Fascia iliaca compartment block for hip fractures: experience of integrating a new protocol across two hospital sites

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**Objective** Fascia iliaca compartment block (FICB) administered through the loss of resistance technique effectively reduces pain and opiate requirement in elderly patients with hip fractures. FICB is a simple technique and is easily taught. This paper plots the implementation of FICB in two hospitals.

**Methods** A continuous audit process of two separate sites recorded the uptake of the FICB on an organizational level. An additional control group (CG) of 100 patients were analysed to compare pain scores (using the Numerical Rating Scale) and opiate requirements between groups of patients receiving fascia iliaca block and those receiving standard care. Documentation habits and adverse drug reactions were monitored over the audit process.

**Results** There were 434 patients audited, with 326 (75.1%) receiving the FICB. The uptake of the FICB and documentation improved over time. The FICB significantly reduced pain scores \((P < 0.001)\) and also opiate requirement \((P < 0.0001)\) compared with those in the CG. Acute length of stay reduced to 9.9 days (FICB group) from 15 days (CG). Inpatient mortality was 5.5% in the FICB group and 15% in the CG \((P = 0.0024)\).

**Conclusion** Organizational learning of this simple procedure can be achieved through a multidisciplinary approach, and committed departmental education and feedback. The impact on length of stay and mortality were striking; however, there may be other confounding factors. Only two cases of true anaesthetic toxicity occurred in 1586 patients. The authors conclude that FICB is a safe procedure and a useful adjunct for preoperative pain control in patients with hip fractures. European Journal of Emergency Medicine 00:000–000 © 2014 Wolters Kluwer Health | Lippincott Williams & Wilkins.

Keywords: analgesia, fascia iliaca compartment block, hip fracture, nerve block

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**Introduction**

Patients with a hip fracture are the most frequently admitted trauma admissions in the UK [1]. The approach to hip fracture care has been revolutionized in the last decade with the aim to provide prompt tailored management to this high-risk elderly group. Audits such as the National Hip Fracture Database have recognized that good hip fracture care may significantly reduce morbidity and mortality. Hip fracture affects 77,000 patients/year in the UK alone [2], with a projected increase of 50% by 2020 [3]. The mean hospital cost for a single patient with a hip fracture is £12,000, with approximately £9000 attributed to the length of hospital stay [4]. The average hospital spends between £3.6 and £4.8 million/year on hip fracture management [4]. In addition to direct patient benefits, quality improvement measures for hip fracture have potentially large service and financial benefits.

Fascia iliaca compartment blocks (FICBs) were initially developed in paediatric anaesthesia in the 1980s for trauma and burn cases of the lower extremity. Interest has recently developed in applying the FICB for perioperative analgesia for hip fractures. The target plexus for the FICB include the femoral nerve, the lateral femoral cutaneous nerve and the obturator nerve (obturator block is variable but detected in 60% of FICB) [5]. The advantages of blocking sensation in these nerves following a hip fracture is greater hip flexion and pain relief at rest [6]. A flexed hip facilitates an upright patient position, reducing lower respiratory tract infections [7] and also makes hoist transfer and basic nursing interventions more tolerable [6].

Multiple studies have identified that pain management has a large impact on elderly patients with a hip fracture. Inadequate pain management can precipitate increased perioperative delirium, reduced postoperative mobility and prolonged hospital stay [8–12]. Elderly patients with lower extremity fractures have also been shown to receive less prehospital analgesia than younger patients [13].

FICB is delivered through either ultrasound guidance or a ‘loss of resistance’ (LOR) technique (also known as the...
‘two-pop’ technique). Anatomical considerations are key to both approaches. Traditionally, an anaesthetist performs the FICB. In recent published practice, the LOR technique has been shown to be safe when performed by specialist nurses, junior doctors and registrars [14–20]. One paper has suggested that the LOR technique for FICB can take less than 5 min to teach to trainee emergency physicians [15]. Høgh et al. [19] demonstrated that in 187 cases the improvement seen in hip flexion and pain relief was not attributable to the experience of the clinician administering the FICB. Høgh et al. [19] conclude that there is a minimal learning curve to achieve a good result, and this reflects the simplicity of the LOR technique.

The aim of this paper is to report on the efficacy and safety of FICB using the LOR technique and to chronicle the uptake of the FICB within an acute hospital setting. This provides a realistic demonstration of organizational compliance that would not be achievable through a more formal study.

Methods
Study design and setting
In October 2010, an advanced surgical practitioner (qualified through the Professional Education in Practice Ltd, Manchester, UK) was trained by an anaesthetist to provide the FICB for preoperative patients with a hip fracture. The successful trial of the initial FICB phase drove the implementation of an FICB training programme and the introduction of the FICB as routine practice to be performed by admitting doctors. The emergency department took over the mainstay of education, safety revisions, equipment selection and delivery (in the vast majority of occasions). A package of training was developed for emergency medicine and orthopaedic middle-grade doctors, who received both formal and informal training. The shared competency between both specialties facilitated the delivery of the FICB out-of-hours.

From November 2010, our protocol dictated that patients who had a radiologically diagnosed hip fracture would be offered an FICB, ideally within 4 h of presentation. Data was collected over a 2-year period. The implementation of the FICB and its clinical impact on the patients and the organization as a whole were broadly monitored by a continuous audit process. The audit was broken into three discrete cycles that plotted the progress in general, but also the feedback brought about changes in practice. In addition to these three audit cycles, continuous and prospective data collection was carried out to assess the process and provided a weekly update and feedback for individual clinicians.

The ideal environment to administer the FICB is within the emergency department. In the event of delayed admission to the ward, it was deemed acceptable for the FICB to be given outside the emergency department setting, in an acute ward. Access to intralipid and adverse local anaesthetic reaction protocols was available in the emergency department and in the acute ward.

Selection of participants
Caldicott ethical approval was granted for the study. Consecutive hip fracture patients were included, regardless of whether they received the FICB or alternative analgesia. The contraindications to FICB were lack of staff competency, nonconsenting or combative patients, superficial groin infection, femoral artery aneurysm, inguinal hernia or blood flashback when aspirating before local anaesthetic infiltration. High BMI and warfarinsation were not considered contraindications to receiving the FICB.

Intervention
The following standardized technique was agreed upon through consultation of anaesthetists, emergency physicians and the previous literature. This technique was formally taught, a procedural guidance and educational video was available on the trust intranet and laminated guidance was also available.

Patients were verbally consented. Those who lacked capacity but were willing to proceed were given the FICB taking into consideration their best interests. The FICB was undertaken in the supine position with adequate exposure over the abdomen, groin and proximal leg. A patent peripheral venous cannula must be placed in situ as a preparation for any adverse drug reaction. Skin was prepared using an aseptic technique with a spray of 2% chlorhexadine in alcohol. A weight appropriate volume of 0.25% levobupivacaine was drawn up with a 50 ml syringe, with an additional 20 ml of sterile saline to increase local anaesthetic (LA) volume (to fill the fascia iliaca compartment).

During staff training emphasis was laid on the strict anatomical entry point. A line was drawn from the pubic tubercle to the anterior superior iliac spine, and the location of the femoral pulse was noted. The FICB entry point was marked 2 cm inferior to line described and at 1/3 from the lateral edge (i.e. from the anterior superior iliac spine). One millilitre of 1% lignocaine was infiltrated in situ as a preparation for any adverse drug reaction. The needle advancement was strictly in a cephalad and sagittal plane at ~60° to the supine patient. The curved tip of the Tuohy needle allowed the judgement of the entry depth below the fascia lata and then fascia iliaca in the LOR technique (also termed ‘two-pop’ technique). Gentle aspiration was performed to ensure nonentry into large blood vessels. Incremental 5 ml bolus were administered until the full dose of levobupivacaine was delivered.
Methods and measurements
Within the three audited cycles, various policy changes were made with regard to the packaged approach to hip fracture admissions. Changes to the provision of the FICB affected by hip fracture admission policy, equipment supply, staff competency and staff attitudes were documented.

The standard that the trust wanted to achieve was administration of an FICB to all patients with hip fracture within 4 h of admission. Local protocol dictated that the FICB should be appropriately documented in the admission notes and be prescribed on the medication chart. Any adverse procedural or drug reaction must be documented, and pain scores should be monitored and actioned before and after FICB. Additional analgesia should be provided in accordance with the WHO analgesia ladder, including intravenous opiates.

Patient demographics, comorbidities, injury patterns and operation dates were recorded. The patient was then monitored for local anaesthetic toxicity. In addition to the audit process described above, a control group of patients was identified to provide an accurate comparison with the FICB group in terms of pain scores and opiate requirements. The control group comprises 50 consecutive patients from each hospital (making a total of 100 patients), managed before the implementation of the FICB in October 2010. The control group had the same management protocol in terms of being fast-tracked to a trauma ward, prioritized for early surgery (aim within 24 h), undergoing orthogeriatric review within 36 h and being subject to a standardized analgesic protocol. The discharge protocol and rehabilitation/care home access was equivalent between both hospitals and both groups.

Preoperative pain was scored on a Numerical Rating Scale (NRS) between 0 and 10, whereby 10 denotes the most extreme pain [21]. At rest, NRS values were recorded by nurses and healthcare assistants in the trauma ward each time general observations were documented. Pain score documentation continued until the time of operation on the basis of the same NRS pain score. Patients with incomplete pain score data or dementia were omitted from analysis as it is recognized that pain score assessment in cognitively impaired patients lacks objectivity. The staff recording the NRS scores were not blinded. The provision of further opiate analgesia for breakthrough pain was permitted irrespective of whether an FICB was administered. Cumulative opiate analgesia was recorded for all patients up until surgery, including preadmission doses administered by paramedics, when applicable.

The primary outcome measures were opiate requirements and NRS pain scores [21], to assess efficacy. Secondary measures included tracking compliance through uptake, monitoring adverse incidents, the impact on length of stay and mortality.

Analysis
Statistical analysis was carried out using GraphPad Prism version 5.3. The analysis of variance (ANOVA) test was used for pain scores and opiate consumption. Fisher’s exact test was used to assess all other outcome measures.

Results
There were 434 patients analysed during the implementation of the FICB protocol from October 2010, who were compared with 100 patients enrolled from March to April 2010 (Table 1). The demographics, mechanism of injury and management are proportionate between the groups. Of the 434 patients audited, 326 patients received the FICB.

Table 2 follows the implementation of the FICB over the three audit cycles and shows the improvement of uptake from 62 to 84%. Table 2 also shows the evolving reasons for not providing an FICB. Clinicians lacking competency added up to 25% in cycle one, falling to 0% in cycle three. Missing equipment became an issue as FICB uptake increased (1.8 to 5.8% between the first cycles); however, this issue was settled by cycle three (1.9%). There was an additional group of patients (n = 8) who fell in the hospital and did not receive the FICB, as they had not been admitted through the emergency department. This was addressed after cycle two and the orthopaedic trainees provided the FICB to all ward referrals thereafter. Figure 1 maps the uptake of the FICB across both hospitals (please note, this graph also includes patients who presented after the cycle 1–3 data). Because of the initial inconsistencies in documentation and the high turnover of rotating junior doctors over the three audit cycles, it was not achievable to identify the number of different clinicians providing the FICB. The majority of FICBs were delivered by emergency department middle-grade and junior-grade doctors. It is estimated that over 40 different clinicians had delivered an FICB at either hospital site over the three cycles.

A continued and significant reduction in the mean hourly pain scores (ANOVA, P < 0.001) is evidenced in Fig. 2. The FICB influenced pain scores for at least 18 h. Equally, there was a significant reduction in opiate consumption by patients (ANOVA, P < 0.0001) receiving the FICB (Fig. 3) over the first 24 h. Table 3 shows a decrease in mortality from 15 to 5.5% (Fisher’s exact test, P = 0.0024) when the FICB protocol was in place, regardless of whether the block was actually delivered. Length of stay reduced from a mean of 15 to 10 days (CG vs. FICB combined).

Implementation
Table 1 and Fig. 1 show the implementation record at each audit cycle and the FICB uptake from both hospitals from October 2010 to August 2013, respectively.
Analgesia scores
Numerical Reporting Scores of pain for the FICB group versus the control group are shown in Fig. 2.

Analgesia requirements
Opiate requirements for the FICB group versus the control group are shown in Fig. 3.

Complications
There were three significant episodes (0.9% of all cases) of potential adverse drug reactions among the 326 FICBs performed, all of which occurred within the first 6 months. These included one episode of convulsions

Clinical outcomes
Length of stay, discharge destination and inpatient mortality figures are shown in Table 3.
following the FICB, likely due to neurological local anaesthetic toxicity, one episode of tachyarrhythmia and bronchospasm, which occurred in a medically unwell patient and was not clearly identified as a direct consequence of the FICB, and chest pain of unknown cause within the first hour after the FICB in a third patient. There was no femoral nerve injury, femoral vascular deficit or mortality attributed to the FICB.

Discussion
The introduction of the FICB to the trust across the two sites was a challenge that required a multidisciplinary approach with engagement from the emergency department, the Department Trauma and Orthopaedics, as well as from among anaesthetic and nursing staff. To achieve a good compliance within the trust, the procedure needed to be agreed upon by all teams.

Figures 2 and 3 show the significant reduction in pain scores and opiate requirements against the control group and provide further evidence that the FICB should be considered for preoperative analgesia for hip fractures. The acute length of stay also reduced from 15 days (CG) to 10 days (FICB group). The reduction of mortality from 15 (CG) to 5.5% (FICB group) is significant (Fisher’s exact test, $P = 0.0024$). Both length of stay and mortality are likely to have been influenced by other departmental confounding factors, such as increased multidisciplinary input, pushing for better nutrition, and the concurrent development of postoperative pain relief protocol. The authors acknowledge that an organizational approach to hip fracture management, including the FICB, is likely to have had an impact on mortality and length of stay.

The ultrasound-guided approach has been shown in a randomized controlled trial (of 80 patients undergoing lower limb arthroplasty) to be more effective in blocking the femoral nerve ($P = 0.006$) and the obturator nerve ($P = 0.033$) than the LOR technique [5]. Dolan et al. [5] also showed that complete sensory block of the anterior, medial and thigh could be achieved in 47% of patients using the LOR technique, as used in this paper. Although using ultrasound provides a more effective analgesic, the disadvantages of using the ultrasound approach are prolonged preparatory time, expensive resources and the requirement for further training. These factors impact the frequency and timing of FICB delivery out-of-hours. Despite evidence that ultrasound-guided FICB is better for analgesia, the LOR technique has been shown to be superior to intravenous nonsteroidals in terms of pain relief for hip fractures, particularly in this at-risk group of elderly patients [15]. Our study clearly shows that the FICB yields superior pain relief over traditional analgesia compared with a historic control group. A randomized controlled study of FICB versus traditional analgesia would have been a superior methodology and is a recommended area of future research.

FICB has been shown to reduce sedation and improve analgesia in patients with hip fractures in a randomized controlled trial [10]. Pain and sedation are significant risk factor for developing perioperative delirium following a hip fracture [8]. Several high-quality studies have specifically focussed on the prevention of delirium using FICB [8–12]. FICB is most useful in reducing delirium in patients with intermediate delirium risk.
Evidence of competency in the form of formal assessments for clinicians before unsupervised practice (available on the Intercollegiate Surgical Curriculum Programme website http://www.iscp.ac.uk and NHS eportfolio www.nhsportfolios.org).

Continuous process audit to identify areas to maintain high levels of uptake and documentation – continual representation of outcomes at departmental and multidisciplinary audit meetings provides education and confidence in the FICB.

The findings of the audit cycles provide insight into the common obstacles involved and the organizational learning curve. Improvement in the administration of the FICB over three cycles provided evidence of institutional uptake and safe practice. Documentation of the procedure initially increased in cycle 2, but then unfortunately declined in cycle 3 despite weekly feedback on documentation compliance.

The following points are recommended while implementing the FICB:

1. An admitting checklist proforma – this provides a section to document the FICB, a reminder to prescribe levobupivacaine and a section to comment on any adverse events and highlight issues such as missing equipment. The proforma also provides accountability and facilitates audit (FICB checklist; Supplemental digital content, http://links.lww.com/EJEM/A77).

2. A bespoke medication chart for patients with a hip fracture – this facilitates the prescription of 0.25% levobupivacaine and a preagreed regimen of multimodal analgesia for all patients (NOF medication chart; Supplemental digital content, http://links.lww.com/EJEM/A76). For simplicity and safety this has now been standardized as 30 ml of 0.25% levobupivacaine for all patients.

3. An educational video on FICB on the intranet (Fascia iliaca block – injection only; Supplemental digital content, http://links.lww.com/EJEM/A78).


5. Continuous process audit to identify areas to maintain high levels of uptake and documentation – continual representation of outcomes at departmental and multidisciplinary audit meetings provides education and confidence in the FICB.

The emergency department embraced this simple technique and performed the majority of the FICBs within the first few hours of admission. Although emergency medicine doctors performed the majority of FICBs, it was also important that trauma and orthopaedic junior- and middle-grade doctors learned perform the block. The requirement for orthopaedic input for the FICB was identified in cycle 2 after a group of patients (n = 8) who had sustained hip fractures while they were inpatients at the hospital did not receive the FICB. Further education and awareness within the orthopaedic department ensured that these patients were no longer missed. Encouraging junior doctors from both specialties to perform the FICB facilitated an additional out-of-hours service. In 2012/2013, 90.6% (n = 604) of 667 patients received an FICB.

In terms of adverse outcomes following FICB, there have been single case reports of pneumoperitoneum, perforated bladder, local haematoma and systemic LA toxicity following FICB [22–24]. However medium-scale and large-scale studies on FICB have reported minimal complications [14,18,19,25]. Despite the low frequency of LA toxicity seen in the literature, it is important to stress that poor anatomical understanding and poor FICB technique can, in theory, be rapidly fatal [24,26].

Our series, the most extensive, had one clear episode of local anaesthetic toxicity among a total of 326 cases. A subsequent audit highlighted the need for a clear adverse reaction strategy. To date, we have performed 1586 FICBs with no further adverse events reported. A laminated poster detailing a strategy to treat an adverse local anaesthetic reaction was displayed in the emergency department and the trauma ward. Intravenous ‘intralipid’ was stored at these locations and was made available at all times. Discussion of access to and provision of intralipid was a mandatory part of the competency assessment of doctors before unsupervised practice.

Conclusion

This paper provides further evidence to the existing literature that the FICB is superior to traditional analgesia for hip fractures and should be seriously considered as the principle means of preoperative analgesia. There are

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FICB, fascia iliaca compartment block.
significant benefits in terms of pain relief; however, further evidence is required to demonstrate that the FICB reduces mortality and length of stay in isolation. The FICB is a safe procedure when performed within competency. Our recommendations for implementing the FICB can provide a successful template to promote institutional uptake and quality improvement.

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Conflicts of interest
There are no conflicts of interest.

References