ORIGINAL STUDY — SHOULDER & ELBOW

acta orthopaedica belgica, 2024, 90, 67-71

doi.org/10.52628/90.1.12493

Perioperative steroid injection in elbow arthroscopy

M. VANDERSTAPPEN[1,2], L. VAN MELKEBEKE[1], J. DUERINCKX[1,3], P. CAEKEBEKE[1,3,4]

[1]Hospital Oost-Limburg, Department or Orthopaedics and Traumatology, Genk, Belgium; [2]University Hospitals Leuven, Department of Orthopaedics, Leuven, Belgium; [3]University of Hasselt, Department of Rehabilitation Sciences, Hasselt, Belgium; [4]University hospital Antwerp, Department of Orthopaedics and Traumatology, Antwerpen, Belgium.

Correspondence at: Dr. Pieter Caekebeke, Hospital Oost-Limburg, Department or Orthopaedics and Traumatology, Genk, Belgium, Phone: +32 89 32 61 18, Email: pieter.caekebeke@zol.be

The goal of the present study was to evaluate the incidence of infection after perioperative intra-articular steroid injection during elbow arthroscopy. Starting from May 2019, we prospectively included all patients that underwent an elbow arthroscopy for various indications. All patients received preoperative antibiotics intravenously and a corticosteroid injection immediately after portal closure. Patients who needed ligamentous repair and aged below 18 years old were excluded. Final follow up of all patients was 3 months. In total, 108 elbow arthroscopies were performed in 100 patients. No major complications and 1 minor complication were seen. One patient developed a seroma that resolved spontaneously after 14 days without intervention or antibiotics. In this patient group, a perioperative corticosteroid injection following elbow arthroscopy did not increase the chance of infection.

Keywords: elbow, arthroscopy, corticoid, steroid, infection.

INTRODUCTION

In recent years, arthroscopic elbow surgery has gained popularity. Advancements in arthroscopic technology and techniques have expanded the indications for elbow arthroscopy, making it a viable treatment option for various elbow pathologies[1-4]. However, as its use has increased, concerns have arisen regarding potential complications. Reported complications include compartment syndrome, septic arthritis, superficial wound infection, heterotopic ossification, and nerve injuries (transient and permanent)[5-9].

Of particular concern is postoperative joint infection, which is rare but can have devastating effects on the patient's joint function, requiring subsequent procedures and a prolonged course of antibiotics. Therefore, identifying patients who are at increased risk of this complication and investigating independent risk factors are critical[4-6]. One potential risk factor that has historically been described, to increase the risk of infection, is corticosteroid injection at the time of surgery[10,11]. Despite this increased risk, multiple studies have shown that a corticosteroid injection at the time of surgery may decrease postoperative pain, reducing the need for narcotics, reduce heterotopic ossification (HTO) and enhance postoperative function[11-14].

In this article, we aimed to assess the risk of postoperative infection after corticosteroid injection in patients undergoing elbow arthroscopy for various indications.

MATERIAL AND METHODS

From May 2019, we prospectively enrolled all consecutive patients who required elbow arthroscopy and received a corticosteroid injection at the time of surgery after portal closure. All surgeries were performed by the senior author. Patients under the age of 18 years old and those requiring ligamentous repair or interventions for septic arthritis of the elbow joint were excluded from the study. We obtained patient information on sex, age, smoking and alcohol habits, diabetes and inflammation status, reason for surgery, and the presence of superficial or deep infection by reviewing their medical records. Additionally, we collected surgical records related to tourniquet duration, occurrence of ulnar nerve problems requiring release, and pre- and postoperative range of motion. A clinical follow-up was conducted on all patients at 2 weeks, 6 weeks, and 3 months after surgery to evaluate their progress.

As a standard practice, all patients received pre-operative antibiotic prophylaxis. For patients weighing more than 70 kg, 1 or 2 grams of intravenous cephazolin was administered. In case of allergy, 600 milligrams of intravenous clindamycin was given before the surgical procedure. All patients were placed in a lateral decubitus position with the affected elbow flexed to 90 degrees and supported by a padded holster (Figure 1). A tourniquet was applied and inflated to 250 mm/Hg before draping to minimize sterility issues. The arm was then prepared using standard sterile protocol with careful attention for sterility. We inserted a needle into the direct lateral portal using sterile normal saline solution to distend the joint. We used multiple portals to visualize the anterior and posterior compartment, depending on the pathology requiring treatment. Portal placement was determined through careful palpation of the underlying osseous structures.

We categorized the procedures into four different types: removal of loose bodies, removal of loose bodies with synovectomy for synovitis or soft tissue limiting range of motion, capsulectomy for cases with limited range of motion after synovectomy and removal of loose bodies and reshaping of the bony anatomy for cases with severe bone formation and osteophytes, such as coronoid or fossa olecranon.

After completing the elbow arthroscopy and expelling any remaining fluid from the joint by extending the elbow joint, we administered a corticosteroid injection (Depo-Medrol 40mg) through a posterior injection site targeting the olecranon fossa. Notably, this approach avoided using the surgical portals (Figure 2).

Following the arthroscopic procedure, we applied cast immobilization in full extension for 24 hours. We allowed immediate mobilization as tolerated by the patient. Patient were seen 2 weeks after surgery. If needed, physiotherapy was started two weeks after surgery. A clinical follow-up was arranged at the 6 weeks after surgery. Finally, at the three-month mark, we conducted a final follow-up to evaluate joint mobility and pain status while noting any signs of possible infection.

The study aimed to assess the effect of covariates on the number of infections (superficial or deep) in patients undergoing elbow arthroscopy who had cortisone infiltration at the end of the procedure. The outcome variable of interest is infection. The following covariates were considered in the analysis: Gender, age, BMI (body mass index), smoking, ASA (American Society of Anesthesiologists physical status classification system), RA (inflammatory disease, diabetes, operation time, ulnar nerve release.

Figure 1. — Installation of the patient during elbow arthroscopy in lateral decubitus. Portals are marked.

Figure 2. — Injection of the cortico-steroids using a different injection site after portal closure.

Given that the number of infections is small, fitting a more complex model or tests based on asymptotic approximations may give poor results. For this reason, Fisher's exact test was used to determine whether there is a significant association between infection and the above categorical variables.

RESULTS

Between May 2019 and December 2022, a total of 141 elbow arthroscopies were conducted. Of these, 33 arthroscopies in 29 patients were excluded from the analysis because ligamentous repair was required or because the patients were under 18 years old. The remaining 108 elbow arthroscopies were performed in 100 patients, with a mean age of 43.8 years (19-73y). All patient received antibiotics intravenously before the start of the operation. All patients received a corticosteroid injection after portal closure. The mean body mass index was 26.5 kg/m2 (17,7-48,3 kg/m2), and 27 patients were active smokers. Three patients had Diabetes and inflammatory disease was present in 5. Patient characteristics are described in Table I.

Table I. — Patient characteristics

Age (years)	43,8 y (19-73)
BMI (kg/m²)	26,6 kg/m² (17,7-48,3)
Gender male female	 54/100 (54%) 46/100 (46%)
Smoking status never former smoker current smoker	 61/100 (61%) 12/100 (12%) 27/100 (27%)
Ulna nerve release	16/100 (16%)
Diabetes mellitus	3/100 (3%)
Inflammatory disease	5/100 (5%)
ASA score 1 2 3	 54/100 (54%) 38/100 (38%) 8/100 (8%)

The indications for elbow arthroscopy varied, with loose bodies removal alone performed in 4 cases, loose bodies removal in combination with plica synovialis resection and extensive synovectomy in 52 cases, capsulotomy in combination with resection of osteophytes in 34 cases, and osteocapsular arthroplasty in 18 cases. Ulnar nerve release was performed simultaneously with the elbow arthroscopy in 16 cases. Surgical specific analysis is represented in Table II.

The mean surgical time was 42 minutes (13-110 minutes), and surgical time increased with the complexity of the procedure. No deep or superficial infections were observed, although one patient developed a seroma that resolved spontaneously after 14 days without any intervention or antibiotics. The seroma originated from the posterolateral portal, possibly due to the larger incision to remove a large loose body.

Table III reports the exact p-value for Fisher's exact test. A Type-I error (α) of 5% is used in decision-making. None of the variables included in this study are associated with infection at the 5% significance level.

Table III. — Fisher's exact test p-value for the association between infection outcome and various covariates

Covariates	**p-value**
Gender	0.459
Age	1.000
BMI	0.422
Smoking	1.000
ASA	1.000
Inflammatory disease	1.000
Diabetes	1.000
Operation time	0.303

DISCUSSION

Corticosteroid injections are frequently used in Orthopaedic surgery to treat various conditions, such as joint pain, inflammation, and arthritis[15,16]. These can be directly administered to the affected joint or tissue, reducing inflammation and pain[17]. However, like all medical procedures, corticosteroid injections have potential risks. These can include local side effects, such as pain, swelling, atrophy, and redness at the injection site, and systemic side effects, such as hyperglycemia, hypertension, and adrenal suppression[18]. Corticosteroid injections have been found to effectively mitigate and prevent the formation of heterotopic ossifications[4,13]. Studies have shown that administering corticosteroid injections during knee arthroscopy can decrease postoperative pain, reduce the need for narcotics, and improve postoperative function[11,13]. Furthermore, Nelson et al. showed a significant relationship between heterotopic bone formation and perioperative corticosteroid injection. They reported symptomatic heterotopic bone formation in 2.5% of patients who did

Table II. — Characteristics of the surgical procedures

Surgical procedure*	**Patients (No)**	**Mean surgival time (range)**	**Mean age (range)**	**Mean BMI (range)**
Removal loose bodies	4	28 min (26-84)	36 y (24-27)	26,9 kg/m² (22,5-31,7)
Extensile synovectomy and plica resection (+ removal loose bodies)	52	37 min (13-31)	39 y (19-70)	26,1 kg/m² (17,7-48,3)
Capsulectomy ± resection osteophytes	34	45 min (14-71)	45 y (21-73)	26,3 kg/m² (19,6-34,1)
Osteocapsular arthroplasty	18	56 min (25-110)	50 y (25-66)	28,0 kg/m² (20,9-35,8)
Total	**108**	**42 min (13-110)**	**43 y (19-73**	**26,5 kg/m² (17,7-48,3)**

* More than 1 procedure per patient is possible.

not receive a corticosteroid injection, compared to none in patients who received a corticosteroid injection[4]. Nonetheless, perioperative injection of corticosteroids has been linked to higher rates of superficial and deep infections[1,4,6].

In this prospective study, we aimed to investigate the potential risks of corticosteroid injection in elbow arthroscopy. In 108 consecutive elbow arthroscopy cases (in patients older than 18 years without ligamentous repair), we observed no deep joint infections (0%) and only 1 case of seroma (0.9%) lasting 2 weeks resolving without antibiotics or revision surgery. These results contrast with previous studies that have reported higher infection rates associated with intraoperative corticosteroid injections[1,4,6].

Nelson et al. conducted a retrospective review in 2014 of all consecutive elbow arthroscopies performed over a 13-year period to determine the early complication rate and identify risk factors for adverse effects[4]. They reported superficial and deep infection rates of 6.7% and 2.2%, respectively. Intraoperative steroid injections were strongly associated with postoperative superficial (14.1% vs. 2.0%) and deep infections (4.9% vs. 0.4%) compared to elbows not receiving an injection.(4) Kelly et al. performed a retrospective review in 2001 of 473 elbow arthroscopies in 449 patients with a 6-week follow-up. They found an overall complication rate of 11%, with prolonged drainage being the most frequent delayed minor complication observed in 5% of the cases. Four cases (0.8%) were diagnosed with deep infection, all of which received a corticosteroid injection during surgery[6]. The study by Camp et al. reported the incidence of joint infection in 2,704 elbow arthroscopies and identified risk factors for postoperative infection. They found an overall complication rate of 1.55% and an odds ratio of 2.79 to develop a postoperative infection when an intra-articular corticosteroid injection was given at the time of surgery. Other risk factors included age over 65 years, morbid obesity, alcohol use, diabetes mellitus, inflammatory arthritis, and hypercoagulable disorder[1].

We hypothesize that the shorter operation time we achieved in our study may be one potential factor contributing to our lower infection rate. Previous studies have reported mean tourniquet times of 71 minutes (range 12-142 minutes) and 61 minutes (range 11-159 minutes) for Nelson et al. and Kelly et al., respectively[4,6]. In contrast, our mean surgical time was 42 minutes, with a range of 13 to 110 minutes. It is important to note that all our arthroscopies were performed by a single elbow surgeon with experience in the procedure. Other studies involved multiple surgeons, some of whom may have had less experience in elbow arthroscopy[4]. The learning curve of elbow arthroscopy is long and may influence surgical time. The corticosteroid injection was performed through a separate injection site after portal closure. This specific technique for this injection has not yet been described in the existing literature. The rationale behind this approach was to minimize inadvertent deposit of corticosteroid in the portal channel, which could potentially prolong portal leakage. Our study found no significant association between various risk factors, such as obesity, smoking, diabetes mellitus, and inflammatory disease, and the occurrence of deep joint infections after elbow arthroscopy. Only one case of seroma formation was reported, which resolved spontaneously without any intervention. This patient had no known risk factors and was not suspected to have an infection.

One strength of the study was the prospective inclusion of all patients scheduled for elbow arthroscopy, which helps mitigate the risk of selection bias. Additionally, all patients were administered corticosteroid injection without consideration of comorbidities, with age and ligamentous repair being the only exclusion criteria.

However, the study had some limitations. First, it only focused on infection rates associated with corticosteroid injection and did not evaluate patient-reported outcomes beyond infection occurrence. Also, a matched control group of patients who did not receive corticosteroid injection was not included, limiting the ability to draw robust conclusions about the specific impact of corticosteroid injection on infection risk.

Furthermore, there was no standardized definition for infection diagnosis, and the study relied on a clinical suspicion index rather than laboratory values or joint aspiration results. Previous studies showed that infection occurring after arthroscopy presented itself within the first 2 weeks but that the insidious nature of the presentation may lead to a delayed diagnosis op to 6 weeks. Therefore, we used an extended follow-up period of three months after surgery minimizing the risk of missing infections. None of the patients had symptoms suggestive of infection during this time.

In the present study a perioperative corticosteroid injection following elbow arthroscopy did not increase the chance of infection in this patient group. Although the benefits of perioperative injection need to be investigated further, and this study must be seen as a preparation study for further evaluation, perioperative corticoid injections may be an additional tool in the arthroscopic treatment of elbow pathology.

CONCLUSION

Despite previous literature reporting a significant higher risk of postoperative infection after perioperative steroid injection, we observed no postoperative deep or superficial infection after elbow arthroscopy. Reducing operating time, rigorous attention for sterility and using a separate injection site after portal closure, steroids may help to reduce the postoperative infection risk. Perioperative steroid injection has been shown to reduce the rate of postoperative heterotopic ossification formation and may aid to reduce postoperative pain and improve the rehabilitation. When used in selected cases and with attention to the pearls mentioned it may be an additional tool in the arthroscopic treatment of elbow pathology.

Acknowledgement: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

REFERENCES

1. Camp CL, Cancienne JM, Degen RM, Dines JS, Altchek DW, Werner BC. Factors That Increase the Risk of Infection After Elbow Arthroscopy: Analysis of Patient Demographics, Medical Comorbidities, and Steroid Injections in 2,704 Medicare Patients. Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 2017;33(6):1175-9.
2. Yeoh KM, King GJ, Faber KJ, Glazebrook MA, Athwal GS. Evidence-based indications for elbow arthroscopy. Arthroscopy: the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 2012;28(2):272-82.
3. Reddy AS, Kvitne RS, Yocum LA, Elattrache NS, Glousman RE, Jobe FW. Arthroscopy of the elbow: a long-term clinical review. Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 2000;16(6):588-94.
4. Nelson GN, Wu T, Galatz LM, Yamaguchi K, Keener JD. Elbow arthroscopy: early complications and associated risk factors. Journal of shoulder and elbow surgery / American Shoulder and Elbow Surgeons [et al]. 2014;23(2):273-8.
5. Elfeddali R, Schreuder MH, Eygendaal D. Arthroscopic elbow surgery, is it safe? Journal of shoulder and elbow surgery/ American Shoulder and Elbow Surgeons [et al]. 2013; 22(5):647-52.
6. Kelly EW, Morrey BF, O'Driscoll SW. Complications of elbow arthroscopy. The Journal of bone and joint surgery American volume. 2001;83(1):25-34.
7. Marti D, Spross C, Jost B. The first 100 elbow arthroscopies of one surgeon: analysis of complications. Journal of shoulder and elbow surgery / American Shoulder and Elbow Surgeons [et al]. 2013;22(4):567-73.
8. Leong NL, Cohen JR, Lord E, Wang JC, McAllister DR, Petrigliano FA. Demographic Trends and Complication Rates in Arthroscopic Elbow Surgery. Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 2015;31(10):1928-32.
9. Savoie FH, 3rd, Field LD. Arthrofibrosis and complications in arthroscopy of the elbow. Clinics in sports medicine. 2001; 20(1):123-9, ix.
10. Kohls M, Magnussen R, Fitzpatrick S, Kaeding C, Flanigan D, Duerr R. Intra-articular steroid injection at the time of knee arthroscopy increases risk of post-operative infection. Knee surgery, sports traumatology, arthroscopy : official journal of the ESSKA. 2022;30(5):1846-53.
11. Bhattacharjee DP, Biswas C, Haldar P, Ghosh S, Piplai G, Rudra JS. Efficacy of intraarticular dexamethasone for postoperative analgesia after arthroscopic knee surgery. J Anaesthesiol Clin Pharmacol. 2014;30(3):387-90.
12. Bhattacharjee S, Lee W, Lee MJ, Shi LL. Preoperative corticosteroid joint injections within 2 weeks of shoulder arthroscopies increase postoperative infection risk. Journal of shoulder and elbow surgery / American Shoulder and Elbow Surgeons [et al]. 2019;28(11):2098-102.
13. McGarry JG, Daruwalla ZJ. The efficacy, accuracy and complications of corticosteroid injections of the knee joint. Knee surgery, sports traumatology, arthroscopy : official journal of the ESSKA. 2011;19(10):1649-54.
14. Light JJ, Pavlesen S, Ablove RH. Hand and Upper Extremity Surgical Site Infection Rates Associated With Perioperative Corticosteroid Injection: A Review of the Literature. Hand (N Y). 2023:15589447221150501.
15. Matzkin EG, Curry EJ, Kong Q, Rogers MJ, Henry M, Smith EL. Efficacy and Treatment Response of Intra-articular Corticosteroid Injections in Patients With Symptomatic Knee Osteoarthritis. The Journal of the American Academy of Orthopaedic Surgeons. 2017;25(10):703-14.
16. Metzger CM, Farooq H, Merrell GA, Kaplan FTD, Greenberg JA, Crosby NE, et al. Efficacy of a single, image-guided corticosteroid injection for glenohumeral arthritis. Journal of shoulder and elbow surgery / American Shoulder and Elbow Surgeons [et al]. 2021;30(5):1128-34.
17. Martin CL, Browne JA. Intra-articular Corticosteroid Injections for Symptomatic Knee Osteoarthritis: What the Orthopaedic Provider Needs to Know. The Journal of the American Academy of Orthopaedic Surgeons. 2019;27(17):e758-e66.
18. Berthelot JM, Le Goff B, Maugars Y. Side effects of corticosteroid injections: what's new? Joint Bone Spine. 2013;80(4):363-7.