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Original Study

Pain management after hip fracture repair surgery: a systematic review and procedure-specific postoperative pain management (PROSPECT) recommendations

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Summary

Hip fracture is associated with moderate-to-severe postoperative pain, which can influence postoperative recovery and length of stay. The aim of this systematic review was to update the available literature and develop recommendations for optimal pain management after hip fracture. A systematic review utilising procedure specific postoperative pain management (PROSPECT) methodology was undertaken. Randomised controlled trials, systematic reviews and meta-analysis published in the English language between 04 April 2005 and 12 May 2021, evaluating the effects of analgesic, anaesthetic and surgical interventions were retrieved from MEDLINE, Embase and Cochrane Databases. A total of 60 studies met the inclusion criteria. For patients having hip fracture, pre, intra and postoperative paracetamol and non-steroidal anti-inflammatory drugs or COX-2 inhibitors are recommended. A single shot femoral nerve block or a single shot fascia iliaca compartment block are recommended. Continuous catheter techniques should be used only in specific circumstances. The choice between femoral nerve block or a fascia iliaca compartment block should be made according to local expertise. The postoperative regimen should include regular paracetamol, non-steroidal anti-inflammatory drugs and COX-2 inhibitors with opioids used for rescue. Some of the interventions, although effective, carry risks, and consequentially were omitted from the recommendations, while other interventions were not recommended due to insufficient, inconsistent or lack of evidence.

Recommendations

1. Paracetamol and non-steroidal anti-inflammatory drugs or COX-2 specific inhibitors should be administered either pre- or intra-operative, if no contraindications.
2. Single shot femoral nerve block or single shot fascia iliaca block should be administered. Choice of nerve block should be based on local expertise. No catheter should be used except in specific circumstances.
3. Postoperative analgesic regimen should include regular paracetamol and non-steroidal anti-inflammatory drugs or COX-2 specific inhibitors with opioids used for rescue.

Why was this guideline developed?

Hip fracture is associated with moderate-to-severe postoperative pain which can influence postoperative recovery and physiotherapy. The aim of this guideline is to provide clinicians with current evidence for optimal pain management following hip fracture surgery.

Introduction

Hip fractures are associated with substantial pain and may be undertreated in the elderly population, and pain is generally undertreated due to concerns of analgesic-related adverse effects[1]. However, inadequate pain relief is associated with delirium, delayed mobilization, longer hospital stay and lower quality of life[1]. Optimal pain management is therefore essential in treating hip fracture patients. Functional recovery, reduced morbidity and mortality at one year and adequate analgesia are linked and better pain relief will improve outcome in this older and frail population.

The procedure-specific postoperative pain management (PROSPECT) Working Group is a collaboration of surgeons and anaesthetists working to formulate procedure-specific recommendations for pain management after common but potentially painful operations[3,4]. The recommendations are based on a procedure-specific systematic review of randomized controlled trials (RCTs). The methodology considers clinical practice, efficacy and adverse effects of analgesic techniques[5].

We emphasize that hip fracture is rather a generic term that includes different types of fractures and different types of surgical interventions. Unfortunately, no studies are available in literature focusing on only one type of intervention with one type of surgical repair and evaluating one type of analgesic intervention. Hence, we had to use the studies that were available.

The aim of this systematic review was to evaluate the available literature on the effects of analgesic, anesthetic and surgical interventions on pain after hip fracture repair surgery. The primary outcome were postoperative pain scores. Other recovery outcomes, including opioid requirements and adverse effects, were also assessed when reported and the limitations of the data were reviewed. The ultimate aim was to develop recommendations for pain management after hip fracture repair surgery.

Methods

The methods of this review adhered to the PROSPECT methodology as previously reported[6]. Specific to this study, the EMBASE, MEDLINE, PubMed and Cochrane Databases (Cochrane Central Register of Controlled Trials, Cochrane Database of Abstracts or Reviews of Effects, Cochrane Database of Systematic Reviews) were searched for RCTs published between 04 April 2005 and 12 May 2021. Search terms related to pain and interventions for "hip fracture" OR "hip trauma" AND "postoperative pain" OR "pain" OR "pain scale" or "rehabilitation" OR " pain management" OR "epidural" OR "spinal" OR "intrathecal anaesthesia" OR "peripheral nerve block" OR "nerve block" OR "local anaesthetics" OR "regional anaesthesia" OR "regional analgesia" OR "plexus block" OR "nerve block" OR "infiltration" OR "local infiltration analgesia" OR "lidocaine" OR "nonsteroidal anti-inflammatory drugs" OR "NSAIDS" OR "non-opioid analgesic" OR "opioid" OR "opioids" OR "dexamethasone" OR "gabapentin" OR "pregabalin" OR "ketamine" OR "paracetamol" OR "acetaminophen" OR "nefopam" OR "cox 2 selective inhibitor" OR "cox 2 inhibitor" OR "clonidine".

Quality assessment, data extraction and data analysis adhered to the PROSPECT methodology[6]. Studies that reported pooled data from patients undergoing mixed procedures or elective hip arthroplasty were excluded. Pain intensity scores were used as the primary outcome measure. In this study, we defined a change of more than 10 mm on the visual analogue scale (VAS) or one point on the numerical rating score (NRS) as clinically relevant[7].

Recommendations were made according to PROSPECT methodology[6]. The proposed recommendations were sent to the PROSPECT Working Group for review and comments and a modified Delphi approach was utilized as previously described. Once a consensus was achieved the lead authors drafted the final document, which was ultimately approved by the Working Group.

Results

The PRISMA flow chart demonstrating the search data are presented in Fig.1.

Pre-operative interventions

1. Pharmacologic interventions

One randomized single-blinded trial compared a low dose transdermal buprenorphine (10 mcg/h) applied the day before surgery to oral tramadol (50 mg three

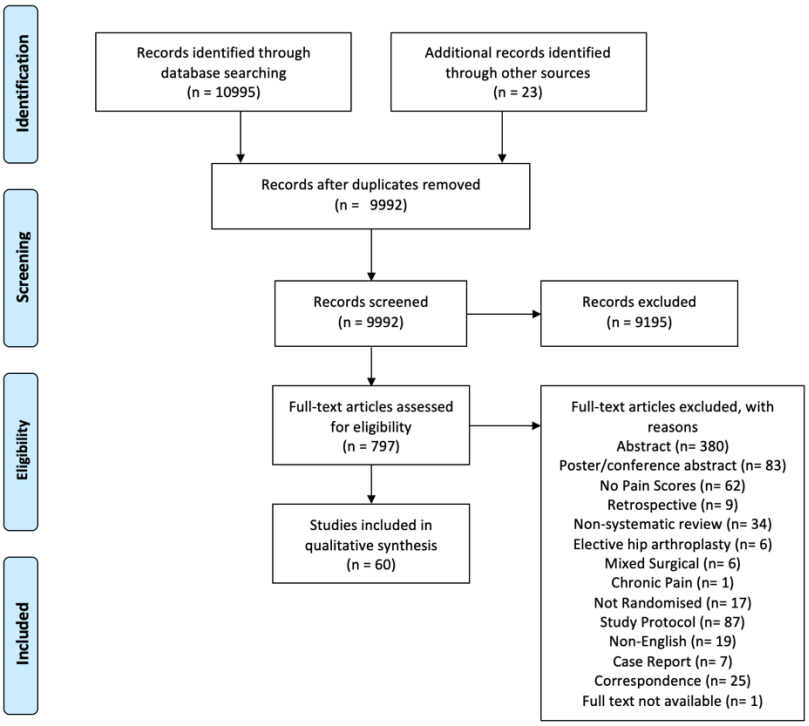

Fig. 1 — CONSORT-STROBE-PRISMA-CARE checklist and flowchart.

times daily). Early postoperative resting pain scores (4 and 12h postoperatively) were similar between both groups but starting from 24 h postoperatively resting pain scores were lower in the transdermal buprenorphine group during the 7-day follow-up period. Similarly pain scores on movement were lower in the intervention group starting from the second postoperative day and continued to be lower in the 7-day treatment and follow-up period. Use of rescue analgesics and incidence of postoperative nausea and vomiting were higher in the tramadol group[8].

Transdermal buprenorphine is not recommended due to limited procedure-specific evidence.

2. Peripheral nerve blocks

Overall, 45 randomized controlled trials and 9 meta-analyses assessing peripheral nerve blocks were included.

Femoral nerve block (FNB)

Four RCT's evaluated the efficacy of single-shot FNB administered in the emergency department. Fletcher et al.[10] reported a significantly faster time (mean difference –2.93 h) to reach the lowest pain score and a decreased requirement of morphine per hour (mean difference –0.68 mg/h) in patients receiving the 3-in-1 FNB. Another RCT made the same comparison and observed a significantly lower median pain scores at 30 minutes in the FNB group (p=0.046), but there were no differences in 24-hopioid consumption[11]. Beaudoin et al.[12] compared this nerve block with placebo using a sham injection. They concluded that patients in the FNB group experienced significantly greater overall pain relief with a median summed pain-intensity difference over 4 hours of 11.0 (interquartile range [IQR] = 4.0 to 21.8) versus 4.0 (IQR = 2.0 to 5.8) in the placebo group (p = 0.001). The opioid consumption was significantly lower in the FNB group, with 0.0 mg (IQR = 0.0 to 1.5 mg) versus 5.0 mg (IQR = 2.0 to 8.4 mg) in the placebo group (p = 0.028). Four years later, Morrison et al.[13] made a comparison between the use of conventional analgesics and a FNB followed by a continuous FICB. There was a significant decrease in pain scores in the intervention group both at 1- and 2-hours following admission and at postoperative day 3, in rest as well as with transfers and with walking. Intervention patients required 33% less morphine in the emergency department (0.8 versus 1.2 mg/hour, p=0.035) and post-operatively for the first 3 days (2.1 versus 3.5 mg/day of parenteral morphine sulfate equivalents, p=0.04).

The postoperative analgesic benefits of the FNB were published by Unneby et al. They compared the FNB with conventional pain management using opioids if required and found that pain scores decreased significantly in patients receiving FNB, from baseline to 12 h after admission (p <0.001)[14]. Besides, patients in the FNB group required less opioids than did controls (2.3±4.0 vs. 5.7 ±5.2 mg, p < 0.001). Shukla et al. evaluated the effect of a FNB versus FICB versus no block[15]. NRS-scores at rest were significantly lower at 1h, 6h, 12h and 24h after application of the FNB and VAS scores after passive

elevation of the leg were also significantly lower from 30 min to 24h after application. VAS scores after 24h were 1.14±1.061 for FNB and 1.89±0.631 without block (p=0.001). The control group had a higher analgesic requirement with a mean value of 229.29 ± 33.478 mg diclofenac as compared to 137.14 ± 37.067 mg for FNB (p>0.001). The only additional requirement of tramadol came from a patient in the control group. There was no significant difference in pain scores or analgesic requirement between the two nerve blocks. Recently, a pilot trial from Beaupre et al. found no significant difference in pain scores between pre-operative FNB versus standard analgesia up to 5 days postoperative[16]. Median opioid consumption was non-significantly higher and more variable in the control group than in the FNB group (p=0.28). The study was defined as a pilot trial and was under-powered to demonstrate effectiveness.

In summary, six out of these 7 RCT's found that a FNB has a significantly better analgesic effect than conventional pain management with systemic analgesia, and in 5 RCT's there was a significant reduction in opioid usage associated with a FNB. In all RCT's, the FNB was placed pre-operatively, mostly in the emergency department.

No significant side-effects were observed with FNB in any of the studies.

Based on this evidence of an analgesic effect and a reduced need of rescue analgesics, the workgroup recommends the use of preoperative FNB in hip fracture patients.

Continuous femoral nerve block (cFNB)

Prolonged analgesia after a peripheral nerve block is possible by placing a catheter and giving continuous or intermittent boluses of local anesthetic. In 2018, Rowlands et al. compared the analgesic efficacy between IV morphine and a cFNB[17]. The cFNB used an elastomeric pump with 0.2% ropivacaine at 5mL/ hour for 48 hours. There was a significant difference in pain scores, but only at rest, in favor of the cFNB. Prolonged regional blockage was not associated with improvements in Cumulative Dynamic Pain Scores or mobility from surgery to 3 days postoperatively. There was no observed benefit on opioid-related side effects such as nausea and constipation. To note is the use of a lower infusion rate (5 ml/hour) which may not have provided sufficient spread of local anaesthetic, and a different dose regimen may have given a different result. Also, the use of a relatively high dose of tramadol (50–100mg in every 6 hours) might have reduced any difference seen between the groups. An earlier RCT in 2012 investigated the analgesic efficacy of cFNB versus standard opiate-based analgesia[18]. Patients with cFNB had lower pain scores at rest, but also during movement, compared to the control group. This was significant in the perioperative period, up to 54 hours after block placement. The cumulative morphine consumption over 72 h was less with cFNB. Patients with cFNB had greater scores for patients overall satisfaction with analgesia [9.4 vs 7.6, p= 0.014]. An RCT from Chaudet et al. could not confirm these findings. The cFNB with ropivacaine was compared with a placebo infusion, using an elastomeric pump at a constant rate of 8 mL/h[19]. There was no significant difference between the two groups. At any point in time, pain scores were similar (mean SD; VAS 29+-15/ 100 versus 33+-13, p = 0.3). The total morphine consumption was not significantly decreased (5 [0–14] versus 8 [4.5–11] mg in the placebo group, P = 0.3). Luger et al. compared cFNB with epidural anesthesia and with systemic pain therapy (piritramide and paracetamol) for preoperative pain management, but could not demonstrate a significant benefit of cFNB[20]. An RCT published in 2014 compared cFNB versus single-shot FICB as postoperative analgesia[21]. There was no significant difference in pain relief between the two groups at rest nor during passive hip flexion in the first 12 hours. The values of the Verbal Descriptive Scale (VDS) were significantly lower in patients with cFNB at rest and during movement at 24 hours (46.67% vs 0% felt moderate pain), 36 hours (43.33% vs 0% felt moderate pain) and 48 hours after the intervention (46.67% vs 3.33% felt moderate to severe pain) p < 0.05. Patients with cFNB received a significantly lower amount of supplemental analgesia, 23.3% in the cFNB group vs 50% in the FICB group (p < 0.05) on POD 2. The added value of this study is limited, since the comparison is made between two different blocks, whereof one continuous and one single-shot nerve block.

For continuous femoral nerve blocks, the different RCT's show heterogeneous results. Further trials are necessary to further clarify the observed differences between trials in pain scores and opioid consumption. Currently the PROSPECT group does not recommend continuous FNB due to inconsistent evidence.

Fascia Iliaca Compartment Block (FICB)

We found twenty-two RCT's assessing the analgesic efficacy of FICB for hip fracture patients compared to other modalities. In 2007, Foss et al. set up an RCT to compare the efficacy of FICB versus intramuscular (IM) morphine for acute pain control[22]. This trail was double blinded using placebo injections for both interventions. Maximum pain relief was superior in the FICB group both at rest (p < 0.01) and on

movement ($p = 0.02$). The median total morphine consumption was 0 mg in the FICB group and 6 mg (interquartile range, 5–7 mg) in the morphine group ($p < 0.01$). A 2010 RCT aimed to determine the effectiveness of FICB versus parenteral NSAID analgesia[23]. Both interventions had an analgesic effect, but at 15 min after administration, the effect more significant in the FICB group with NRS scores of 6.24± 0.17 with NSAIDs and 2.9±0.16 with FICB ($p < 0.001$). By 2 h after administration, both groups had achieved similar pain relief. Fujihara et al. as well studied the efficacy of FICB in comparison to systemic NSAIDs alone[24]. Significant differences in VAS scores were demonstrated between the groups in both the pre- and postoperative periods, until 12h after surgery. The proportion of patients who requested additional use of NSAIDs during the 12-h postoperative period was 21 % in the FICB group and 82 % in the control group; this inter-group difference was significant. One year later, Deniz et al. assessed the postoperative analgesic efficacy of FICB and 3-in-1 FNB, compared to no block[25]. They observed a similar decrease in VAS values and opioid consumption, both in FICB and FNB, compared to no block. There were no statistically significant differences in VAS scores or opioid consumption between the blocks. Compared to the control group, the differences were both significant. VAS scores were decreased up to 2 hours ($p < 0.05$) and the consumption of tramadol was found 33.2% less in the FICB group and 27.4% in the FNB group compared to the control group. A small RCT from 2015 tried to examine the efficacy and feasibility of paramedic performed FICB for patients with suspected hip or femur fractures in the prehospital setting compared to IV morphine alone[26]. Patients who received FICB had a greater reduction in median pain score than the standard care group (50% vs. 22%, $p = 0.025$) after 15 min. The standard care group received significantly more supplementary morphine than patients in the FICB group.

In 2016, two RCT's evaluated the analgesic efficacy of FICB compared to standard care with paracetamol, codeine, and opioids. Williams et al. concluded that VAS for pain was significantly lower after standard analgesia plus FICB than standard analgesia alone ($p = 0.001$)[27]. The mean opioid dose was reduced from 6.2 to 2.0 ($p = 0.001$) in the FICB group, and the percentage of opioid overdose from 7.2% to 0% ($p = 0.001$). Bang et al. could not confirm these findings on postoperative pain scores in the first 24h post-surgery, but they did confirm a significant opioid sparing effect in this period[28]. The amount of fentanyl required at 4 hours (18.5 µg vs 74.8 µg), 8 hours (36.4 vs 78.3 µg), and 12 hours (60.4 µg vs 80.5 µg) was significantly less in the FICB group ($p < 0.05$). The total amount of fentanyl required in the first 24 hours was 246.3 ± 85.5 µg in the FICB group and 351.4 ± 87.53 µg in the non-FICB group ($P=0.01$).

Three RCT's from 2019 used a sham block as placebo in the control group to evaluate the efficacy of FICB. The first one found a significant benefit from FICB, with lower VAS scores up to 24h postoperative and less total analgesic consumption[29]. The second one concluded that a FICB is of benefit in pre-operative pain management as an adjuvant treatment to routine preoperative analgesia with morphine and paracetamol[30]. The mean VAS score for pain on movement improved significantly in the FICB group during the first 15 min ($p < 0.001$). They had significantly lower pain scores on movement at 2h and 6h after admission ($p=0.09$ and $p=0.02$, respectively), but there was no significant improvement for pain at rest at these time points. There were also no significant differences between both groups in the use of morphine nor in the consumption of paracetamol. The third RCT could not make the same conclusions[31]. They found no significant benefit in pain scores nor opioid consumption from FICB. We must mention that in this trial there was, despite randomization, a difference in pre-hospital opioid administration and therefore also in baseline pain scores; the FICB group had a higher pre-procedure morphine consumption and a lower baseline pain score than the sham injection group. The next year, Diakomi et al. evaluated the effect of FICB on both acute postoperative and chronic pain. They concluded that at all intervals in the acute postoperative period (6, 24, 36 and 48 h), patients in the FICB group reported lower NRS scores both at rest and during movement, compared to the sham FICB group[32]. Additionally, NRS scores, as well as intravenous fentanyl administration, both prior and after positioning for spinal anesthesia, were statistically significantly lower in the FICB group ($p < 0.05$). Postoperatively, patients in the FICB group requested tramadol less frequently and received significantly lower total tramadol doses for pain relief, compared to the sham FICB group (95.5 ± 21 mg versus 169.6 ± 16.5 mg respectively, $p < 0.05$). The overall sample reported a considerably high incidence of hip–related chronic postsurgical pain (CPSP) (60% at 3 months, 45% at 6 months). Characteristic pain intensity (CPI) at 3 and 6 months postoperatively was lower in the FICB group ($p < 0.01$ and $p < 0.05$, respectively). The number of patients who experienced no pain (von Korff grade 0) at 3- and 6-months post-surgery was higher in the FICB group than in the sham FICB group ($p < 0.001$).

In the previously mentioned RCT from Shukla et al. the effect of a FICB, but also of a FNB, was compared to no block 15. Compared to each of the peripheral nerve blocks, the group without nerve block experienced more pain, with NRS scores after 24h of 1.14±1.061 for FNB, 1.17±0.985 for FICB and 1.89±0.631 without block (p = 0.001). Patients without block had a higher analgesic requirement, with a mean value of 229.29 ± 33.478 mg diclofenac as compared to 137.14 ± 37.067 mg for FNB and 141.43 ± 41.098 mg for FICB (p= 0.000).

In 2019, Yamamoto et al. used IV acetaminophen to compare postoperative analgesic efficacies with FICB[33]. The VAS scores on movement at 24 h after surgery were significantly lower in the FICB group [median (the 25th to 75th percentiles), 20 (10–30) vs 40 (30–53); p < 0.01]. The VAS scores on movement at any time point after surgery and VAS scores at rest at 12 h after surgery were also significantly lower in the FICB group. The two groups did not differ in terms of the total number of rescue analgesics required. In 2020, a RCT by Thompson et al. compared the postoperative analgesic consumption between standardized, multimodal postoperative analgesia and a FICB[34]. There was a statistically significant reduction of 98% in opioid consumption in the FICB group (0.4 mg morphine vs 19.4 mg, p = 0.05). The reductions in consumption of acetaminophen were not statistically significant. Schulte et al. found a tendency towards lower VAS scores in the FICB group on day 2 post-operative, 0 vs. 2, p = 0.06, compared to the no-block group[35]. There was a statistically significant difference in preoperative morphine equivalents between both groups (13 mg for the FICB vs. 17 mg for the control group, p = 0.04).

The efficacy of FICB is also studied in the context to provide analgesia during positioning for spinal anesthesia (SA) In 2009, Yun et al. compared the FICB with continuous IV alfentanil in this specific preoperative setting[36]. The NRS scores during positioning were lower in the FICB group [2.0 (1–4) vs. 3.5 (2–6), P=0.001]. No patient who received FICB needed additional analgesics during positioning. On the other hand, VAS scores in the IV alfentanil group increased again during positioning for SA after they had initially decreased in the first 2 minutes after administration. They also noted that the mean VAS at 6 h after surgery was significantly lower in the FICB group but the amounts of rescue analgesics (Demerol i.v.) at either 6 or 24 h were not significantly different between the two groups. A 2014 RCT used IV fentanyl to compare the FICB with[37]. The FICB group had significantly lower NRS scores in all instances following the intervention (p < 0.001), shorter spinal performance time (p = 0.001), and better quality of patient positioning (p = 0.001)[37]. Postoperative morphine consumption was lower (p = 0.026), and patient satisfaction rates were higher (p < 0.001) in the FICB group. Two years later, these findings were confirmed by Madabushi et al.[38] . They also compared the FICB with IV fentanyl. The nerve block group had a significantly greater decrease in VAS scores (24.72 ± 15.70 mm vs 61.22 ± 18.18 mm for FICB and IV fentanyl respectively (p = 0.01). The FICB group had less postoperative analgesic requirement (43.3% vs 83.3%; p = 0.04). Kacha et al. compared the effect of FICB against placebo for the same purpose[39]. The NRS scores with FICB decreased significantly from 8.02 to 2.28 (p < 0.05) at the time of positioning for SA, whereas in the sham block group there was barely a reduction, from 7.98 to 7.90 (p > 0.05). At 4h postoperative, there was a significant difference between VAS scores of both groups (p < 0.05). The mean total duration of analgesia was longer in the FICB group, namely 428.3 min after SA in the FICB group, whereas 240.1 min in the placebo group (p < 0.05). The mean doses of analgesics (IV diclofenac) required in the 24 hours postoperative were statistically significantly lower in the FICB group.

Two recent RCT's compared the FICB with other nerve blocks for the preoperative pain management for hip fracture. Zhou et al. made the comparison with the femoral obturator nerve block (FONB)[40]. Both nerve blocks provided pain control, but FONB resulted in significantly better analgesia with a reduced requirement for analgesic drugs. The VAS scores at rest and on exercise in the FONB group were significantly lower at 30 min and one day after nerve block (p < 0.05). The requirement for postoperative analgesics in the FONB group was significantly lower (p = 0.048). Aprato et al. evaluated the intra-articular hip injection (IAHI)[41]. Pain was significantly lower in the IAHI group, compared to the FICB group, during movement of the fractured limb at 20 min (p < 0.05), 12 h (p < 0.05), 24 h (p < 0.05) and 48 h (p < 0.05) post administration. There were no differences in pain scores at rest. In the FICB cohort 72.9% of patients needed to take oxycodone, in contrast to 28.6% of the IAHI cohort (p<0.05). In the FICB cohort 14.09 +- 11.57 mg of oxycodone was administered, while in the IAHI cohort 4.38 +- 7.63 mg (p < 0.05). So, they concluded that IAHI provides better pre-operative pain management in elder patients with intracapsular hip fractures, with a reduced need for supplementary systemic analgesia. Further research is needed on the FONB as well as on the IAHI. We also mention that a 2009 RCT investigated the effect of FICB on perioperative delirium and found

a decreased incidence of delirium versus placebo in patients who were a priori at intermediate risk for developing delirium[42].

In 15 out of the 20 RCT's comparing FICB with placebo or conventional systemic analgesia, there is a significant benefit on perioperative pain scores and there is a reduced opioid usage in 11 out of the 20 RCT's, from which 4 had no data on opioid consumption. Two RCT's compared FICB with another regional technique, FONB or IAHI to specify, and found no benefit of FICB on pain score nor opioid consumption. More future RCT's are necessary to assess the effect of FICB compared to these other regional techniques, in the perioperative pain management of hip fractures.

The current data support the use of FICB in acute management of hip fracture pain because it is an effective, low-tech, low risk, easily learned procedure that has the potential to reduce opioid side effects in this fragile group of patients. Based on this evidence, the workgroup recommends the preoperative use of a single-shot FICB in hip fracture patients.

Continuous fascia iliaca compartment block (cFICB)

In 2015, Nie et al. made a comparison between postoperative cFICB and patient controlled intravenous analgesia (PCIA) with fentanyl[43]. Patients who received FICB reported less postoperative pain ($p = 0.039$), but the change in pain scores over time was similar between the two groups. Patients in the cFICB group received postoperative analgesia equivalent to 7.35±2.18 mg morphine, compared with 65.83±2.13 mg in the PCIA group ($p < 0.0001$). As previously mentioned, Morrison et al. made a comparison between the use of conventional analgesics and a FNB followed by a cFICB[13]. There was a significant decrease in pain scores in the intervention group both at 1- and 2-hours following admission and at postoperative day 3, in rest as well as with transfers and with walking. Intervention patients required less morphine in the emergency department and up to 3 days postoperative. A 2018 RCT compared preoperative cFICB with traditional analgesia (tramadol and paracetamol orally)[44]. In the preoperative period, in the morning of the day of surgery, the VAS pain scores at rest were lower in the cFICB group ($p = 0.023$). The VAS passive movement scores with cFICB were also significantly lower 1 h following analgesia ($p < 0.05$) and in the morning of the day of surgery ($p < 0.05$). In the same year, Mostafa et al. compared patient-controlled FICB (PC-FICB) with patient-controlled intravenous fentanyl (PC-IVF)[45]. Patients with a PC-FICB received a continuous infusion of 4 ml/h levobupivacaine 0.125% and 2 ml demand boluses with a lockout interval of 15 min. VAS score decreased significantly in the PC-FICB group at 1h, 3h and 6h postoperative ($p < 0.05$) compared to PC-IVF. There was no significant difference at 12 and 24h. There were fewer patients in the PC-FICB group who requested post-operative rescue analgesia than in the PC-IVF group ($p < 0.05$). Total postoperative analgesic consumption was significantly decreased in the PC-FICB group (31.4 ± 10.7 mg) compared to PC-IVF (70.5 ± 20.4 mg) ($p < 0.05$). Hao et al. did an RCT to compare a preoperative cFICB with 0.25% ropivacaine at 6 ml/h with a continuous placebo infusion and noticed significantly less consumption of IM fentanyl in the cFICB group before surgery (0.08 mg +-0.21 vs 0.28 mg +-0.13, $p = 0.037$) 46. The cFICB group had lower VAS scores compared with the control group, except upon admission ($p < 0.05$), and no significant differences were found for postoperative pain scores between the 2 groups. The incidence of postoperative delirium was significantly lower in the cFICB group (13.9% versus 35.7%, $p = 0.018$).

In conclusion, all 5 studies on cFICB are positive for reduction in analgesia consumption and/or opioid rescue. The method is associated with increased need of surveillance, catheter dislocation and increased risk of infection. The extra analgesia provided by cFICB may not always be needed on top of simple multimodal drugs, and thus we have not included cFICB in our recommendations for the routine case.

FNB vs FICB

We found 6 recent RCT's comparing both peripheral nerve blocks, to determine which one is superior for the pain management of hip fractures.

Newman et al. compared the analgesic efficacy and opioid sparing effect of FNB with FICB in patients awaiting surgery for hip fractures[47]. Following the FNB, the reduction in the mean VAS pain score was 0.9 (95% CI 0–1.8) greater compared with FICB ($p = 0.047$). Although this is statistically significant, this is not considered clinically important[48]. The FNB group also required less morphine than those receiving FICB ($p = 0.041$). The authors noted that, although FNB has better analgesic properties according to their study, FICB might benefit more patients if other organizational factors are considered. The relative simplicity of FICB may be considered an advantage. More specifically, FNB requires more costly equipment (a nerve stimulator and a supply of insulated nerve block needles) and takes more time to perform, up to twice as long (~20 min vs ~10 min) in their experience of over 1600 blocks. So, to deliver adequate safe analgesia to

the greatest proportion of these patients, weighing logistical, financial and training issues in the balance may favour FICB in some circumstances, according to Newman et al.

As previously mentioned, in 2014 Deniz et al. aimed to compare the postoperative analgesic efficiency of these nerve blocks too 25. FICB and 3-in-1 FNB had better analgesic properties and opioid sparing effects, compared to no block, but there was no significant difference between both blocks. In 2015, Ghimire et al. assessed which block was better for analgesia during positioning for spinal anesthesia (SA)[49]. The FICB group had lower VAS scores compared to FNB (1.0±1.1 versus 2.1±0.8; $p < 0.05$). Furthermore, the time to perform SA was shorter and patient acceptance was better in the FICB group. Despite this, there was no difference in quality of patient positioning for SA. The same year, Reavley et al. could not differentiate one block as the best one[50]. VAS pain scores at 60 min did not have a clinically important difference. Also, the use of supplemental analgesia (oral paracetamol and codeine) was very similar between the FICB and the FNB group. A 2018 RCT by Cooper et al. found no significant mean reduction in pain score at 20 min post-block administration when comparing FNB with FICB (2.6 versus 2.3, $p = 0.41$)[51]. They had no data on opioid usage. Samewise Shukla et al. found no significant difference in pain scores or analgesic requirement between the two nerve blocks[15]. The VAS scores after 24h were 1.14±1.061 for FNB and 1.17±0.985 for FICB, ($p = 0.907$) at rest and 2.77±0.877 for FNB and 2.89±0.867 for FICB ($p = 0.585$) after passive elevation of the leg. The analgesic requirement of diclofenac was 137.14 ± 37.067 mg for FNB and 141.43 ± 41.098 mg for FICB, $p = 0.458$. Only in the control group with no block there was an additional requirement of tramadol.

Based on this evidence that the differences in analgesic benefit between FNB and FICB are rather small, the workgroup recommends the use of one of both blocks.

Adjuvant drugs to regional blocks

Last year, Amin et al. conducted an RCT to determine the efficacy of adding dexmedetomidine to the local anesthesia mixture for a FICB for positioning patients with a femur fracture for spinal anesthesia[52]. They added 80 µg dexmedetomidine to 40 ml bupivacaine 0.25%. The time to sensory block was significantly shorter and pain during positioning for spinal anesthesia was significantly lower in the dexmedetomidine group, but there were no differences regarding fentanyl requirements. Postoperatively, pain scores were significantly lower after 6 and 8 hours, time to first analgesic request was longer and total analgesic requirement was less in the dexmedetomidine group.
Currently, the PROSPECT workgroup does not recommend dexmedetomidine as an adjuvant drug to local anesthetics in peripheral nerve blocks due to limited procedure-specific evidence.

Pericapsular nerve group (PENG) block

In our literature search, we found 2 recent RCT's concerning the pericapsular nerve group (PENG) block in the pain management for hip fractures. The PENG block targets the articular branches of the femoral nerve and the accessory obturator nerve between the anterior inferior iliac spine and iliopectineal eminence., Local anesthetic spread to the subpectineal plane is assumed to block the branches of the obturator nerve[53].

Lin et al. made a comparison between the PENG block and the FNB and found a reduction in postoperative pain[54]. In the recovery room on POD 0, 19 patients (63%) in the PENG group experiencing no pain, compared with 9 patients (30%) in the FNB group ($p=0.04$). The duration of this extra analgesic benefit was short, with no difference in pain intensity between PENG block and FNB on POD 1. Patients who received the PENG block had better preservation of quadriceps strength compared to the FNB group. Despite the short-term analgesic benefit and improved quadriceps strength, there were no differences detected in the total opioid consumption nor in the quality of recovery. A 2020 RCT by Alrefaey et al. assessed the analgesic efficacy of the PENG block for positioning for spinal anesthesia[55]. They concluded that the PENG block was associated with statistically significant lower pain levels ($p<0.001$) during positioning for spinal anesthesia compared to placebo in the control group. The patient sitting angle during positioning was also better in the PENG group.

These 2 trials are promising, but further research on the PENG block in the context of analgesia for hip fractures is needed. Currently, the PROSPECT workgroup does not recommend the use of a PENG block for analgesia in hip fracture patients due to limited procedure-specific evidence.

Intra-operative interventions

1. Local infiltration analgesia (LIA)

One randomized controlled trial examined the effect of peri-operative local infiltration analgesia combined with the placement of a catheter on the anterior side of the greater trochanter in hip fracture patients surgically treated with a sliding hip screw[56]. The intervention group received perioperative LIA

with ropivacaine (200mg in 75mL) followed by 6 injections of ropivacaine (100mg in 20mL) via the catheter every 8h during the first 48h postoperatively. The control group received a saline infiltration and saline via the catheter. The study found no statistically significant effect in pain scores, at rest and during hip flexion, or postoperative opioid consumption between the intervention and the placebo group[56].

Another randomized controlled trial examined the combined effect of LIA and preoperative oxycodone & celecoxib versus no intervention or preoperative analgesics in hip fracture patients undergoing surgical repair with a hemi-arthroplasty[57]. The infiltration, consisting of a volume of 100mL, was a mix of ropivacaine 300mg, morphine 10mg, ketorolac 30mg, epinephrine 300µg and cefmetazole 1000mg[57]. The infiltration was injected intramuscular, in the periost, in the synovium, in the capsule & in the subcutaneous tissue. VAS scores were statistically lower in the intervention group on postoperative day 1 and 4 (the first two assessments) but not on postoperative day 7 and at discharge. Postoperative cumulative fentanyl dose, via patient controlled intravenous analgesia, was higher in the control group. Other outcomes, nausea and vomiting, postoperative delirium or length of hospital stay were not different between intervention or control group[57].

Based on these studies, current evidence does not unequivocally support the use of LIA in hip fracture patients. The study by Bech et al. did not show any benefit of LIA in reducing postoperative pain scores or opioid consumption, even when extending the duration of action via catheter[56]. Therefore, the PROSPECT group does not recommend the use of local infiltration analgesia due to inconsistent evidence.

2. Neuraxial anesthesia

Spinal anesthesia

A randomized controlled trial by Haghighi et al. showed a clear analgesic benefit in spinal anesthesia in the immediate postoperative phase[58]. The study reported a significantly lower VAS and mean morphine consumption in the spinal anesthesia group versus general anesthesia in the post anesthesia care unit. The spinal group also had less nausea and vomiting but had a longer time to discharge to general ward and a lower mean arterial pressure[58]. A trial by Heidari et al. also compared neuraxial anesthesia to general anesthesia. The neuraxial group consisted of both spinal and epidural anesthesia (86,3% spinal, 12,1% epidural, 1,6% not specified) and showed a significantly lower mean VAS in the post anesthesia care unit[59]. However, the difference was not statistically significant on the second and fifth postoperative day and not clinically significant on the third postoperative day (only 0.5 difference in VAS)[59].

Luger et al. compared different outcome parameters in a systematic review and found one study that showed an early analgesia benefit for spinal analgesia at 1h postoperatively but not later[60]. However, another study showed no difference in postoperative diclofenac use when comparing spinal and general anesthesia[60].

A systematic review by Abou-Setta et al. examined one RCT that showed a benefit in analgesia in spinal anesthesia, but it had insufficient strength of evidence 1. The addition of fentanyl, sufentanil or morphine does not result in a difference in pain scores, but the quality of the examined RCT's deemed to be insufficient as well[1].

Further research is needed to validate differences in outcome between spinal and general anesthesia. There does seem to be an early analgesic benefit for spinal anesthesia but the choice between spinal and general anesthesia depends on factors other than pain. The use of opioids as adjuvant drugs to local anesthetics is not recommended due to lack of evidence.

Epidural anesthesia & analgesia

A randomized placebo-controlled trial by Foss et al.[61] assessed the effect of continuous epidural analgesia on analgesia and mobility in hip fracture patients. The epidural analgesia was administered until the fourth postoperative day and consisted of a mixture of bupivacaine (0.125%) and morphine (50µg/mL) at a rate of 4mL/h. The resting pain scores were lower in the epidural group on the first and second postoperative day, and the cumulative opioid consumption was significantly lower in the epidural group during all four postoperative days. Pain during mobilization was assessed during different types of mobilization (knee & hip flexion, walking, supine to sitting transfer, and sitting to standing transfer). The pain scores during any type of mobilization were significantly lower in the epidural group at all timepoints except when performing sitting to standing on the third and fourth postoperative day. As for postoperative mobility, there was no significant difference in the previously described types of mobilization. However, the reason for not being able to mobilize was different, pain was the dominant impairing factor in the non-epidural group on the first two postoperative days, nausea was the dominant factor impairing mobilization in the epidural group on the first postoperative day. Interestingly, the epidural group did not have a statistically significant higher incidence of motor block.

A randomized controlled trial by Luger et al. compared epidural analgesia, 3-in-1 block, and piritramide for analgesia in hip fracture patients in the emergency department[20]. They found an analgesic benefit of epidural analgesia and 3-in-1 block in hip fracture patients lasting until surgery but not postoperatively[20]. However, in the 14 patients initially allocated to epidural analgesia 8 patients (57.1%) did not receive epidural analgesia due to unsuccessful catheter placement, refusal of patients or, in one patient, anticoagulation therapy[20]. Therefore, the authors of the trial do not recommend the use epidural analgesia in this setting due to frequent technical problems[20]. A systematic review by Rubin et al. analyzed three randomized controlled trials studying pre-operative epidural analgesia in hip fracture patients and did not find a difference between epidural analgesia and systemic therapy[62].

Sonawane et al. compared the addition of dexmedetomidine (1µg/mL) or ketamine (0.5mg/mL) to bupivacaine (0.125%) in hip fracture patients receiving combined spinal epidural anesthesia[63]. Motor and sensory block were significantly prolonged in the dexmedetomidine group. Mean pain scores over 48h were significantly lower in the dexmedetomidine group, but not clinically significant (0.2 in dexmedetomidine group versus 1 in the ketamine group). The use of rescue analgesia, however, was not statistically significant. The rate of epidural administration of bupivacaine and dexmedetomidine or ketamine was not described and since there was no control group in this study receiving plain bupivacaine, it is difficult to assess an added value of either ketamine or dexmedetomidine as an adjuvant drug in epidural analgesia in hip fracture patients. The prolonged motor block in the dexmedetomidine group may also impair mobilization. Based on these areas of uncertainty, the PROSPECT group does not recommend the use of ketamine or dexmedetomidine as adjuvant drug in epidural anesthesia for hip fracture patients.

3. Alpha-2-agonists

Dexmedetomidine

A randomized controlled trial by Zhang et al. assessed the effect of perioperative intravenous administration of dexmedetomidine on pain and postoperative delirium and found no difference in pain scores between groups. Postoperative delirium was, however, reduced on the first postoperative day in the dexmedetomidine group[64]. There was no difference in postoperative delirium on the second and third postoperative day. Based on this single study, the PROSPECT group cannot recommend perioperative intravenous dexmedetomidine for analgesic purposes. The observed decrease in postoperative delirium after intravenous dexmedetomidine may improve outcome in hip fracture patients but further research is necessary.

Clonidine

Mannion et al. examined the effect of intravenous or perineural administration of clonidine (both 1µg/kg) as an adjuvant drug to psoas compartment block (0.4 mL/kg levobupivacaine 0.5%) in hip fracture surgery[65]. Intravenous clonidine, but not perineural clonidine, resulted in a longer time to first rescue analgesic drugs. Pain scores were similar between the different groups and no difference in adverse events was observed[65].

The PROSPECT group does not recommend clonidine, either intravenous or as adjuvant drug to local anesthetics in peripheral nerve blocks, due to lack of procedure-specific evidence.

Post-operative interventions

1. Nonsteroidal anti-inflammatory drugs (NSAIDs)

One RCT in a systematic review by Abou-Setta et al. compared the analgesic effect of parecoxib with diclofenac and meperidine postoperatively favoring parecoxib but the RCT was found to have insufficient strength of evidence[1].

2. Non-pharmacologic interventions

Transcutaneous electrical nerve stimulation

Transcutaneous electrical nerve stimulation (TENS) is a non-pharmacological intervention designed to provide analgesia using low-voltage electrical current. One placebo-controlled study examined the effect of TENS on postoperative pain and mobility in a follow-up period of 5 days[66]. TENS resulted in lower pain scores during walking starting from the third postoperative day but did not, at any time, result in significant difference during rest. Opioid consumption did not differ at any time in the 5 day follow up period. Mobility assessed by functional ambulation classification (FAC) was higher in the TENS group starting from the third postoperative day, the 2-minute walking test (2MWT) was also higher in the intervention group, however there was no difference in the five times sit to stand test (5xSTS) between groups[66].

A systematic review by Abou-Setta et al. analyzed 3 RCT's that reported an analgesia benefit by TENS but the strength of evidence was categorized as insufficient 1. Further randomized controlled trials should be performed in the future to further validate the observed analgesic benefit when using TENS. Currently the use of TENS is not recommended due to limited procedure-specific evidence.

Continuous-flow cryocompression therapy

Continuous-flow cryocompression therapy (CFCT) is a therapy that utilizes the flow of ice-cold water and intermittent compression to provide analgesia and hemostasis.

One randomized controlled trial examines the effect of CFCT on postoperative pain and found a clinically not relevant difference in pain scores at 72h postoperatively[67]. Pain scores at 24h & 48h postoperatively, postoperative analgesic use, incidence of delirium, transfusion rate and functional outcome were identical between intervention and control group[67]. Based on this study CFCT is not recommended for postoperative use in hip fracture surgery due to lack of procedure-specific evidence.

Supportive psychotherapy

The effect of supportive psychotherapy was examined in one randomized controlled trial. Pain scores decreased more rapidly in the counseling group, but this effect was only statistically significant in one of the two assessments on the fourth and fifth postoperative day[68]. Lower anxiety and depression scores (assessed by STAI-YI, state–Trait anxiety inventory and HAM-D, Hamilton rating scale for Depression respectively) were observed in the supportive psychotherapy group. These results show a modest analgesia benefit, but further research needs to further corroborate these results before a clear recommendation can be made. Currently supportive psychotherapy is not recommended due to limited procedure-specific evidence.

Leg in traction

No randomized controlled trials were published on this topic.

Discussion

The majority of the studies included in this systematic review were determined to be of high quality. The updated PROSPECT methodology strengthens the recommendations, because it goes beyond assessment of the available evidence based solely on statistical analysis[6]. No procedure-specific studies were identified for paracetamol. Nevertheless, paracetamol is recommended as part of basic multimodal analgesia because it contirbutes to pain relief, particularly when combined with NSAIDs or COX-2 specific inhibitors[6]. No procedure-specific studies were identified for NSAIDs/COX-2-specific inhibitors. Here again, NSAIDs/COX-2- selective inhibitors are recommended as part of basic multimodal analgesia, when not contra-indicated. Of note, gastro-intestinal, cardiac and renal complications of NSAIDs should be taken into account particularly in older patients [69].

Both the FICB and the FNB have been shown to reduce pain scores and opioid consumption. Our findings on FNB and FICB confirm previous systematic reviews and meta-analyses, which conclude that either FNB or FICB are safe and effective to provide good perioperative analgesia and to reduce the total amount of opioid consumption[70-78]. Typically, peripheral nerve blocks can reduce pain on movement within 30 minutes of block placement and effect size is proportional to the concentration of local anaesthetic used[70]. Both the FICB and the FNB are easy and safe, there is no evidence to favor one technique over the other. Therefore, the choice between FNB or FICB should be based on clinician experience and/or institutional preferences. Interestingly, in theory, FICB should provide better pain relief than FNB, as it blocks the lateral femoral cutaneous nerve along with the femoral nerve, but several investigations have shown them to be equally effective[15]. Also, FICB might provide better outcomes in terms of chronic postsurgical pain and might be preferable because of its relative simplicity in technique and less invasiveness, but also because of its less expensive equipment and a faster time to perform the FICB placement[15,32,47]. In this review, we grouped the 3-in-1 block and the FNB although the terminology differs in the literature. Of note, FICB is a heterogeneous group of blocks, the distal and the proximal supra-inguinal blocks, and some may consider then as different technqiues. Since the supra-inguinal approach covers a broader area than the infra-inguinal approach, the supra-inguinal approach is preferred.

Motor blockade can occur depending on the local anesthetic dilution. However, this should not preclude the use of peripheral nerve blocks because patients typically due to ambulate for about 24 h. Nevertheless, depending on the timing of surgery, single shot nerve blocks are recommended as continuous catheter techniques might delay ambulation. Also, peripheral blocks could be repeated if necessary. Thus, the analgesic benefits of continuous infusion techniques are not sufficient to justify the placement of catheters on a routine basis, but may be considered if there is an expected delay for surgery. There is a need for further research assessing the balance of risks and complexity versus analgesic benefits of continuous techniques in presence of optimal basic analgesic administration. A novel regional technique, the pericapsular nerve group (PENG) block has been reported to provide excellent pain relief while

preserving motor function. Thus, the PENG block has great potential, however, further trials are necessary before it can be recommended.

We also would like to emphasize that adjuvant drugs added to a peripheral nerve block have been almost not studied in this patient and surgical population. Future studies should evaluate different adjuvants which might be especially useful in this frail population. We also emphasize that a pre-operatively placed regional block might potentially be beneficial to our fracture patients. Unfortunately the evidence is not yet available.

Spinal anaesthesia may provide superior pain relief in the immediate postoperative phase; however, the observed benefits may be unequivocally attributed to neuraxial anesthesia[58-60]. However, neuraxial anaesthesia may contribute to improvement in other outcomes. The review of Luger et al. found that spinal anesthesia lowers the incidence of deep vein thrombosis, postoperative delirium, pneumonia, fatal pulmonary embolism, myocardial injury, postoperative hypoxia and is associated with an early mortality benefit[60]. However, in patients receiving spinal anesthesia the incidence of hypotension and cerebrovascular accidents was higher, and the duration of surgery was longer[60]. In the systematic review by Abou-Setta 30-day mortality was not different between general anesthesia and spinal anesthesia with a low strength of evidence[1]. The review found no difference in incidence of delirium, myocardial injury, renal failure & stroke when compared to general anesthesia but the RCT's also had insufficient strength of evidence[1]. The Cochrane review by Guay et al. does not show a difference in mortality rate, incidence of pneumonia, delirium, myocardial injury, cerebrovascular accident, or deep vein thrombosis but the quality of the evidence is low[81]. Neumann et al. in the REGAIN study and Li et al. in the RAGA trial could not demonstrate different outcomes whether spinal versus general anesthesia was used in hip surgery patients[82,83]. It must be emphasized that in both studies sedation supplemented the smpinal anesthetic confounding the potential results. Future trials are necessary to assess differences in outcome between different anaesthetic techniques in hip fracture patients. It is also unclear whether the observed analgesic benefit persist in patients who have received a pre-operative nerve block. The PROSPECT workgroup advises, however, that despite early analgesic benefits of spinal anesthesia, the choice of spinal or general anesthesia depends on factors other than pain (e.g. patient-, surgeon- and institution- related factors).

Although local infiltration analgesia (LIA) have been reported to be of benefit for joint arthroplasty, it is not recommended for hip fracture surgery due to inconsistent evidence[56,57]. Epidural analgesia is not recommended due to limited procedure-specific evidence. Concerns of motor block impairing early mobilization[61]. Also, technical issues may impair its use in the emergency department[20]. The use of the less invasive peripheral nerve blocks might further mitigate the need for epidural analgesia in hip fracture patients. The addition of dexmedetomidine as an adjuvant to local anaesthetic solution administered epidurally is not recommended due to an increased risk of motor block. Similarly, dexmedetomidine as an adjuvant drug to local anesthetics in peripheral nerve blocks is currently not recommended due to limited procedure-specific evidence. Also, addition of ketamine to local anaesthetic is not recommended due to lack of procedure-specific evidence for an analgesic benefit[63]. Intravenous use of alpha-2-agonists dexmedetomidine or clonidine is also not recommended due to lack of procedure-specific evidence[64,65]. The observed decrease in postoperative delirium after perioperative intravenous dexmedetomidine may affect outcome in hip fracture patients and warrants further research[64]. Low dose transdermal buprenorphine is not recommended due to limited procedure-specific evidence, one RCT showed an analgesic benefit but the workgroup has concerns about the systematic use of long-acting opioids[8]. This study administered non-opioid analgesics (paracetamol & diclofenac) only as rescue medication. Therefore, the benefit of transdermal buprenorphine might be less in clinical practice and alternatives with less addictive potential might be more suitable. More trials studying adverse effects when using transdermal buprenorphine should be performed before a recommendation can be made. Further trials are necessary to assess the analgesic benefits of continuous-flow cryocompression therapy and transcutaneous electrical nerve stimulation (TENS) before they could be recommended. No RCTs were identified examining either the use of intravenous ketamine, gabapentinoids or intravenous corticosteroids.

The influence on postoperative pain from surgical techniques is probably of lesser clinical importance due to the fact that different types of hip fracture require different types of surgical repair[79]. The decision about surgical technique, therefore depends on factors other than pain.

The study carries limitations. Type of hip fracture and method of surgery are heterogeneous, and this might influence pain postoperatively. However, uniform studies on similar types of fractures, similar surgical interventions and similar pain solutions

have not been published. Hence, no conclusions can be made. As with all PROSPECT recommendations we are unable to suggest one type of NSAID above another type. Many obvious interventions such as traction, early surgery, various adjuvant drugs, intrathecal morphine, etc.. have not been tested in this specific group of patients with hip fracture who are generally old and frail. We suggest that research on postoperative pain after hip fracture focusses on these issues.

Table I. — Interventions that are recommended.

Time of administration	Intervention	Reasons for recommending
Pre-operative	Paracetamol	Part of basic multimodal analgesia
	NSAIDs or COX-2- selective inhibitors	Part of basic multimodal analgesia
	Single shot femoral nerve block [including 3-in-1 block] (no catheter except in specific circumstances)	Analgesic effect and reducing the need for rescue analgesics. The choice between FNB and FICB should be made according to local expertise.
	Single shot fascia iliaca compartment block (no catheter except in specific circumstances)	Analgesic effect and reducing the need for rescue analgesics. The choice between FNB and FICB should be made according to local expertise.
Intra-operative	Paracetamol	Part of basic multimodal analgesia
	NSAIDs or COX-2- selective inhibitors	Part of basic multimodal analgesia
	Spinal anaesthesia or general anaesthesia	Choice depends on factors other than pain
Post-operative`	Paracetamol	Part of basic multimodal analgesia
	NSAIDs or COX-2- selective inhibitors	Part of basic multimodal analgesia
	Opioids as rescue	Part of rescue analgesia

Table II. — Interventions not recommended.

Time of administration	Intervention	Reasons for not recommending
Pre-operative	Transdermal buprenorphine	Limited procedure-specific evidence
	PENG block	Limited procedure-specific evidence
Intra-operative	Local infiltration analgesia (LIA)	Inconsistent evidence
	Epidural anesthesia & analgesia	Limited procedure-specific evidence
	Epidural adjuvant drugs	Lack of procedure-specific evidence & increased risks
	Dexmedetomidine IV	Lack of procedure-specific evidence
	Dexmedetomidine adjuvant to LA in PNB	Limited procedure-specific evidence
	Clonidine IV & adjuvant to LA in PNB	Lack of procedure-specific evidence
Post-operative	Continuous-flow cryocompression therapy (CFCT)	Lack of procedure-specific evidence
	Supportive psychotherapy	Limited procedure-specific evidence
	Transcutaneous electrical nerve stimulation (TENS)	Limited procedure-specific evidence

Finally, we feel that early versus late surgery will surely also affect outcome and potentially postoperative pain. In the context of pain this has not yet been studies, but we recommend early surgery to be performed.

In summary, for patients having hip fracture, pre, intra and postoperative paracetamol and non-steroidal anti-inflammatory drugs or COX-2 inhibitors are recommended. A single shot femoral nerve block or a single shot fascia iliaca compartment block are recommended. Continuous catheter techniques should be used only in specific circumstances. The choice between femoral nerve block or a fascia iliaca compartment block should be made according to local expertise. The postoperative regimen should include regular paracetamol, non-steroidal anti-inflammatory drugs and COX-2 inhibitors with opioids used for rescue.

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