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이 케이스로 관절경하 회전근개 봉합술 후 견봉하 봉합사 매듭 충돌 현상을 확인했다 할 수 있을까?: 증례 보고

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Can It be Said that this Case Confirmed the Phenomenon of Subacromial Suture Knot Impingement after Arthroscopic Rotator Cuff Repair?: A Case Report

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Rotator cuff tears are common shoulder injuries, particularly in older adults. Arthroscopic rotator cuff repair (ARCR) is the preferred treatment due to its successful outcomes, but complications like suture knot impingement may arise. Knot impingement, although rare, can lead to subacromial bone erosion and persistent pain. The condition remains under-reported, and direct evidence linking knot impingement to subacromial erosion is scarce. A 63-year-old woman presented with progressively worsening shoulder pain and restricted range of motion, 10 years after undergoing ARCR. Clinical assessment indicated subacromial impingement with positive Neer, Hawkins test results and reduced shoulder mobility. Arthroscopic evaluation revealed suture knots embedded in the subacromial bone, directly causing erosion. This is the first case to confirm through arthroscopy that subacromial bone erosion resulted from knot impingement. This case emphasizes the importance of follow-up and highlights the need to consider alternative suture techniques to avoid complications like knot impingement. Surgeons should be vigilant in minimizing risks associated with suture materials and techniques to improve long-term outcomes for patients undergoing ARCR.

Keywords: Knot impingement, Subacromial erosion, Arthroscopic rotator cuff repair, Shoulder

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Introduction

Rotator cuff lesions resulting from injury or degeneration are among the most prevalent shoulder pathologies. Its prevalence ranges from 5% to 30% and increases with age[1]. Treatment options depend on factors such as tear thickness, size, and morphology, as well as the patient's symptoms, and can range from physical therapy to surgical repair. The mainstay treatment for partial-thickness cuff tears is systematic rehabilitation with short-term analgesics and anti-inflammatory drugs. For full-thickness cuff tears,

initial rehabilitation is also an accepted management strategy. Surgical repair is indicated in cases where rehabilitation fails after 3 months, in acute traumatic tears, in younger patients, or in those with intractable pain and good muscle quality[2].

Techniques for rotator cuff repair have advanced significantly over the past few decades from open repair to arthroscopic surgery and repair augmentation[3]. Arthroscopic rotator cuff repair (ARCR) is associated with favorable clinical outcomes and substantial improvements in quality of life[4]. Reports indicate that more than 80% of patients achieve satisfactory results[5]. Despite improvements in shoulder function and pain relief provided by arthroscopic repair in patients with rotator cuff tears, recurrent rotator cuff tears continue to cause significant postoperative complications, leading to suboptimal clinical outcomes[6]. To mitigate the risk of recurrent tears, repair techniques have been refined to enhance the security of tendon fixation to the bones. The primary stability of various rotator cuff repair interfaces can be significantly improved by increasing the number of knots, stitches, and suture anchors[7]. Recently, new rotator cuff repair techniques utilizing knotless anchors have been developed to simplify the procedure by reducing the number of knots at the repair sites[8-10]. However, in some patients, knot tying remains necessary to provide anatomical repositioning of the torn tendon.

A notable complication of ARCR is the prominence of the suture knots, which can cause friction or impingement in the subacromial space, potentially leading to retears or persistent pain during follow-up[1,11,12]. Due to its rarity, limited information is available on the clinical features of patients experiencing knot impingement after ARCR. Recent reports have highlighted the cases of knot impingement accompanied by subacromial bone erosion. However, it was unclear whether subacromial erosion occurred simply by removing the cortical bone or was triggered by knot impingement. Therefore, the question remains whether subacromial erosion occurs following knot impingement. To date, studies published in English have failed to provide direct evidence and have been limited to indirect inferences[1,11,12]. The role of different suture materials and techniques in this complication remains under investigation. We present the case of a patient who underwent single-row rotator cuff repair 10 years prior and subsequently developed significant subacromial impingement caused by suture knots.

Case Report

This report was approved by the Institutional Review Board of Soonchunhyang University Bucheon Hospital (No. 2024-07-007). Written informed consent was obtained from the patient for the publication of this report including all clinical images.

1. Preoperative evaluation

A 63-year-old woman visited our clinic with the primary complaint of pain and limited range of motion (ROM) in the right shoulder. She had undergone ARCR at a private hospital 10 years ago. She experienced persistent pain postoperatively but was managed with intermittent medication and injections, as the pain was not debilitating. Three months prior to the current presentation, her shoulder pain had worsened spontaneously. She had a positive subacromial impingement test result (Neer, Hawkins test). The active shoulder ROM was 180° (both sides) in forward flexion, 160° (right) and 180° (left) in abduction, 30° (right) and 60° (left) in external rotation, and T12 (right) and T7 (left) in internal rotation. All muscle strengths during abduction, external, and internal rotation were grade 5. The Constant-Murley shoulder score (CSS) was used to evaluate the functional status of the shoulder. The CSS score was 41 points. According to the laboratory test results, the white blood cell count was 4,100/㎕ (normal range, 4,000–10,000/㎕) with 54.8% neutrophils. C-reactive protein and erythrocyte sedimentation rate were also normal at 0.04 mg/dL (normal range, 0.0–0.5 mg/dL) and 3 mm/hr (normal range, 0–43 mm/hr), respectively. No signs of infection are observed. Plain radiography revealed no abnormalities (Fig. 1). Initial T2-weighted coronal magnetic resonance imaging (MRI) showed a retear at the site of the previous rotator

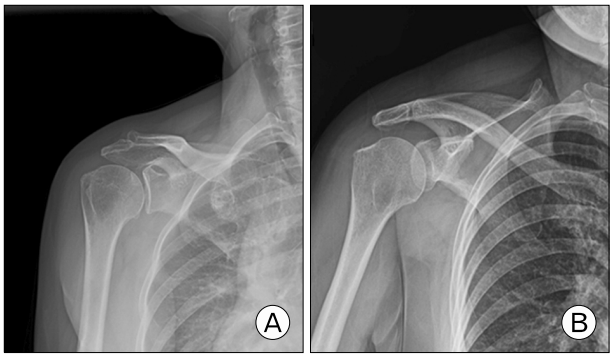

Fig. 1. Plain radiographs of the right shoulder. (A) Antero-posterior and (B) 20° caudal tilting view.

cuff repair and irregular subacromial bone erosion at the acromioplasty site (Fig. 2).

2. Surgical procedure

Arthroscopy revealed suture knots at musculotendinous junction presumably from a previous single-row repair procedure (Fig. 3). The adhesions were extensive, with sutures and knots visible in several areas and embedded in the irregular subacromial bone surface. During acromioplasty, bone removal exposes sutures that penetrate deeply into the bone, making complete removal difficult despite extensive cortical bone removal.

3. Postoperative care

After surgery, the patient was regularly followed up in the outpatient clinic. The patient's symptoms subsided after the procedure. She was advised to use a shoulder abduction pillow brace during the day and night to sleep and undergo rehabilitation programs. For 6 weeks after surgery, we did not actively move the operated arm and performed gentle exercises such as passive pendulum, elbow bending, and straightening with assistance. After 6 weeks, the patient gradually started passive shoulder motion, such as flexion stretching and actively supported external rotation exercises. The CSS score was 58 points 6 months after surgery. Complete restoration of ROM without pain at rest or during activity was observed at the 1-year follow-up after surgery. The 1-year follow-up CSS was reported to be 73 points, showing significant improvement compared to the preoperative CSS (41 points). A 1-year follow-up radiograph revealed no abnormalities (Fig. 4).

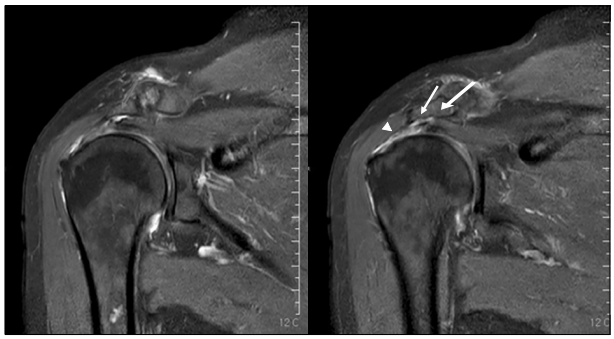

Fig. 2. Initial T2-weighted coronal magnetic resonance imaging showing irregular subacromial bone erosion (arrows) and rotator cuff retear (arrowhead).

Discussion

The shoulder joint has the most extensive ROM in the human body, largely because of the stabilizing role of its muscles. The primary muscle group supporting this joint is the rotator cuff, which consists of four muscles that originate from the scapula and are inserted into the superior aspect of the humeral head. The subscapularis muscle is inserted into the lesser tubercle of the humerus and functions as an internal rotator. The supraspinatus attaches to the greater tubercle of the humerus and is responsible for the initial 30° shoulder abduction. The infraspinatus, which is also inserted into the greater tubercle but slightly below the supraspinatus, serves as an external rotator. The teres minor is

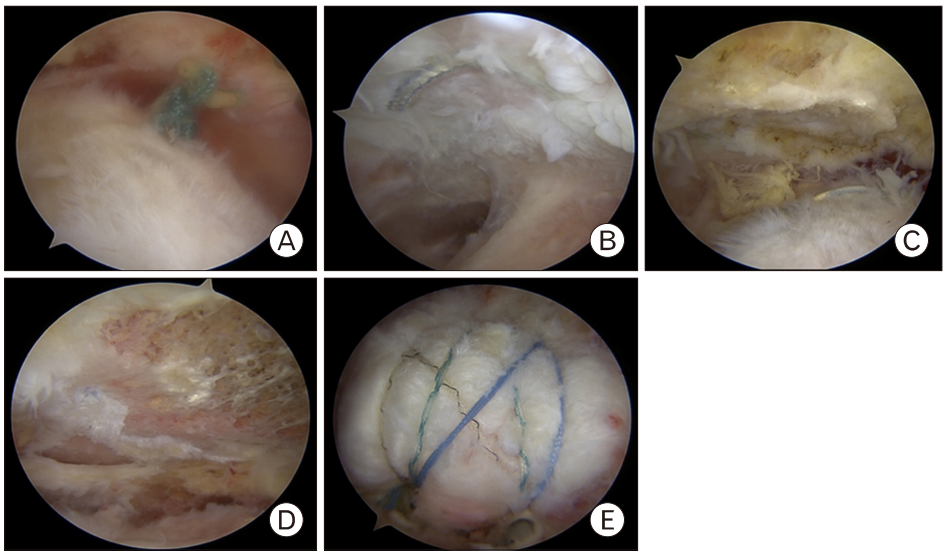

Fig. 3. Findings during arthroscopy. (A) Suture knot near the musculotendinous junction from the single-row repair. (B) Wire of suture knot attached to the subacromial bone surface. (C) Erosion and suture embedded in the subacromial bone surface. (D) Suture penetrating the bone, visible even after partial cortical bone removal. (E) Post-bridge repair for rotator cuff retear.

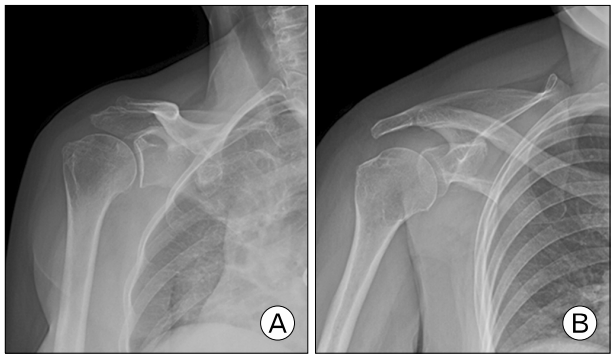

Fig. 4. Plain radiographs of the right shoulder 1 year after surgery. (A) Anteroposterior and (B) 20° caudal tilting view.

inserted below the infraspinatus of the greater tubercle and acts as an external rotator. These muscles are crucial for glenohumeral joint stabilization[13].

Subacromial impingement caused by suture knots is a recognized complication after ARCR, potentially leading to postoperative pain or retear, necessitating knot removal procedure. Recent studies have documented knot impingement and its correlation with subacromial bone erosion. The incidence is estimated to be around 1% to 2%, with only 14 reported cases so far, indicating a limited understanding of the clinical features of patients experiencing knot impingement following ARCR[1,11,12]. Over time, sutures have evolved to become stronger and thicker. In single-row repairs, multiple knotting can make the knots more prominent after surgery. Although bridge repairs are becoming more common, reducing concerns about knot impingement, wide and thick sutures such as tapes still require consideration of impingement risk. The type of suture material and technique can significantly influence the risk of knot impingement. Studies comparing outcomes between different suture materials and techniques could provide valuable insights. Park et al.[12] found no statistical difference in the frequency of knot impingement between bridge and single-row repairs. Acromioplasty is often performed during ARCR, with cortical bone removal exposing cancellous bone, which can naturally resorb and potentially mask knot impingement[1]. Therefore, most reports deduce conclusions based on the location of bone erosion and knot placement[1]. In this case, identical sutures were observed deeply embedded in the subacromial bone, indicating a high likelihood of knot impingement. Although the MRI did not clearly identify the exact location of the suture anchor, the distribution of sutures suggested that the repair might have been done without anchors, leading to knot impingement at the musculotendinous junction. However, considering that subacromial erosion can also be caused by the removal of cortical bone, studies to date have not provided direct evidence as to whether subacromial erosion is caused by knot impingement. This case is the first to confirm through arthroscopy that subacromial bone erosion is caused by knot impingement.

A limitation of this case report is that it describes a single instance of knot impingement. Although this case is illustrative, a larger series of cases may provide more robust evidence. If the number of cases increases, it will be possible to draw conclusions about the suture technique or type of suture that can prevent knot impingement. Additionally, the follow-up period for this patient was only 1 year, which may not be sufficient to observe long-term outcomes and potential late-onset complications. Future studies should aim to quantify the prevalence of this complication and explore preventive measures in surgical practice. Although its incidence is rare, surgeons should consider the possibility of knot impingement after surgery and recognize that personalized surgical approaches can enhance patient outcomes.

Subacromial impingement from suture knots after rotator cuff repair is not just a hypothetical concern but a real possibility, especially with repairs performed medially to the tendon attachment. Therefore, carefully considering suture type and knot placement is essential in surgical planning to minimize postoperative complications.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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