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Pre-operative pain management with nerve block in patients with hip fractures: a randomized, controlled trial

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\textbf{ABSTRACT}

\textbf{Introduction:} Pain management in patients with hip fractures is a major challenge for emergency care. The objective of this study was to evaluate whether the supplementation of pre-operative analgesia with low-dose fascia iliaca compartment block (FICB) compared with placebo would improve pain relief in patients with hip fractures.

\textbf{Methods:} A double-blind, randomized, controlled trial was conducted on 127 patients. At hospital admission, a low-dose FICB was administered to patients with hip fractures as a supplement to regular pre-operative analgesia. Patients with and without cognitive impairment were included. The instruments used were a visual analogue scale (VAS), a numerical rating scale and a tool for behavior related pain assessment. The primary endpoint was the change in reported pain on movement from hospital admission to two hours after FICB.

\textbf{Results:} The intervention group showed improved pain management by mean VAS score for pain on movement compared with the control group ($p = 0.002$).

\textbf{Conclusions:} Our results support the use of low-dose FICB as a pain-relieving adjuvant to other analgesics when administered to patients with a hip fracture.

\textbf{Introduction}

Hip fractures are an international challenge, and projections indicate a threefold global rise to over six million per year by 2050 (Dhanwal et al. 2011). In Sweden, the annual number of patients with hip fractures is approximately 18,000 per year with a predicted twofold increase by 2050 (Rosengren and Karlsson, 2014). The average age of patients with hip fractures is 83 years; they are frail and often receive insufficient pain relief, which increases the incidence of delirium and leads to longer hospital stays (Kuske et al. 2016; NHFD, 2016; Johansen et al. 2017). Cognitive impairment is found in at least one third of this group of patients. Randomized clinical trials (RCTs) are scarce involving patients with hip fractures and rarely include cognitively impaired patients (Mundi et al. 2014). This paper, reports a study that aimed to consider the effectiveness of Fascia Iliaca Compartment Block (FICB) for pain relief following hip fracture.

\textbf{Background}

Pain management during emergency care is a major problem for patients suffering from hip fracture and is especially problematic in persons with cognitive impairment. The objective for nurses and other healthcare professionals when caring for patients with hip fractures is to assess pain, use pain scales and listen to the patient’s story, as well as to ensure adequate and effective pain relief which may include the initiation of nerve blocks (Wennberg et al. 2018).

During the acute phase of hip fracture, providing patients with sufficient pain relief for them to easily move about in bed, use a bedpan or undergo pre-operative preparation is a major challenge (Foss et al. 2007). Another challenge is assessing pain using self-report scales for patients with cognitive impairment, so focusing on behavioural pain assessment is essential (Herr and Titler, 2009; Maher et al. 2012).

Research shows that nerve blocks can provide effective analgesia
and reduce the incidence of delirium (Foss et al. 2007; Godoy Monzon et al. 2007; Mouzopoulos et al. 2009; McRae et al. 2015). The Fascia Iliaca Compartment Block (FICB) has been used and tested in several settings and has proved to be a simple method for managing acute pain following hip fracture (Candal-Couto et al. 2005; Hauritz et al. 2009; Elkhodair et al. 2011; Fujihara et al. 2013; Haslam et al. 2013; Rashid et al. 2014). FICB can provide analgesia that is as good as, or even better than, morphine (Foss et al. 2007) and, when compared with injections of non-steroidal anti-inflammatory drugs, provides equal analgesia (Godoy Monzon et al., 2010). However, investigation of the potential for improved pain relief accomplished by adding a FICB to pre-operative analgesia with intravenous opioid analgesia is called for (Williams et al. 2016). There is previous research in the field of regional nerve blocks for patients with hip fractures, but more RCTs are needed due to a lack of high quality studies (Ritcey et al. 2016).

The objective of this study was, therefore, to evaluate whether supplementation with low-dose FICB, in addition to pre-operative analgesia, compared with a placebo, would improve pain relief in patients with hip fractures. The primary endpoint was change in reported pain on movement following FICB administration and up to 2 h afterwards.

Secondary endpoints were:

- the change in pain scores on movement 15 min and 6 h after the FICB
- the change in pain scores at rest, 15 min, 2 h and 6 h after the FICB
- pain relief among patients with cognitive impairment
- analgesic consumption
- length of hospital stay

Materials and methods

A prospective, double-blind, randomized, controlled trial was carried out at a university hospital in Sweden. The inclusion criteria were: 1) a radiographically confirmed hip fracture; 2) age > 64 years; 3) Fascia Iliaca Compartment Block administered within 1 h of admission to hospital.

The exclusion criteria were: 1) refusal to participate; 2) more than one fracture; 3) trauma more than 12 h before inclusion; 4) hyper-sensitivity to local anaesthetics; 5) infection in the injection area; 6) neuro-vascular problems in the affected leg; 7) unable to receive FICB due to health status.

Sample size calculation was performed using data from Candal-Couto (Candal-Couto et al. 2005). It was proposed that, using a Visual Analogue Scale (VAS), the pain score on movement would be reduced from 7.2 (SD 1.8) prior to injection to 3.6 (SD 2.4) 1 h after the injection (Candal-Couto et al. 2005). In the control group, we expected a reduction in pain score on movement from 7.2 (SD1.8) to 5.5 (SD2.4) using a VAS. This would give a power of 90% at a significance level of 0.05 using a two-sided Mann-Whitney U test if 70 patients, 35 in each arm, were included.

Randomization was carried out using Statistical Package for the Social Sciences for Windows, Version 14.0.1, and information about the study intervention was sealed in envelopes. The envelopes were numbered and stacked in numerical order; the code number matched the consecutive inclusion of patients. Randomization and preparation were carried out by a statistics expert not involved in the evaluation of the study. A flowchart presenting the inclusion and randomization process can be found in Fig. 1.

Baseline characteristics

Demographic data was retrieved from the patients’ medical records. Classification of comorbidity was made using the American Society of Anesthesiologists (ASA) Physical Status Classification System. The fracture was defined according to the classification of hip fractures used by the Swedish National Registry of Hip Fracture Patient Care, i.e. cervical, trochanteric and sub-trochanteric fracture.

Pre-operative analgesia

In this study, pre-operative analgesia was defined as pre-hospital and in-hospital analgesia administered before surgery. Morphine was administered on demand. In Sweden, ambulances are staffed by a prehospital emergency nurse (PEN) for whom it is standard procedure to titrate morphine for intravenous pain relief at the site of injury, during transport, and until admission to hospital. The titration of morphine on demand is continued by nurses on the ward. Before surgery, paracetamol is often prescribed on demand and has been found to be effective. There was no standard prescribed pre-operative dosage of either morphine or paracetamol. The average dosage is presented in the results.

The procedure

The hospital where this study took place had adopted a fast-track protocol. This means that the prehospital emergency nurse (PEN) made an assessment at the site of the injury and diagnosed suspected hip fracture. Typical symptoms were assessed, including classical clinical signs such as: an externally rotated, shortened leg; severe hip pain; inability to lift the leg; and a history of falling prior to the hip pain. Pain medication was provided, and the patient was transported to the X-ray department (the PEN routinely made a call to prepare the X-ray department). The X-ray confirmed or rejected the suspicion of fracture. If there was no fracture, the patient was transported to the emergency department.

Following the verification of hip fracture, potential participants were transferred directly to the orthopaedic ward. The nurse in charge informed the patient of the opportunity to participate in the study. Inclusion was commenced less than 1 h after hospital admission as FICB had to be performed within 1 h of hospital admission in order to fulfill the inclusion criteria. After inclusion, a sealed opaque envelope with instructions was opened by a nurse not connected to the study, who prepared a syringe with 30 ml of 2 mg/ml ropivacaine or 30 ml of placebo (saline) depending on allocation to the intervention or control group. The FICB was administered to the affected hip by the orthopaedic surgeon who examined the patient by perpendicular injection with a two-pop technique as a complement to pre-operative analgesia. The insertion point was identified by drawing a line between the spina iliaca anterior superior and os pubis, 1 cm lateral to the conjunction of the two thirds closest to the spina iliaca anterior superior. The insertion was made by loss of resistance; when passing first the fascia lata and then the fascia iliaca (2 pops), the investigation fluid was then injected (Fig. 2). The needle used was a regular needle for intramuscular injections; a choice made depending on what was available on the ward.

The case report form was filled out by the ward staff, who also conducted the assessment of the study patients. The patient, the doctor performing the FICB and the nursing staff performing tests and filling out case report forms were blinded to the substance administered.

Thirty-four physicians performing the FICB underwent training for involvement in the study, consisting of theory and practice under supervision. All staff members were educated in pain assessment (using the Stockholm South General Hospital Pain Instrument), filling out case report forms, randomization and blinding, according to the study protocol. The study was conducted under the surveillance of an external monitor between October 2010 and February 2012.

Measurements

The instrument used to assess pain was the Stockholm South General Hospital Pain Instrument (SSGPHI) (Fig. 3). The SSGPHI is a combination of self-rating scales: a visual analogue scale (VAS), a numerical rating scale (NRS) from 0 to 10, a verbal rating scale (VRS) and a behavioural rating scale (BRS) (Edberg and Soderqvist, 2012). The
The patient used the scale that he or she found most appropriate. The fourth scale, the BRS, was used by the staff only when the patients were not able to assess and describe their own pain. The BRS is a three-category scale categorizing pain from the patients' behavior used when cognitive impairment makes self-assessment difficult. The three categories are: 1 - no pain or mild pain; 2 - moderate pain; and 3 - severe pain. The BRS has been agreement-tested with acceptable agreement with the VAS when used with patients suffering from hip fractures (Edberg and Soderqvist, 2012). Similar categorizations of numerical pain scales into three categories have previously been carried out (Hansson et al. 2005; Dale and Bjornsen, 2015).

In order to compare pain measurements with the different scales, a synthesis of the scales was made; NRS and VRS scores were converted to the VAS. We will now refer to this synthesis of as “generalized VAS”; this is presented as VAS in our results with a scoring range from 0 to 10.

For a comparison of all patients, regardless of cognitive function, our “generalized VAS” was then converted into the three BRS categories (primarily used in cases of cognitive impairment) in the following way: 0–3.0 = 1; 3.1–7.9 = 2 and 8.0–10 = 3 (Edberg and Soderqvist, 2012).

Baseline assessments for pain scores were made before the FICB was administered. The consumption of opioids was recorded at baseline, since patients had already received analgesics from the PENs.

Pain was scored on movement and at rest. Intervals for pain scores, apart from baseline and 2 h after the FICB, were 15 min and 6 h after the FICB. Movement was assessed by ability to perform foot rotation. In this setting, foot rotation was defined thus: the injured leg was rotated with the knee extended to evaluate whether or not, due to pain, it could be rotated past its neutral position. Rest was defined as the patient...
choosing a position for the best comfort (Candal-Couto et al. 2005).

Statistics

Continuous variables are presented as the mean, standard deviation, median and range. Categorical variables are presented as percentages. For comparisons between the intervention group and the control group, the Mann-Whitney U test was used for continuous variables, the Mantel-Haenszel chi-square test was used for ordinal categorical variables, Fisher’s exact test was used for dichotomous variables and the Pearson chi-square test was used for non-ordinal categorical variables. Changes in pain score from baseline to 15 min, 2 h, and 6 h were compared between the intervention and the control group. Mean differences in changes between intervention and control group are given, together with a bootstrapped 95% confidence interval for the VAS in the tables.

Adjustments for differences in baseline variables were made using covariance analysis (ANCOVA) for continuous variables. An adjusted mean difference with 95% confidence intervals was calculated in the ANCOVA analyses. Changes within groups were analyzed with Wilcoxon’s signed rank test for continuous variables and with the sign test for ordered categorical variables. All significance tests were two-sided and conducted at the 5% significance level. All statistical analyses and tests were carried out using IBM SPSS Statistics Version 22.

Ethical considerations

Ethical approval was received from the Regional Ethics Board in Uppsala, Dnr. 2008/172. The procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration. Approval was also given by the Swedish Medical Products Agency, Dnr. 151:2008/60682. Trial registry: EudraCT number 2008-004303-59.

Written consent was obtained from participants. Patients who were unable to give their consent were included following presumed consent; they were assessed as not having the capacity for consent at the time of inclusion. This assessment was made by the including physician, together with the nurse responsible for the patient. The Short Portable Mental Status Questionnaire was used to support the decision of inclusion on presumed consent (Pfeiffer, 1975).

Presumed consent was given with the support of the Regional Ethics Board in Uppsala, as directed by Swedish law.

The FICB was given in addition to the regular analgesia that all

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Fig. 3. Stockholm South General Hospital Pain Instrument: visual explanation of the translation of the four scales. The three categories are separated by the lines in the figure, categories represented by the numbers. All four possible versions of pain assessment using the Stockholm South General Hospital Pain Instrument: visual analogue scale (VAS), verbal rating scale (VRS), numerical rating scale (NRS) and behavioural rating scale (BRS). The latter is used by staff to assess pain in patients who are unable to use any of the other scales.
patients received. In order to find evidence for whether FICB is of real benefit to patients with hip fractures or not, blinding was necessary. The fact that half of the patients were exposed to an invasive placebo procedure without pain-relieving substance may be regarded as questionable from an ethical perspective. The control group received “regardless of change” (SD 2.0) in the intervention group compared with the control group (p = 0.36), or between arrival at hospital and 6 h after the FICB, mean 3.1 mg (SD 3.6) vs. 3.4 mg (SD 2.9) (p = 0.37).

There was no significant difference in the consumption of paracetamol between the two groups. The following doses of paracetamol were given on the day of admission: mean 0.9 g (SD 0.9) in the intervention group (n = 65) and mean 1.1 g (SD 1.0) in the control group (n = 61) (p = 0.29).

The mean length of stay in hospital (LOS) was 10.9 days (SD 5.8) in the intervention group and 10.6 days (SD 5.6) in the control group (p = 0.79).

No serious adverse events due to the FICB were reported in this study.

Discussion

In this study, which evaluated the pain-relieving effect of nerve block when added to routine analgesia for patients with hip fractures in the preoperative setting, it was found that pain was further relieved after the nerve block was given in 27% of the patients during the subsequent 2 h. The two groups were relatively well balanced at baseline with the exception of pain on movement according to theVAS, where patients in the intervention group scored higher than the control group.

The change in the BRS, (according to whether the pain on movement improvement significantly in the intervention group compared with the control group (p = 0.36), or between arrival at hospital and 6 h after the FICB, mean 3.1 mg (SD 3.6) vs. 3.4 mg (SD 2.9) (p = 0.37).

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The mean length of stay in hospital (LOS) was 10.9 days (SD 5.8) in the intervention group and 10.6 days (SD 5.6) in the control group (p = 0.79).

No serious adverse events due to the FICB were reported in this study.
Fifteen minutes after the FICB, pain scores improved in the intervention group compared to the control group. This is in contrast to most previous studies where no analgesia had been administered before the FICB (Capdevila et al. 1998; Candal-Couto et al. 2005; Foss et al. 2007; Hauritz et al. 2009; Elkhodair et al. 2011; Fujihara et al. 2013; Haslam et al. 2013; Rashid et al. 2014). The improvement in pain after the FICB was less marked than calculated in our power analysis. The mechanisms behind this finding are unclear.

Two randomized clinical trials have previously been carried out to evaluate the effect of an FICB on pain in hip fractures. One of them compared nerve block with intramuscular morphine (Foss et al. 2007), while the other compared nerve block with non-steroidal anti-inflammatory drugs (Godoy Monzon et al., 2010). Both studies showed that the effect had started to wear off 8 h after the block. Other studies have implied that the use of nerve blocks may reduce the duration of the FICB, although the difference did not exceed 12 h (Bjoerkelund et al. 2011). Shorter waiting times mean less movement at the fracture site and it is reasonable to suppose that this would improve the overall pain relief. Repeated FICB administration, or the insertion of a catheter, might be an alternative approach.

The most appropriate timing for an eventual administration of a FICB in the emergency chain of care for hip fractures should be considered in future investigations. Administration of pre-hospital FICB to patients with hip fractures has been identified as a possibility (Chesters and Atkinson, 2014; Dochez et al. 2014; McRae et al. 2015).

Cognitively impaired patients are an important group of patients with hip fractures that have previously mostly been excluded from participation in clinical trials. The reason for this is most likely that the methods used to evaluate pain among these patients are insufficient. Since the sample size in this study was small and the analysis of these patients was a secondary endpoint, no definitive conclusions were drawn.

There was no significant difference between the two groups in terms of morphine administered pre-hospital or morphine administered up to 2 h after the block. Other studies have implied that the use of nerve blocks may reduce the requirement for morphine (Fletcher et al. 2003; Foss et al. 2007; Beaudoin et al. 2013; Diakomi et al. 2014). Eighty-five percent of the patients in this study received pre-hospital analgesia. This is in contrast to most previous studies where no analgesia had been administered before the FICB (Capdevila et al. 1998; Candal-Couto et al. 2005; Foss et al. 2007; Hauritz et al. 2009; Elkhodair et al. 2011; Fujihara et al. 2013; Haslam et al. 2013; Rashid et al. 2014).

Since limited patient monitoring was available (oxygen saturation and heart rate), a dose reduction was recommended by the Swedish Medical Products Agency for safety reasons. The dose of ropivacaine in our study proved to be safe – no serious adverse events were reported.

### Strengths and limitations

This study was a double blind randomized clinical trial incorporated in the everyday clinical work at a university orthopaedic department. This is regarded as the highest ranked methodology when clinical trials are performed. The reduction of reported pain, by 1.5 on a 10-point
Table 3
Change in the VAS and BRS from admission to 15 min, 2 h and 6 h, test between and within groups. and bootstrapped 95%CI (all patients).

<table>
<thead>
<tr>
<th></th>
<th>0–15 min</th>
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<th>0–6 h</th>
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<tbody>
<tr>
<td></td>
<td>Intervention group</td>
<td>Control group</td>
<td>p-value(^b) (adj p-value)</td>
<td>Mean change (95% CI)(^d)</td>
<td>Intervention group</td>
<td>Control group</td>
</tr>
<tr>
<td>Change VAS Movement</td>
<td>−1.5 (2.3)</td>
<td>0 (−7; 2) n = 33</td>
<td>p &lt; 0.01(^a)</td>
<td>0.8 (1.8)</td>
<td>&lt; 0.001</td>
<td>−1.0 (1.9)</td>
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<td></td>
<td>0 (−2; 7) n = 38</td>
<td>p = 0.006(^a)</td>
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<td>&lt; 0.001</td>
<td>0 (−6; 2) n = 39</td>
<td>&lt; 0.001</td>
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<tr>
<td>Change VAS Rest</td>
<td>−1.0 (2.8)</td>
<td>0 (−10; 8) n = 37</td>
<td>p = 0.008(^a)</td>
<td>0.6 (2.0)</td>
<td>0.002</td>
<td>−0.6 (2.6)</td>
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<td>0 (−3; 6) n = 41</td>
<td>p = 0.05(^a)</td>
<td></td>
<td>&lt; 0.001</td>
<td>0 (−7; 6) n = 40</td>
<td>&lt; 0.001</td>
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<tr>
<td>Change BRS Movement</td>
<td>Decrease</td>
<td>14 (26.9%)</td>
<td>1 (1.9%)</td>
<td>13 (21.0%)</td>
<td>6 (10.7%)</td>
<td>10 (31.3%)</td>
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<td>Equal</td>
<td>35 (67.3%)</td>
<td>41 (77.4%)</td>
<td>44 (71.0%)</td>
<td>36 (64.3%)</td>
<td>17 (53.1%)</td>
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<td>Increase</td>
<td>3 (5.8%)</td>
<td>11 (20.8%)</td>
<td>&lt; 0.001</td>
<td>5 (8.1%)</td>
<td>14 (25.0%)</td>
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<tr>
<td>Change BRS Rest</td>
<td>Decrease</td>
<td>14 (24.1%)</td>
<td>3 (5.4%)</td>
<td>20 (31.7%)</td>
<td>7 (12.1%)</td>
<td>14 (37.8%)</td>
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<td>42 (72.4%)</td>
<td>43 (76.8%)</td>
<td>39 (61.9%)</td>
<td>46 (79.3%)</td>
<td>19 (51.4%)</td>
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<tr>
<td></td>
<td>Increase</td>
<td>2 (3.4%)</td>
<td>10 (17.9%)</td>
<td>&lt; 0.001</td>
<td>4 (6.3%)</td>
<td>5 (8.6%)</td>
</tr>
</tbody>
</table>

For continuous variables, the mean and SD are presented at the top and the median, min; max and n are presented below.
For categorical variables, n (%) is presented.

\(^a\) p-value within group.
\(^b\) Test between groups, intervention change vs. control change.
\(^c\) Adjusted p-values are given for variables that differ significantly (p < 0.05) at baseline between the Intervention and control group.
\(^d\) Difference between groups. Calculation of confidence interval for continuous variables is based on bootstrapping of 10000 replicates picking the 2.5 and 97.5 percentiles of the 10000 mean differences as confidence interval. Outlined values present the primary endpoint.
The routine at this hospital) can relieve pain effectively; and 4) if a blunt
a failure of the nerve block; 3) morphine administered on demand (as is
As a result, a lack of further pain relief should not always be regarded as
increased doses may have improved pain relief even further. However,
number of health-care providers with a varying degree of clinical ex-
imbalance at baseline between the two study groups.

### Table 4

<table>
<thead>
<tr>
<th>Variable</th>
<th>Change 0–15 min</th>
<th>Change 0–2 h</th>
<th>Change 0–6 h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intervention group (n = 21)</td>
<td>Control group (n = 21)</td>
<td>p-value&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Change VAS Movement</td>
<td>-1.83 (2.64)</td>
<td>0.63 (1.85)</td>
<td>0.032</td>
</tr>
<tr>
<td>n = 6 p = 0.13&lt;sup&gt;b&lt;/sup&gt;</td>
<td>n = 8 p = 0.75&lt;sup&gt;b&lt;/sup&gt;</td>
<td>n = 7 p = 0.93&lt;sup&gt;b&lt;/sup&gt;</td>
<td>n = 6 p = 0.50&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Change VAS Rest</td>
<td>-0.29 (0.95)</td>
<td>0.75 (2.70)</td>
<td>0.53</td>
</tr>
<tr>
<td>n = 10 p = 0.75&lt;sup&gt;b&lt;/sup&gt;</td>
<td>n = 10 p = 0.63&lt;sup&gt;b&lt;/sup&gt;</td>
<td>n = 10 p = 0.63&lt;sup&gt;b&lt;/sup&gt;</td>
<td>n = 10 p = 0.63&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Change BRS Movement</td>
<td>Decrease</td>
<td>3 (16.7%)</td>
<td>1 (5.3%)</td>
</tr>
<tr>
<td>Equal</td>
<td>15 (83.3%)</td>
<td>14 (73.7%)</td>
<td>15 (65.2%)</td>
</tr>
<tr>
<td>Increase</td>
<td>0 (0.0%)</td>
<td>4 (21.1%)</td>
<td>0.075</td>
</tr>
<tr>
<td>Change BRS Rest</td>
<td>Decrease</td>
<td>5 (23.8%)</td>
<td>1 (4.8%)</td>
</tr>
<tr>
<td>Equal</td>
<td>15 (71.4%)</td>
<td>18 (85.7%)</td>
<td>14 (60.9%)</td>
</tr>
<tr>
<td>Increase</td>
<td>1 (4.8%)</td>
<td>2 (9.5%)</td>
<td>0.18</td>
</tr>
</tbody>
</table>

For continuous variables, the mean and SD are presented at the top and the median, min; max and n are presented below. For categorical variables, n (%) is presented.

<sup>a</sup> p-value within group.

<sup>b</sup> Test between groups, intervention change vs. control change.

<sup>c</sup> Difference between groups. Calculation of confidence interval for continuous variables is based on bootstrapping of 10000 replicates picking the 2.5 and 97.5 percentiles of the 10000 mean differences as confidence interval.

### VAS scale in favour of the intervention group, can be considered clinically meaningful.

The endpoints with dynamic pain were chosen because it is challenging to provide good pain relief for patients when they move about in bed, use a bedpan or undergo pre-operative preparation. The static pain endpoints reflect pain during the larger part of the waiting time for surgery. The different time intervals were chosen with the purpose to measure the onset and the duration of the fascia iliaca compartment block.

At least two pain observations in each patient were required to be included in the analyses. Logistical reasons were given for missing information on pain assessment, for example that the patient was asleep, was undergoing investigations elsewhere or was already at surgery. The loss of data was evenly distributed between the two groups and had a random occurrence without any connection to the patient’s condition. Due to the internal loss of data, our results must be interpreted with some caution.

The BRS has only been validated once with acceptable agreement for the pre-operative care received by patients with hip fractures. Even though nurses themselves may not execute the intervention, suggesting routine clinical work with all its advantages and disadvantages.

Three important factors may have influenced our results: 1) a large number of health-care providers with a varying degree of clinical experience in using the method may have affected the results in a negative fashion; 2) low doses of ropivacaine were used and it is not unlikely that increased doses may have improved pain relief even further. However, these patients had received pharmacological pain relief before the FICB. As a result, a lack of further pain relief should not always be regarded as a failure of the nerve block; 3) morphine administered on demand (as is the routine at this hospital) can relieve pain effectively; and 4) if a blunt needle for FICB insertion had been chosen, instead of the sharp one that was used, the results might have been different (Foss et al. 2007; Hög et al. 2008). Although information on concomitant pain-relieving medication both before and after the intervention was at hand, this information could have been even more detailed in terms of treatment protocols. Furthermore, the definition of cognitive impairment could have been even more detailed, although an instrument was used. However, such deficits must be viewed from the perspective of a clinical trial incorporating routine clinical work with all its advantages and disadvantages.

Part of our presentation is based on the principle that since ordinal data was available, a statistical analysis of individual changes in pain was considered the most appropriate. Making a synthesis of several pain scales can be regarded as unconventional. Dividing the VAS into three groups makes the scales less sensitive. To compensate for this discrepancy, we included more patients than the power calculation recommended.

In most countries, nerve blocks are interventions mainly led by nurses. Nerve block interventions have been led by trained nurses in the United Kingdom, the Netherlands and Australia (Layzell, 2007; Dochez et al. 2014; McRae et al. 2015). In the United Kingdom this is encouraged where local standards are applicable (AAGBI, 2013).

### Conclusion

A FICB, as an adjuvant treatment to routine pre-operative analgesia with morphine and paracetamol, is of benefit in pre-operative pain

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management in a significant proportion of patients with hip fractures. One out of four patients with a hip fracture appears to obtain further pain relief with a pre-operative FICB. Further research on the Fascia Iliaca Compartment Block with different dosages is required to give this strategy its optimal position in the preoperative handling of patients with hip fracture.

Ethical statement

Ethical approval was received from the Regional Ethics Board in Uppsala, Dnr. 2008/172. The procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration. Approval was also given by the Swedish Medical Products Agency, Dnr. 151:2008/60682. Trial registry: EudraCT number 2008-04303-59.

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Competing interests

The authors declare that they have no competing interests.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijotn.2018.11.003.

References


