Complete Intrasubstance Long Head Biceps Brachii Rupture with Successful Repair: A Case Report

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Abstract: Intrasubstance biceps rupture is a rare injury. Closed traumatic biceps rupture is a relatively rare injury, and although an intramuscular tear, appropriate surgical timing and technique can be well treated. We report a case of traumatic abdominal Intrasubstance biceps rupture, mainly repaired by using a modified Mason-Allen (allograft tendon augmentation) technique. After 6-month follow-up, physical strength and good repair, clinical and MRI examination. The DASH score showed 0 out of 100 (no disability). Application of this technique can successfully repair acute traumatic closed biceps cross section, with good postoperative function.

***Keywords*:** intrasubstance biceps rupture, modified Mason-Allen technique, repair

1. Introduction

Intrasubstance biceps rupture is a rare injury. The most commonly reported cause of closed, intrasubstance ruptures is a static line injury sustained by parachutists, which is characterized by a sudden, concentrated force applied to the front of the upper arm[1]. The injury occurred when the parachute's static line was incorrectly routed under the arm as the paratrooper exited the aircraft. As he entered the airstream and descended, the static line forcefully abducted his arm. This resulted in biceps ruptures, causing the muscle to bulge due to a loss of tension and leading to a cosmetic and visible defect in the arm, commonly referred to as the “Popeye” deformity[2].

Clinical presentations of intrasubstance biceps rupture typically include pain, tenderness, and a palpable gap along the biceps muscle belly. These symptoms can resemble those of a distal biceps tendon rupture; however, they can be differentiated using either ultrasonography or magnetic resonance imaging (MRI)[3]. The treatment for these injuries ranges from nonsurgical management to surgical repair. Most reports of surgical intervention occur in the acute phase following the injury, with limited documentation on the surgical treatment of subacute or chronic injuries.

We present the case of a 54 year-old patient with a subacute intrasubstance rupture of the biceps brachii muscle, which was treated with direct surgical repair.

2. Materials and Methods

A healthy 54-year-old right-hand-dominant male experienced an accidental fall while working at a construction site. The mechanism of the fall is unclear, but the left upper arm was impacted, leading to severe pain, difficulty in elbow flexion, weakness in external rotation, and a noticeable depression deformity at the front of the left upper arm, without any radiation of pain or sensory numbness in the left forearm. The patient presented for evaluation on the fourth day post-injury, complaining of pain and swelling in the left arm. Physical examination revealed swelling and tenderness upon palpation of the mid-shaft of the left humerus, with a prominent defect observed at the distal anterior aspect of the left upper arm, accompanied by tenderness. The "power grip" test was positive, and there were bruises at the distal end, but no open wounds were noted (Figure 1).X-ray results showed no fractures or other abnormalities. MRI revealed a partial discontinuity of the distal segment of the left biceps brachii long head, measuring approximately 32 mm in width and 90 mm in length, with partial retraction of the torn ends. (Figure 2)

Figure 1. Preoperative photos showed that the patient had a "Popeye sign" after biceps rupture.

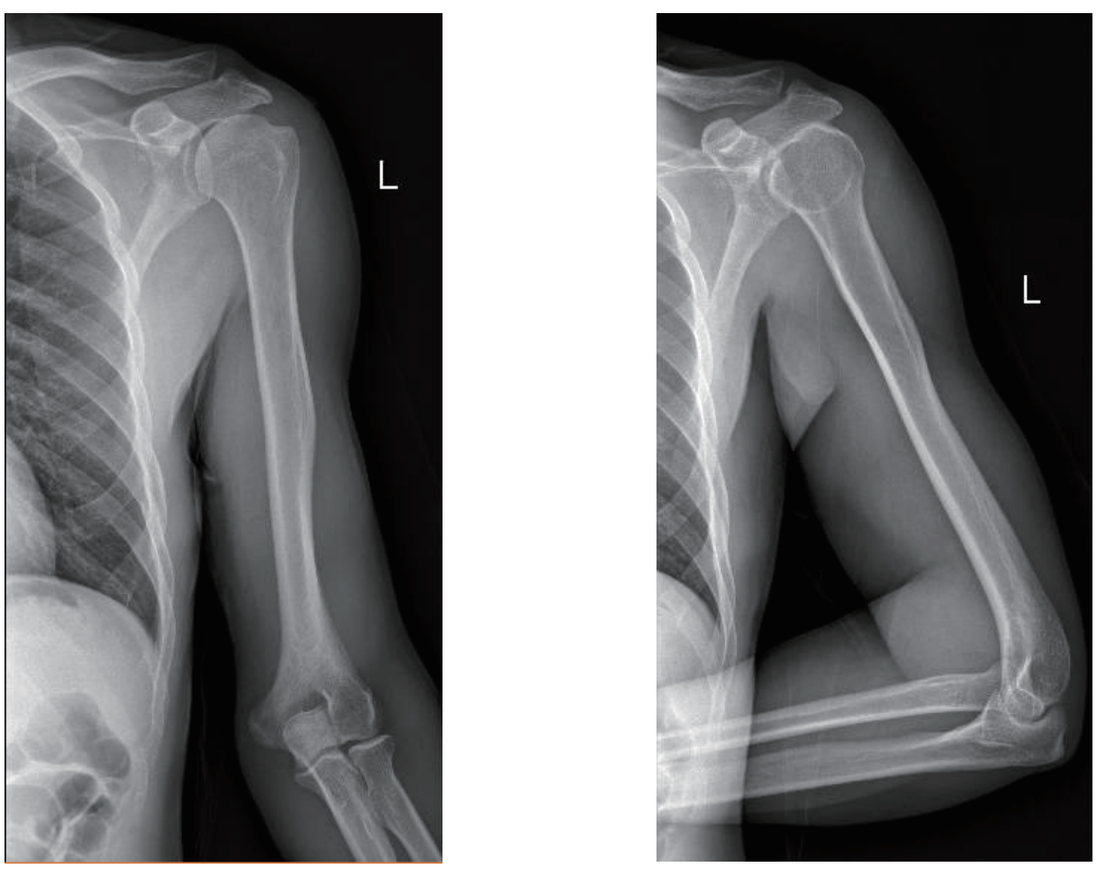

Figure 2. Preoperative X-ray showed no significant abnormality.

The patient aimed to maximize strength and minimize deformity, opting for surgical repair 6 days after the injury. Once the anesthesia was satisfactory, the patient was positioned supine on the operating table, and the left upper limb was routinely disinfected and draped with sterile coverings.

A curved incision approximately 13 cm long was made on the anterior side of the middle to distal segment of the left upper arm. The skin and subcutaneous tissue were incised, followed by opening the fascia, revealing that the majority of the distal portion of the biceps tendon was ruptured with associated hematoma at the torn ends, (Figure 3) while the musculocutaneous nerve was not touched. The hematoma was removed, and the torn muscle ends were freshened. The ends were divided into two equal portions, and a single allograft palmaris longus tendon (Kejian Biotechnology, Beijing) was used to reinforce the deep layers around the biceps tendon ends. The ends were sutured together and fixed using 2# Ethibond (Johnson & Johnson, USA) high-strength sutures in a modified Mason-Allen technique for proximal and distal fixation. A 2-0 absorbable suture was used for interlocking the fascia with appropriate tension for end-to-end anastomosis.

The elbow joint was then subjected to a series of flexion, extension, supination, and pronation movements without hindrance to movement or gaps at the repair site. Subsequently, the wound was closed in layers, and a sterile dressing was applied, with the left elbow fixed in a 90-degree flexed position using a cast. (Figure 4-8)

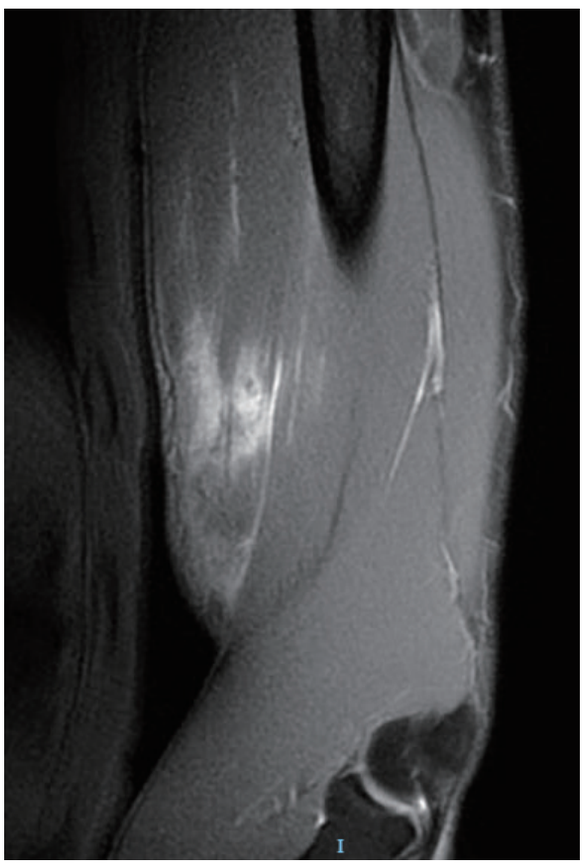

Figure 3. The T2 sagittal magnetic resonance image of the upper arm revealed intrparenchymal Intrasubstance biceps rupture.

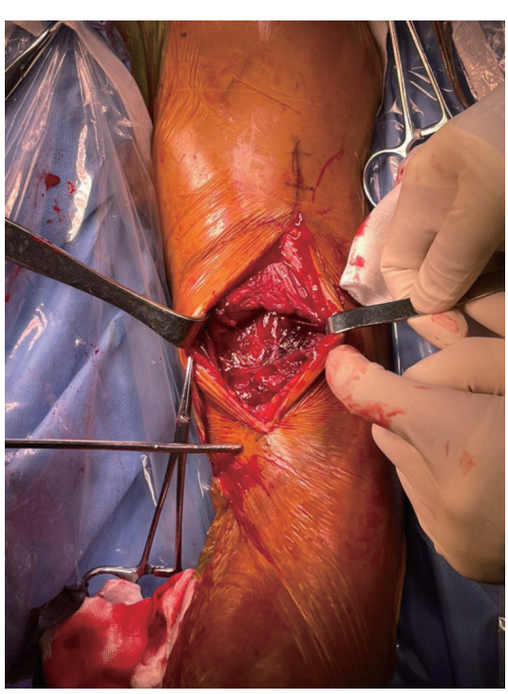

Figure 4. After full exposure, the broken biceps can be seen.

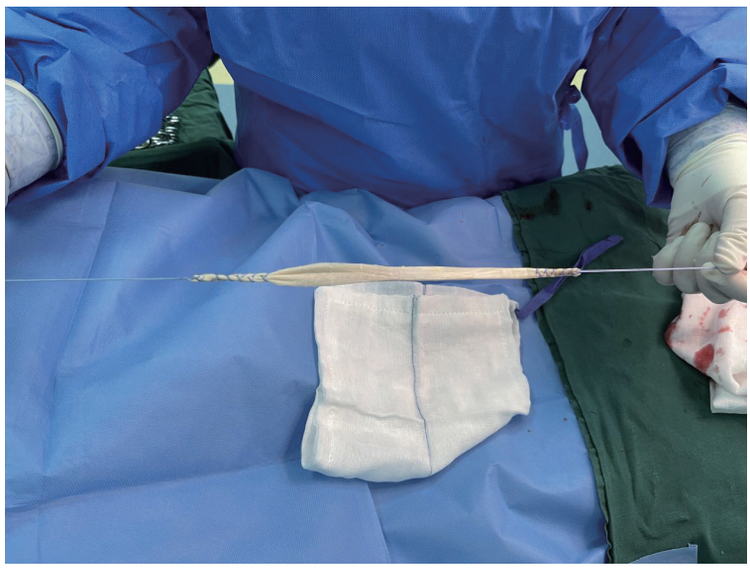

Figure 5. Allogeneic tendon with braided finish.

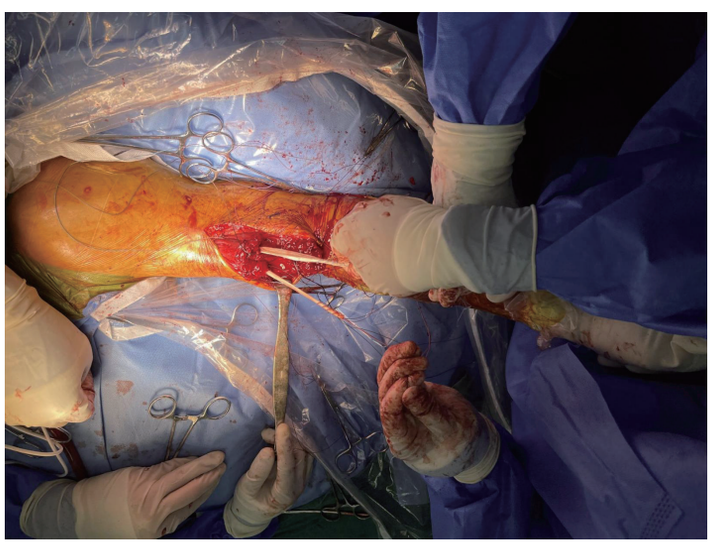

Figure 6. The allogeneic tendon body was sutured and fixed at the proximal end of the biceps.

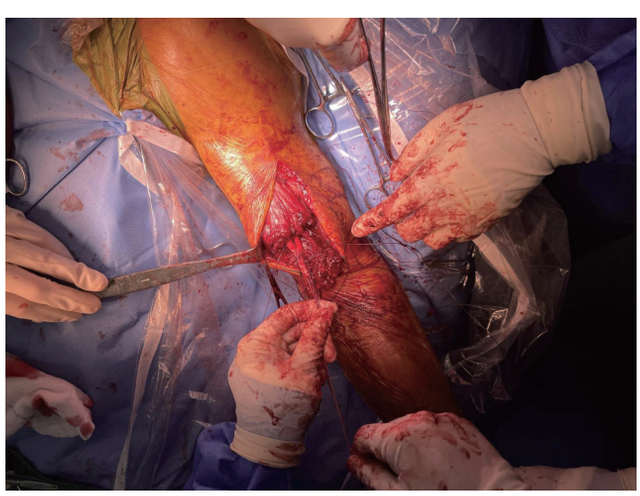

Figure 7. The allogeneic tendon was sutured to the distal end of the biceps.

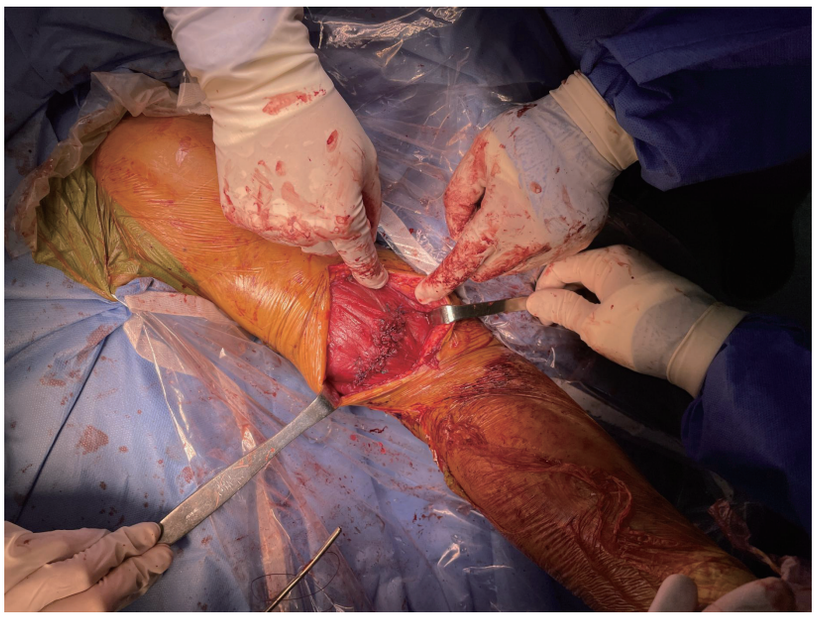

Figure 8. Suture the biceps.

Our rehabilitation plan includes the use of a dynamic splint for early mobilization. Between 3 to 5 days post-surgery, the cast and dressing will be removed, and a light compression wrap along with an elbow brace will be applied.

Active range of motion exercises will begin with gravity-eliminating 30° extension blocks, without resistance during supination. The extension will be gradually increased by 10° each week. Resistance is allowed for active movements beyond supination and elbow flexion. After three weeks, the brace will be discarded, and gentle, progressive movements against gravity will be introduced. By the eighth week, resistance training will commence.

There is a long 13cm scar on the surface of the repair site, which is acceptable to the patient and similar to the contralateral arm (Figure 9).

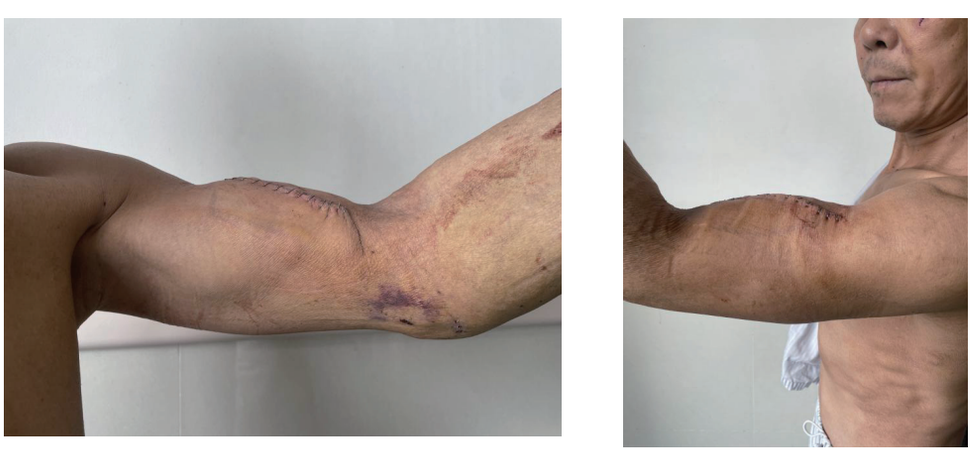

Figure 9. A clinical image after surgery demonstrates no Popeye deformity.

The patient subsequently returned for outpatient evaluations at 2 weeks, 2 months, and 6 months post-surgery to assess the recovery of biceps function. During the physical examination, the patient exhibited full range of motion, with strength rated at 4/5; however, he was temporarily unable to flex or supinate the elbow. At this time, the Disabilities of the Arm, Shoulder, and Hand (DASH) score was obtained, resulting in a score of 95 (indicating no disability) out of a maximum of 100. Additionally, the scores for the work and sports modules were both 0 (indicating no difficulty).

The follow-up MRI at this time revealed that the muscle belly of the biceps had been completely reconstructed, with no scar formation observed between the muscle fibers. (Figure 10-11)

Figure 10. Sagittal magnetic resonance image showing the repaired biceps 2 days after surgery.

Figure 11. Sagittal magnetic resonance image 2 months after surgery showed intact biceps muscle abdomen and allograft ligaments.

Informed consent was obtained from the patient for the publication of this case report and accompanying images.

3. Results and Discussion

Most biceps ruptures are commonly observed in military paratroopers or individuals involved in water sports. We

present a previously unreported mechanism of injury: a significant biceps rupture resulting from a high fall. In this case, we suspect that the patient may have sustained indirect damage to the biceps muscle, as there was no bruising at the rupture site during the initial emergency room evaluation. The high-energy nature of the fall likely produced a forced eccentric load on the biceps.

The regenerative capacity of muscle following transection is limited, and injured muscle tissue may develop fibrosis. [4]Muscle regeneration follows a predictable, time-dependent process, peaking at around two weeks post-injury before gradually declining. [5]Fibrosis typically begins approximately two weeks after the injury occurs. Reducing fibrosis is essential for enhancing muscle function after an injury.Strategies to mitigate fibrosis include (1) minimizing the size of the defect and (2) utilizing biological factors to boost the muscle's regenerative potential.

Surgical repositioning of intramuscular injuries presents greater technical challenges compared to tendon injuries, primarily due to the absence of reliable suturing and fixation techniques.Although numerous suturing methods have been documented in the literature, there is no consensus on the optimal approach.[6]All reported repairs of the biceps utilize non-absorbable sutures.[7]

The surgical approach to treating significant biceps ruptures remains non-standardized. Case reports on short head muscle belly ruptures describe a variety of repair techniques, such as suturing the muscle core with interrupted stitches surrounded by double Kessler stitches, using Kessler and Bunnell-type sutures to repair both the muscle belly and fascia, and placing non-absorbable stitches along the edges of the rupture site.[9,10,11,12]

During surgical repair, there is a risk of iatrogenic nerve injury, making it essential to identify and safeguard the musculocutaneous nerve before suturing and securing the muscle. Biceps muscle denervation can negatively affect the functional outcome of the repair and complicate the rehabilitation process.

We are now reporting on the case of a biceps tendon rupture repaired using an improved Mason-Allen allograft tendon augmentation technique, with follow-up results at 2 and 6 months post-primary repair. The clinical and radiological outcomes were excellent. The patient achieved full strength recovery, expressed satisfaction with the cosmetic outcome, and reported no disability on the DASH questionnaire. MRI results indicated complete reconstruction of the biceps muscle belly.

In conclusion, our patient sustained a rare intrasubstance biceps brachii muscle rupture, presented in a subacute fashion, and was successfully treated with direct end-to-end repair.

When evaluating patients with similar injury mechanisms, upper extremity surgeons must maintain a high index of suspicion for this type of injury. Our case demonstrates that satisfactory outcomes can be achieved through surgical repair of this type of injury, and surgeons may consider this approach.

4. Conclusions

We report a case of traumatic biceps muscle belly rupture that was repaired using an improved Mason-Allen technique with allograft augmentation. Follow-up evaluations at 2 weeks, 2 months, and 6 months post-surgery showed intact repair on both clinical examination and MRI, with complete functional recovery and a DASH score indicating no disability. The application of this technique successfully repaired acute traumatic closed biceps rupture, resulting in excellent postoperative function.

References

[1] Heckman JD, Levine MI. Traumatic closed transection of the biceps brachii in the military parachutist. J Bone Joint Surg Am. 1978;60(3):369e372.

[2] Wilson DJ, Parada SA, Slevin JM, Arrington ED. Intrasubstance ruptures of the biceps brachii: diagnosis and management. Orthopedics. 2011;34(11):890e896.

[3] Chen HW, Chew FS. Complete rupture of both heads of the biceps brachii muscle belly by blunt trauma. Radiol Case Rep 2006;1:145-8.

[4] Ramos LA, de Carvalho RT, Abdalla RJ, Ingham SJ. Surgical treatment for muscle injuries. Curr Rev Musculoskelet Med. 2015;8(2):188e192.

[5] Huard J, Li Y, Fu FH. Muscle injuries and repair: current trends in research.J Bone Joint Surg Am. 2002;84(5):822e832.

[6] Kragh JF, Basamania CJ. Surgical repair of acute traumatic closed transection of the biceps brachii. J Bone Joint Surg Am. 2002;84(6):992e998.

[7] Salmons HI, Warrender WJ, Smith S, Kearns KA, Strohl A. Intrasubstance tear of the short head of biceps with musculocutaneous and median nerve compression. J Am Acad Orthop Surg Glob Res Rev. 2019;3(12):e19.00074.

[8] DiChristina DG, Lustig KA. Rupture through the short head of the biceps muscle belly. A case report. Clin OrthopRelat

Res 1992;277:139-41.
[9] Mizuno S, Ikegami H, Nakamura T, Satoh K, Okazaki M, Toyama Y, et alComplete rupture through the short head of the biceps muscle belly: A case report. J Shoulder Elbow Surg 2011;20:e14-7.
[10] Traumatic Isolated Closed Rupture of the Short Head of the Biceps Brachii in a Military Paratrooper. Knee Surg Sports TraumatolArthrosc 2010;18:1759-61.
[11] Shah AK, Pruzansky ME. Ruptured biceps brachii short head muscle belly: A case report. J Shoulder Elbow Surg 2004;13:562-5.