Pain Scores and Activity Tolerance in the Early Postoperative Period After Hip Arthroscopy

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Background: Despite the rapid growth in the use of hip arthroscopy, standardized data on postoperative pain scores and activity level are lacking.

Purpose: To quantify narcotic consumption and use of the stationary bicycle in the early postoperative period after hip arthroscopy.

Study Design: Case series; Level of evidence, 4.

Methods: In this prospective case series, patients undergoing a primary hip arthroscopy procedure by a single surgeon were asked to fill out a daily survey for 9 days postoperatively. Patients were asked to report their pain level each day on a visual analog scale from 1 to 10, along with the amount of narcotic pain pills they used during those postoperative days (PODs). Narcotic usage was converted to a morphine-equivalent dosage (MED) for each patient. Patients were also instructed to cycle daily starting on the night of surgery for a minimum of 3 minutes twice per day and were asked to rate their pain as a percentage of their preoperative pain level and the number of minutes spent cycling on a stationary bicycle per day.

Results: A total of 212 patients were enrolled in this study. Pain levels (POD1, 5.5; POD4, 3.8; POD9, 2.9; $P < .0001$) and the percentage of preoperative pain (POD1, 51.6%; POD4, 31.8%; POD9, 29.5%; $P < .01$) significantly decreased over the study period. The amount of narcotics used per day (reported in MED) also significantly decreased (POD1, 27.3; POD4, 22.3; POD9, 8.5; $P < .0001$). By POD4, 41% of patients had discontinued all narcotics, and by POD9, 65% of patients were completely off narcotic medication. Patients were able to significantly increase the number of minutes spent cycling each day (POD1, 7.6 minutes; POD4, 13.8 minutes; POD9, 19.0 minutes; $P < .0001$). Patients who received a preoperative narcotic prescription for the affected hip were significantly more likely to require an additional postoperative narcotic prescription ($P < .001$).

Conclusion: Patients can expect a rapid decrease in narcotic consumption along with a high degree of activity tolerance in the early postoperative period after hip arthroscopy.

Keywords: femoroacetabular impingement; hip arthroscopy; narcotics; pain management

The use of hip arthroscopy has increased by 365% in the past decade.[22] However, postoperative pain management and rehabilitation vary among hip preservation physicians and are not as standardized as more established procedures such as arthroscopic rotator cuff repair or total shoulder arthroplasty.[34] Furthermore, use of a fascia iliaca nerve blockade in patients undergoing hip arthroscopy may be associated with complications such as medial thigh numbness and quadriceps weakness, without significant improvements in postoperative pain control.[2,4,10] With the ongoing opiate crisis, it is important to understand the expected severity of pain after hip arthroscopy in order to anticipate and manage the types of analgesia required postoperatively. It has been shown that more than one-quarter of patients receive opioid analgesic prescriptions for more than 3 months after hip arthroscopy and that orthopaedic surgeons are the third most common prescribers of narcotic medications.[1,23,29]

Multiple studies have reviewed different practices in the use of analgesics for postoperative hip arthroscopy pain control, such as the use of various regional blocks, intra-articular or local soft tissue anesthetic injections, and nonsteroidal anti-inflammatory drugs (NSAIDs), without concluding evidence for a best-practice protocol.[3,26] Furthermore, postoperative rehabilitation after hip arthroscopy is not standardized and may include brace wear, early weightbearing and range of motion restrictions, and sport-specific training to return

The Orthopaedic Journal of Sports Medicine, 8(10), 2325967120960689
DOI: 10.1177/2325967120960689

each patient to his or her desired level of activity. Reaching these rehabilitation goals can be influenced by 3 key elements: (1) pain, (2) the timeline to hip movement, and (3) the amount of time spent on rehabilitation. This study focuses on these 3 factors through a patient survey encompassing the first 9 days after surgery.

Arthroscopy techniques and instrumentation are rapidly evolving, and currently no standardized postoperative pain and rehabilitation protocol exists.[14] The purpose of this study was to quantify narcotic consumption and use of a stationary bicycle in the early postoperative period after hip arthroscopy. We hypothesized that patients would be able to significantly reduce narcotic usage and increase stationary bicycle time in the early postoperative period after hip arthroscopy.

METHODS

After institutional review board approval was obtained, we prospectively analyzed a convenience sample of patients undergoing primary hip arthroscopy who were being evaluated for hip pain at a dedicated hip preservation clinic between April 2014 and August 2018. Common indications for referral included femoroacetabular impingement (FAI), acetabular dysplasia, and associated abnormalities of femoral torsion or acetabular version. Inclusion criteria were patients with the following conditions: (1) persistent hip pain and mechanical symptoms refractory to nonoperative management (physical therapy, NSAIDs, activity modifications, and corticosteroid injections) lasting at least 3 months, (2) reproducible clinical examination findings suggestive of impingement and/or instability, and (3) joint-space width exceeding 3 mm on all views of plain radiography and cross-sectional imaging. Patients who had undergone previous hip surgery and those presenting with severe anatomic deformity such as slipped capital femoral epiphysis, Legg-Calvé-Perthes disease, osteochondromatosis, or postdislocation syndrome were excluded from this study. No patients were lost to follow-up during the study period.

Clinical Evaluation

The physical examination tests we used included passive hip range of motion (supine, lateral, and prone), the flexion-adduction–internal rotation test, the flexion-abduction–external rotation test, the ligamentum teres test, the posterior impingement test, use of the Beighton hypermobility score, and subjective reports of hip instability.[15]

Imaging Protocol and Measurements

After a comprehensive clinical evaluation by the senior author (O.M.-D.), patients underwent a standardized series of anteroposterior (AP) pelvis radiographs,[33] and once scheduled for surgery, all patients underwent magnetic resonance imaging and whole-pelvis computed tomography (CT) scans. The presence of a cam lesion was determined by an alpha angle exceeding 50° on CT radial sequences of the head-neck junction and a femoral head-neck offset ratio <0.18 on both radiographs and CT. Clinical diagnosis of osseous impingement was determined according to accepted pathomorphologic signs and measurements.[13,27] Physical examination findings suggestive of FAI included reduced hip flexion range of motion, reduced hip internal rotation range of motion, and/or positive provocative tests.[6] The diagnosis was confirmed by imaging findings of focal acetabular overcoverage as indicated by a lateral center-edge angle (LCEA) $>40°$ and/or a Tönnis angle $<0°$ for pincer-type FAI and the presence of an anterior or lateral cam lesion for cam-type FAI. LCEA was determined on AP pelvis radiographs as described previously.[24] Patients with an LCEA between 20° and 24.9° were diagnosed with borderline hip dysplasia, and those with values $<20°$ were diagnosed with frank hip dysplasia.

All patients underwent hip arthroscopy under general anesthesia. Hip arthroscopy was performed without a perineal post, as described previously,[20,32] on a specially designed hip arthroscopy distraction apparatus in the standard supine and in an 11° to 15° Trendelenburg position to allow access to the affected hip. Additionally, fluid pressure utilized during the procedure was maintained at $\leq$30 mm Hg to reduce soft tissue fluid extravasation (20-25 mm Hg during central compartment work and 25 mm Hg in $>95\%$ of cases during peripheral compartment work, with $<5\%$ of cases at 25-30 mm Hg during peripheral compartment work). Visualization under low fluid pressure was facilitated through meticulous hemostasis and atraumatic technique. An interportal capsulotomy was used during hip arthroscopy, which was repaired in all patients.

All patients were encouraged to bear weight as tolerated on both hips, utilizing crutches for balance and support during the first 10 to 14 days postoperatively, unless microfracture was performed, in which case 6 weeks of

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Final revision submitted May 6, 2020; accepted May 19, 2020.

One or more of the authors has declared the following potential conflict of interest or source of funding: K.L.W. has received education payments from Smith & Nephew, grant support from Arthrex, and hospitality payments from Smith & Nephew. T.G. has received consulting fees from Stryker and hospitality payments from Smith & Nephew. O.M.-D. has received education payments from Arthrex; research support from Stryker; consulting fees from Stryker, Smith & Nephew, and ArthroCare; nonconsulting fees from Smith & Nephew and Arthrex; and royalties from Stryker; and has stock/stock options in MITA. AOSSM checks author disclosures against the Open Payments Database (OPD). AOSSM has not conducted an independent investigation on the OPD and disclaims any liability or responsibility relating thereto.

Ethical approval for this study was obtained from the University of Colorado, Anschutz Medical Campus (ref No. CRV006 -1).

nonweightbearing was prescribed without changing the cycling regimen. In cases of large cam resection, patients were asked to use full weightbearing crutches when walking outside for the first 6 weeks in order to prevent the possible risk of a stress fracture. Patients were instructed to avoid active hip flexion past 90° and external rotation past 25° for 3 weeks, to use naproxen for 21 days in order to prevent heterotopic ossification, and to use a prescribed narcotic and diazepam (2 mg) as needed for pain control and muscle cramps, respectively.

All patients were instructed to use a stationary bicycle without resistance beginning the day of surgery and no later than 24 hours postoperatively. Patients were given comprehensive instructions as well as video tutorials before surgery to demonstrate safe technique for riding the stationary bicycle postoperatively. The stationary bicycle protocol did not differ based on labral repair versus reconstruction or other concomitant procedures, including microfracture. In addition, patients undergoing simultaneous bilateral hip arthroscopy underwent the same protocol, as previous studies have demonstrated no significant differences in postoperative pain or stationary cycling time in comparison with patients undergoing unilateral hip arthroscopy.[19,21] Patients were to continue use of the stationary bicycle without resistance for the first 4 weeks, starting with 3 to 7 minutes during the first session and cycling twice on postoperative day (POD) 2 for 5 to 7 minutes per session. Beginning on POD3, patients were instructed to increase cycle time by 10% to 15% daily until they reached a goal of 20- to 30-minute sessions twice per day by POD21. Cycling with resistance was introduced at 5 weeks postoperatively.

Patient sex, age, and the type of procedures performed were recorded. Patients were asked to fill out a written survey each day from POD1 through POD9, in which they reported their pain level on a visual analog scale (VAS) from 1 to 10, along with the total minutes they spent riding the stationary bicycle per day. In addition, they reported the number of tablets taken for narcotics, antiinflammatories (500 mg naproxen), antiemetics (4 mg ondansetron), and anxiolytics (2 mg diazepam) each day. All survey responses were collected and analyzed, although not every patient completed every survey question.

All patients were prescribed a narcotic such as 5 mg hydrocodone/325 mg acetaminophen, 5 mg oxycodone/325 mg acetaminophen, or 2 mg hydromorphone. The amount of tablets used was recorded by patients and converted to the appropriate morphine-equivalent dosage (MED) using the following conversion factors: 1 MED = 1 mg hydrocodone = 0.25 mg hydromorphone = 0.67 mg oxycodone.[30] The number of tablets prescribed ranged from 40 to 60, per patient's weight. Patients who had recent narcotic prescriptions for other reasons were given the same or a slightly higher number of tablets for postoperative pain. These patients were instructed before surgery to meet with their primary care physician or a pain management specialist in order to plan how to better control their surgical pain. Narcotic prescriptions were verified by review of electronic medical records and through the state Prescription Drug Monitoring Program (PDMP) for both preoperative and postoperative narcotic prescriptions. Use of preoperative narcotics was determined by the history of narcotic prescription for pain related to the indicated hip before 6 months from the date of surgery or within 3 months from the initial visit with the senior author.

TABLE 1
Procedures Performed

Procedure	%
Femoroplasty	91.3
Labral repair	81.3
Labral reconstruction	10.0
Labral debridement	8.7
Microfracture	33.1
Acetabuloplasty	28.0
Bilateral procedure	13.8

Statistical Analysis

Means and standard deviations were measured for all continuous outcome variables. A repeated-measures analysis of variance (ANOVA) test was performed to compare each continuous outcome variable between PODs 1, 4, and 9. A Tukey-Kramer post hoc analysis test was performed for pairwise comparisons when the ANOVA test resulted in a P value of $<.05$. A Student t test was used to compare each continuous outcome between men and women and bilateral and unilateral patients on each POD. In addition, a Student t test was used to compare postoperative narcotic usage on each POD between preoperative narcotic users and nonusers. Last, a 2-proportion z test was used to compare the proportion of patients who received additional narcotics postoperatively between preoperative narcotic users and nonusers. A P value of $<.05$ was considered statistically significant.

RESULTS

A total of 212 patients were included in this study. Of these patients, 72% were women and 28% were men, with a mean age of 35.4 years (range, 17-62 years) and mean LCEA of 29.2°. Femoroplasty was the most common procedure performed (Table 1). The use of NSAIDs remained stable throughout the early postoperative period, with an average range of 869 to 1000 mg daily for 21 days, as prescribed for heterotopic ossification prophylaxis. Review of the state PDMP found that 23.8% of patients had an existing narcotic prescription preoperatively for the indicated hip before their date of service. Postoperatively, 35 patients (16.5%) received an additional narcotic prescription at or before the first postoperative visit, 20 of whom (57.1%) had received a preoperative narcotic prescription for the affected hip. Patients who received a preoperative narcotic prescription for the affected hip were significantly more likely to require an additional postoperative narcotic prescription ($P < .001$). No significant difference was found in the sex ratios between the preoperative narcotic users (2 men, 18 women) and narcotic-naïve patients

TABLE 2
Survey Outcomes[a]

Outcome	POD1	POD4	POD9	*P* Value
VAS pain	5.5	3.8	2.9	<.0001
% preoperative pain	51.6	31.8	29.5	<.01
Narcotics, MED	27.3	22.3	8.5	<.0001
Stationary bicycle use, min	7.6	13.8	19.0	<.0001

[a]MED, morphine-equivalent dosage; POD, postoperative day; VAS, visual analog scale.

(1 men, 14 women) who received an additional postoperative narcotic prescription ($P = .73$).

The average total narcotic consumption per patient over the study duration (PODs 1-9) was 136 MEDs, equivalent to 91 mg oxycodone. Overall, there was no significant difference in reported postoperative narcotic use on individual days between preoperative narcotic users and nonusers on POD1 ($P = .75$), POD4 ($P = .74$), or POD9 ($P = .89$). It is important to note that while 92% of patients reported use of narcotics on POD1, only 35% of patients reported narcotic use on POD9. Pain levels and amount of narcotic use decreased significantly each day from POD1 to POD9, while stationary bicycle use significantly increased each day over the study duration (Table 2). The patients' pain, reported as a percentage of their preoperative pain, decreased significantly from POD1 to POD4, and while it continued to decrease from POD4 to POD9, this difference was not statistically significant. As expected, the amount of NSAID use did not significantly change, as this dose was prescribed for heterotopic ossification prophylaxis.

There was a trend toward a significantly higher stationary bicycle time on POD9 among women compared with men (women, 20.0 minutes; men, 17.3 minutes; $P = .072$). Otherwise, no significant differences were found on any outcomes between men and women. There were also no significant differences in VAS, stationary bicycle use, or MEDs between bilateral and unilateral patients on any POD. There were no reported falls from getting on or off the stationary bicycle during the study period.

DISCUSSION

We found in this study that during the early postoperative period after hip arthroscopy, there was a gradual and significant decline in patients' reported pain levels and narcotic use, with a high level of activity tolerance. Further, the study results indicate that the severity of pain after hip arthroscopy was reasonably managed with fewer narcotics, as 41% of patients were not using narcotics by POD4 and 65% of patients were not using narcotics by POD9. Patients in our study consumed an average of 136 MEDs (equivalent to 91 mg oxycodone) during PODs 1 through 9. Therefore, we recommend a postoperative prescription of 20 tablets of 5 mg oxycodone or Percocet (5 mg oxycodone/325 mg acetaminophen) after hip arthroscopy using our surgical technique. Some patients will require a refill on this prescription, but the majority (65% of patients in our study) will not be taking narcotics by POD9.

Cunningham et al[7] studied patient opioid tablet use at 2 and 6 weeks after hip arthroscopy for FAI. They found that the orthopaedic surgeon prescribed a higher amount of opioids if he or she concurrently recommended postoperative active range of motion, but that the amount of opioid use was not elevated among patients participating in exercises. In the current study, it was found that 41% of patients stopped taking narcotics by POD4 and 65% by POD9. This finding is likely multifactorial and could be related to changes in public knowledge, prescribing practices, and surgical technique.

The amount and type of prescribed narcotics needs to be individualized to patient- and procedure-specific factors. In patients undergoing outpatient shoulder surgeries, those undergoing rotator cuff repair consumed more analgesics compared with those undergoing other procedures.[16] Morris and Mir[23] found that patient-specific factors such as older age, current smoking status, and preoperative opioid use were associated with postoperative opioid use. Patient sex should also be considered a patient-specific factor. Previous studies have reported differences between male and female patients regarding preoperative hip morphology, hip function, and self-reported functional deficits.[22,25] Additionally, 1 study found a higher failure rate among women undergoing nonoperative care with physical therapy.[25] The patients in our study were predominantly women, and we did not identify any statistically significant differences in any outcome measures based on sex.

In a retrospective study of 321 patients undergoing hip arthroscopy for FAI, Westermann et al[36] found that 55 patients (17%) were current opioid users at the time of surgery and another 89 patients (28%) were past users (more than 3 months before surgery). Opioid use in the 2 weeks before surgery has been found to be a strong predictor of increased postoperative opioid use after hip arthroscopy, leading to increased tolerance and potential hyperalgesia.[7] Interestingly, in the current study no significant differences in narcotic usage were found between preoperative narcotic users and nonusers on PODs 1, 4, and 9. However, patients who used narcotics preoperatively were significantly more likely to need an additional postoperative narcotic prescription when compared with patients who did not have a preoperative narcotic prescription. Hip arthroscopy has demonstrated consistently improved patient-reported pain and function,[5] and a shorter duration in narcotic use may be associated with a reduced risk of revision hip arthroscopy and other postoperative complications.[1] With the US Centers for Disease Control and Prevention recently establishing guidelines for primary care providers to manage opioid prescriptions,[8] it is time for orthopaedic surgeons to join in controlling the opioid epidemic.

Postless hip arthroscopy aims to reduce pressure on the perineum and the risk of resultant complications. Using low arthroscopy fluid pressure ($\leq$30 mm Hg), facilitated by meticulous hemostasis and atraumatic technique, is a further attempt to reduce postoperative soft tissue swelling from fluid extravasation. Venting of the hip joint to aid in joint distraction at the initiation of the procedure, a

technique that was utilized in all patients involved in this study, may also reduce postoperative pain.[12] Other factors, such as the procedure performed and the duration of surgery, may also contribute to postoperative soft tissue swelling. These factors have not been independently studied with regard to their effects on postoperative pain, and therefore additional case-control studies must be performed to further investigate these potential advantages of postless low-pressure hip arthroscopy.

Currently, no consensus exists on a standardized approach for hip arthroscopy rehabilitation, as existing studies are heterogeneous and report limited information on the rehabilitation process.[11] However, previous studies have proposed general guidelines for phased rehabilitation.[28,31] During the early postoperative period, patients in our study were expected to engage in phase 1 of rehabilitation, which includes pain and inflammation control, restoration of range of motion within the restrictions of ongoing healing, and prevention of muscular inhibition.[28,31] The patients were instructed to follow an immediate postoperative rehabilitation plan until the first postoperative visit 12 to 15 days later. Patients were to limit weightbearing completely, partially, or as tolerated with 2 crutches for a specified number of weeks, and then to transition to partial, as tolerated, or full weightbearing for another few weeks until off crutches. Cycling on an upright stationary bicycle without resistance was to begin as early as the evening of surgery and no later than 24 hours postoperatively. Hip range of motion was meant to be limited for external rotation and hip flexion past 90° for 4 weeks postoperatively. Physical therapy was recommended after the first postoperative visit once sutures were removed.

Cycling restores range of motion and prevents muscle inhibition with low impact while using the largest muscle groups of the lower extremity.[35] Patients in this study demonstrated increased endurance with stationary cycling while reporting decreased pain in the early postoperative period. Whether this association was related to the low impact of stationary cycling, inhibition of joint adhesions from motion restoration, or other factors requires further study.[9,17,18,35,37]

The limitations of this study should be noted. This was a single-surgeon, single-technique study, and therefore the results of this study may not be broadly applicable. Recall and reporting bias must be considered with respect to the patients' daily pain surveys. Other than confirming the narcotic prescriptions through the state PDMP, it was not possible to objectively verify the patient responses regarding medication consumption and amount of time on the stationary bicycle each day. Additionally, we did not stratify outcomes based on procedure type or patient-specific factors except for sex. Last, inclusion of a control group would have enabled future studies to draw meaningful comparisons between different techniques for hip arthroscopy.

CONCLUSION

Patients can expect a rapid decrease in narcotic consumption along with a high degree of activity tolerance in the early postoperative period after hip arthroscopy.

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