

Outcomes After Peripheral Nerve Block in Hip Arthroscopy

Publish date: June 22, 2018

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Author Affiliation | **Disclosures**

Authors' Disclosure Statement: Dr. Rosneck reports that he is a paid consultant to Smith & Nephew. Dr. Ahmad reports that he is a paid consultant to Arthrex; receives stock/stock options from At Peak; receives publishing royalties, financial or material support from Lead Player; and receives research support from Major League Baseball and Stryker. Dr. Lynch reports that he is a paid consultant to Smith & Nephew. Dr. Steinhaus reports no actual or potential conflict of interest in relation to this article.

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Take-Home Points

- Postoperative PACU pain was consistently reduced in the PNB group.
- Patients with PNBs had lower postoperative pain medication requirements and lower rates of inpatient admission compared with controls.
- Similar rates of nausea/vomiting and time to discharge were reported for PNB patients and controls.
- PNBs are associated with high rates of satisfaction and few complications.
- Future research should focus on comparing across PNB techniques.

Hip arthroscopy has emerged as a useful procedure in the diagnosis and treatment of hip pathology,¹⁻⁸ experiencing a substantial rise in popularity in recent years, with the number of procedures growing by a factor of 18 from 1999 to 2009⁹ and 25 from 2006 to 2013.¹⁰ Though hip arthroscopy is beneficial in many cases, marked postoperative pain has presented a substantial challenge, with patients requiring considerable doses of opiate-based medications in the post-anesthesia care unit (PACU).^{11,12} Increased narcotic use carries increased side

effects, including postoperative nausea and vomiting,¹³ and poorly managed pain leads to increased unplanned admissions.¹⁴ Furthermore, patients with chronic hip pain and long-term opioid use may experience heightened and prolonged pain following the procedure, owing to medication tolerance and reduced opioid efficacy in this setting.¹⁵

Several pain control strategies have been employed in patients undergoing hip arthroscopy. General anesthesia^{16,17} and combined spinal epidural (CSE)¹⁸ are commonly used. However, such techniques rely heavily on opioids for postoperative pain control,¹¹ and epidural anesthesia commonly requires adjunctive treatments (eg, neuromuscular blockade) to ensure muscle relaxation for joint distraction.¹⁹ One technique that has been employed recently is peripheral nerve block (PNB), which has been associated with a significant decrease in postoperative opioid use and nausea and vomiting.^{13,20} This method has proven successful in other fields of arthroscopy, including shoulder arthroscopy, in which it resulted in faster recovery, reduced opioid consumption,²¹ and demonstrated cost-effectiveness²² compared with general anesthesia and knee arthroscopy.²³⁻²⁶ As it is a relatively new field, little is known about the use of PNB in hip arthroscopy.

The goal of this systematic review was to comprehensively review the studies reporting on PNB in hip arthroscopy. We specifically focused on outcomes, including postoperative pain; analgesic use; nausea, vomiting, and antiemetic use; discharge time; inpatient admission; and patient satisfaction, as well as the complications associated with the use of PNB. Our knowledge of outcomes associated with PNB in hip arthroscopy is based on a few individual studies that have reported on small groups of patients using a variety of outcome measures and other findings. Furthermore, each of these studies commonly reflects the experience of an individual surgeon at a single institution and, when taken alone, may not be an accurate representation of the more general outcomes associated with PNB. A comprehensive review of such studies will provide surgeons, anesthesiologists, and patients with a better understanding of the anticipated outcomes of using PNB in hip arthroscopy. We hypothesize that the use of PNB in hip arthroscopy leads to improved outcomes and is associated with few complications.

Materials and Methods

A systematic review of outcomes associated with PNB in hip arthroscopy was performed using the available English-language literature in accordance with the guidelines laid out by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement and included studies retrieved from the PubMed, Medline, Scopus, and Embase computerized literature databases. Searches were executed comprising all years from database inception through January 2015. Articles were retrieved by an electronic search of medical subject headings and keyword terms and their respective combinations (**Table 1**). The inclusion criteria for studies in this systematic review were studies that (1) were written in the English language and (2) reported explicit outcome data. The exclusion criteria were (1) review articles, meta-analyses, case reports, abstracts/conference papers, comments/letters, or technique articles without reported patient data and (2) basic research, biomechanics, or animal/cadaveric studies without reported patient data.

The literature search strategy is outlined in the **Figure**. The initial title search yielded a subset of possible articles that were then further included or excluded on the basis of the contents of the article's abstract, wherein articles were again selected on the basis of the aforementioned inclusion and exclusion criteria. Articles selected in both the title and abstract phases underwent full-text review, during which the full text of each qualifying article was reviewed. In addition, the reference sections from articles undergoing full-text review were scanned to identify any additional studies that had not been identified in the original literature search. Appropriate studies for final inclusion were then selected at this stage. The title, abstract, and full-text selection process were performed by 2 of the study authors (Dr. Steinhaus and Dr. Lynch), with any discrepancies being discussed and resolved by

mutual agreement.

For all 6 included studies,^{16-18,27-29} data were collected regarding the study specifics, patients included, and outcomes measured in the study. The journal of publication, type of study, level of evidence, and type of PNB, as well as the presence of a comparator group were noted (**Table 2**). Patient information included the number of patients at baseline and follow-up, mean age, gender, weight, height, body mass index, American Society of Anesthesiologists (ASA) status, and the specific procedures performed. In addition, data were collected on outcomes, including postoperative pain, as well as secondary outcomes and additional findings reported by the studies (**Table 3**). Where possible, weighted averages were calculated across all studies to obtain aggregate data.

Results

Study Inclusion

Six studies, all published between 2012 and 2014, were included in this systematic review (Table 2). Three studies involved lumbar plexus block, 2 studies involved femoral nerve block, and 1 study evaluated fascia iliaca block. Two studies used a control group of patients who received only general anesthesia (compared with the treatment group who received both general anesthesia and PNB); another study compared intravenous morphine with PNB; and 1 study compared CSE alone with PNB in addition to epidural.

Demographic Data

Demographic data from the included studies are presented in Table 2. In total, 710 and 549 patients were evaluated at baseline and final follow-up, respectively, which represents a follow-up rate of 77%. The frequency-weighted mean age of patients receiving PNB was 37.0 years compared with 37.7 years in the comparison groups, and the studies reported a total of 281 (40.5%) male and 412 (59.5%) female patients. The procedures performed were heterogeneously reported; therefore, totals were not tabulated, although the reported procedures included osteochondroplasty, labral débridement, labral and/or capsular repair, gluteus minimus repair, and synovectomy.

Postoperative Pain

Four studies reported on postoperative pain, and these data are presented in Table 3. In a retrospective study of patients receiving femoral nerve block in addition to general anesthesia, Dold and colleagues¹⁶ noted postoperative pain at 0, 15, 30, 45, and 60 minutes following arrival in the PACU, and discovered a statistically significantly lower level of pain at 60 minutes compared with inpatients receiving general anesthesia alone. YaDeau and colleagues¹⁸ found a significantly lower level of pain at rest in the PACU for those receiving CSE and lumbar plexus blockade compared with those receiving CSE alone. This significant difference did not persist at 24 hours or 6 months after the procedure, nor did it exist for pain with movement at any time point. Similarly, Schroeder and colleagues¹⁷ examined patients receiving general anesthesia and lumbar plexus block and found a significant reduction in pain immediately postoperatively in the PACU, though these effects disappeared the day following the procedure. Krych and colleagues²⁷ also reported on postoperative pain in patients undergoing fascia iliaca blockade, although they did not include a comparator group. Outcome comparison between patients who received PNB and controls in the PACU and 1 day following the procedure are presented in **Table 4**.

Analgesic Use

Four studies reported on analgesic use after PNB, and these data are presented in Table 3. Dold and colleagues¹⁶ noted analgesic use intraoperatively, in the PACU, and in the surgical day care unit (SDCU). These authors found a significant reduction in morphine equivalent dose given in the operating room and in the PACU in the group receiving PNB, with a nonsignificant trend toward lower use of oxycodone in the SDCU. Schroeder and colleagues¹⁷ similarly reported significant reductions in morphine equivalent dose intraoperatively and in Phase I recovery for patients receiving PNB, and these differences disappeared in Phase II recovery as well as intraoperatively if the block dose was considered. In addition, these authors found a significant reduction in the use of fentanyl and hydromorphone in the operating room in the PNB group, as well as a significant reduction in the proportion of patients receiving ketorolac in the operating room or PACU. Finally, YaDeau and colleagues¹⁸ reported total analgesic usage in the PACU among PNB patients compared with those receiving CSE alone and showed a strong trend toward reduced use in the PNB group, although this difference was not significant ($P = .051$). PACU analgesic use is presented in Table 4.

Postoperative Nausea/Vomiting and Antiemetic Use

Five studies presented data on nausea, vomiting, or antiemetic use following PNB and are shown in Table 3. YaDeau and colleagues¹⁸ reported nausea among 34% of patients in the PNB group, compared with 20% in the control group, vomiting in 2% and 7%, respectively, and antiemetic use in 12% of both groups. Dold and colleagues¹⁶ identified a similar trend, with 41.1% of patients in the PNB group and 32.5% of patients in the control group experiencing postoperative nausea or vomiting, while Krych and colleagues²⁷ noted only 10% of PNB patients with mild nausea and none requiring antiemetic use. In their study of patients receiving PNB, Schroeder and colleagues¹⁷ found a significant reduction in antiemetic use among PNB patients compared with those receiving general anesthesia alone. Similarly, Ward and colleagues²⁹ noted a significant difference in postoperative nausea, with 10% of patients in the PNB group experiencing postoperative nausea compared with 75% of those in the comparator group who received intravenous morphine. The mean percentage of patients experiencing postoperative nausea and/or vomiting is shown in Table 4.

Discharge Time

Four studies presented data on discharge time from the PACU and are summarized in Table 3. Three of these studies included a comparator group. Both Dold and colleagues¹⁶ and YaDeau and colleagues¹⁸ reported an increase in the time to discharge for patients receiving PNB, although these differences were not significant. The study by Ward and colleagues,²⁹ on the other hand, noted a significant reduction in the time to discharge for the PNB group. In addition to these studies, Krych and colleagues²⁷ examined the time from skin closure to discharge for patients receiving PNB, noting a mean 199 minutes for the patients in their study. Mean times to discharge for the PNB and control groups are presented in Table 4.

Inpatient Admission

Four studies presented data on the proportion of study participants who were admitted as inpatients, and these data are shown in Table 3. Dold and colleagues¹⁶ reported no inpatient admissions in their PNB group compared with 5.0% for the control group (both cases of pain control), while YaDeau and colleagues¹⁸ found that 3 admissions occurred, with 2 in the control group (1 for oxygen desaturation and the other for intractable pain and nausea) and 1 from the PNB group (epidural spread and urinary retention). Two additional studies reported data

on PNB groups alone. Krych and colleagues²⁷ observed no overnight admissions in their study, while Nye and colleagues²⁸ reported 1 readmission for bilateral leg numbness and weakness due to epidural spread, which resolved following discontinuation of the block. The mean proportion of inpatient admissions is presented in Table 4.

Satisfaction

A total of 3 studies examined patient satisfaction, and these data are presented in Table 3. In their study, Ward and colleagues²⁹ reported a significantly greater rate of satisfaction at 1 day postoperatively among the patients in the PNB group (90%) than among patients who received intravenous morphine (25%) ($P < .0001$). Similarly, YaDeau and colleagues¹⁸ noted greater satisfaction among the PNB group than among the control group, with PNB patients rating their satisfaction at a mean of 8.6 and control patients at a mean of 7.9 on a 10-point scale (0-10) 24 hours postoperatively, although this difference was not significant. Finally, Krych and colleagues²⁷ found that 67% of patients were “very satisfied” and 33% were “satisfied”, based on a Likert scale.

Complications

Four studies presented data on complications, and these findings are summarized in Table 3. In their work, Nye and colleagues²⁸ reported most extensively on complications associated with PNB. Overall, the authors found a rate of significant complications of 3.8%. In terms of specific complications, they noted local anesthetic systemic toxicity (0.9%), epidural spread (0.5%), sensory or motor deficits (9.4%), falls (0.5%), and catheter issues. In their study of patients receiving PNB and CSE, YaDeau and colleagues¹⁸ identified 1 patient in the PNB group with epidural spread and urinary retention, while they noted 1 case of oxygen desaturation and another case of intractable pain and nausea in the group receiving CSE alone, all 3 of which required inpatient admission. They found no permanent adverse events attributable to the PNB. In another study, Dold and colleagues¹⁶ observed no complications in patients receiving PNB compared with those in 2 admissions in the control group for inadequate pain control. Similarly, Krych and colleagues²⁷ identified no complications in patients who received PNB in their study.

Discussion

Hip arthroscopy has experienced a substantial gain in popularity in recent years, emerging as a beneficial technique for both the diagnosis and treatment of diverse hip pathologies in patients spanning a variety of demographics. Nevertheless, postoperative pain control, as well as medication side effects and unwanted patient admissions, present major challenges to the treating surgeon. As an adjuvant measure, peripheral nerve block represents one option to improve postoperative pain management, while at the same time addressing the adverse effects of considerable opioid use, which is commonly seen in these patients. Early experience with this method in hip arthroscopy was reported in a case series by Lee and colleagues.¹² In an attempt to reduce postoperative pain, as well as limit the adverse effects and delay in discharge associated with considerable opioid use in the PACU, the authors used preoperative paravertebral blocks of L1 and L2 in 2 patients requiring hip arthroscopy with encouraging results. Since then, a number of studies have attempted the use of PNB in hip arthroscopy.^{16-18,27-29} However, we were unable to identify any prior reviews reporting on peripheral nerve blockade in hip arthroscopy, and thus this study is unique in providing a greater understanding of the outcomes associated with PNB use.

In general, we found that PNB was associated with improved outcomes. Based on the studies included in this review, there was a statistically significantly lower level of pain in the PACU for femoral nerve block (compared

with general anesthesia alone)¹⁶ and lumbar plexus blockade (compared with general anesthesia¹⁷ and CSE¹⁸ alone). Nevertheless, these effects are likely short-lived, with differences disappearing the day following the procedure. In terms of analgesic use, 2 studies report significant reductions in analgesic use intraoperatively and in the PACU/Phase I recovery,^{16,17} with a third reporting a strong trend toward reduced analgesic use in the PACU ($P = .051$).¹⁸ Finally, we report fewer admissions for the PNB group, as well as high rates of satisfaction and few complications across these studies.

Unlike these measures, postoperative nausea, vomiting, and antiemetic use, as well as time to discharge, showed more mixed results. With regard to nausea/vomiting, 2 studies^{16,18} reported nonsignificantly increased rates in the PNB group, whereas others reported significant reductions in nausea/vomiting²⁹ and in the proportion of patients receiving antiemetics.¹⁷ Similarly, mixed results were seen in terms of patient discharge time from the PACU. Two studies^{16,18} reported a nonsignificant increase in time to discharge for the PNB group, while another²⁹ noted a significant reduction for the PNB group compared with those receiving intravenous morphine. These mixed results were surprising, as we expected reductions in opioid use to result in fewer instances of nausea/vomiting and a quicker time to discharge. The reasons underlying these findings are not clear, although it has been suggested that current discharge guidelines and clinical pathways limit the ability to take advantage of the accelerated timeline offered by regional anesthesia.^{16,30} As experience with PNB grows, our guidelines and pathways are likely to adapt to capitalize on these advantages, and future studies may show more reliable improvements in these measures.

While rare, the risk of bleeding requiring blood transfusion following hip arthroscopy is one of the most common complications of this procedure. Though the studies included in this review did not report on the need for transfusion, a recent study by Cvetanovich and colleagues¹⁰ used a national database and found that, of patients undergoing hip arthroscopy ($n = 1338$), 0.4% ($n = 5$) had bleeding requiring a transfusion, with 0.3% ($n = 4$) requiring return to the operating room, similar to an earlier study by Clarke and colleagues,³¹ who noted bleeding from the portal site in 0.4% of hip arthroscopy patients. In terms of risk factors, Cvetanovich and colleagues¹⁰ found that ASA class, older age, and prior cardiac surgery were significantly associated with minor and overall complications, whereas both regional anesthesia/monitored anesthesia care and alcohol consumption of >2 drinks a day were significantly associated with minor complications, including bleeding requiring transfusions. They noted, however, that these risk factors accounted for only 5% of the variance in complication rates, indicating that other unidentified variables better explained the variance in complication rates. These authors concluded that complications associated with hip arthroscopy are so rare that we may not be able to predict which risk factors or anesthesia types are more likely to cause them. Further characterization of bleeding following hip arthroscopy and its associated risk factors is a valuable area for future research.

Limitations

Our study contains a number of limitations. This review included studies whose level of evidence varied from I to IV; therefore, our study is limited by any bias or heterogeneity introduced in patient recruitment, selection, variability of technique, data collection, and analysis used in these studies. This heterogeneity is most apparent in the block types and comparator groups. Furthermore, several different outcome measures were reported across the 6 studies used in this review, which decreased the relevance of any one of these individual outcomes. Finally, given the limited data that currently exist for the use of PNB in hip arthroscopy, we are unable to note meaningful differences between various types of PNBs, such as differences in postoperative pain or other measures such as quadriceps weakness, which can accompany femoral nerve block.¹² While it is important to read our work with these limitations in mind, this systematic review is, to our knowledge, the only comprehensive review to date of studies reporting on PNB in hip arthroscopy, providing clinicians and patients with a greater understanding of the

associated outcomes across these studies.

Conclusion

This systematic review shows improved outcomes and few complications with PNB use in hip arthroscopy, with reductions in postoperative pain, analgesic use, and the rate of inpatient admissions. Although opioid use was reduced in these studies, we found similar rates of postoperative nausea/vomiting as well as similar time to discharge from the PACU, which may reflect our continued reliance on outdated discharge guidelines and clinical pathways. Current attempts to provide peripheral nerve blockade are quite varied, with studies targeting femoral nerve, fascia iliaca, L1/L2 paravertebral, and lumbar plexus blockade. Future research efforts with a large prospective trial investigating these techniques should focus on which of these PNBs presents the optimal risk-benefit profile for hip arthroscopy patients and thus appropriately address the clinical questions at hand.

This paper will be judged for the Resident Writer's Award.

Key Info

Figures/Tables

Figures / Tables:

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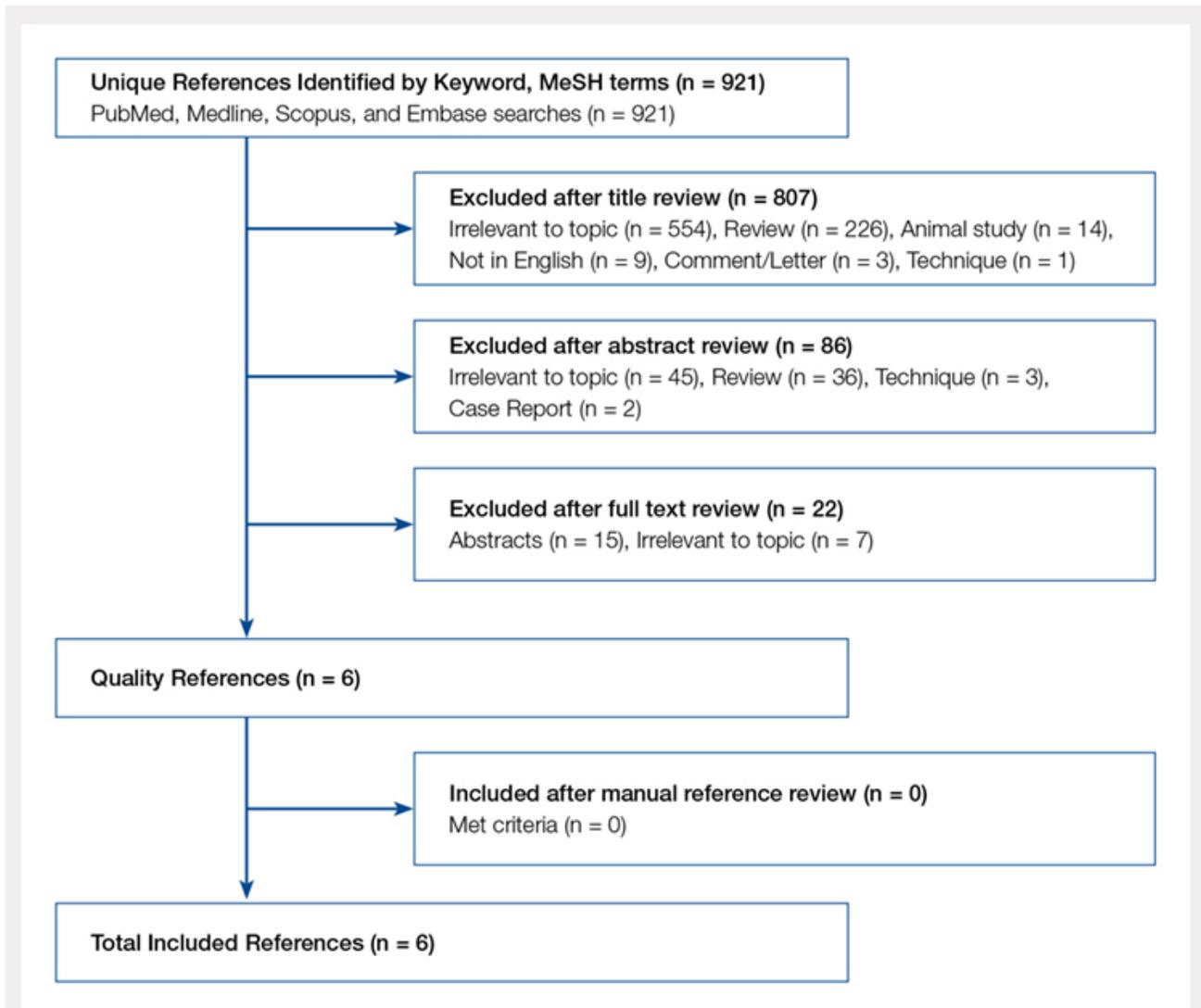


Figure. Flow diagram representing the systematic review process used in this study. A total of 6 studies were included for final analysis.

Table 1. Search Terms Entered to Identify English-Language Studies Through January 2015

Database	Search terms
PubMed, Scopus	Keyword: (hip AND arthroscopy) AND (pain control OR pain management OR pain regimen OR nerve block OR spinal anesthesia OR regional anesthesia OR general anesthesia)
Medline	MeSH (includes both MeSH terms and keywords): (Hip) AND (Arthroscopy) AND ("Pain Management" OR "Anesthesia, General" OR "Anesthesia" OR "Anesthesia, Inhalation", OR "Balanced Anesthesia" OR "Anesthesia, Local" OR "Anesthesia, Spinal" OR "Anesthesia, Conduction" OR "Nerve Block")

Embase	MeSH (includes both MeSH terms and keywords): (Hip) AND (Arthroscopy) AND ("Pain Management" OR "General Anesthesia" OR "Anesthesia" OR "Inhalation Anesthesia", OR "Balanced Anesthesia" OR "Local Anesthesia" OR "Spinal Anesthesia" OR "Regional Anesthesia" OR "Nerve Block")
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Table 2. Demographic Details of Included Studies (click link below for full table)

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Table 3. Outcomes of Included Studies (click link below for full table)

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Table 4. Outcomes Comparison, PNB vs Control (click link below for full table)

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Michael E. Steinhaus, MD James Rosneck, MD Christopher S. Ahmad, MD T. Sean Lynch, MD . Outcomes After Peripheral Nerve Block in Hip Arthroscopy. Am J Orthop.

Publish date: June 22, 2018

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