Elbow Injuries in the Overhead Athlete: MUCL Avulsion and Tears

22

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Introduction

The throwing motion of overhead athletes, especially pitchers, creates a large valgus force across the elbow. This repetitive strain can cause microtrauma to the main valgus stabilizer, the medial ulnar collateral ligament (MUCL), which may eventually lead to failure in function.

The anterior bundle of the MUCL is the primary restraint to the valgus force, predominantly from 20 to 120°. The act of pitching nears the max resistive capabilities of this ligament of up to 290N and angular velocities around 3,100°/s [1].

A thorough history is important in evaluating these patients. MUCL injuries typically present with chronic medial-sided elbow pain that is worse with activity, though occasionally may present in an acute fashion after a specific event. Pitchers may note decrease in their velocity or control as well as decreased arm endurance. It is also important to note any evidence of ulnar nerve irritation as this may impact the treatment plan.

Physical examination includes the valgus stress test, moving valgus stress test, and milking maneuver noting any pain or instability elicited. The ulnar nerve should be evaluated for any subluxation and presence or absence of a Tinel's sign. If surgery is a consideration, palpation for presence of the palmaris longus should be performed for possible use as autograft.

Plain radiographs of the elbow with a MUCL injury are often normal, though in an avulsion or a small fleck of bone, most commonly from the humeral aspect, may be seen. In radiographs of the chronic setting, one would more commonly see calcifications in the area of the ligament. Magnetic resonance imaging (MRI) is the primary imaging modality to confirm the diagnosis of a MUCL injury. MRI findings include edema, partial versus full thickness MUCL tear, avulsion injuries, as well as other associated injuries such as loose bodies, flexor-pronator tears, and cartilage injury.

Indications for surgical treatment include athletes who are unable to return to play due to pain or instability associated with a compromised MUCL. Recreational athletes that do not intend to pursue further athletic careers can often forgo surgery, as the function of normal day activities does not stress the elbow to the point of pain or instability even in the presence of MUCL insufficiency.

Before the techniques for surgical reconstruction were developed, tears or avulsions of the MUCL would typically signal the end to a player's career. Nonoperative treatment of these injuries, according to one study, resulted in only 42 % of players returning to their previous level of play [2]. Jobe in 1986 published the first description of a technique for MUCL reconstruction. This technique consisted of an ulnar nerve transposition and figure-of-8 graft construct through bone tunnels in the ulna and medial epicondyle [3]. Since then, multiple technique variations have been developed including interference screws, docking, and hybrid techniques. Due to these advances, return to play at the previous level of competition has been reported between 80 and 90 % [4–7]. Though reconstruction of the MUCL has become the mainstay treatment option for competitive athletes, it should be noted that repair of the ligament, especially in the younger population with isolated proximal or distal injuries to the ligament, can result in successful outcomes [8].

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Case 1: MUCL Avulsion

History/Exam

A 17-year-old, right-hand-dominant pitcher injured his elbow throwing during the previous season. He underwent a period of nonoperative treatment including bracing and

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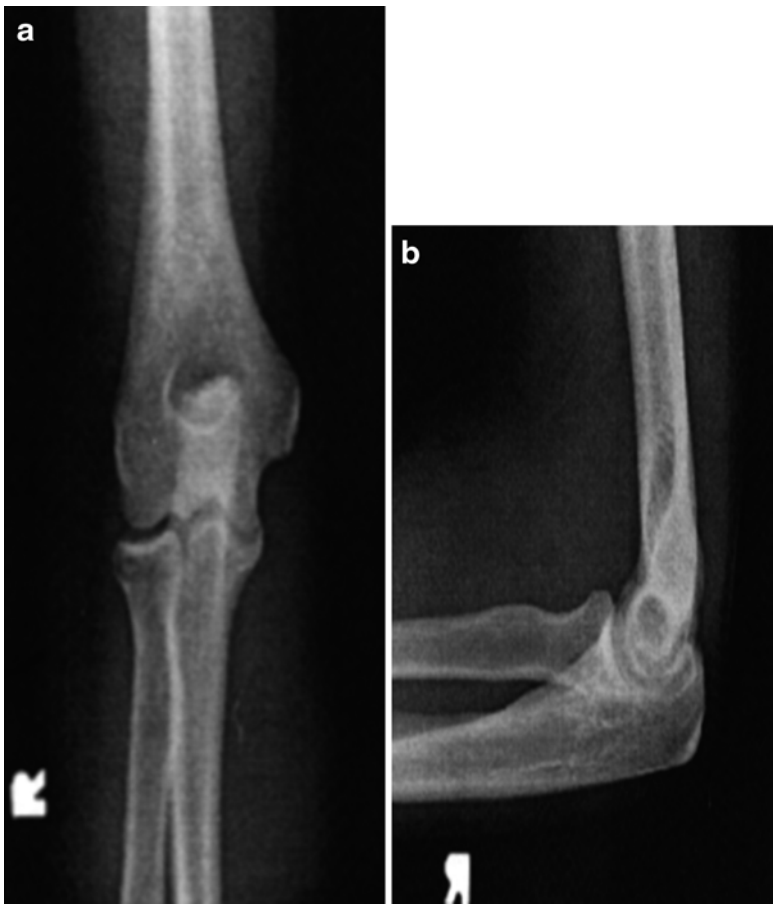

Fig. 22.1 (**a**, **b**) Plain radiographs (anteroposterior (AP) and lateral) of the elbow do not show any evidence of injury (**a**, **b**: Published with kind permission. Copyright © Felix H. Savoie, III, MD)

physical therapy, but was unable to achieve pain-free throwing ability; thus he was referred for surgical evaluation.

During physical examination, the patient was found to have a positive moving valgus stress test. He had noted 3+ instability with valgus stress at 30° and palpable tenderness to palpation along the medial aspect of the elbow. Milking maneuver was also positive. Range of motion was full with no loss of extension or flexion. Patient did not have any evidence of lateral-sided pathology.

Imaging

Plain radiographs as seen in Fig. 22.1a, b did not demonstrate any significant pathology. No bony avulsions were observed. No degenerative changes were noted in the olecranon fossa or ulnohumeral and radiocapitellar joints. Magnetic resonance imaging was obtained to further evaluate the medial ulnar collateral ligament. Complete sequences were obtained including coronal T1 and fat-saturated T1 and T2 sequences, sagittal T1 and fat-saturated T2 sequences, and axial T1 and fat-saturated T2 sequences. Coronal fat-saturated T2 sequences are shown in Fig. 22.2a–d and coronal T1 sequence images are shown in Fig. 22.3a–d.

An ulnar-sided avulsion of the MUCL from the sublime tubercle of the ulna is seen in both Figs. 22.1a, b and 22.2a–d. The fragment from the sublime tubercle measures 7×4 mm and has sclerotic margins indicating pathology is likely subacute. Some marrow edema can also be noted on the T2 images. The ulnar collateral ligament can still be seen inserting onto the fragment, and the remainder of the ligament demonstrates no evidence of tearing. Evaluation of the lateral collateral ligament shows no evidence of pathology. Likewise, no chondromalacia or chondral defects are seen on imaging.

Given the clinical and radiographic correlation and failure of nonoperative treatment, the risks and benefits of operative intervention were discussed with the patient and his family. The patient desired to return to his previous level of play; thus, the decision was made to proceed with elbow arthroscopy and open repair of the ulnar collateral ligament.

Operative Treatment

The patient was taken to the operating room and placed in the prone position. A standard diagnostic elbow arthroscopy was performed as seen in Fig. 22.4a–c. The radiocapitellar

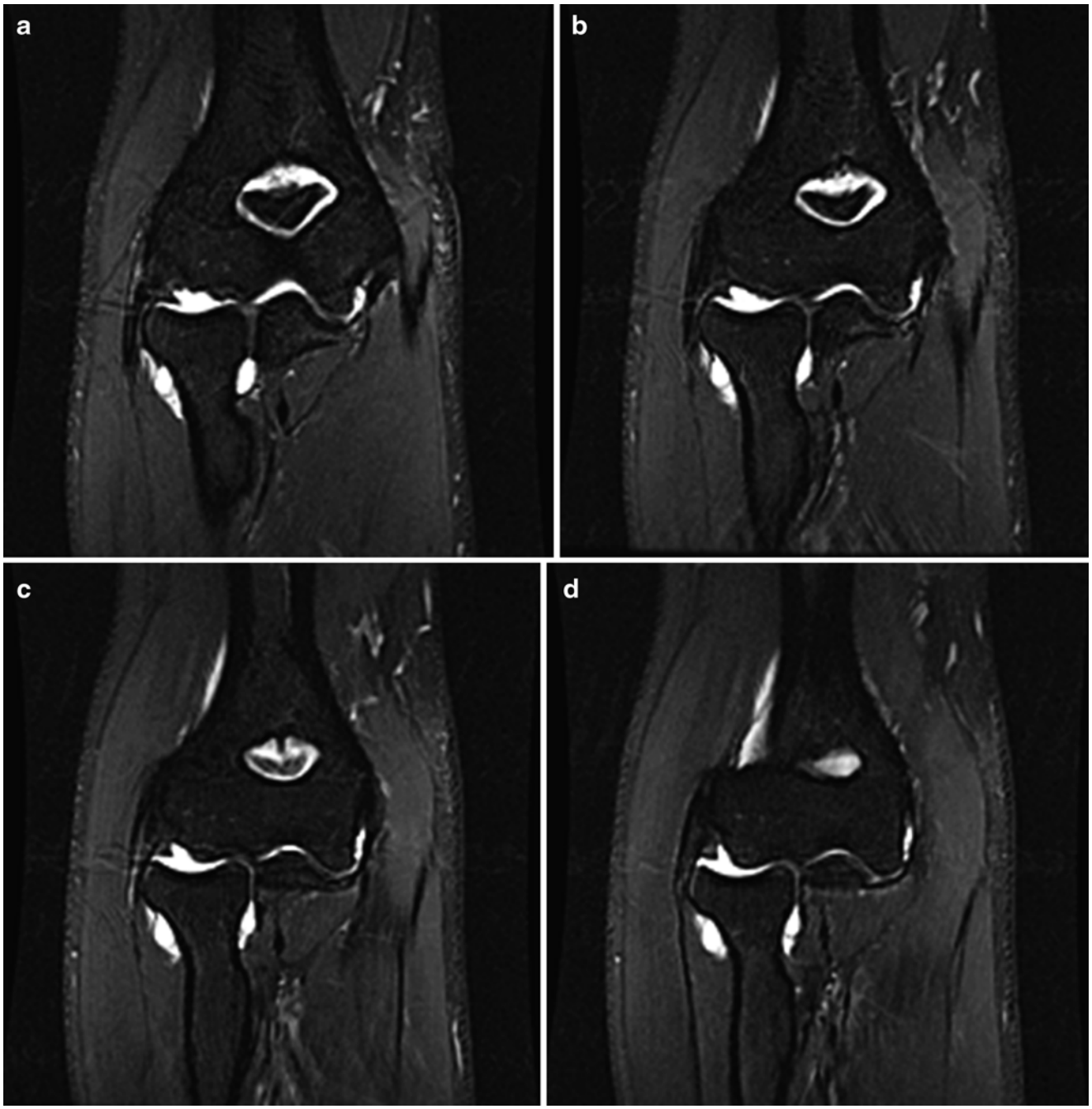

Fig. 22.2 (**a–d**) Coronal T2 fat-saturated images showing signal change and a small bony avulsion of the UCL from the sublime tubercle (**a–d**: Published with kind permission. Copyright © Felix H. Savoie, III, MD)

joint and capsule were found to be normal. The medial aspect showed evidence of instability but no signs of capsular damage. The medial gutter was found to be normal. A thickened plica was noted within the lateral gutter and was excised. The arthroscopic portion was completed.

The arm was then rotated to expose the medial aspect of the elbow and the open portion of the case was completed as seen in Fig. 22.5a–d. A direct approach to the medial ulnar collateral ligament was used. A split in the flexor-pronator fascia was made posterior to the medial conjoined tendon while keeping a blunt retractor in position to protect the ulnar nerve. Upon inspection of the MUCL, the ligament itself appeared in good condition. The humeral insertion was intact; however, a small ossicle and disruption of the ulnar attachment were noted. The ligament was carefully dissected to visualize the attachment site on the sublime tubercle. The small ossicle was excised, and the bony footprint was roughened to improve healing of the ligament. A double-loaded

Fig. 22.3 (**a–d**) Coronal T1 images showing the small avulsion from the sublime tubercle of the ulnar insertion of the UCL (**a–d**: Published with kind permission. Copyright © Felix H. Savoie, III, MD)

suture anchor was placed at the footprint. Two limbs of the anchor were placed through the more posterior aspect of the ligament, while the remaining two limbs were placed through the anterior aspect. The two strands were then tied, securing the MUCL to its footprint. A #1 Vicryl was then used to plicate the midportion of the tendon. The elbow was tested and found to be stable. The incision was then irrigated and closed in standard fashion.

MRI Case 2: MUCL Tear

History/Exam

A 19-year-old, right-hand-dominant pitcher injured his elbow while pitching. Despite initial activity modification and therapy, he was unable to return to play due to pain and dysfunction.

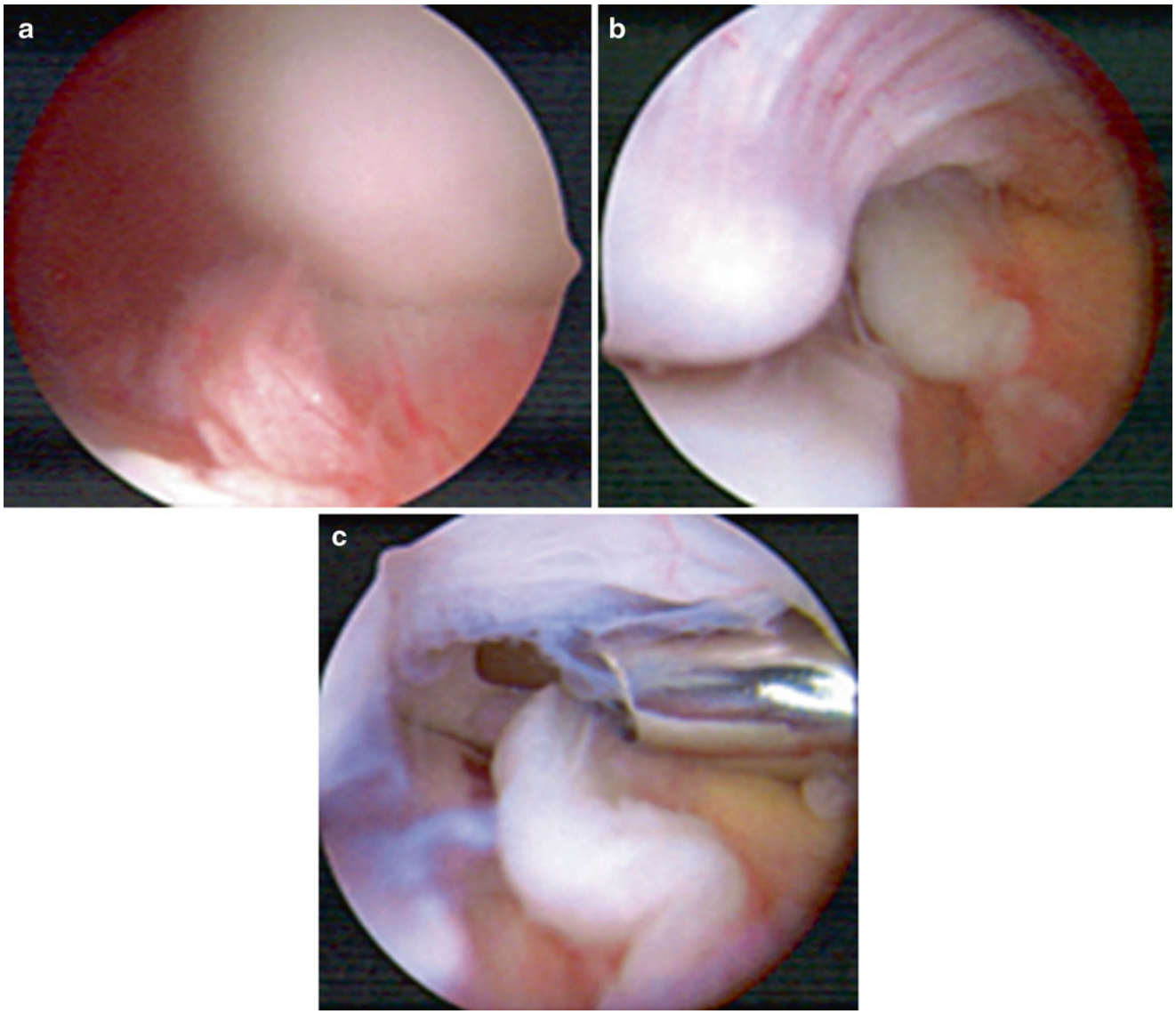

Fig. 22.4 Arthroscopic images showing the lateral gutter and synovitis (**a**, **b**), the medial gutter, and debridement of tissue in the lateral gutter (**c**) (**a–c**: Published with kind permission. Copyright © Felix H. Savoie, III, MD)

A physical examination concluded the patient had no specific tenderness to palpation. He had 3+ instability to valgus stress testing at 30°. Range of motion did not show any flexion or extension deficits. Strength testing was 5/5 in all muscle groups. Patient did not have any evidence of lateral-sided pathology.

Imaging

Plain radiographs in Fig. 22.6a, b show a small bony avulsion from the medial epicondyle. No degenerative changes were noted. Magnetic resonance imaging was obtained to further evaluate the medial ulnar collateral ligament. Complete sequences were obtained, including coronal fat-saturated T1 and T2 sequences, sagittal fat-saturated T2 sequences, and axial fat-saturated T1 and T2 sequences. Coronal T2-weighted images are shown in Fig. 22.7a–f and coronal T1-weighted images are shown in Fig. 22.8a–e.

A mid-substance tear can be seen in both Figs. 22.7a–f and 22.8a–e close to the medial epicondyle. Signal change and the small bony avulsion from the medial epicondyle are better appreciated on the T2-weighted images in Fig. 22.7a–f. The lateral collateral ligament is shown to be intact. The cartilage of the ulnohumeral and radiocapitellar joints shows no significant cartilage pathology on any of the sequences.

Due to the clinical and radiographic correlation and failure of nonoperative treatment, the risks and benefits of operative

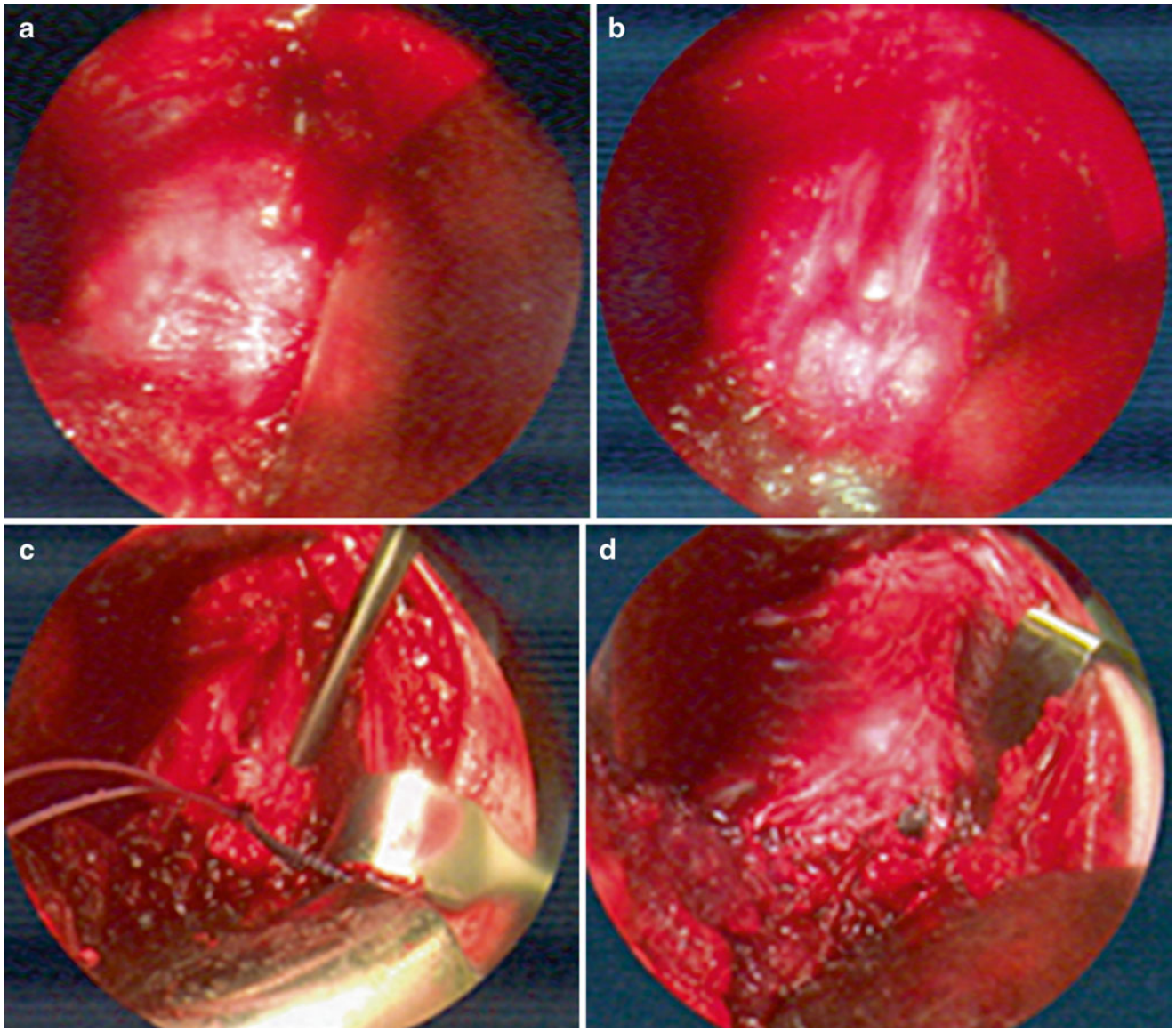

Fig. 22.5 Images of the open portion of the procedure showing (**a**) the intact mid-substance of the MUCL. (**b**) Again a preserved mid-substance of the ligament with avulsion of the ulnar aspect. (**c**) Suture anchor placement into the sublime tubercle. (**d**) Completed repair of the distal MUCL to the sublime tubercle (**a–d**: Published with kind permission. Copyright © Felix H. Savoie, III, MD)

intervention were discussed with the patient and his family. The patient desired to return to play and elected to proceed with elbow arthroscopy and open ulnar collateral ligament reconstruction with palmaris tendon autograft.

Operative Treatment

The patient was taken to the operating room, and an exam under anesthesia was performed. Again, gross instability was noted in the elbow. The patient was placed in the prone position and prepped and draped in standard fashion. The arm was rotated to provide access to the palmaris which was harvested from the proximal wrist crease and transected from the palmar fascia. A second incision, further proximal, was used to dissect out the tendon followed by the use of a tendon stripper to complete the harvest. The tendon was then prepped on the back table.

A standard diagnostic elbow arthroscopy was performed as demonstrated in Fig. 22.9a–d. The lateral aspect of the elbow showed some mild synovitis but no evidence of chondromalacia or an osteochondritis dissecans (OCD) lesion. Gross medial opening was visualized from the medial and lateral portals with no end point. The lateral gutter was

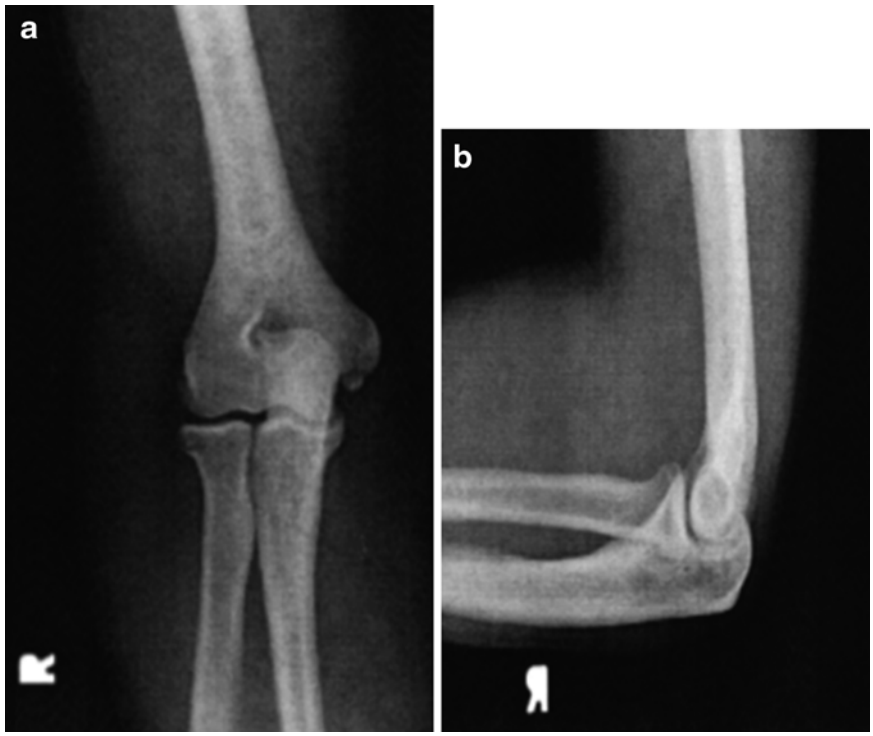

Fig. 22.6 (**a**, **b**) AP and lateral of the right elbow showing a small bony avulsion from the medial epicondyle (**a**, **b**: Published with kind permission. Copyright © Felix H. Savoie, III, MD)

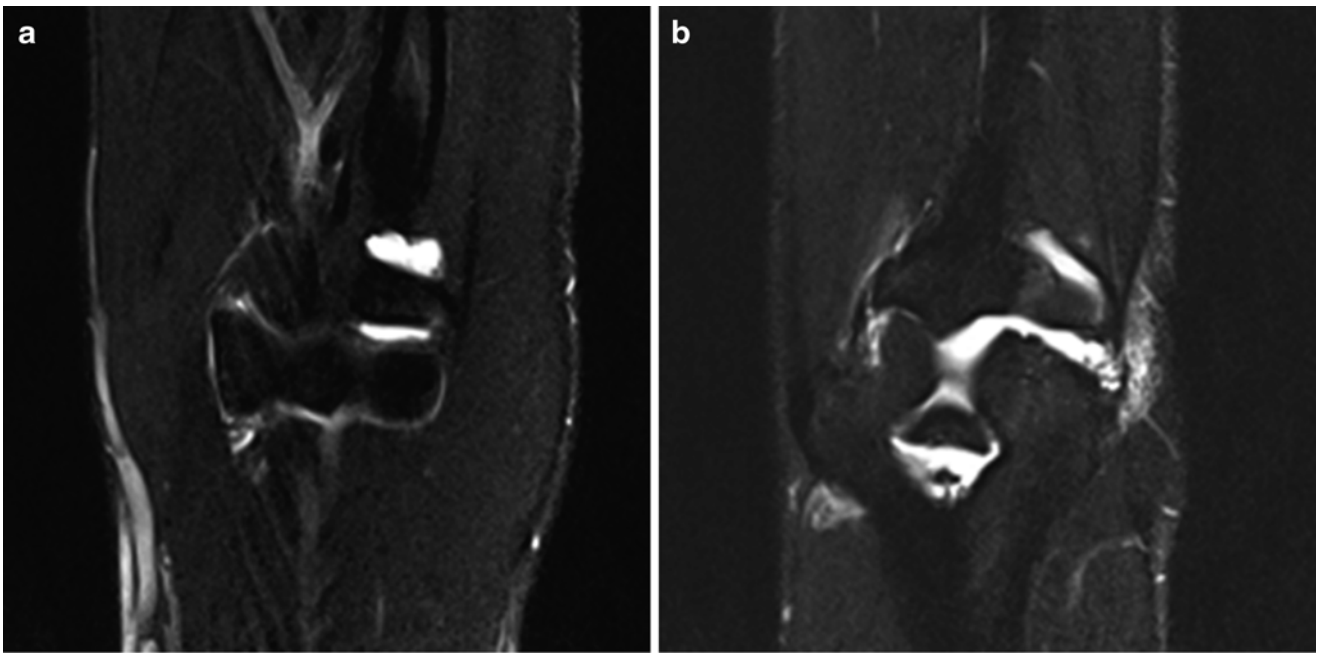

Fig. 22.7 (**a–f**) Coronal T2 fat-saturated images show the avulsed fragment from the medial epicondyle as well as signal change within the ligament indicative of a tear (**a–f**: Published with kind permission. Copyright © Felix H. Savoie, III, MD)

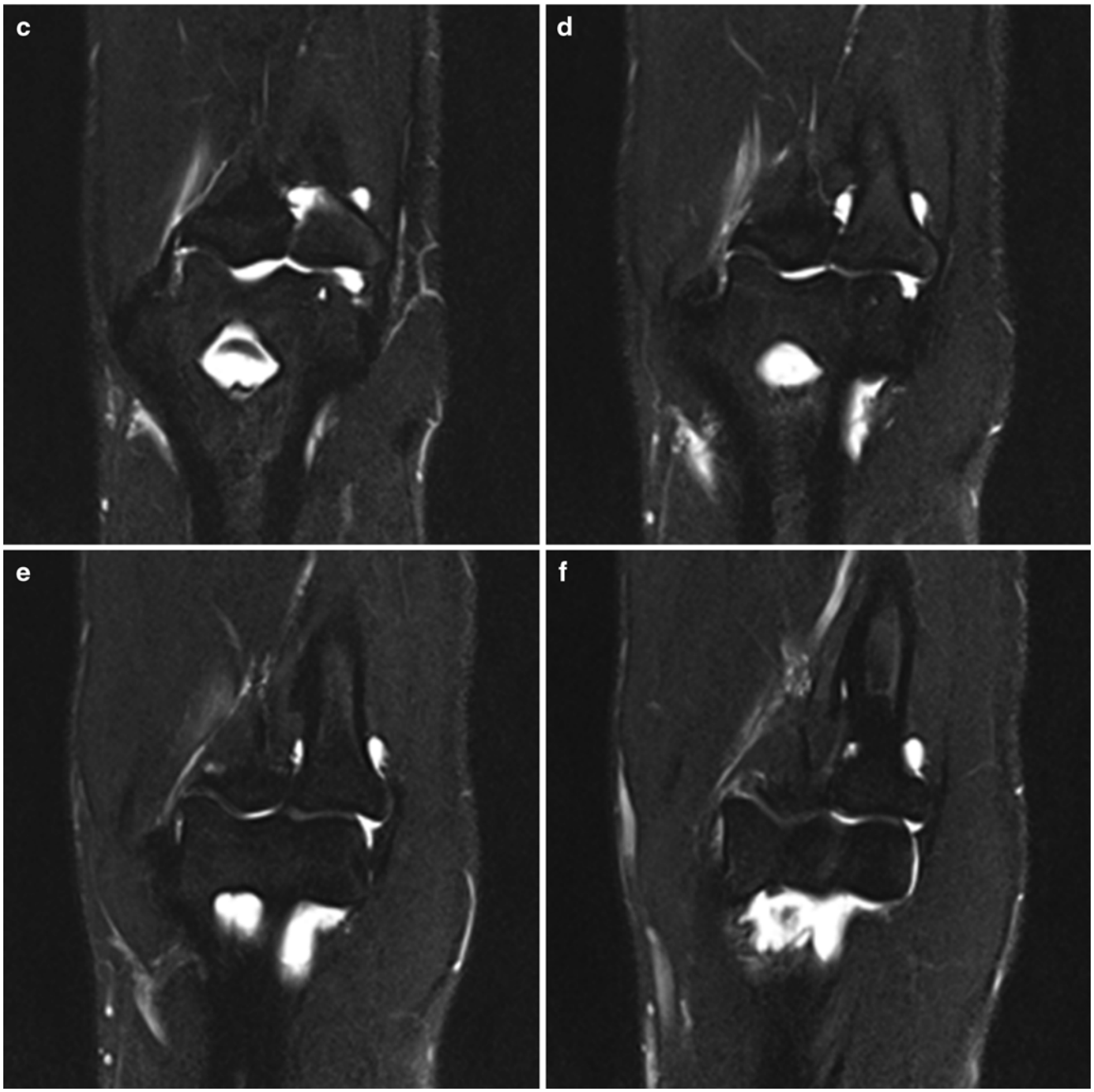

Fig. 22.7 (continued)

visualized and a "drive-through sign" of the elbow was noted again indicative of medial instability. The arthroscopic portion of the procedure was then terminated.

The arm was rotated to gain access to the medial aspect of the elbow; the UCL reconstruction was started as seen in Fig. 22.10a–d. A medial approach to the elbow was made and the ulnar nerve was protected. The flexor-pronator group was incised and split. Upon inspection of the ligament, it was noted that there was a bony avulsion from the medial epicondyle that likely represented an older injury given the ligament was not actually detached from the epicondyle. There was also tearing of the mid-substance of the ligament as well as evidence of avulsing of the ligament from the sublime tubercle. The ligament was dissected posteriorly to obtain

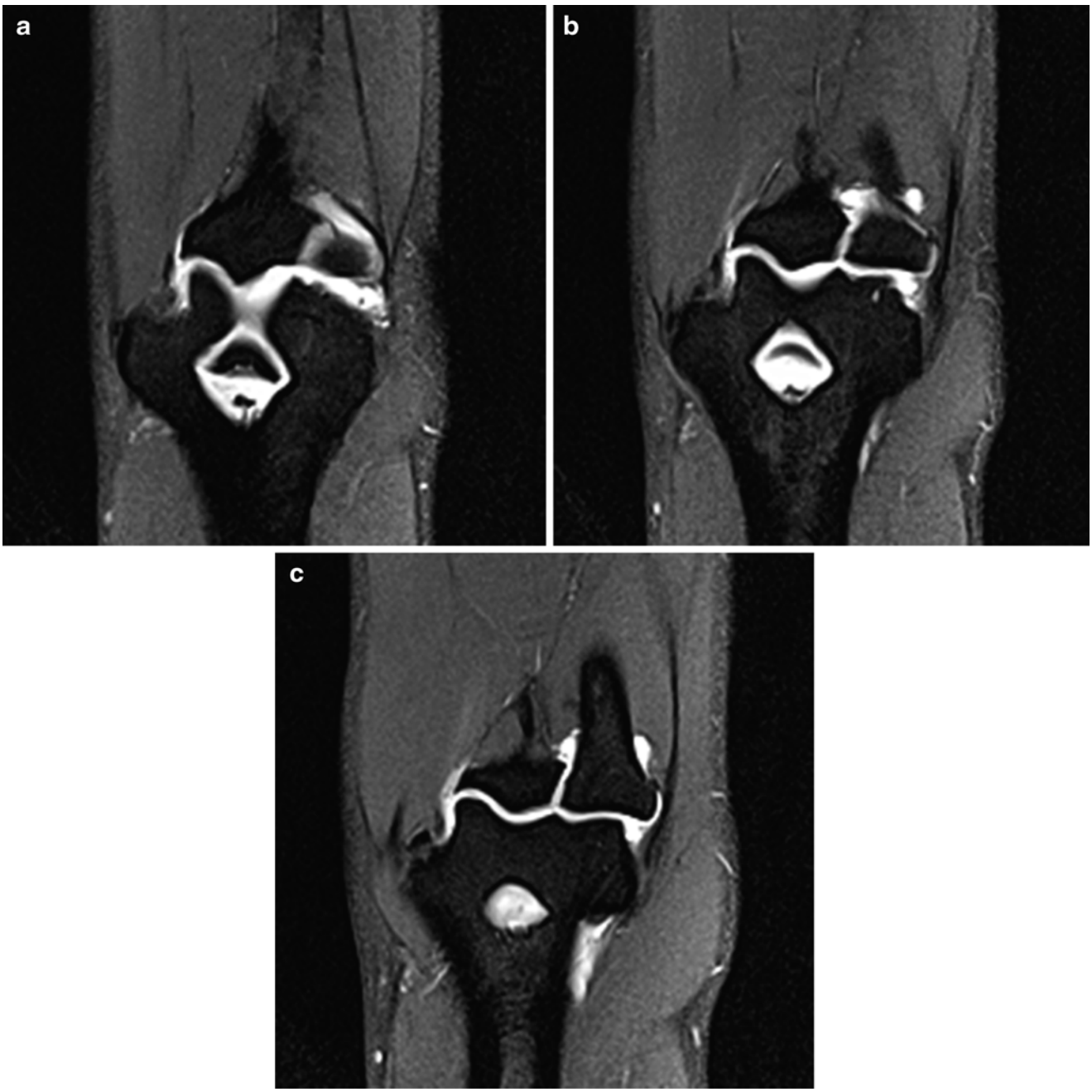

Fig. 22.8 (**a–e**) Coronal T1 fat-saturated images again show the avulsed fragment from the medial epicondyle as well as signal change in the mid-substance of the ligament indicating a tear (**a–e**: Published with kind permission. Copyright © Felix H. Savoie, III, MD)

access to the insertion site. A pilot hole was drilled through the sublime tubercle and reamed with a 5 mm reamer. The prepared palmaris graft was then pulled into the hole and transfixed with an interference screw. A pilot hole was drilled into the origin of the medial epicondyle. A Y-tunnel configuration was made with a 4.5 mm tunnel at the origin and two intersecting 3.5 mm tunnels out posteriorly. The palmaris graft was docked into these tunnels followed by reinforcing of the graft by sewing the remaining MUCL to the graft. The elbow was tested and found to have no gapping medially with a solid end point. The capsule was repaired and the wound closed in standard fashion.

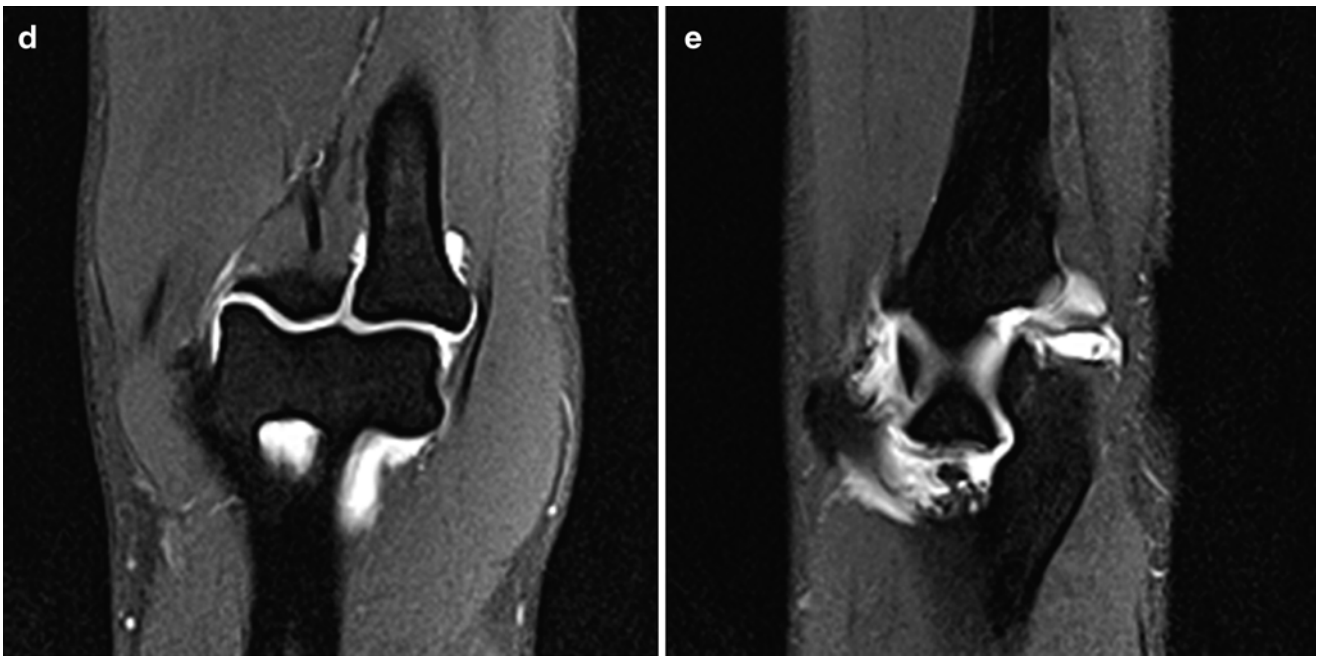

Fig. 22.8 (continued)

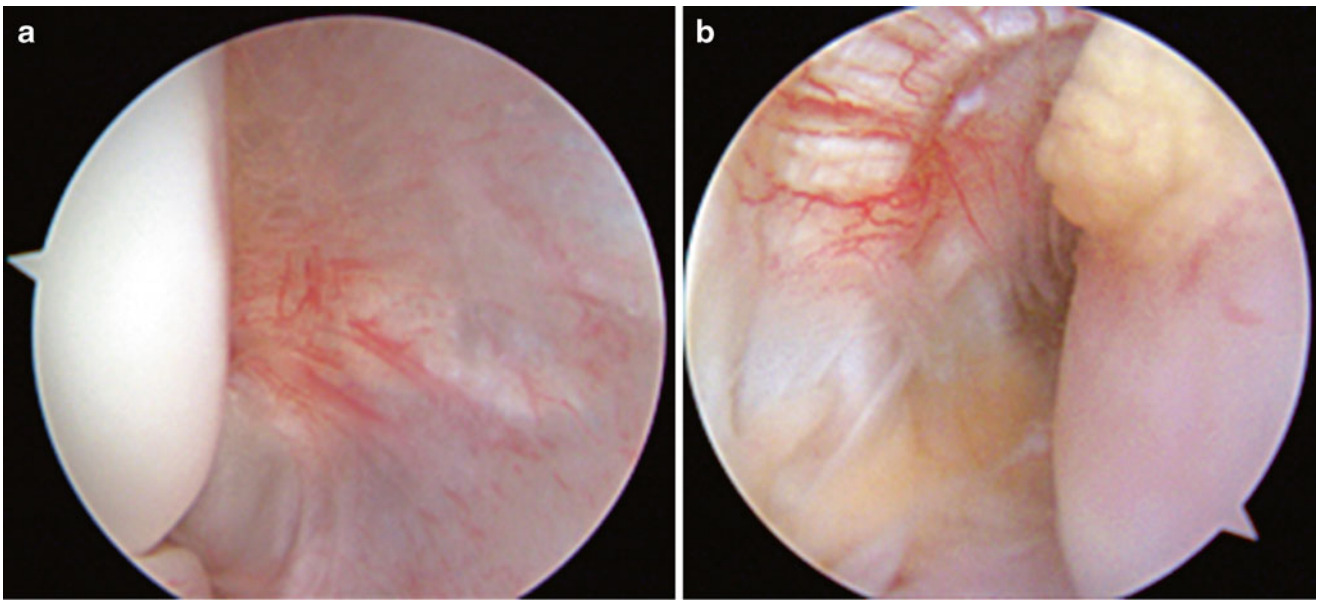

Fig. 22.9 (**a–d**) Arthroscopic images showing lateral synovitis, medial synovitis, and evidence of instability with a "drive-through sign" and medial gapping (**a–d**: Published with kind permission. Copyright © Felix H. Savoie, III, MD)

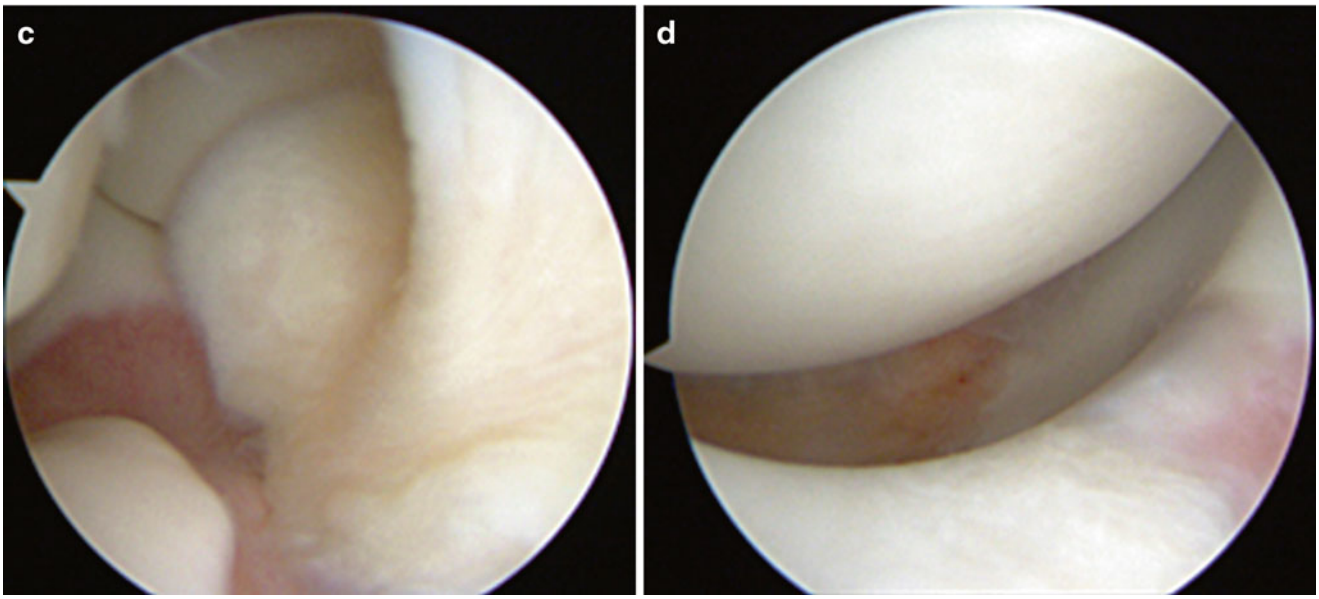

Fig. 22.9 (continued)

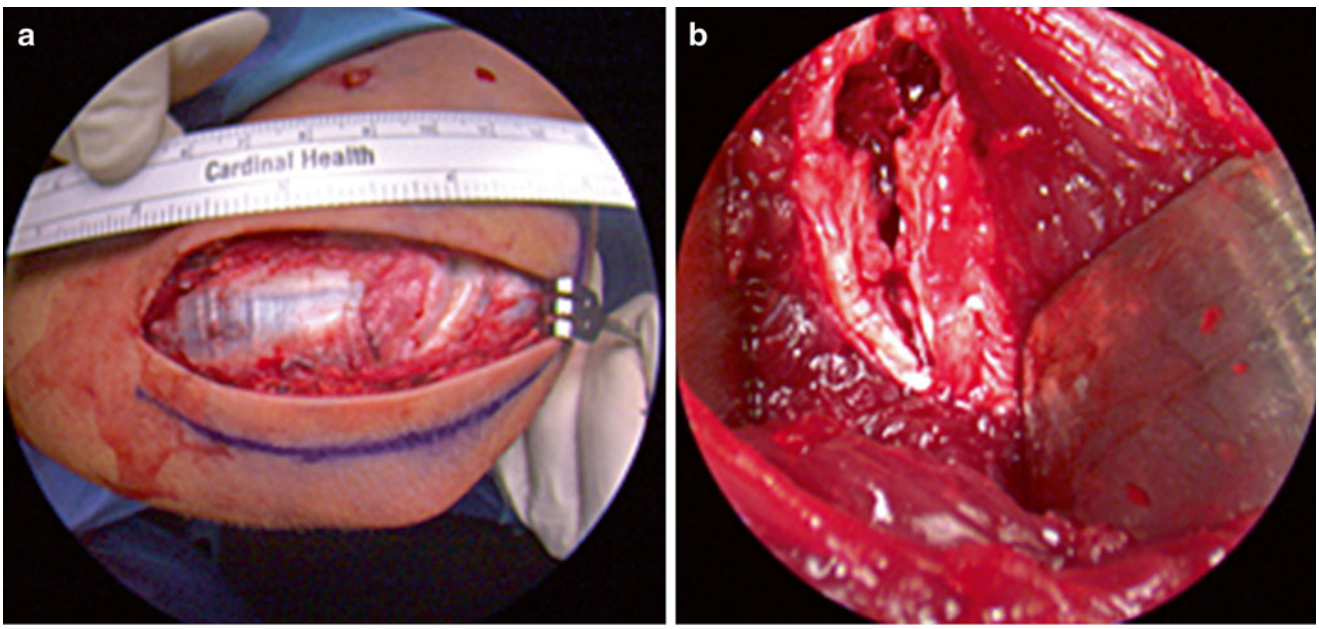

Fig. 22.10 (**a**) Initial incision and identification of the flexor mass and the ulnar nerve. (**b**) Initial identification of the torn UCL. (**c**) Excision of the small avulsion fragment from the medial epicondyle. (**d**) Placement of the palmaris graft (**a–d**: Published with kind permission. Copyright © Felix H. Savoie, III, MD)

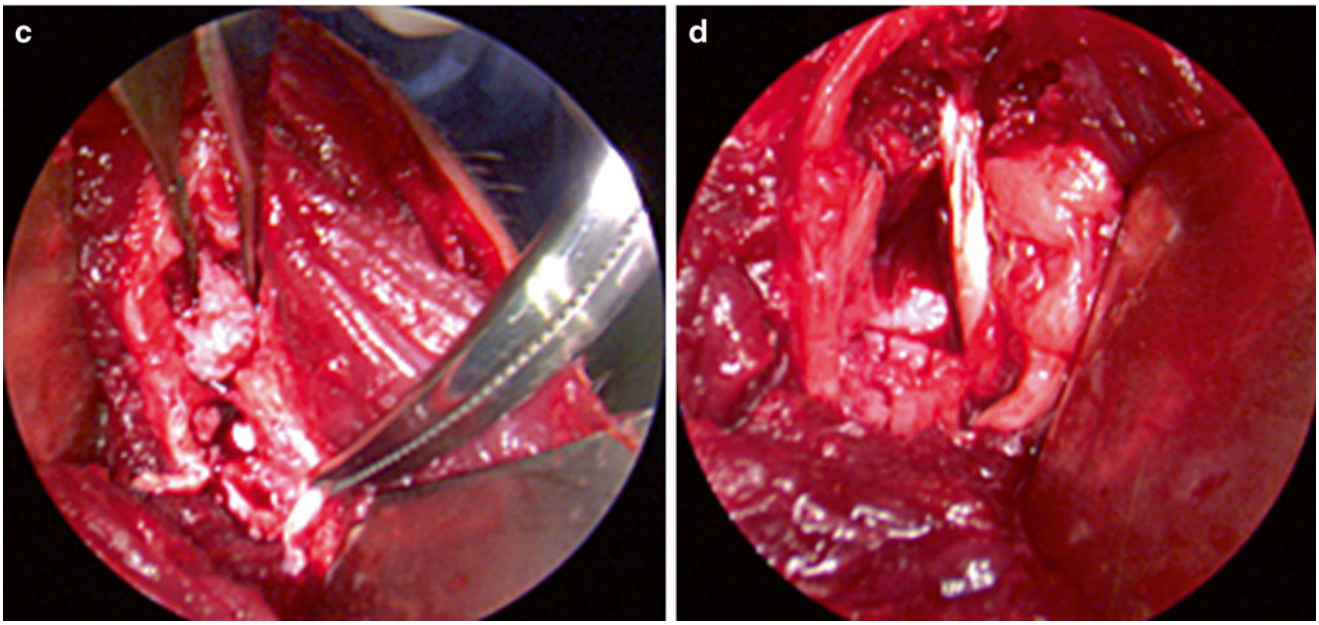

Fig. 22.10 (continued)

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