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Cadaveric Simulations in Anaesthesia: Unveiling the Practical Significance for Ultrasound-Guided Regional Blocks.

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ABSTRACT

Ultrasound-guided brachial plexus block for upper limb surgeries has been practiced worldwide by anesthesiologists for ensuring safe Regional Anesthesia practice. However, the Hand-eye coordination is very important for making the procedure's success by reducing the number of attempts or block failures while performing the blocks. Therefore, the cadaveric-based teaching provides three-dimensional relations and allows both postgraduates and senior residents to experience tissue handling, and importantly, allows for easy repetition of the technique. Thirty-five participants, including postgraduates, senior residents, junior and senior faculty members, engaged in this one-day workshop, which comprised two sessions (Session 1 - Anatomical aspects of the brachial plexus and Session 2 - Live scanning on volunteers). The Feedback (Incorporating closed - ended questions (10) and open feedback & Closed-ended questions utilized a Likert scale rating of 1-10) was distributed to the participants and the Data's were analyzed by Descriptive statistics. The results indicate a high level of recommendation for future cadaveric workshops, with 10 delegates giving a perfect rating of 10, 19 recommending it with a rating of 9, 6 with a rating of 8, and 1 delegate giving a rating of 7.54. Regarding cadaveric anatomy, 2% of delegates could clearly identify structures, while 25.7% found identification excellent, 14.2% very good, and 5.7% good. Cadaver labs are valuable tool for improving procedural knowledge and understanding difficult anatomic relationships and fostering confidence among medical professionals.

Keywords: Simulator, Medical Education, Cadaveric learning, Procedural skill, Knowledge.

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INTRODUCTION

Ultrasound-guided brachial plexus block for upper limb surgeries has been practiced ever since it was introduced by Le Grange et al in the early 1970s [1]. Since then, the use of ultrasound in Regional Anaesthesia (RA) has evolved and gained popularity among anesthesiologists worldwide, ensuring safe RA practice. Even the American Society of Regional Anaesthesia and Pain Medicine (ASRA), the European Society of Regional Anaesthesia (ESRA), and pain therapy insist that institutions encourage the use of Ultrasound-Guided Regional Anaesthesia (UGRA) to provide quality care to patients [2].

Hand-eye coordination plays a crucial role for anesthesiologists in making this procedure successful by reducing the number of attempts or block failures while performing the blocks. Additionally, proper needle placement close to the targeted nerves is paramount for the success of these blocks. Various parts of the brachial plexus are blocked, both above and below the clavicle for upper limb surgeries with minimal sedation, thereby avoiding the need for general anesthesia. Ultrasound-guided brachial plexus block decreases the risk of complications, such as vascular puncture and pneumothorax, which may occur under blind techniques. Importantly, it also reduces the local anesthetic dosage compared to nerve stimulator techniques [3].

Mastering this technique has become a necessary skill. The teaching of this skill benefits both postgraduates during their course period and senior residents, enabling them to start practicing the skill on patients for the first time. According to the newly introduced Competency-Based Medical Education (CBME) for postgraduates by the National Medical Commission (NMC) of India, performing UGRA is a competency they must attain by the end of their course. Due to the necessity of this procedural skill in UGRA, medical educators have adopted numerous teaching methodologies, including virtual learning, simulators, plastinated specimens, phantoms, animal specimens, video-based learning, and manikins [4-13].

However, these methods lack three-dimensional relationships of the structures and the feel of real tissue handling and needle insertions. This gap is addressed by the introduction of cadaveric-based teaching, where most three-dimensional relations are maintained. This allows both postgraduates and senior residents to experience tissue handling, and importantly, allows for easy repetition of the technique. Despite disadvantages such as formalin irritation and a lack of real patient experience, practicing the procedure directly on live individuals is often not accepted, especially following the COVID-19 pandemic. While cadaveric learning in medical education is not a new method, its need and importance have increased due to changes in the curriculum of postgraduate training and the widespread usage of ultrasound-guided regional blocks. Studies have reported that cadaveric learning enhances procedural skills in surgeons and anesthesiologists [13-15]. But such studies are limited among Indian anesthesiologists. Therefore, this study aims to understand the perceptions of Indian anesthetists regarding cadaveric-based learning to support ultrasound-guided regional anesthesia.

MATERIALS AND METHODS

Following the approval from the Institutional Ethics Committee, the Department of Anaesthesia, in collaboration with the Department of Anatomy at Pondicherry Institute of Medical Sciences (PIMS), Puducherry, conducted a cadaveric workshop in 2022. The primary focus of this workshop was to provide training in Ultrasound-Guided Regional Anesthesia, specifically targeting the Brachial Plexus block. Thirty-five participants, including postgraduates, senior residents, and junior and senior faculty members, engaged in this one-day workshop, which comprised two sessions.

The first session took place in the dissection hall and featured four stations. Station "1" showcased a cadaveric specimen on the supraclavicular part of the brachial plexus, while Station "2" featured a cadaveric specimen on the infraclavicular part of the brachial plexus with a focus on its relation to the axillary artery. Station "3" involved a cadaveric specimen highlighting the suprascapular nerve and axillary nerve courses, and Station "4" presented a cadaveric specimen explaining the complications associated with brachial plexus injury and block [Figure1,2]. Each station was moderated by anatomists (covering the anatomical aspects of the brachial plexus) and anaesthetists (providing insights on approaching the nerve block and interpreting it with ultrasound).



Figure 1 (a & b): Shows the cadaveric session, (c & d): Shows the ultrasound session.



Figure 2 (e & f): Shows the cadaveric session.

The second session involved live scanning on volunteers. Ultrasound scanning of the brachial plexus was performed, and experienced anaesthesiologists explained various parts of the brachial plexus, from its roots to its branches. Subsequently, delegates were given hands-on experience in ultrasound scanning of the volunteers, as illustrated in [Figure 1,2].

Feedback was collected for the cadaveric and hands-on sessions, incorporating closed-ended questions (10 questions) and open feedback. Closed-ended questions utilized a Likert scale rating of 1 - 10.

Statistical Analysis

Quantitative data were analysed by Descriptive statistics and the qualitative data's were measured in percentage.

RESULTS

In this study, closed-ended feedback was gathered from all 35 delegates. The results indicate a high level of recommendation for future cadaveric workshops, with 10 delegates giving a perfect rating of 10, 19 recommending it with a rating of 9, 6 with a rating of 8, and 1 delegate giving a rating of 7.54. Regarding cadaveric anatomy, 2% of delegates could clearly identify structures, while 25.7% found identification excellent, 14.2% very good, and 5.7% good [Figure 3]. Almost all delegates demonstrated an understanding of structure relationships and the ability to orient cadaveric anatomy. In terms of

understanding relevant clinical anatomy, 12 delegates rated 10, 9 delegates rated 9, 11 rated 8, 2 delegates rated 7, and only one delegate rated 6.

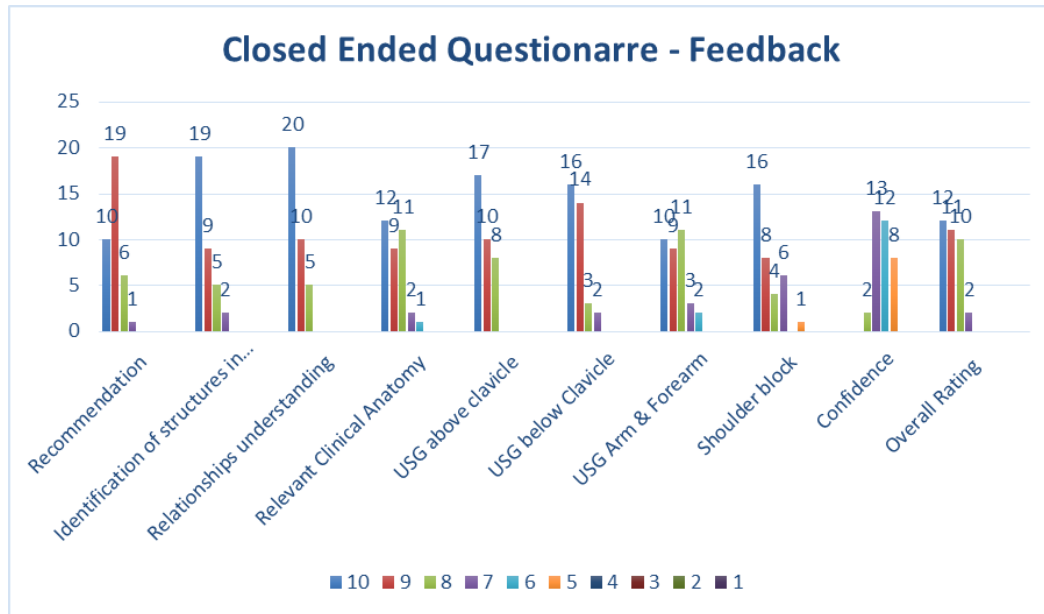


Figure 3: Shows graph representing the feedback for cadaveric session and USG session by delegates in the questionnaire

Delegates' understanding of ultrasonography above the clavicle was rated very good by 8, excellent by 10, and outstanding by 17. Below the clavicle, 2 found it good, 3 very good, 14 excellent and 16 outstanding. For the arm and forearm, 2 found it above average, 3 good, 11 very good, 9 excellent and 10 outstanding. Shoulder block procedure understanding was rated excellent by 16, very good by 8, good by 4, and above average by 1. Delegates overwhelmingly found the workshop useful, with confidence levels rated good by 8, very good by 12, excellent by 13, and outstanding by 2 [Table].

Closed ended questions – Feedback from delegates	
1.	Will you recommend Anatomy and Anaesthesia cadaveric workshop to your colleagues?
2.	Can you able to identify the structures in the cadaver?
3.	Can you able to orient and understand the three-dimensional relationship of structures in cadaver?
4.	How much did you understand the relevant clinical Anatomy?
5.	How much do you understand the ultrasonography of structures above the clavicle?
6.	How much do you understand the ultrasonography of the structures below the clavicle?
7.	How much do you understand the ultrasonography of the structures in the arm & forearm?
8.	How much do you understand the ultrasound guided approach for shoulder block?
9.	How much do you feel confident in performing this procedural skill after this workshop?
10.	Overall rating of this workshop?

Table: Closed ended questions – Feedback from delegates

Open feedbacks revealed as shown in the [Figure 4] 30% found it a good learning experience, 23% found it useful and informative, 21% felt it cleared doubts about the procedure, 11% praised the workshop's coordination and organization, 9% suggested providing reading materials, and 6% noted time restrictions.

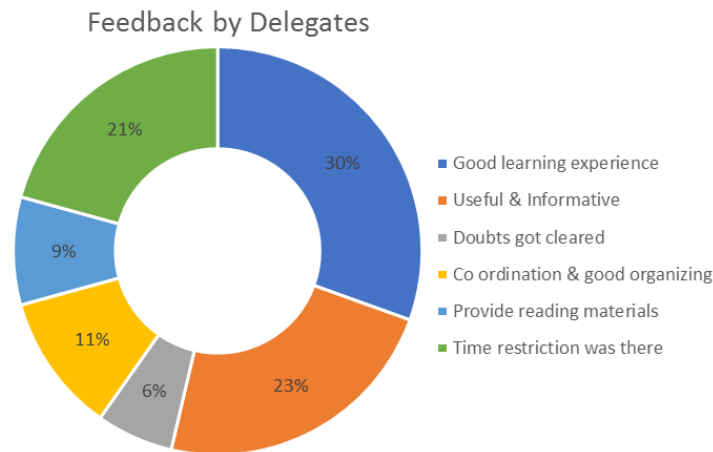


Figure 4: Shows graph representing the open feedback by delegates

DISCUSSION

This study is primarily focused on the assessing the perspective of the Anaesthetists about the cadaveric learning to improve the procedural skill. Almost all Anaesthetists who participated in this workshop preferred similar cadaveric workshop in future which clearly showed the effectiveness of cadaveric learning. All the delegates were able to orient them to the cadaveric specimens and they were also able to correlate the relationship with live scanning volunteers. Delegates reported their doubts were cleared, indicating refreshing their knowledge of Anatomy by cadaveric learning and feel confident about their procedural skill. Overall, feedback for the cadaveric workshop for the UGRA was found to be positive, useful and informative for anaesthetists. Cadaveric workshops were conducted among different surgical specialities like gynaecology, urology, orthopaedics and general surgeons which emphasise the importance of importance of cadaveric learning and also found to improve their surgical skills [16-27].

In USRA, various tools were being used for teaching like phantoms, plastinated specimens, video-based learning, manikins but these lack originality and lack of understanding anatomical relationships [5-7, 9, 10, 13]. Henceforth, cadaveric learning stands out to be the best in understanding the normal anatomical relations. Similar studies which were conducted in various parts of the globe also reported that cadaveric laboratory is the preferred method of teaching regional anaesthesia [25, 26, 28, 29].

Though some disadvantages have been noted in cadaveric learning namely experiencing rigidity in formalin embalmed cadaver which makes the needle entry difficult. To overcome this, soft embalmed cadavers can be considered and also found they can provide a more realistic feeling of tissue and easy needling [30-33]. Fresh frozen cadavers are also used for surgical training and were considered to be a best tool for training in surgical specialities [34,35]. Hocking et al recorded that the unembalmed cadavers is also used in the training of UGRA and found to be an effective learning method [36]. Hence cadaver and cadaveric lab acts a perfect valuable tool for the core training of the procedural skills in post graduates and junior faculties. It also provides a space for practicing the procedural skill mainly to get well versed in USG and also in UGRA [37]. Cadaver act as a good simulator and undergoing such simulator-based training will help to boost the confidence level of the individual in performing USG regional blocks [23, 24, 28, 29, 38-40]. Though learning in the cadaver might not give equivalent learning experience in live individuals but its benefits overweigh disadvantages, making it very useful method of learning. Cadaver as such is expensive tool for learning and training purpose. Lack of time for hands on session and formalin irritants are main limiting factors in this workshop.

This study suggests that cadaveric courses can be developed in future for procedural skills like different modules for different specialities. At institutional levels, cadaveric teaching can be followed for procedural teaching so that clinicians will acquire a good procedural skill especially in changing the post graduate’s curriculum, can contribute to the development of competent clinicians.



CONCLUSION

To conclude, the cadaver, serving as both a simulator and a valuable tool and proves instrumental in enhancing procedural skills and fostering confidence among medical professionals. The effectiveness of cadaveric training underscores the potential for the development of specialized cadaveric courses. Such courses hold the promise of not only facilitating doctors in achieving the required competence but also contributing significantly to their continuous learning and mastery of procedural skills.

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