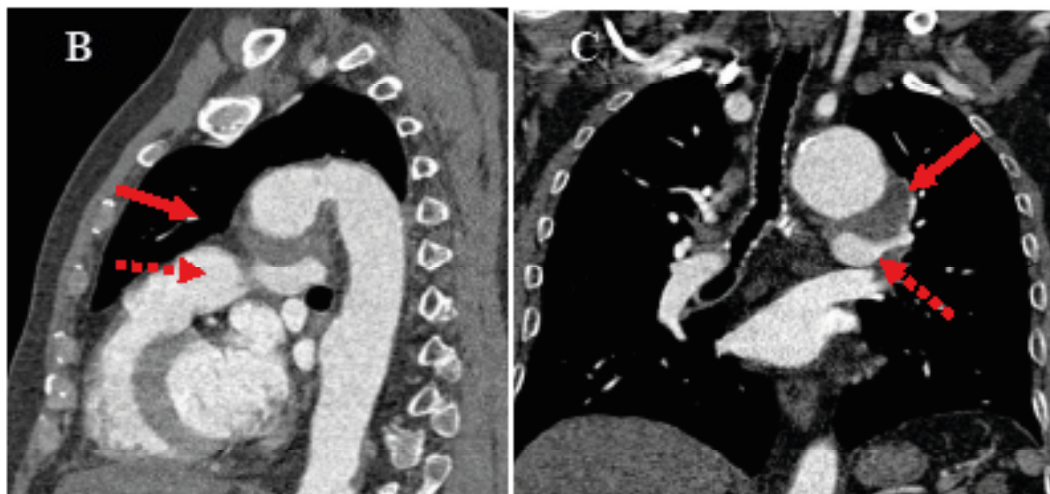
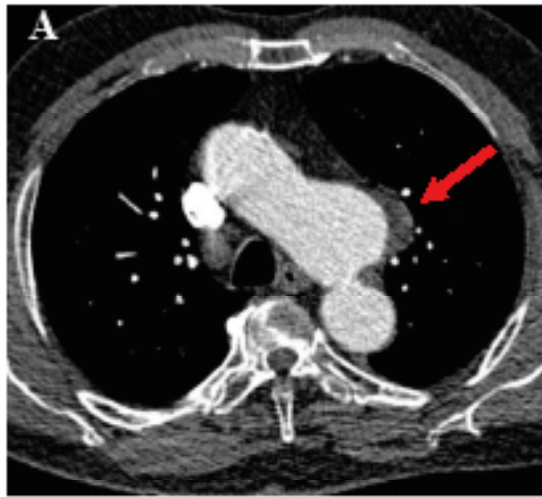


Figure 2 (A) Axial, (B) sagittal, and (C) coronal reformatted images of CTA thorax showing a wide neck aortic arch saccular aneurysm with peripheral mural thrombus (solid red arrow) and its dome pointing inferiorly protruding to the aortopulmonary window along the course of the left recurrent laryngeal nerve and compressing onto the left proximal main pulmonary artery (red dotted arrow).

DISCUSSION

An aortic arch aneurysm is a known risk factor for Ortner's syndrome, and occurrences of this illness as a subsequent complication have been reported in the medical literature (Madhuraj et al., 2021; Mulpuru et al., 2008). In addition to thoracic aortic aneurysm causing hoarseness due to vocal cord paralysis, patients presenting symptoms are dysphagia for oesophageal compression, difficulty breathing due to tracheal compression, and either superior vena cava or innominate vein compression resulting in superior vena cava syndrome. In addition, chest discomfort, fatigue, and jaw, neck, or back pain are nonspecific symptoms related to this condition (Isselbacher et al., 2022).

The immobility of the vocal cords characterises Ortner's syndrome. It is linked to damage or injury to the left RLN or vagus nerve along its course, extending from the jugular foramen until the aortopulmonary window (Agarwal et al., 2020; Zhang et al., 2022). Due to its long meandering route and proximity to the significant mediastinal vessels, oesophagus, trachea, and lung apex, the left RLN is more susceptible to compression than its right-side counterpart. Therefore, understanding the pathophysiology of Ortner's syndrome mandates a review of the anatomy of the left RLN. The vagus nerve's branch is left RLN that begins in the superior mediastinum and descends inferiorly, where it courses anterolateral to the aortic arch and aortopulmonary artery through the aortopulmonary window, distal to the ligamentum arteriosum, before it ascends in the tracheoesophageal groove (Wang et al., 2016; Zangirolami et al., 2015).

The vocal cord palsy treatment relies on the condition's underlying causes, symptoms, severity, and duration. Options for treatment include voice therapy, surgical procedures such as bulk injections, structural implants, vocal cord repositioning, and nerve replacement. A tracheotomy may be necessary if both vocal

cords are paralysed. Voice therapy consists of exercises and activities to strengthen the vocal cords, improve breath control, and safeguard the airway during swallowing. Surgical interventions aim to enhance the ability to speak and swallow by repositioning the paralysed vocal cord, repositioning the vocal cord, or replacing the damaged nerve. Emerging electrical stimulation treatments may also be considered (Williamson & Shermetaro, 2022).

Most patients with TAA are asymptomatic (Isselbacher et al., 2022). Therefore, hoarseness as a symptom in the absence of any cardiac symptoms in the case of TAA is an unusual presentation. In this case, our patient presented with hoarseness due to a saccular aneurysm developing from the aortic arch compressing the left RLN. Imaging revealed that the aneurysm was near the point where the left RLN loops around the aortic arch, suggesting either stretching of the nerve or compression of the nerve at the aortopulmonary window likely caused the nerve palsy.

Aneurysms of the aortic root and ascending thoracic aorta are often heritable and occur at younger ages. In contrast, aneurysms of the descending thoracic aorta are typically degenerative and occur at older ages (Isselbacher et al., 2022). Therefore, CT angiography is ideal for depicting TAA, measuring its size and neck diameter, delineating its morphology, evaluating extension to the adjacent great vessels, and its effect on the neighbouring structures. However, a chest radiograph should be performed as a baseline screening to avoid suboptimal scanning resulting in scan repetition and exposing the patient to double radiation dose, as happened in our patient. Furthermore, should a chest radiograph be performed prior, the aortic aneurysm could be detected early, and a CT neck and thorax can be performed together.

Surgical or endovascular intervention in TAA is intended to lower the risk of unfavourable aortic events, such as aortic rupture, dissection, and aortic-related death. The AHA guidelines for thoracic aortic aneurysm dictate that an aneurysm more than or equal to 5.5 cm at the time of diagnosis, an aneurysm with an expansion rate of more than 0.5 cm per year and the onset of symptoms (which includes hoarseness) are the indications for surgical intervention (Isselbacher et al., 2022).

When the TAA diameter is more than 6 cm, there is an increased prevalence of aortic-related events such as dissection or rupture. This justifies intervention when the diameter exceeds or exceeds 5.5 cm. In addition, previously identified high-risk features of TAA rupture support the decision to intervene at a smaller diameter threshold when specific parameters are met. These parameters include rapid aortic growth (≥ 0.5 cm/y), symptomatic or infected aneurysm, saccular aneurysm morphology, underlying connective tissue disorder or heritable thoracic aortic diseases, and female gender (Isselbacher et al., 2022).

Therefore, determining the appropriate timing of intervention necessitates a detailed anatomic evaluation, followed by a consideration of the relative risks of intervention versus unfavourable aortic events. Early detection of Ortner's syndrome may aid in initiating immediate treatment to prevent permanent left RLN damage and restore vocal cord function. Voice improvement is expected within a few weeks of surgery, and hoarseness is reported to resolve entirely within four months (Zhang et al., 2022). In addition, endovascular stent grafting of the underlying TAA may result in progressive shrinkage of the thrombosed aneurysm, reducing nerve compression and subsequent resolution of the left RLN palsy.

Our patient's age and multiple comorbidities precluded a high-risk open thoracic repair. Hence, a thoracic endovascular aneurysm repair (TEVAR) is the best option. However, he refused any surgical intervention due to financial constraints and the high risk associated with the procedure and opted for surveillance imaging follow-up.

CONCLUSION

Ortner's syndrome is an uncommon condition that occurs as a result of a variety of cardiopulmonary disorders. Nerve compression between the pulmonary artery and the aorta is a constant factor. This report highlights the significance of conducting a cardiovascular workup in unilateral vocal cord palsy cases when no other obvious aetiology can be identified.

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 this case. A copy of the written consent is available for review by Chief Editor.

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CONCEPT PAPER

KhitanAid Model: An Innovative and Realistic Homemade Circumcision Model

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ABSTRACT

Circumcision is a procedure of removal of the penile foreskin. It is among the highest procedures performed worldwide, primarily for ritual and religious purposes among Muslims and Jews. It is also performed for hygiene and the prevention of malignancy. All practitioners must master the procedure, especially in identifying the normal anatomy and avoiding possible morbidities. Since the available simulated circumcision model is costly and not readily available, we invented a step-by-step technique to create a model for circumcision aiming to master this standard procedure, especially the dorsal slit.

INTRODUCTION

Circumcision is a procedure of removal of the excess skin at the tip of the penis (preputial or foreskin skin). It is called khitan or khatna in Arabic. According to the global prevalence from the World Health Organization, almost 70% of cases of circumcision occurred due to religious reasons, especially among Muslims and Jews (World Health Organization & UNAIDS, 2008). It is among the highest procedures performed worldwide, with a prevalence of 30% (World Health Organization & UNAIDS, 2008). Besides ritual reasons, circumcision is performed for hygiene as it can reduce cases of urinary tract infections and human papillomavirus (Larke et al., 2011; Singh-Grewal et al., 2005). Among

other reasons why circumcision is performed is to protect against penile cancer. The incidence of penile cancer is 0.84 among the 100,000 population. However, the rate is almost 0% among Jews, Asian and African (Montes Cardona & García-Perdomo, 2017). The risk of developing penile and cervical cancer is 5-10 times higher among those harbouring the human papillomavirus (Morris et al., 2011).

There are various methods of performing circumcision, but two widely used techniques are dorsal slit and guillotine circumcision. All practitioners must master performing the procedures, especially identifying the normal anatomy and avoiding possible morbidities. Currently, there is one available simulated circumcision model for training in the market by Limbs & Things (n.d.). Still, it is without cost.

Traditionally, most healthcare providers performed it during a circumcision event on an actual patient. However, healthcare providers can practice this procedure with a simulator before performing it on a patient. This will avoid any intraoperative complications. The need for this training is crucial, as published by previous innovators and researchers (Campain et al., 2017; Abdulmajed et al., 2012).

To pursue the objectives, we have developed a step-by-step technique for creating a circumcision model which is low-cost and reproducible as well as has a realistic-feeling and tactile sensation during circumcision. Besides, by having this model, we aim to assist the practitioners in mastering the standard technique of circumcision, namely the dorsal slit.

Steps of Model Construction

Our model was slightly modified from the Brill and Wallace model, especially on the model base (Brill & Wallace, 2007). We introduced our model as the KhitanAid model, in which we adapted the Arabic word for circumcision to our model's name. This model is designed to **Kickstart** as a pandemic-proof **H**ands-on training and performed **I**nnovatively to have a **T**actile sensation. It is **A**ffordable and feels **N**atural as a real organ. Hence, the abbreviation KHITAN is derived.

Equipment

Among the essential supplies and equipment used include non-latex gloves size 6 to 7, carrots, packages of rubber bands of any colour (clear colour will be the best), a blade or knife and a scissor.

Preparation of the Penile Body Model

Firstly, we need to find a suitable size and diameter carrot. The carrot must be fresh and not too ripe. Next, we need one side of the carrot to form a round end. Meanwhile, the other end must be cut flat to create a base. Finally, the rounded end must be carved to resemble the glans penis (Figure 1A).

Preparation of the Glans Penis

The gloves will be prepared to form the surfaces of the glans and the foreskin. Since the whole length of glove fingers will be utilised, getting the ring, middle or index finger is the option. The glove finger will be stretched to cover the carrot's round end/glans penis (Figure 1B). The rubber band will be applied and tightened at the groove of the glans penis (Figure 1C). The tip of the glove finger will resemble the skin surface of the glans penis.

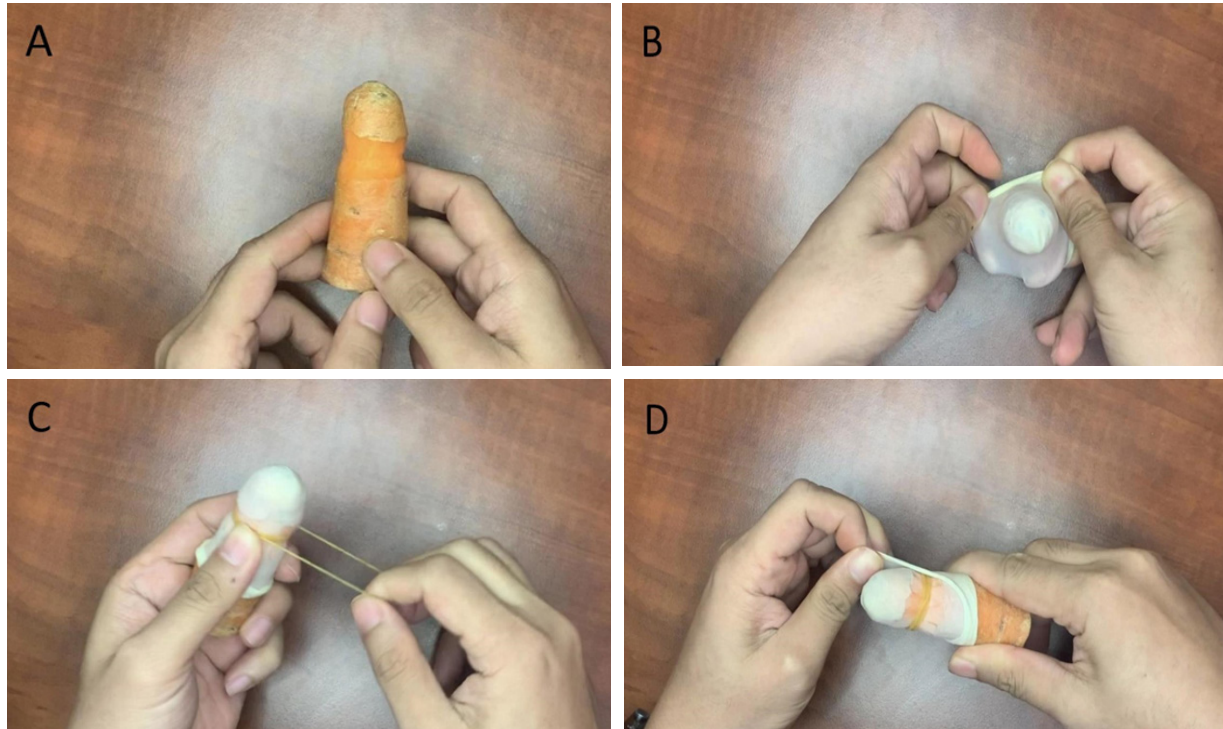


Figure 1 (A) The round end is carved to form a glans penis, (B) The glove finger will be stretched to cover the carrot's round end/glans penis, (C) A rubber band is tightened at the groove of the glans penis, (D) The remaining glove finger will be pulled distally

Preparation of the Foreskin

The body of the glove finger will later form the foreskin of the glans. The remaining glove finger will be pulled distally while maintaining the tight rubber band at the groove. The remaining glove finger will cover the glans penis, and it acts as the mucosal surface of the foreskin (Figure 2A). The remaining glove finger will be folded (Figure 2B). The cut end of the glove finger will be pulled proximally. It will be pulled until the base of the glans penis. The cut end will be placed on the initial groove of the glans penis (Figure 2C). Another rubber band will be tightened on the remaining residual glove (Figure 2D). This is to ensure the foreskin is tight and not loose during circumcision.

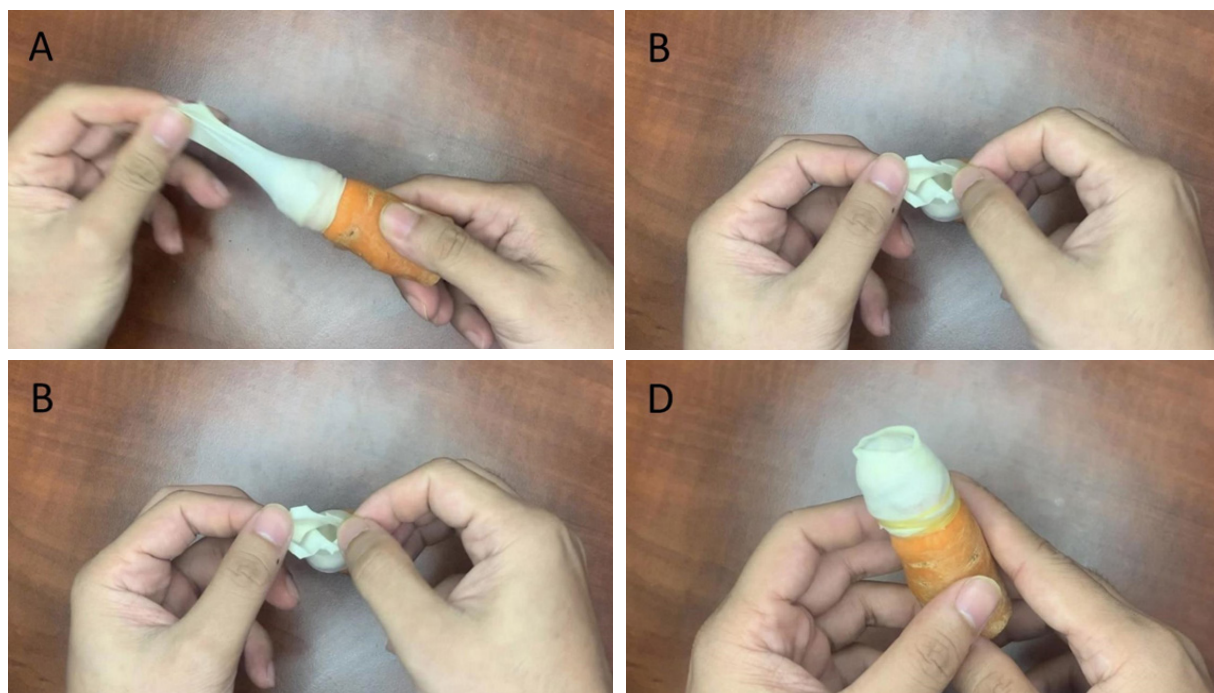


Figure 2 (A) The remaining glove finger will cover the glans penis, (B) The remaining glove finger will be folded, (C) The cut-end will be placed on the initial groove of the glans penis, (D) Another rubber band will be tightened on the rest of the residual glove

FINAL RESULT

The model shows a similar appearance to the uncircumcised male genitalia. The foreskin can be retracted, exposing the glans. The operator can practice this to mimic cleaning the glans from smegma.

Limitation

Firstly, our penile model is made of a carrot. Even though it has the benefit of carving to create a glans, the consistency of the penile body is hard, not mimicking the real penile organ. Secondly, our current model does not have a base, including the scrotum. This, unfortunately, cannot provide a model for operators to learn how to give a penile ring block. Nevertheless, modifying the model in the future can improve all the limitations.

CONCLUSION

The step-by-step technique of creating the KhitanAid model is simplistic. Being economical, the model is easily reproducible and can assist practitioners in mastering the standard technique of circumcision.

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Video of this circumcision model has been registered as copyright with a registration number of LY2022S02128, dated 14/6/2022.

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