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Is a Suction Drain Necessary in Arthroscopic Rotator Cuff Repair?

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Background: The purpose of this study was to evaluate the efficacy of suction drain use following arthroscopic rotator cuff repair by comparing early pain score and range of motion (ROM) between groups with and without suction drains.
Methods: The study included 153 patients with rotator cuff tears who underwent arthroscopic repairs at our clinic from April 2014 to March 2015. Following surgery, a suction drain was used in 85 patients (group D) and not used in 68 patients (group ND). There was no statistical difference between the groups in terms of age, gender, or total operation time. The clinical outcome with regard to pain (assessed by pain scores and analgesic requests) and passive ROM was assessed preoperatively and postoperatively.
Results: Immediate postoperative analgesic requirement was significantly higher in group D ($p=0.001$), although there was no difference in pain outcomes between the groups during the 3-month follow-up period. A statistically significant difference in passive ROM was observed at the postoperative 2- and 6-week follow-ups ($p=0.036$, 0.035, and 0.034 in forward elevation (FE), external rotation at the side (ER) and 90 ER at weeks 2, respectively; 0.045 and 0.009 in FE and ER at weeks 6, respectively); however no significant difference was observed at the end of 3 months. During the study period, no complication was reported in either group.
Conclusions: Use of suction drains after arthroscopic rotator cuff repair provided little benefit in terms of ROM or pain in the early postoperative period (up to 3 months).
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Key Words: Shoulder; Arthroscopy; Rotator cuff tear; Suction drain; Range of motion

Introduction

Suction drains have been used routinely in orthopedics, including arthroplasty, fracture fixation, and spinal surgery, to avoid hematoma formation and thereby reduce wound complications.[1-3] Waugh and Stinchfield[3] reported that patients who had postoperative wound drainage experienced less pain, less swelling at the wound, better soft tissue healing, less frequent infections, and more rapid mobilization of extremities compared with patients whose wounds were not drained. However, despite the widespread use of closed suction drainage, the need for drains has recently been questioned.[4-7] Some researchers reported evidence of the migration of skin microorganisms along drains to deep surgical wounds, delays in wound healing, and increased bleeding, leading them to oppose the use of drains.[4,8,9]

Rotator cuff repair is a common surgical procedure performed in the shoulder and most patients enjoy functional recovery after the procedure. With recent advancements in arthroscopic techniques, many surgeons are now performing arthroscopic repairs. The advantages of this procedure include decreased disruption of the soft tissues, which may result in less scarring and adhesions, reduced surgical morbidity and more rapid return to baseline shoulder compared with the open and mini-open cuff repair techniques.[10] Despite these advantages, most surgeons use a suction drain when performing an arthroscopic rotator cuff repair for fear of local complications with lack of support in the literature.

Most literature reports have assessed the effects of suction drainage after arthroscopic knee surgery, whereas the efficacy of suction drains after arthroscopic shoulder surgery is generally

unknown. Godino et al.[11] found that the placement of a postoperative intra-articular drain after an arthroscopic Bankart repair did not improve clinical results. However the effect of routine postoperative drainage use on clinical outcome after arthroscopic rotator cuff repair has rarely been studied. We investigated the effects of postoperative suction drain use in arthroscopic rotator cuff repair during the early postoperative period (up to 3 months).

Methods

This study was approved by the Konkuk University Medical Center Institutional Review Board (IRB) (IRB No.: KUH1060112). Between April 2014 and March 2015, arthroscopic repairs of 271 rotator cuff tears were performed by the senior author (JYP). Among these, 153 patients (40 partial-thickness, 34 small-sized full-thickness, and 79 medium-sized full-thickness rotator cuff tears) were enrolled in the study (Table 1). Tear size was classified according to the rating system of DeOrio and Cofield[12] in which a tear of 1 cm or less in length was classified as a small-sized tear, and one of 1–3 cm was classified as a medium-sized tear.

Ninety-seven patients (51, 38, and eight full-thickness tears in large, massive, and revision rotator cuff tears) who were not allowed to perform early passive motion exercises and 18 patients with a history of shoulder trauma, were receiving medications affecting the coagulation system or a bleeding diathesis, or who had diabetes were excluded. Three additional patients were also

excluded: one who underwent surgical fixation of the os acromiale; another who was not available for follow-up postoperatively; and another who suffered additional trauma after surgery.

A randomization chart was used to divide the patients into two groups: group A included 85 patients (32 men, 53 women; mean age, 58.9 ± 9.1 years) in whom suction drains were used for 24 hours postoperatively; and group B included 68 patients (23 men, 45 women; mean age, 59.2 ± 9.0 years) in whom no drain was used (Table 1).

In all patients, interscalene nerve block was performed using a 23-gauge scalp vein needle for injecting the local anesthetic solution, 20 ml of 0.25% bupivacaine for pain control after the operation. Loss of motor function and shoulder joint sensation was confirmed in 15 minutes, followed by administration of general anesthesia. Patients were then prepared for arthroscopic surgery in the beach-chair position. Four routine arthroscopic portals (anterior, posterior, lateral, and posterolateral) were used in performance of the rotator cuff repair. Diagnostic glenohumeral arthroscopy via a standard posterior portal was performed, followed by visualization of the subacromial space. After a bursectomy, arthroscopic subacromial decompression was performed with acromioplasty and spur removal to create a flat acromial undersurface in all patients. Preoperatively, a 30° caudal tilt view was used to measure the length of the inferior projection of the acromial spur to be removed.[13] Distal clavicle resection (DCR) was performed in 22 patients (group A, 14; group B, eight) who had experienced symptomatic acromioclavicular arthritis, and a capsulectomy in 17 patients (group A: 10, group B: seven) with shoulder stiffness concomitant with the rotator cuff tear (Table 1).

The rotator cuff tear was then examined and measured using a standard probe or shaver of a known size to obtain the medial-to-lateral and anterior-to-posterior dimensions. The margin of the tear and the tendon footprint were debrided using a shaver. All arthroscopic rotator cuff repairs were performed using a transosseous equivalent technique. For insertion of a suture anchor, a suture anchor portal was placed on the extension line of the posterior border in the clavicle just lateral to the acromion.[14] Medial row anchors (4.5 mm, Genesys; Conmed Corp., Utica, NY, USA) were inserted at the osteochondral junction. The number of suture anchors varied depending on rotator cuff tear size, but with no statistically significant difference between the groups ($p=0.598$). Both limbs of each suture were passed through the tendon by applying the 'two-hand technique,' as described previously.[14] The sutures were then tied with a sliding knot (Seoul Medical Center arthroscopic knot) and two half-hitch knots. Then, pilot holes were prepared for knot-less, laterally inserted anchors (4.75 mm, SwiveLock SP; Arthrex, Naples, FL, USA), –20 mm distal to the lateral edge of the footprint. The anchor was inserted while constant tension was maintained, and the tendon was reduced at the desired position on the footprint.

In the group with suction drains (group D), at the end of the

Table 1. Patient Demographic Data and Operative Characteristics for Group D and Group ND

Characteristic	Group D	Group ND	p-value
No. of patient	85	68	
Age (yr)	58.9 ± 9.1	59.2 ± 9.0	0.807
Gender			0.624
Male	32 (37.6)	23 (33.8)	
Female	53 (62.4)	45 (66.2)	
Operative time (min)	98.9 ± 18.5	102.7 ± 21.0	0.230
Tear size			0.146
Partial	23	17	
Small	24	10	
Medium	38	41	
Length of spur resection (mm)	8.0 ± 2.6	8.3 ± 3.0	0.522
Capsulectomy	10 (11.8)	7 (10.3)	0.774
Distal clavicle resection	14 (16.5)	8 (11.8)	0.410
Anchors used	3.08 ± 0.76	3.01 ± 0.82	0.598

Values are presented as a number only, mean ± standard deviation, or number (%). Group D: group with suction drains, Group ND: non-suction drain group.
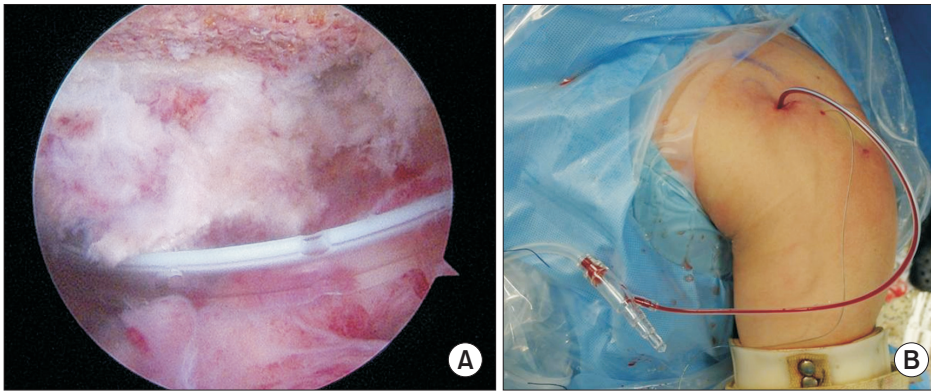
Fig. 1. (A) The suction drain was placed into the subacromial space. (B) The suction drain was inserted through the anterior portal.

procedure, a suction drain was placed into the subacromial space through the anterior portal (Fig. 1). In the non-suction drain group (group ND), the shoulder was closed subcutaneously without drain placement. All portals were closed tightly in all patients. The same postoperative pain management protocol was used in all patients (zaltoprofen 80 mg, orally two times per day). In all patients, ice application was started immediately postoperatively, and its continuation for 2 weeks was advised. For group D patients, the suction drains were removed 24 hours postoperatively, and the amount of blood collected by each drain was documented. During the inpatient stay, wound healing and local complications were assessed by an independent surgeon.

The postoperative rehabilitation program was the same for both groups. A shoulder-immobilizing sling with an abduction pillow was applied to the operated arm to maintain the shoulder at 30°–40° internal rotation. Patients began free passive range-of-motion exercise on postoperative day 1. Active motion was initiated at postoperative 5 weeks.

The degree of pain was measured using a visual analogue scale (VAS) and the frequency of postoperative analgesia (diclofenac sodium 75 mg, intramuscularly) requirements. Postoperative analgesia requirements were noted for the first 2 days following surgery. VAS scores for pain and range of motion (ROM) of the shoulder, including forward elevation (FE), external rotation at the side (ER), external rotation at 90° of abduction (90 ER), and internal rotation (IR), were checked by a single senior surgeon during outpatient visits before the operation and then at 2 and 6 weeks and 3 months after the operation, except that IR was not measured at 2 weeks postoperatively to avoid patient discomfort. In addition, we attempted to examine some important factors (age, operation time, rotator cuff tear size, DCR, capsulectomy, length of spur resection, and number of anchors used) that might influence the volume of drainage after arthroscopic rotator cuff repair.

Statistical analyses were performed using IBM SPSS software ver. 22.0 (IBM Co., Armonk, NY, USA) and descriptive statistics (mean value, standard deviation) were used. Independent t-tests for continuous data and the χ^2 test for categorical data were used for comparisons between the two groups. The Mann-Whitney U-test was used for evaluation of preoperative and postoperative VAS scores between groups. Correlation between variables and the volume of drainage was analyzed using Pearson's and Spearman's correlation tests. The results were evaluated with a p-value <0.05 indicating significance.

Results

Preoperatively, there was no significant difference in demographics between the two groups (Table 1). The mean operating time was 98.9 minutes (range, 60–165 minutes) in group D and 102.7 minutes (range, 70–165 minutes) in group ND. The average drain output in group A was 53.2 ml (range, 5–250 ml) (Table 1). All drains functioned properly.

Results of a repeated-measures ANOVA on VAS scores comparing the preoperative day with postoperative 2 and 6 weeks and 3 months showed a statistically significant decrease in VAS scores ($p<0.001$), and the same decreasing trend was observed from the preoperative period to postoperative 3 months in both groups ($p=0.068$). No statistically significant difference in VAS score on any of the preoperative or postoperative days ($p=0.067$, 0.681, 0.793, and 0.601, respectively) was observed between the groups. However, there was a significant difference in the analgesic requirements during the first 2 days postoperatively (group D>group ND, $p=0.001$; Table 2).

No statistically significant difference in passive ROM was observed between the groups during the preoperative period. Postoperatively, passive ROM had decreased significantly in group D at 2 and 6 weeks ($p=0.036$, 0.035, and 0.034 in FE, ER and 90 ER at weeks 2, respectively; 0.045 and 0.009 in FE and ER at weeks 6, respectively); however, no significant difference in 90 ER and IR was observed between the groups postoperatively at 6 weeks (Table 3). After 3 months, ROM showed no significant difference in FE, ER, 90 ER, and IR between the groups ($p=0.161$, 0.409, 0.232, and 0.073, respectively; Table 3). No infection was recorded in either group during the follow-up period. We

Table 2. Comparison of Preoperative and Postoperative Pain between Group D and Group ND

Characteristic	Group D	Group ND	p-value
Postoperative analgesic request	1.34 ± 1.04	0.72 ± 0.91	0.001*
Visual analog scale			
Preoperative	6.14 (3–10)	6.47 (5–9)	0.067
Postoperative 2 weeks	4.74 (2–9)	4.75 (3–7)	0.681
Postoperative 6 weeks	3.61 (1–8)	3.60 (1–6)	0.793
Postoperative 3 months	2.00 (0–4)	1.84 (0–5)	0.601

Values are presented as mean ± standard deviation or median (range).
Group D: group with suction drains, Group ND: non-suction drain group.
*p<0.02.

Table 4. Correlation between Operation Related Factors and Volume of Drainage in Group D

Factor	r*	Rho[†]	p-value
Age	0.079		0.474
Operative time	0.030		0.708
No. of anchors used	0.107		0.190
Length of spur resection	−0.045		0.577
Tear size		0.022	0.840
Distal clavicle resection		0.130	0.237
Capsulectomy		−0.019	0.859

Group D: group with suction drains.
*Pearson's correlation coefficients. [†]Spearman's correlation coefficients.

Table 3. Comparison of Preoperative and Postoperative Range of Motion between Group D and Group ND

Range of motion	Group D	Group ND	p-value
Forward elevation			
Preoperative	128.5 ± 19.6	134.1 ± 17.5	0.072
Postoperative 2 weeks	108.1 ± 17.0	114.1 ± 17.9	0.036*
Postoperative 6 weeks	110.8 ± 16.7	116.9 ± 20.6	0.045*
Postoperative 3 months	127.5 ± 14.1	130.8 ± 14.6	0.161
External rotation at the side			
Preoperative	53.1 ± 19.3	54.7 ± 17.5	0.614
Postoperative 2 weeks	12.7 ± 8.9	16.1 ± 10.8	0.035*
Postoperative 6 weeks	12.0 ± 11.1	17.5 ± 14.7	0.009*
Postoperative 3 months	29.8 ± 18.4	32.2 ± 15.5	0.409
External rotation at 90° of abduction			
Preoperative	60.5 ± 18.0	63.6 ± 13.4	0.242
Postoperative 2 weeks	28.2 ± 18.1	34.7 ± 19.6	0.034*
Postoperative 6 weeks	30.0 ± 18.5	35.8 ± 19.9	0.067
Postoperative 3 months	54.5 ± 14.8	57.5 ± 14.9	0.232
Internal rotation			
Preoperative	T9.6 ± 3.2	T9.5 ± 3.3	0.845
Postoperative 6 weeks	L3.8 ± 1.5	L3.8 ± 1.3	0.951
Postoperative 3 months	L2.2 ± 2.2	L1.5 ± 2.7	0.073

Values are presented as mean ± standard deviation.
Group D: group with suction drains, Group ND: non-suction drain group.
*p<0.05.

attempted to find factors affecting the volume of drainage; however, no correlative factor was detected in this study (Table 4).

Discussion

Hemarthrosis after arthroscopic procedures has a toxic ef-

fect on both chondrocytes and the matrix and has appeared to result in increased scar formation, decreased ROM, and greater subsequent synovitis.[15] Coupens and Yates[16] concluded that hemarthrosis resulted in joint distension, which may lead to increased pain and subsequent decreased ROM. In addition, the formation of a hematoma is thought to increase the risk of tissue compression, which can result in neurological compromise.[17] Hemarthrosis is also considered a good bacterial culture medium, and its accumulation within a wound provides a chance for the development of infection.[6,18] Although hemarthrosis is usually thought to be associated with immediate postoperative morbidity, it has been shown to cause long-term sequelae and to compromise the final functional result by promoting synovitis and scar tissue formation.[15,19] Despite studies challenging the practice, suction drains have been used routinely in orthopedic surgery to reduce the formation of hematomas. Despite increased performance of arthroscopic shoulder operations, few reports in the literature have examined suction drain use after arthroscopic procedures on the shoulder, whereas many such reports address the effects of suction drainage use after arthroscopic knee surgery. For these reasons, we examined the need for suction drains in improving outcomes after arthroscopic rotator cuff repairs.

Some authors have reported that there are theoretical benefits to the use of prophylactic drains in orthopedic procedures.[15,20] O'Driscoll et al.[20] supported the use of suction drains because they considered that all cavities must be drained following surgery to decrease the theoretical risk of intra-articular adhesions and joint stiffness. Karahan et al.[21] reported on knee flexion, extension, and VAS scores on days 1, 3, 5, and 7 after arthroscopically assisted anterior cruciate ligament reconstruction. Significantly less restriction of movement was observed on day 7 (p=0.04) and decreases in the VAS score on days 1, 3, 5, and 7 (p=0.07, 0.001, 0.001, and 0.001 at days 1, 3, 5, and 7, respectively) in the drained group.

In contrast, several recent studies reported no difference,

or even disadvantages, associated with the use of suction drains.[22-24] Confalonieri et al.[23] concluded that drainage did not influence the ease of postoperative rehabilitation. Alkan et al.[22] found that the use of a suction drain did not affect the clinical course of knee effusion during the first postoperative month following a partial meniscectomy with partial fat pad or synovium resection. Dhawan et al.[24] also found no statistically significant difference in knee ROM between groups, but they did find a statistically significant increase in the pain score for the drained group ($p=0.014$). Although the current study did not evaluate the postoperative presence of a hematoma because it is difficult to measure, ROM was assessed at postoperative 2 and 6 weeks and 3 months in both groups. The results of our study showed that placement of a suction drain in the subacromial space after arthroscopic rotator cuff repair resulted in statistically significant decreases in the following parameters: decreased forward flexion at postoperative weeks 2 and 6, decreased external rotation at postoperative weeks 2 and 6, and decreased external rotation at 90° in postoperative week 2 (Table 3). However, there was no significant difference in ROM at postoperative 3 months. The decreased ROM in group D is an interesting finding. The presumption is that analgesics requirements, i.e., greater non-steroidal anti-inflammatory drug (NSAID) consumption in the first 2 days postoperatively, in Group D may have increased blood loss related to the NSAID mechanism of action,[25,26] paradoxically causing subsequent formation of an intra-articular hematoma. The increased pain in the first 2 days postoperatively observed in the group with suction drains is another interesting finding. Dhawan et al.[24] reported results similar to those of our study regarding pain, and suggested that it might be related to pain from the portal site or a response to the foreign body. Another possibility is that removal of the drain may be an additional painful procedure following surgery.

A purported advantage of suction drain use includes minimizing hematoma and seroma formation, which lowers the possibility of infection and other wound complications, as well as reducing the demand for changes in postoperative wound dressings.[27,28] In our study, there was no occurrence of wound complication in either group. Our results are similar to those reported by Holt et al.,[6] who suggested that increased bleeding might also be observed with drained wounds because drainage of the wound might remove the tamponade effect of an undrained wound. Other studies have reported that the infection rate associated with drain use is a time-related phenomenon.[3,4] Willett et al.[4] suggested removal of drains at 24 hours after surgery.

In their study on meniscectomies via arthrotomy, Browett et al.[29] found that patients gained significant benefit from the reduction in painful distension and from the removal of blood, which might be a synovial irritant with subsequent effusion, so that suction drainage might be indicated if increased bleeding was expected in more extensive procedures. Tatari et al.,[30] who examined arthroscopic knee procedures requiring the subsequent use of suction drainage concluded that suction drains were essential for arthroscopic interventions that increased the amount of fluid in the drains, including subtotal meniscal resection, drilling the osteochondral faces, and longer operation duration. We sought to examine factors that might influence the volume of drainage after arthroscopic operations on the shoulder; however, we found no correlation between any operation-related factors that we assessed and the volume of drainage (Table 4).

Our study has some limitations. First, our series was not large because of our inclusion criteria to obtain a homogenous group of patients, and the follow-up period was relatively short. Further prospective randomized controlled studies including a much larger number of patients and with longer follow-up periods may be needed to determine whether there are differences in long-term results. Second, we included patients with partial thickness, small, and medium-sized rotator cuff tears, not large or massive cuff tears, because delayed and limited passive motion is recommended for these large tears in our clinic. Third, the same senior surgeon followed all patients and assessed the clinical outcomes, which may have resulted in some bias. Finally, patient compliance with the rehabilitation program was not evaluated. Variations in patient compliance with the rehabilitation might have affected the recovery of ROM.

Conclusion

We showed that suction drainage did not improve ROM or pain in patients for whom suction drains were used after arthroscopic rotator cuff repair. In addition, no complication was recorded in either group during the follow-up period. We believe that this study does not support routine use of suction drains after arthroscopic rotator cuff repair.

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