

## Teaching ultrasound guided femoral nerve block in the emergency department

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### Abstract

**Aims:** Patients with hip fracture are often not given adequate analgesia in the Emergency Department. Ultrasound guided femoral nerve block is an effective option but it is not commonly used due to limited experience, inadequate training and infrequent clinical exposure. We aimed to develop a workshop to bridge the current gap in the training of ultrasound guided femoral nerve block. **Material and methods:** A 3-hour workshop was developed in accordance to guidelines for education and training in ultrasound-guided regional anesthesia. The components included an online learning module for pre-reading, as well as team-based learning and simulation practice during the session. Evaluation of the participants was performed and feedback of the course was collected. **Results:** The workshop was conducted successfully for a total of 30 participants. All participants achieved the minimum standard required. Across all domains, the mean scores for the workshop were more than 4.7 out of 5 on the Likert scale. Participants were satisfied with the workshop and would recommend it to a colleague. **Conclusion:** This workshop met its educational objectives and various principles of medical education were used effectively in the delivery of the content. Further research is necessary to demonstrate the impact of this educational effort on clinical practice and patient outcomes.

**Keywords:** analgesia; education; hip fracture; nerve block

### Introduction

Hip fracture is common problem affecting the geriatric population. Patients are often not given adequate analgesia or have developed side effects from the administration of opioids used for pain control in the Emergency Department. Femoral nerve block is recognized as a safe and effective option for pain control [1-8]. The use

of ultrasound can improve the efficacy and safety of the femoral nerve block [9-13]. Despite this, the utilization of the femoral nerve block in the Emergency Department is low at 7% in Australia and 10% in the United Kingdom [14-15]. This has been attributed to the limited experience, inadequate training and infrequent clinical exposure of both senior and junior doctors in the department [16]. There is also a lack of related courses and resources on ultrasound guided femoral nerve block specific to the Emergency Department [17-20].

In order to address this deficit in medical education, we aimed to develop a workshop to bridge the current gap in the training of ultrasound guided femoral nerve block for doctors in the Emergency Department so that they may be equipped with the necessary skills and be able to optimize pain relief for patients presenting with a hip fracture.

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## Material and methods

### Setting

This study was conducted in the Emergency Department of a tertiary hospital in Singapore which had an annual attendance of about 110,000 patients. There were, on average, 2 cases of patients with hip fracture presenting to the Emergency Department every day. Analgesia was provided only in the form of oral or parental medications – femoral nerve block was not performed in any patients.

### Assessment of learning needs

In order to understand the educational objectives of the workshop, we conducted an assessment of learning needs among 46 doctors in the unit. The response rate was 93%. We found that less than a quarter had received prior training on femoral nerve block. Deficits in knowledge and skill of the procedure were commonly reported.

### Curriculum of workshop

The curriculum was developed in accordance to guidelines for education and training in ultrasound-guided regional anesthesia from the American Society of Regional Anesthesia and Pain Medicine, and the European Society of Regional Anesthesia [21]. Figure 1 shows the educational objectives.

### Conduct of workshop

Two sessions of the workshop were conducted in February 2019. Each session of the workshop ran for 3 hours and was conducted by 3 facilitators for a maximum of 15 participants. This was based on current recommendations for psychomotor skills training in medicine [22]. The principles of flipped classroom, team-based learning and deliberate practice using simulation were incorporated into the programme of the workshop [23–28] (See Supplementary Materials 1–4, on the journal site).

#### 1) Principle of flipped classroom

An online learning module was specifically created for pre-reading and covered relevant anatomy, pharmacology, indications, contraindications, complications and current evidence from the literature. A video demonstration of ultrasound guided femoral nerve block was also shown. It was meant to be interactive in order to engage the learner. Participants were given access to the session objectives and materials 2 weeks prior to the scheduled date of the workshop.

#### 2) Principle of team-based learning

During the workshop, readiness assurance tests for individuals (iRAT) and groups (gRAT) based on the online learning module were carried out. Immediate feedback was provided during gRAT using an immediate feedback assessment technique. In this way, participants could find out the answer for each question and their learning would be immediately re-

By the end of this activity, learners will be able to:

1. Identify relevant anatomy (femoral artery, femoral vein, femoral nerve, fascia lata and fascia iliaca) of femoral nerve block using an ultrasound
2. Describe the pharmacology of lignocaine and bupivacaine used for femoral nerve block
3. List 3 common indications, contraindications and complications of femoral nerve block
4. Cite evidence of increased effectiveness and reduced side effects of femoral nerve block as compared to conventional methods of analgesia
5. Demonstrate once the appropriate technique of performing an ultrasound guided femoral nerve block using Directly Observed Procedural Skills form

Fig 1. Educational objectives

inforced. In their groups, the participants then worked on an application exercise created based on case scenarios in the Emergency Department. Discussion was generated by a debate between the groups for best answers to the case scenarios.

#### 3) Principle of deliberate practice using simulation

A healthy volunteer was recruited to allow participants to visualize anatomy using the ultrasound. The facilitator demonstrated the following structures: femoral artery, femoral vein, femoral nerve, fascia lata and fascia iliaca using an ultrasound. The participant would then perform the ultrasound on their own to identify these structures to the facilitators. The facilitator would assist the participant and provide feedback on image acquisition.

This was followed by performing a femoral nerve block on a task trainer which was a self-made gelatin model. The self-made gelatin model consisted of the following structures: femoral artery, femoral vein, femoral nerve, fascia lata and fascia iliaca, replicating normal anatomy. Dexterity and hand-eye coordination were important for the acquisition of this skill of performing an ultrasound guided femoral nerve block. The facilitator would first demonstrate the procedure by going through the steps involved. The participants were subsequently given time to practice on the model, with feedback from the facilitator about the participant's technique.

### Evaluation of Workshop

Evaluation of the course was based on the Kirkpatrick Model [29]. A feedback form and a Directly Observed Procedural Skills form were used to assess for reaction and learning respectively (See Supplementary Materials 5, on the journal site).

#### 1) Evaluation of reaction

Feedback form allowed the participants' reaction to the workshop to be evaluated, thus allowing us to understand their learning experience during the workshop and what made it positive or negative.

Participants were asked to evaluate statements about the workshop on a 5-point Likert scale, with 1 being strongly disagree and 5 being strongly agree. This was done immediately at the end of the workshop.

### 2) Evaluation of learning

Evaluation was necessary to confirm that participants were able to meet the educational objective of our workshop adequately. More importantly, evaluation would determine their ability to apply the skill in a clinical setting. We used a Directly Observed Procedural Skills form specific for ultrasound guided regional anesthesia procedures [30]. The participants were required to meet the defined standard for competency which was a minimum of 4-point across all domains with a satisfactory performance for overall assessment. The participants were assessed by a different facilitator on their performance of ultrasound guided femoral nerve block on the task trainer.

### Statistical Methods

Statistical analysis was performed using SPSS version 22 (SPSS, Chicago, IL). Categorical and continuous data were presented as frequency with percentage and mean with standard deviation (SD) respectively.

## Results

A total of 30 doctors from the Emergency Department participated in the workshop. All participants completed both the Feedback Form and the Directly Observed Procedural Skills Form.

For the Feedback Form, the mean scores were more than 4.7 across all domains. Participants felt most positive about the workshop meeting the stated educational objectives, the ease of understanding the content and the

training materials used in the workshop. Overall, participants were satisfied with the workshop and would recommend it to a colleague (Table I).

For the Directly Observed Procedural Skills form, all participants achieved the defined standards (a minimum of 4-point across all domains with a satisfactory performance) for competency for this workshop.

## Discussions

We developed this workshop to address the current gap in the training of ultrasound guided femoral nerve block for doctors in the Emergency Department. Emphasis was placed on tailoring the content to work experience, as well as allowing participants to practice what they had learnt in a safe environment. Ultimately, we wanted participants to apply what they had learnt directly to patient care by providing adequate and timely pain relief for patients with a hip fracture. This workshop met its educational objectives and was well received by the participants.

A key contributor to the success of this workshop was the use of various principles of medical education in delivery of the content. Flipped class room, team-based learning and deliberate practice were important components, each with a role in guiding the participants through the learning process. The flipped classroom concept allowed participants to go through the didactic material in an environment of their choice at their own pace and review concepts they do not understand as needed before attending the workshop [23]. Team-based learning ensured that contact time was given to allow participants to come together, generating discussions and reinforcing learning among peers [24]. The safety of a controlled environment using simulation allowed the translation of knowledge to skill in teaching of ultrasound guided regional anesthesia [25-27]. Deliberate practice with facilitator's feedback would provide external motivation and stimulate learners' reflection to improve competency and confidence [28]. All these components were integral in the teaching of ultrasound guided regional anesthesia [31,32].

Sawyer et al described a six-step pedagogical framework consisting of "Learn, See, Practice, Prove, Do and Maintain" for training of procedural skills in medicine [33]. Our workshop was only able to address the first 4 components of "Learn, See, Practice and Prove" as we only had a single learning encounter with the participants. After the workshop, "Do and Maintain" are important steps required for translating the education program into a sustained clinical practice. The department would need to provide opportunities for continued practice and further training. For instance, participants of the work-

Table I. Feedback scores for workshop

Statement	Score (n=30)
The course was relevant to my work.	4.73±0.45
The course met the stated objectives.	4.90±0.31
The content covered was comprehensive.	4.83±0.38
The content was easy to understand.	4.90±0.31
The training materials assisted my learning.	4.93±0.26
I gained new knowledge and skills.	4.87±0.35
I can apply the knowledge and skills to my work.	4.80±0.41
The time allocated to the course was just right.	4.83±0.38
Overall, I am satisfied with this course.	4.93±0.25
I would recommend this course to a colleague.	4.97±0.19

The results are expressed as mean±standard deviation; n – number of participants.

shop would need to perform the procedure under direct supervision and an accreditation process should be developed to allow for independent practice. The practice of ultrasound guided femoral nerve block could also be incorporated into the Hip Fracture Clinical Pathway as a standard of care.

Similarly, higher levels of evaluation based on the Kirkpatrick Model could not be ascertained immediately. In order to assess for behavioral change and organizational performance, a period of follow-up would be necessary. Regular audit could be carried out in the department to assess for pain relief in patients with hip fractures and the outcome of ultrasound guided femoral nerve block performed.

Finally, informal and unstructured instruction, as well as teaching by faculty who may not be competent in the procedure are common pitfalls in the teaching of psychomotor skills [34,35]. Therefore, educators must be familiar with performing ultrasound guided femoral nerve block before developing and implementing a workshop. We do not encourage the attempt of unfamiliar procedures without guidance as this can lead to incorrect techniques, causing harm to patients.

#### **Limitations**

The successful conduct of our workshop was largely based on the experience of a single center. We recognize that the direct implementation of our education approach and materials may have limited applicability in other settings. Educators would need to identify current training gaps and carry out needs assessment of the targeted learners when developing their curriculum. By doing this, the educational methodology and references provided in this paper could be modified accordingly to meet the objectives.

As the workshop was developed for doctors in a single Emergency Department, we only had 30 participants. Furthermore, doctors on rotations accounted for a minority, with rotations occurring every 6-months. These reasons made it difficult to organize more sessions to involve a larger number of participants so that more feedback about the workshop could be obtained for a robust evaluation. Nonetheless, the feedback scores were consistent across domains with narrow standard deviations, suggesting that the educational benefits of the workshop were evident despite the number of participants.

In **conclusion**, our workshop was a success and it was useful for the teaching of ultrasound guided femoral nerve block. Various principles of medical education were used effectively in delivery of the content. Further research is necessary to demonstrate the impact of this educational effort on clinical practice and patient outcomes.

**Conflict of interest:** none

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