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Hip Arthroscopy Learning Curve and its Association with Early Postoperative Pain Scores

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Abstract

Purpose: To describe the learning curve of hip arthroscopy based on postoperative pain scores. Hip arthroscopy is technically demanding and entails a learning curve. Postoperative pain as immediate postoperative side effect may be tested with numerical scales.

Methods: A retrospective and descriptive epidemiology study was performed reviewing the levels of postoperative pain of the first 61 surgeries indicated for femoroacetabular impingement of the hip in our service. Visual Analogue Scale (VAS) was obtained during first 24 hours, searching for cases with VAS > 3, which had been previously catalogued as out of control, creating a series of cumulative cases (CUSUM) and analyzing the order of appearance within that series.

Results: Sequential analysis by Cumulative Sum Method (CUSUM) shows a learning curve that stabilizes at case 33. From then on, the remaining patients did not present uncontrollable pain.

Conclusion: The reduction in patients with VAS > 3 may reflect an improvement in pain management and surgical technique over time.

Keywords

Hip arthroscopy, Learning curve, Pain management, CUSUM analysis, Anaesthesia

Introduction

Hip arthroscopy is a surgical technique that has been described for a long time, but it has gained popularity more recently due to an increase in both diagnostic and therapeutic indications. The number of surgeries and publications regarding hip arthroscopy has increased considerably more recently [1,2].

This increase brought together a significant magnification in the number and type of surgical complications, as well as placing the management of immediate postoperative pain under the spotlight. In this regard, the current literature proposes several analgesic guidelines that range from oral and/or intravenous to local nerve blocks [3]. There has been a great improvement in the performance of hip arthroscopies in daily clinical practice, due to the great improvements within the surgical technique as well as big advances in the instrumentation used. Despite being a widely used procedure in surgical practice today, it is still an emerging technique, which requires the results to be analyzed with caution, keeping in mind that it is a surgically high-skilled procedure of

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long duration with an arduous learning curve. However, the results obtained with this technique have already been described in the literature as comparable to those obtained with open surgery, having the advantage of being a minimally invasive approach [4].

Furthermore, hip arthroscopy requires progressive skill development including the fine-tuning of arthroscopic triangulation skills in a deep joint. This gives the learning curve greater relevance when assessing both procedure and results [5-8]. The Cumulative Sum Control chart (CUSUM analysis) is used for quality control purpose, capable of detecting trends over a consecutive series. Lee, et al. has used the CUSUM analysis for studying learning curve within hip arthroscopy [7].

The aim of the present study was to evaluate the impact that arthroscopic hip surgery has on patients measured with postoperative pain management and to what extent does the surgical team's experience influences postoperative pain scores, thereby assessing their learning curve. VAS score within the first 24 postoperative hours was used to assess early postoperative pain as a surgical pain, rather than to reflect the real patient's status. Patients' postoperative pain scores may reflect the hip arthroscopy learning curve. In this study, we evaluated the relationship of postoperative pain scores with the surgeon's operative experience.

Material and Methods

A retrospective study was carried out to evaluate the first 65 consecutive hip arthroscopies that were performed at our centre between December 2007 and June 2010. These procedures were performed for symptomatic Femoroacetabular Impingement (FAI). Out of these 65 arthroscopies, 4 of them were dismissed due to lack of some kind of information required for the present study, leaving the final studied number in 61 hip arthroscopies. Variables including demographics, type of FAI, preoperative pain score, surgical time, hospital stay and postoperative analgesic treatment were collected from all patients, along with postoperative pain during the first 24 hours.

The same surgeon performed all hip arthroscopies, within the same hospital and the same operating room personnel. Arthroscopy was always performed under spinal anesthesia. All patients were operated upon using a hip traction table with padded perineal post. With the aid of fluoroscopy, the traction table supports were adjusted, establishing the necessary traction for the entry portals.

First, a wide synovectomy was performed, capsulotomy with lateral and anterior portals, partial labrectomy if required, microfractures on the injured areas in head and acetabulum, and finally, the cervicocephalic osteoplasty under arthroscopic and fluoroscopy vision. Within this group, the portals or surgical technique were not changed.

The Visual Analogue Scale (VAS) was used to evaluate pain, both preoperatively (one week prior being based on the regular pain upon the last four weeks) and postoperatively within the first 24 hours. Measurements were performed at 8, 16 and 24 hours after surgery to every patient and later performed the mean score to every patient, in order to avoid any bias from anesthesia. None of the patients required local blocks or analgesia pumps during the immediate postoperative period. VAS scores > 3 were considered as insufficient analgesic control, as suggested previously [9].

The postoperative analgesic treatment regimen was the same for all patients, consisting of intravenous analgesia during the first 24 hours plus rescue analgesia on demand. The analgesic regimen consisted of 25 mg dexketoprofen every 8 hours, 1 g paracetamol every 8 hours and 2 g metamizole every 8 hours alternating with the previous. Additional analgesia was with 100 mg tramadol on demand. Patients started rehabilitation treatment at 12-24 hours post surgery following the established protocol and walking with two crutches with complete weight-bearing. Discharge from hospital was between 24 and 48 hours following the surgical procedure.

Statistical analysis was performed with Cumulative Sum Control chart (CUSUM analysis), used to monitor change detection. This format plots the current CUSUM score on the vertical axis against the case number on the horizontal axis for a consecutive series of patients [10]. Thus, an acceptable performance will show a horizontal or down-sloping line whereas an unacceptable performance will show an up-sloping line. Statistically significant difference was set up on a p-value of 0.05.

Results

57 patients underwent surgery, three of them bilaterally with an additional repeat surgery in one case, reaching a total of 61 hip arthroscopies. Gender distribution was 16 females and 41 males. Mean age was 39.3 years old (SD 13.4), ranging from 14 to 70. Surgical indications were as follows: 61 cases with FAI, being 28 of them with cartilage lesion. All FAI were Cam-type. A revision of the joint space was performed in all patients, as well as partial labrum resection and Cam deformity resection. Labrum sutures were not performed in this group of patients. Microfractures were carried out due to full-thickness acetabular chondral defects.

Mean presurgical VAS was 6.4 (SD 2.04), whereas postoperative VAS decreased to 1.9 (SD 1.75) at 24 hours postoperative. Eight patients qualified their postoperative pain as uncontrollable with a VAS score > 3 (13.11%). Results from the first 33 patients (first group) with the remaining patients of the series (second group).

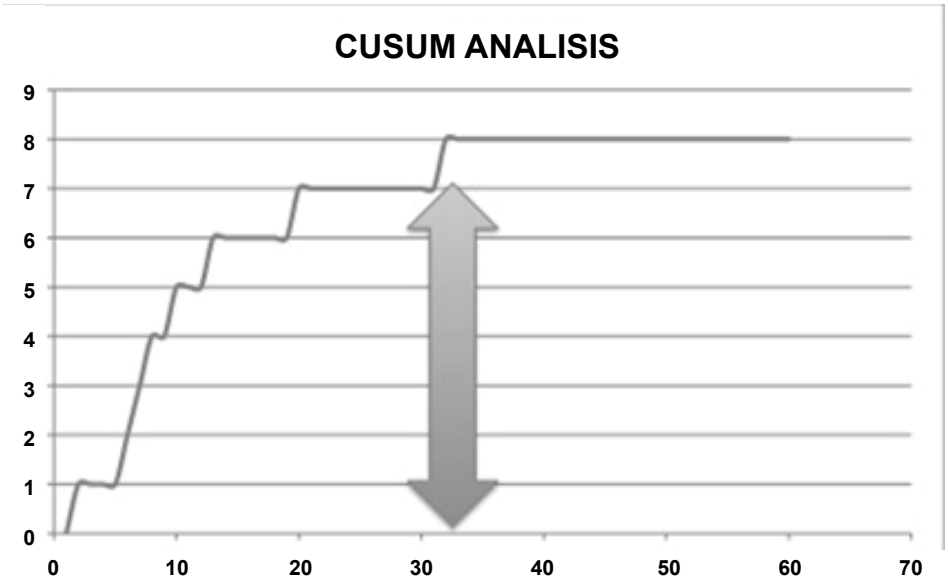

Figure 1: Visual Analogue Scale (VAS) during the first 24 hours postoperative for the series of patients that underwent arthroscopic hip surgery. The horizontal line (VAS = 3) marks the initial score at which patients are considered as being under insufficient pain management.

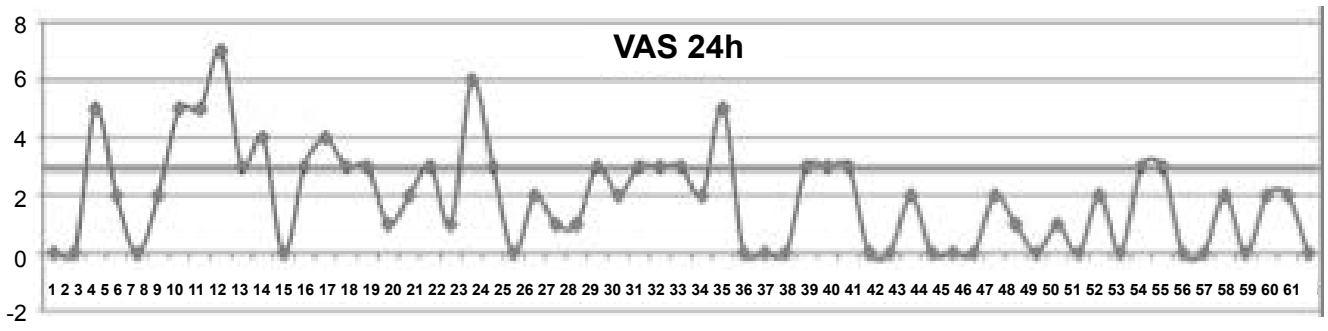

Figure 2: Number of cases with insufficient pain management during the first 24 hrs. The cumulative stabilizes at case 33. The CUSUM (cumulative sum control chart) allows for the observation of the learning curves' behavior up to the first 30 cases approximately where it stabilizes.

VAS scores during first 24 hours are collected in Figure 1, classifying VAS scores over 3 as bad analgesic control. Rescue medication was administered to patients presenting with VAS > 3, who were also considered patients with bad postoperative analgesic control. These patients were marked with value 1 and becoming part of the accumulative sum graphic, represented in Figure 2 (CUSUM analysis - accumulative sum method).

Mean surgical time was 172.8 min. (SD 59.4), ranging from a minimum 39.6 up to 330 min. (5.5 hours) long. Kolmogorov-Smirnov test of the variable surgical time achieved normal criteria (p 0.31 and p 0.60).

Mean hospital admission was 42 h (SD 12).

Discussion

The present manuscript shows that pain reached a steady line after the first 33 cases. Pain was evaluated with VAS scale and described as an early postoperative complication of hip arthroscopy. The pain control results obtained in our series show that adequate pain control was achieved in most patients, keeping a VAS < 3 in the immediate postoperative period (first 24 hrs), using the same analgesic regimen of paracetamol, metamizole and dexketoprofen (Figure 1). Looking at the distribution of postoperative VAS scores over time, we can observe that despite the irregular control in the first surgeries performed, a clear tendency exists towards maintaining a VAS ≤ 3, becoming constant from surgery 33 onwards.

The irregular VAS distribution within the first surgeries becomes more regular as the number of surgeries performed increases, becoming more evident from case 33 onwards, where VAS scores remain steady below 3 (Figure 1). That is, comparing these results to those obtained in other studies, we observe that it is possible to ef-

ficiently manage immediate postoperative pain with basic analgesic regimens, achieving similar results to those obtained with other means of pain management such as local nerve blocks (isolated or combined) and associated opioid medication [3,11-13].

Comparing data from the first 33 cases and the remaining cases until case 61, it can be observed that the level of pain measured with VAS, although lacking statistical significant differences, it does present a trend towards the first cases. Obviously, the uncontrollable pain of this group has an influence increasing the mean although not reaching significant differences.

These results can be related to the natural evolution of the surgeons' learning curve, highlighting the difficulty in initial stages to control postsurgical pain, possibly as a result of poor surgical management due to the difficulty of the arthroscopic surgical technique itself. As the number of surgeries performed increases it becomes evident that the surgeon's dexterity with mentioned technique improves, thus making postsurgical pain management more regular [1,14]. In fact, similar results have been observed to those described in other publications regarding the learning curve in hip arthroscopy, where the estimated number of around 30 surgeries is also described as the milestone for satisfactory short-term clinical results, along with reduced surgical time and lower complication rates [6]. Lee, et al. reported on approximately 20 cases required to achieve satisfactory outcomes in terms of clinical outcomes [7].

Bad pain management, quantified as VAS > 3, is considered as an accumulative case of bad control in each case, being able to elaborate a graphic illustrating a Cumulative Sum Control chart (CUSUM), clearly showing the evolution of the surgical learning curve (Figure 2). This curve evolves to its stabilization at case 33, from which point subsequent cases of bad pain management cease to occur.

There are numerous papers published on hip arthroscopy and other joints, which stress the need for an extensive period of training on simulators or cadavers in order to perfect the taxing orientation, triangulation and use of different access portals [7,8,14]. Arthroscopic hip surgery is a technique with a drawn-out learning period.

Meanwhile, Lee, et al. applied a method for evaluating results for the learning curve assessment, maintaining that Modified Harris Hip Score less than 80 at 6 months postoperative was considered as failure of treatment using CUSUM method [7]. Regarding the effort to control this curve, it is interesting to point out that training on simulators show improvement rates after relatively few simulated episodes, as described by Pollard [14].

Some publications advocate the evaluation of the learning curve according to the decreasing number of complications [14-16], positioning the point of adequate control at 30 initial surgeries and 30 annual surgeries as the necessary number for obtaining a reasonable learning curve.

Similar results arise when reviewing studies on postoperative pain management in other joints such as knee and shoulder, observing that pain management is regularized with determined analgesic regimens as the number of surgeries performed by the surgeon increases [11,17]. Within shoulder arthroscopy, the published studies agree on the administration of post surgical oral analgesics, adding adjuvant treatment in refractory cases with opioid analgesics on demand and/or relaxants [18], for pain management during the first postoperative hours [19].

Several limitations to our study must be taken into consideration when reviewing our work. First, ours is a single-centre and retrospective study. Furthermore, VAS scores before surgery, reflecting the current clinical status of the patient, is not comparable to the postoperative VAS taken within first 24 hours after surgery, as this score should be considered as a surgical complication rather than the real clinical status, which should be measured 6-12 months after surgery. However, as aforementioned, the purpose of the present was to evaluate early postoperative pain as a surgical complication.

Using Student's t-test for paired samples, both means were compared with no significant differences (2.63 (SD 1.8) from the first group vs. 1.03 (SD 1.2) from the second group), although a positive trend was observed.

Conclusion

Postoperative pain in hip arthroscopy is manageable with first line analgesic regimens. The learning curve might influence pain management within the first 24 postoperative hours given the observed results of a decrease in pain with more surgeries performed by the physician.

Conflict of Interests

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

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