Knee Surg Sports Traumatol Arthrosc (2014) 22:843–847
DOI 10.1007/s00167-013-2665-y

HIP

Utility of multimodal analgesia with fascia iliaca blockade for acute pain management following hip arthroscopy

Aaron J. Krych · Sean Baran · Scott A. Kuzma · Hugh M. Smith · Rebecca L. Johnson · Bruce A. Levy

Received: 13 June 2013 / Accepted: 2 September 2013 / Published online: 24 September 2013

Abstract
Purpose The purpose of this study was to evaluate the utility of multimodal analgesia with fascia iliaca blockade and for acute pain control in patients undergoing hip arthroscopy.
Methods Thirty consecutive patients undergoing primary hip arthroscopy were prospectively studied. All patients were treated preoperatively with ultrasound-guided single injection fascia iliaca blockade and multimodal analgesia. Data collected included post-operative nausea, numeric rating scale (NRS) pain scores during rest and activity, opioid consumption during the first five days (recorded as tablets of 5 mg hydrocodone/500 mg acetaminophen) and overall patient satisfaction with analgesia.
Results This study included 23 female and 7 male patients with a median age of 35 years (range 14–58). No patient required medication for post-operative nausea. The overall NRS scores were an average of 3.9 on day 0, 3.6 on day 1, 3.4 on day 2, 2.9 on day 3, 3.0 on day 4 and 2.7 on day 5. The average tablets of opioid taken were 1.5 on day 0, 1.2 on day 1, 1.3 on day 2, 1.0 on day 3, 1.1 on day 4 and 0.9 on day 5. Overall, 20 patients rated their post-operative pain control as very satisfied (67 %), and 10 patients as satisfied (33 %). There were no complications or side effects from the fascia iliaca blockade.
Conclusion In this prospective study, multimodal analgesia with fascia iliaca blockade following hip arthroscopy was safe and effective. The quality of early post-operative analgesia provided by the fascia iliaca blockade was excellent and resulted in low opioid consumption, high quality of pain relief and high overall patient satisfaction.
Level of evidence Prospective case series, Level II.

Keywords Fascia iliaca blockade · Multimodal analgesia · Hip arthroscopy · Acute pain management

A. J. Krych · S. Baran · S. A. Kuzma · B. A. Levy (✉)
Department of Orthopedic Surgery and The Sports Medicine Center, Mayo Clinic and Mayo Foundation, 200 First Street SW, Rochester, MN 55905, USA

H. M. Smith · R. L. Johnson
Department of Anesthesiology, Mayo Clinic, Rochester, MN, USA

Introduction

Hip arthroscopy is an increasingly common surgical intervention to address pathology of the hip joint. Facilitating successful outpatient hip arthroscopic procedures requires safe and effective post-operative analgesia. Previous attempts to provide post-operative analgesia have included intraarticular or arthroscopic portal analgesic injection [3], L1-2 paravertebral blocks [15] and femoral nerve blockade [22]. An alternative method, which involves blockade of the lumbar plexus by injecting local anaesthetic deep to the fascia iliacus, has been used successfully for perioperative pain control in patients undergoing surgery for femur fractures, anterior ligament reconstruction and total hip arthroplasty. In these procedures, fascia iliaca blockade (FIB) has resulted in decreased pain and opioid requirements during the post-operative period [7, 12, 14, 16, 18, 21, 23]. These results suggest that fascia iliaca blockade during hip arthroscopy may be beneficial for acute post-operative pain control. There are no data available on the efficacy or potential advantages/disadvantages of fascia iliaca blockade in patients undergoing hip arthroscopy.

Therefore, a prospective study utilising fascia iliaca blockade and multimodal analgesia after hip arthroscopy was designed with the purpose of determining its utility in providing early post-operative pain control and facilitating discharge from the ambulatory surgical centre. Based upon a limited number of pilot patients, it is hypothesised that the fascia iliaca blockade for pain control following hip arthroscopy will be safe and effective.

Materials and methods

For this prospective study, we identified patients undergoing primary hip arthroscopy by two experienced hip surgeons (BAL and AJK) performed between March and September 2012. All patients provided written consent to participate in the study, and the study was approved by our institutional review board.

Inclusion/exclusion criteria

Inclusion criteria for study participants included (1) patients requiring arthroscopy on a native hip, (2) no prior hip surgery, (3) English speaking, (4) able to sign consent form and (5) between the ages of 18 and <50 years old. Exclusion criteria included (1) patients outside defined age limits (2) prior hip surgery, (3) non-English speaking, (4) inability to provide informed consent, (5) allergy to analgesic agent (i.e. bupivacaine), (6) patients with opioid dependence and (7) intolerance or contraindication to NSAIDS.

Outcome variables

Outcomes important to this analysis included post-operative nausea, VAS pain scores during the first 5 days following surgery, opioid consumption and overall patient satisfaction.

Fascia iliacus nerve blockade and surgical procedure

On the day of surgery, each patient received a standardized multimodal analgesic protocol, which consisted of preoperative medications, ultrasound-guided fascia iliaca blockade immediately prior to the start of surgery and predefined intraoperative and post-operative opioid medications. Preoperatively, each study patient received oral analgesic medications including acetaminophen 1,000 mg, celecoxib 400 mg, gabapentin 300 mg and oxycodone 10 mg.

Regional anaesthetic technique

Patients received sedation using midazolam 2 mg and fentanyl 50–100 mcg intravenously. With the anterior thigh prepped and draped in standard sterile fashion, the ultrasound probe was placed inferior to the inguinal ligament of the operative side to obtain imaging of the iliacus muscle and overlying fascia iliaca. Equipment for the fascia iliaca blockade included a GE LOGIQe ultrasound machine, 12 L, 8–13 MHz probe, and a BBraun Stimuplex 22 gauge, 5-cm insulated 30° bevel needle. Using out-of-plane technique and real-time sonographic guidance, the needle was advanced to enter the potential space superficial to the iliacus muscle and inferior to the fascia iliacus (Fig. 1). At this location, 40 ml 0.25 % bupivacaine with 1:200,000 epinephrine was injected in incremental fashion. Intraoperatively, all patients received the same general anaesthesia protocol including general endotracheal anaesthesia with non-depolariser muscle relaxation, propofol/remifentanil infusion titrating to BIS of 40–60 or volatile anaesthetic. Analgesics included ketamine 10 mg IV at the start of case and 10 mg IV ketamine and ketorolac 15 mg IV at the end of the case. Anti-emetics included scopolamine 1.5 mg transdermal patch, granisetron 0.1 mg and droperidol 0.625 mg intravenously, to minimise post-operative nausea and vomiting as a confounding factor in discharge.

All surgeries were performed arthroscopically in the supine position utilising a standard hip arthroscopy table. Either two or three standard portals were used based on the surgeon's preference. In all cases, diagnostic arthroscopies, pincer resections with labral repair and cam resection with femoral neck osteochondroplasties were performed.

Following skin closure and extubation, patients were transferred to the outpatient ambulatory surgery recovery room and received a standardised post-operative analgesic protocol of fentanyl and acetaminophen/hydrocodone as needed for pain. All patients were discharged home from the outpatient recovery area, and the time from skin

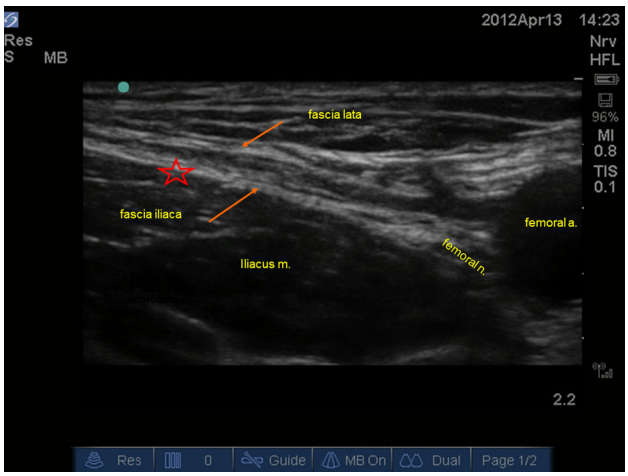

Fig. 1 Ultrasound image of fascia iliaca blockade with the *red star* denoting the location for injection of local anaesthetic in the potential space superficial to the iliacus muscle and inferior to the fascia iliacus

incision closure to discharge was recorded. In addition, post-operative nausea and any medications required for post-operative nausea were prospectively recorded. All patients received the same standard post-operative medication regimen that included heterotrophic bone prophylaxis for the first 4 days post-operatively with indomethacin sustained release 75 mg daily and the use of hydrocodone/acetaminophen 5/500 mg tablets. Patients were instructed to take one to two tablets every four to six hours as needed for pain and record their use in a pain diary. During this time, patients are mobilised without a brace and instructed to use crutches with foot flat partial weight-bearing.

Assessment of pain control

Post-operative pain diaries were given to study patients at their preoperative visit and provided with instructions for recording their opioid usage and visual analogue scale (VAS) pain score during rest and activity. The pain diaries included (1) 10-cm visual analogue pain scale as described by DeLoach et al. [10]; (2) category ratio or numerical rating scale (NRS; 0 for no pain, 10 for extreme pain) as described by Borg recorded for both pain at rest and pain with activity [6]; (3) quantitative opioid use (number of tablets of oxycodone); and (4) overall satisfaction with post-operative pain control (4-category Likert scale) as described by Woods et al. [24] They were specifically asked in a written questionnaire, "What is your overall satisfaction with post-operative pain control?" Patients completed the pain diaries at 6:00 pm on the day of surgery and at 6:00 am, 12:00 noon and 6:00 pm post-operative days 1–5.

Potential complications

Any potential complications were recorded including any vascular puncture, intraneural injection, persistent pain or numbness or post-operative fall. In addition, all patients were assessed by the treating surgeon at 2 weeks post-operatively to assess for any thigh or groin numbness, paresthesias or dysesthesias that may have been a complication of the blockade.

This study protocol was approved by Mayo Clinic IRB #08-002259 prior to enrolment of patients.

Statistical analysis

Descriptive analyses of the patient data were performed using means and standard deviations for continuous variables. Changes in subjective patient outcome (VAS scores) and objective outcome (amount of opioid consumed) were assessed using paired t-tests comparing various time points. Two-tailed tests were used for all statistical analyses with a critical alpha set to 0.05. All analyses were done using SPSS version 18.0 (SPSS Inc., Chicago, IL).

Results

Thirty patients met inclusion criteria, were enroled and analysed in the present study. The group consisted of 23 females and 7 males with an average age of 34 (SD 13.3). Patients reported a mean pain score of 3.5 ± 2.3 in the post-operative recovery room. Six patients required only oral opioids in the recovery room, 2 received only IV opioids, 20 received both IV and oral opioids and 2 required no opioids. The average time from skin incision closure to discharge from the outpatient area was 199 min (SD 60 min). Three patients had mild nausea, but none required any anti-emetic medications. The overall NRS scores are reported in Table 1. Statistically, there was no significant change in NRS score or opioid consumption at any time point following surgery (all p values > 0.05). Six-hour variations in VAS scores are presented in Fig. 1.

In rating their overall satisfaction with the post-operative pain control, 20 were very satisfied (67 %) and 10 were satisfied (33 %). No complications were identified in patients who received the fascia iliaca blockade. There were no overnight admissions.

Discussion

The most important finding of the present study was that patients undergoing hip arthroscopy had low opioid requirements and a high level of satisfaction with pain control utilising a fascia iliaca blockade and multimodal analgesic plan. Hip arthroscopy continues to increase in frequency as understanding of hip pathology and surgical techniques and equipment improves. It is feasible to perform these procedures on an outpatient basis, but there is little information to guide optimal post-operative pain management.

The fascia iliaca block is a lumbar plexus block providing blockade of the femoral, lateral femoral cutaneous and obturator nerves. This was first described by Dalens et al. [9] using surface landmarks and loss of resistance technique. However, Dolan and colleagues have demonstrated that ultrasound visualisation increased the efficacy of fascia iliaca blockade from 60 % using the resistance technique to 95 % using ultrasound guidance [11]. Fascia iliaca blockade has been previously demonstrated as both safe and effective following surgery for femur fractures and total hip arthroplasty, with studies reporting decreased pain and reduced opioid requirement post-operatively [7,

Table 1 Mean VAS and NRS pain scores and tablets of opioid pain medicine taken on the day of surgery and the first 5 days post-operatively

Day	VAS*	NRS Activity*	NRS Rest*	Overall NRS[a]*	Tabs Vicodin*
0	4.7 ± 2.5	4.8 ± 2.9	3.1 ± 2.4	3.9 ± 2.8	1.5 ± 0.8
1	4.7 ± 2.5	4.4 ± 2.5	2.9 ± 2.2	3.6 ± 2.5	1.2 ± 0.8
2	4.6 ± 2.2	4.1 ± 2.5	2.7 ± 1.9	3.4 ± 2.3	1.3 ± 1.3
3	4.0 ± 2.2	3.5 ± 2.2	2.4 ± 1.9	2.9 ± 2.1	1.0 ± 1.1
4	3.9 ± 2.0	3.6 ± 1.9	2.4 ± 1.9	3.0 ± 2.2	1.1 ± 1.2
5	3.4 ± 1.9	3.2 ± 2.1	2.1 ± 1.7	2.7 ± 2.0	0.9 ± 1.2

VAS visual analogue scale, *NRS* numeric rating scale

* All p values not significant ($p > 0.05$)

[a] Overall = mean of all NRS activity and NRS rest pain scores

12, 14, 16, 18, 21]. The main working portals in hip arthroscopy are the mid-anterior and anterolateral portals, which are within the anatomic distribution of the lateral femoral cutaneous nerve and anterior branches of the femoral nerve [19]. A capsulotomy is also performed during hip arthroscopy, and the anterior and anterolateral capsules are innervated by the femoral and obturator nerves [4]. The rationale for using the fascia iliaca blockade for analgesia with hip arthroscopy is that all the working portals and capsulotomy are potentially encompassed within the distribution of a fascia iliaca nerve block.

In this study, patients required low amounts of opioid following hip arthroscopy. This finding agrees well with previously published data on fascia iliaca blockade. In the setting of total hip arthroplasty, Stevens et al. performed a randomised, double-blinded study of fascia iliaca blockade versus saline control. They found that the trial group used significantly less opioid as 12 and 24 h [21]. Less opioid medication is associated with higher patient satisfaction and decreases in side effects, including nausea, urinary retention and constipation [12]. In the setting of hip fractures, Dulaney-Cripe et al. demonstrated the benefits of fascia iliaca blockade with lower pain scores, decreased opioid consumption and shorter hospital stays compared to medication alone [12]. Elkhodair and colleagues showed that the technique is readily teachable, as it was able to be successfully performed by junior emergency department staff in a busy environment with inexpensive equipment for preoperative analgesia in patients with femoral neck fracture [13].

No complications of fascia iliaca blockade were identified in the present study. Overall, fascia iliaca blockade is considered safe and appears to have few clinical risks [8]. In reviewing the literature, only two complications are reported. Blackford and colleagues report a case of accidental bladder puncture with a fascia iliaca blockade, but this occurred in a patient with a marked hip flexion contracture [5]. Atchabahian et al. describe post-operative neuropathy following fascia iliaca compartment blockade [1]. Paut et al. found fascia iliaca blockade to be well tolerated with no adverse side effects [17]. In their study in children undergoing fascia iliaca blockade for post-operative analgesia, they demonstrated safe plasma bupivacaine concentrations that were well within established safety margins with 0.375 % ropivacaine [17]. Pneumoretroperitoneum has also been reported as a consequence of the injection [20], but does not have any direct adverse consequences. It is important to note that in treating patients with this nerve block, femoral motor blockade may result in buckling or give-way of the knee, and therefore, it is recommended that patients be educated on the risk of post-operative falls, and assistive devices such as crutches and/or a temporary knee immobiliser should be considered.

The main strength of the present study is that, to our knowledge, it is the first to attempt to quantify the potential effect of fascia iliaca blockade in the setting of hip arthroscopy. There are several limitations, including no control group and use of multimodal analgesia. Although the current study is prospective, the lack of comparison group makes it possible that the placebo effect of the block could have contributed to the positive results of the study. We are currently designing a randomised control trial to further answer this question. The second limitation is the use of multimodal analgesia, including pre-emptive oral analgesics and a combination of post-operative anti-inflammatories (for heterotopic ossification prophylaxis) and an opioid medication. With these multiple medications, it may be difficult to isolate the beneficial effects of the fascia iliaca blockade. In addition, we did not see a significant increase in pain scores or opioid consumption after the expected wearing off of the fascia iliaca blockade (8–12 h), requiring further study to determine whether the block contributes added pain relief above the multimodal analgesia. Baker et al. have previously reported that a large amount of IV opioid requirements are needed in the majority of patients following hip arthroscopy [2], and such

requirements were not observed in this study. Future studies such as our randomised control trial in development isolate the impact of the fascia iliaca blockade from benefits attributable to multimodal analgesia alone. Despite these limitations, we recommend routine utilisation of this multimodal analgesic protocol be considered for hip arthroscopy.

Conclusion

In conclusion, in this prospective study, treatment with multimodal analgesia with fascia iliaca blockade for postoperative analgesia following hip arthroscopy resulted in low opioid consumption, high quality of pain relief and high overall patient satisfaction.

Conflict of interest Dr. Bruce Levy is a consultant and receives royalties from Arthrex Inc. and serves on the editorial board for Knee Surgery, Sports Traumatology, Arthroscopy.

References

1. Atchabahian A, Brown A (1994) Postoperative neuropathy following fascia iliaca compartment blockade. Anesthesiology 94:534–536
2. Baker JF, Byrne DP, Hunter K, Mulhall KJ (2011) Post-operative opiate requirements after hip arthroscopy. Knee Surg Sports Traumatol Arthrosc 19(8):1399–1402. doi:10.1007/s00167-010-1248-4
3. Baker JF, McGuire CM, Byrne DP, Hunter K, Eustace N, Mulhall KJ (2011) Analgesic control after hip arthroscopy: a randomised, double-blinded trial comparing portal with intra-articular infiltration of bupivacaine. Hip Int 21(3):373–377. doi:10.5301/hip.2011.8390
4. Birnbaum K, Prescher A, Hessler S, Heller K (1997) The sensory innervation of the hip joint–an anatomical study. Surg Radiol Anat 19(6):371–375
5. Blackford D, Westhoffen P (2009) Accidental bladder puncture: a complication of a modified fascia iliaca block. Anaesth Intensive Care 37(1):140–141
6. Borg G (1998) Borg's perceived exertion and pain scales. Human Kinetics, Champaign
7. Candal-Couto JJ, McVie JL, Haslam N, Innes AR, Rushmer J (2005) Pre-operative analgesia for patients with femoral neck fractures using a modified fascia iliaca block technique. Injury 36(4):505–510. doi:10.1016/j.injury.2004.10.015
8. Capdevila X, Coimbra C, Choquet O (2005) Approaches to the lumbar plexus: success, risks, and outcome. Reg Anesth Pain Med 30:150–162
9. Dalens B, Vanneuville G, Tanguy A (1989) Comparison of the fascia iliaca compartment block with the 3-in-1 block in children. Anesth Analg 69(6):705–713
10. DeLoach LJ, Higgins MS, Caplan AB, Stiff JL (1998) The visual analog scale in the immediate postoperative period: intrasubject variability and correlation with a numeric scale. Anesth Analg 86(1):102–106
11. Dolan J, Williams A, Murney E, Smith M, Kenny GN (2008) Ultrasound guided fascia iliaca block: a comparison with the loss of resistance technique. Reg Anesth Pain Med 33(6):526–531
12. Dulaney-Cripe E, Hadaway S, Bauman R, Trame C, Smith C, Sillaman B, Laughlin R (2012) A continuous infusion fascia iliaca compartment block in hip fracture patients: a pilot study. J Clin Med Res 4(1):45–48. doi:10.4021/jocmr724w
13. Elkhodair S, Mortazavi J, Chester A, Pereira M (2011) Single fascia iliaca compartment block for pain relief in patients with fractured neck of femur in the emergency department: a pilot study. Eur J Emerg Med 18(6):340–343. doi:10.1097/MEJ.0b013e32834533dd
14. Foss NB, Kristensen BB, Bundgaard M, Bak M, Heiring C, Virkelyst C, Hougaard S, Kehlet H (2007) Fascia iliaca compartment blockade for acute pain control in hip fracture patients: a randomized, placebo-controlled trial. Anesthesiology 106(4):773–778. doi:10.1097/01.anes.0000264764.56544.d2
15. Lee EM, Murphy KP, Ben-David B (2008) Postoperative analgesia for hip arthroscopy: combined L1 and L2 paravertebral blocks. J Clin Anesth 20(6):462–465. doi:10.1016/j.jclinane.2008.04.012
16. Monzon DG, Iserson KV, Vazquez JA (2007) Single fascia iliaca compartment block for post-hip fracture pain relief. J Emerg Med 32(3):257–262. doi:10.1016/j.jemermed.2006.08.011
17. Paut O, Sallabery M, Schreiber-Deturmeny E, Rémond C, Bruguerolle B, Camboulives J (2001) Continuous fascia iliaca compartment block in children: a prospective evaluation of plasma bupivacaine concentrations, pain scores, and side effects. Anesth Analg 92(5):1159–1163
18. Pavy E, Compere V, Fourdrinier V, Beghin CE, Dujardin F, Dureuil B (2007) Evaluation of postoperative analgesia with continuous iliofascial nerve sheath block after total hip arthroplasty replacement: a pilot study. Ann Fr Anesth Reanim 26(2):125–131. doi:10.1016/j.annfar.2006.10.026
19. Robertson WJ, Kelly BT (2008) The safe zone for hip arthroscopy: a cadaveric assessment of central, peripheral, and lateral compartment portal placement. Arthroscopy 24(9):1019–1026. doi:10.1016/j.arthro.2008.05.008
20. Shelley BG, Haldane GJ (2006) Pneumoretroperitoneum as a consequence of fascia iliaca block. Reg Anesth Pain Med 31(6):582–583. doi:10.1016/j.rapm.2006.08.009
21. Stevens M, Harrison G, McGrail M (2007) A modified fascia iliaca compartment block has significant morphine-sparing effect after total hip arthroplasty. Anaesth Intensive Care 35(6):949–952
22. Ward JP, Albert DB, Altman R, Goldstein RY, Cuff G, Youm T (2012) Are femoral nerve blocks effective for early postoperative pain management after hip arthroscopy? Arthroscopy 28(8):1064–1069. doi:10.1016/j.arthro.2012.01.003
23. Wongswadiwat M, Pathanon P, Sriraj W, Yimyaem PR, Bunthaothuk S (2012) Single injection fascia iliaca block for pain control after arthroscopic anterior cruciate ligament reconstruction: a randomized, controlled trial. J Med Assoc Thai 95(11):1418–1424
24. Woods G, O'Connor D, Calder C (2006) Continuous femoral nerve block versus intra-articular injection for pain control after anterior cruciate ligament reconstruction. Am J Sports Med 34:1328–1333