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ARTHROSCOPY AND SPORTS MEDICINE

Rotator cuff repair is more painful than other arthroscopic shoulder procedures

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Abstract

Aim To evaluate the influence of the specific procedure performed and other variables on the intensity of acute postoperative pain following outpatient shoulder arthroscopy.

Methods One hundred patients undergoing outpatient shoulder arthroscopy under single-shot interscalene block plus general anaesthesia were prospectively studied. Acetaminophen with ibuprofen was prescribed for postoperative pain control and tramadol HCl as rescue medication. Patients scored pain intensity at 2, 6, and 24 h postoperatively. The influence of the surgical procedure, age, gender, surgery duration, and irrigation volume used on the intensity of postoperative pain was studied.

Results Five patients were excluded due to ineffective block or protocol deviation. Among the 95 remaining patients, 51 underwent rotator cuff tear repair, 25 shoulder stabilisation, and 19 subacromial decompression. While there were no differences at 2 and 6 h after surgery, pain intensity was significantly higher among those undergoing rotator cuff tear repair (5.2, 1–10) at 24 h compared to stabilisation (4.1, 1–8) or subacromial decompression (5, 1–8) ($p < 0.0001$). No association was found between pain intensity and other variables.

Conclusion A higher degree of acute postoperative pain should be expected in patients undergoing arthroscopic rotator cuff tear repair compared to other arthroscopic shoulder procedures, and additional pain treatment is recommended.

Keywords Shoulder · Arthroscopy · Postoperative pain · Brachial plexus block · Rotator cuff tear repair · Procedure

Introduction

Outpatient surgery has progressed spectacularly in recent years due to outstanding advances in surgical techniques allowing complex procedures to be carried out more quickly and less aggressively and because improved anaesthetic management has led to shortened recovery times. Postoperative pain is the major limiting factor for discharge after outpatient surgery. Pain involves a number of deleterious effects that affect the physical and emotional status of the patient and it is not only the most significant and frequent cause of delayed discharge and unplanned hospital admission but also clinical outcome is more strongly related to patient satisfaction in outpatient surgery [1].

Shoulder arthroscopy is often scheduled as an outpatient surgery procedure, and its indication is growing in number and complexity [2]. Postoperative pain, which can be intense in the first postoperative hours, constitutes the main limitation for outpatient shoulder arthroscopy [3, 4]. Different approaches have been described to reduce pain following shoulder arthroscopy but none has considered the possibility that postoperative pain control should be tailored to the specific type of surgical procedure carried out neither pain intensity after the different arthroscopic shoulder procedures has been categorized [3–11].

We hypothesised that arthroscopic rotator cuff tear repair is more painful than other arthroscopic shoulder procedures performed on an outpatient basis. Identifying arthroscopic rotator cuff tear repair, as a more painful procedure would help to tailor postoperative pain treatment and to adequately select patients for outpatient surgery avoiding unplanned admissions.

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The objective of this study was to compare the intensity of postoperative pain after arthroscopic rotator cuff tear repair to other common arthroscopic shoulder procedures.

Patients and methods

In this prospective study, the intensity of acute postoperative pain was assessed in 100 consecutive adult patients undergoing arthroscopic shoulder surgery on an outpatient basis at the Outpatient Major Surgery Unit of our institution. The senior author performed all operations. Following the institutional inclusion criteria protocol for scheduling of patients at the Outpatient Major Surgery Unit, all patients preoperative physical status were classified as American Society of Anesthesiologist (ASA) I or II. Patients younger than 18 years, patients diagnosed or suspected of psychological problems, mental disease, fibromyalgia, or any other condition associated with chronic pain, as well as patients with previous shoulder surgery, either on the same or the contralateral shoulder, were excluded.

Anaesthesia was carried out by the same anaesthesiologist following a standardised protocol based on a single-shot interscalenic blockade under ultrasound control (L-bupivacaine 0.5% 30–40 ml plus epinephrine) combined with general anaesthesia (propofol 2–2.5 mg/kg iv and alfentanil 20–150 µg/kg iv initially, plus 15 µg/kg bolus, and maintenance with sevoflurane). The effectiveness of the brachial plexus blockade was evaluated pre- and postoperatively and was considered effective if the patient showed complete anaesthesia and severe paresis in the operated limb. In those patients with hypoesthesia or with preserved sensitivity, the brachial block was deemed ineffective, and these patients were excluded from the study. According to the Outpatient Major Surgery Unit guidelines, patients were discharged following surgery if they were hemodynamically stable and had uneventful oral tolerance and satisfactory pain control. Patients who did not fulfil any one of these three requirements stayed in the hospital overnight. Postoperative analgesia after discharge consisted of an oral non-steroidal anti-inflammatory (NSAID) agent (ibuprofen, 600 mg/8h, Ibuprofeno Ratio, Ratiopharm España, Madrid) combined with acetaminophen (Paracetamol Ratio, Ratiopharm España, Madrid) 1000 mg/8 h, and continuous cold therapy. Patients were instructed to receive tramadol HCl (Adolonta, Grünenthal Pharma, Madrid) nasal spray, one shot/15 min as a rescue medication if the combination of ibuprofen and acetaminophen was insufficient to control postoperative pain. The Outpatient Major Surgery Unit provides operated patients with a 24 h mobile phone number to offer postoperative attention to those seeking additional medical attendance, usually due to insufficient pain control.

To assess the degree of postoperative pain, patients were requested to score the intensity of pain according to a numeric pain rating scale at 2, 6, and 24 h after surgery. The numeric pain rating scale assigns numerical values ranging from zero to ten points, in which zero means absence of pain, and ten, the worst possible pain. The same observer, a senior resident in anaesthesiology, recorded the intensity of pain at the 3 time periods after instructing the patients on how to use the scale. Postoperative pain intensity at 2 h was assessed in person while the patient was in the recovery room. This first evaluation served to confirm that patients had understood how to use the scale. Subsequent information on pain intensity at 6 and 24 postoperative hours was obtained by telephone interview following the same protocol. Acute postoperative pain was evaluated at this time points to evaluate the intensity of pain while the blockade is partially and completely disappeared. Those variables that might influence the intensity of postoperative pain were studied: surgical procedure performed, age, gender, duration of surgery, and irrigation volume used during the procedure. To evaluate the potential influence of each specific procedure in terms of acute pain intensity patients undergoing the three more frequent shoulder arthroscopic techniques were considered: subacromial decompression, shoulder stabilisation, and rotator cuff tear repair. Patients undergoing other surgical procedures were excluded. Subacromial decompression included only patients undergoing bursectomy and isolated acromioplasty, while patients undergoing additional procedures such as acromioclavicular joint excision, os acromiale resection, calcifying tendonitis evacuation or long biceps head intervention were ruled out. Regarding arthroscopic shoulder stabilisation only patients undergoing soft tissue procedures were included because patients who undergo arthroscopic bone block procedures stayed overnight according to the protocol of our department. The circulating nurse recorded data on surgery duration and irrigation volume. The duration of surgery was defined as strict surgical time, i.e. from the first stab incision to the last stitch, to discard the time due to the anaesthetic procedure, patient positioning, draping, or any potential delays caused by affiliated personnel.

Those patients that needed to take tramadol HCl as additional pain medication due to insufficient pain control were recorded. Patients who requested telephone medical assistance due to insufficient pain control were also recorded as a surrogate of poor control of pain, as well as those who required to be readmitted for the same reason. The institutional review board approved the protocol for this investigation under proceeding number EO 05/2014.

Statistical analysis

Concerning sample size determination, when comparing arthroscopic rotator cuff tear repair with the other two procedures a total of 17 participants per group would have 80% power in detecting 2 points or more in pain intensity following the VAS scale, assuming a common SD of 4, and a two-sided α level of 0.05. This would result in a total of 51 participants. If 20% of participants is estimated that might drop out of the study due to inefficient blockade or protocol deviation, a minimum of 64 participants would be considered adequate for the study. Owing to a lack of prospective studies for this type of end point, our assumptions in the sample size estimation are conservatively stipulated.

Categorical variables are described using relative frequency, and continuous variables are described using mean and standard deviation (SD). Pain intensity among the three groups of procedures was compared using the ANOVA. The 95% confidence intervals were estimated when necessary. A multivariate linear regression analysis was performed to define the independent variable (arthroscopic rotator cuff tear repair to other common arthroscopic shoulder procedures) influencing pain intensity. A p value lower than 0.05 was considered statistically significant for all statistical analyses. Data analyses were performed using the SPSS (version 20.0) statistical package for Windows (SPSS Inc., Chicago, IL, USA).

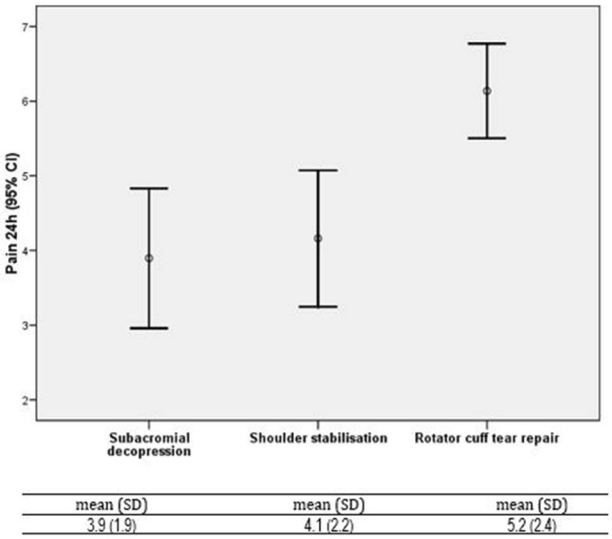

Fig. 1 Graph of the intensity of pain measured at 24 h after surgery according to the VAS

Results

Four out of the initial 100 consecutive patients recruited were excluded due to partially or totally ineffective brachial plexus block, and six additional patients dropped out due to deviation from the protocol, leaving 90 patients (55 females and 35 males) enrolled in the final study. Nineteen patients underwent arthroscopic subacromial decompression, 21 arthroscopic shoulder stabilisation, and 51 arthroscopic rotator cuff tear repair. The average age of patients was 51 (18–77) years. There were no patients requiring subscapularis repair in the group undergoing arthroscopic rotator cuff tear repair. No wound problems or other surgical complications in the immediate postoperative period were identified in any of the patients studied.

The intensity of pain 24 h following surgery was significantly greater after arthroscopic rotator cuff tear repair than the other two techniques ($p=0.001$), while no significant differences were found when arthroscopic subacromial decompression and arthroscopic shoulder stabilisation were compared ($p=0.916$) (Fig. 1). Thirty-two patients (35.5%) required tramadol HCl combined with acetaminophen and ibuprofen as rescue medication due to insufficient pain control. Twenty of these patients had undergone arthroscopic rotator cuff tear repair, ten arthroscopic shoulder stabilisation, and two arthroscopic subacromial decompression. Three patients reported side effects (drowsiness and nausea) while taking tramadol. Four patients contacted the Outpatient Major Surgery Unit by phone due to poor control of pain, and one patient who underwent arthroscopic rotator cuff tear repair had to be admitted overnight for the same reason.

A linear regression model was adjusted taking into account several variables found clinically relevant for arthroscopic rotator cuff tear repair, the most painful of the different surgeries. These selected variables were age (patients were significantly younger in arthroscopic shoulder stabilization), duration of surgery (longest in arthroscopic rotator cuff tear repair), and volume of irrigation fluid infused (lower in subacromial decompression) (Table 1). When arthroscopic rotator cuff tear repair was compared to other procedures, statistically significant differences regarding mean pain intensity at 24 h were observed when compared to arthroscopic subacromial decompression (2.4 times higher) and arthroscopic shoulder stabilization (2.6 times higher). After adjustment by age, duration of surgery and volume of irrigation fluid used, the results remained statistically significant as shown in Table 2. Neither were any correlation between surgery time, age, gender or even irrigation volume with those patients who needed stronger pain medication, the majority of them had undergone rotator cuff tear repair.

Table 1 Age, surgery duration and irrigation volume used in the three arthroscopic procedures studied

	Subacromial decompression	Shoulder stabilisation	Rotator cuff tear repair	*p*
Age (years)	53.8 (8.1)	32.6 (11.1)	58 (12.4)	< 0.0001
Surgery duration (min)[a]	43.2 (17.5)	63 (18.5)	73.6 (27.5)	< 0.0001
Irrigation volume (l)	7.5 (3.6)	16.5 (8.8)	21.2 (14.1)	< 0.0001

[a]As measured from the first stab incision to the last stitch. Data are given as mean (standard deviation)

Table 2 Results of linear regression analysis modelling for those variables found clinically relevant for arthroscopic rotator cuff tear repair

	Coefficient	95% CI	*p*
Surgical procedure			
Subacromial decompression	− 1.97	− 3.03/− 0.92	< 0.0001
Shoulder stabilization	− 2.24	− 3.40/− 1.07	< 0.0001

Discussion

Appropriate pain control is both a key prerequisite for a successful procedure as well as the most effective means of avoiding unplanned admissions due to uncontrolled pain [2, 12]. Several protocols have been proposed after shoulder arthroscopy for acute postoperative pain control including oral analgesia, cold therapy and continuous perfusion of local anaesthetics, either at the brachial plexus, into the subacromial space, or even into the glenohumeral joint [4–6, 10–13]. However, recent comparative studies have failed to demonstrate the superiority of any of these modalities over the others [14–18]. The anaesthetic procedure followed in our patients, single-shot interscalenic blockade combined with general anaesthesia is commonly used in outpatient shoulder arthroscopy and has been demonstrated to provide good acute postoperative pain control and allow same-day discharge with a success rate of up to 98% and a complication rate of 1% [1, 2, 11, 19]. It is a well-known fact that pain after shoulder arthroscopy peaks in the first 24 h and diminishes in the following days [4] and the main drawback of single-shot interscalene block is that although it provides good analgesia in the first hours patients may experience pain once the block wears off [20]. Therefore, oral analgesia after discharge is recommended after single-shot interscalenic blockade but evidence favouring any specific protocol is lacking. The findings of this study show that the combination of an NSAID, like ibuprofen, with acetaminophen, together with cold ice therapy achieves good pain control in the majority of patients, as demonstrated by the low pain intensity reported by patients in this study at 24 h after surgery. However, there is a certain number of patients in whom this combination might prove insufficient for pain control, and additional rescue medication is recommended. Oral solution of tramadol HCl permits self-titration of postoperative analgesia by the patient and has proven to be effective with a low number of side effects for this group of patients. Following this protocol, only one patient in this series required an overnight stay and just a few others requested additional help by phone due to poor pain control.

Several variables like advanced age, preoperative pain score, low preoperative patient threshold, involvement in workers' compensation proceedings, alcohol abuse in preoperative treatment with narcotics or antidepressants have been recognised as risk factors for high postoperative pain score after arthroscopic shoulder surgery [21–23]. However, surgeons are well aware that the degree of tissue trauma or the duration of surgery may vary significantly depending on the procedure carried out and these circumstances might have an influence on acute pain intensity following shoulder arthroscopy. The most important finding in this investigation is that patients undergoing outpatient arthroscopic rotator cuff tear repair reported higher intensity of postoperative pain after discharge. This tendency was already indicated at the evaluation performed 6 h after surgery, when arthroscopic rotator cuff tear repair showed a degree of pain superior to other procedures. However, the mean pain intensity recorded at that time point for arthroscopic rotator cuff repair was 1.5 points, which is clinically irrelevant. Stiglitz et al. published the only report in the literature analysing the effect of the specific arthroscopic shoulder procedure on the degree of postoperative pain [9]. These authors followed a non-standardised anaesthesia procedure including isolated general anaesthesia and different systems of combined general anaesthesia plus interscalene block. Several additional postoperative analgesic protocols were used, including subacromial and intraarticular catheters, single-shot subacromial injections, and different types of analgesics and narcotics. Furthermore, numerous procedures were included under the group of decompressive surgery, such as acromioplasty, acromioclavicular resection, calcifying tendonitis removal, and biceps tenotomy or tenodesis. Our study prospectively evaluates a group of patients who underwent operation according

to the same anaesthetic and surgical protocols and were treated postoperatively with the same medication.

Koorevaar et al. included arthroscopic surgery to develop a prediction model to identify prognostic factors for postoperative frozen shoulder after shoulder surgery [24]. However, comparative studies have concluded that arthroscopic rotator cuff tear repair shoulder surgery does not pose a higher risk of postoperative pain compared to arthroscopic repair [25]. The fact that arthroscopic rotator cuff tear was more painful when compared with other procedures cannot be explained based on the findings in this study but it seems reasonable to think that rotator cuff tear repair constitutes a more aggressive surgical technique, requiring tendon tissue mobilisation, compared to other arthroscopic procedures in the shoulder. In our practice, all sizes of rotator cuff tears are repaired arthroscopically on an outpatient basis, and extensive soft tissue dissection and mobilisation is frequently required. Furthermore, arthroscopic rotator cuff tear repair was also the longer lasting procedure and the procedure that required most irrigation volume. Clinical consequences drawn from this finding are remarkable not only because patients scheduled for outpatient arthroscopic rotator cuff tear repair must be informed accordingly and adequate treatment to prevent acute postoperative pain provided, but also because surgery shall be scheduled in anticipation of this possible complication. It is thus advisable to schedule patients undergoing outpatient arthroscopic rotator cuff tear repair at a time when adequate additional medical support can be provided to control pain once the blockade has subsided.

This study is not without limitations. Acute pain intensity was only evaluated during the first postoperative day, though it is known that the anaesthetic effect of single-shot interscalene block lasts much less, and other authors have observed that pain following arthroscopic shoulder surgery peaks at 24 h [9]. Since ours is a prospective study performed in a consecutive series of patients, a minimum number of patients per group of procedures had not been established, and the number of patients allocated to certain groups (i.e. calcifying tendonitis evacuation) were small. This drawback, however, does not limit the validity of the conclusion that arthroscopic rotator cuff tear repair was significantly more painful than the other procedures. Certain factors, such as rotator cuff size tear, tendon quality, stiffness or the presence of synovitis that might influence postoperative pain intensity were not addressed in variance analysis although these factors might strongly influence surgical time. Finally, the study included the most common procedures in shoulder arthroscopy, though pain experienced during the acute postoperative period of others, i.e. arthroscopic bone block procedures, was not assessed. In addition, other variables in the rotator cuff tear repair group that might influence in postoperative pain like tear size and retraction or long head of the biceps procedures were not considered.

In conclusion, our findings show that patients undergoing outpatient arthroscopic rotator cuff tear repair is followed by superior acute postoperative pain than other frequent arthroscopic shoulder procedures. Therefore, adequate analgesic treatment to prevent acute postoperative pain should be recommended and surgery scheduled at a time when adequate additional medical support can be provided if pain is poorly controlled once the blockade has subsided when performed on an outpatient basis.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval The Institutional Review Board of Hospital Universitario Fundación Jiménez Díaz (Universidad Autónoma de Madrid) approved the study (no. EO 05/2009).

Informed consent Informed consent was obtained from all individual participants included in the study.

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