

TECHNIQUE

Anconeus Muscle Transposition for Chronic Lateral Epicondylitis, Recurrences, and Complications

Riccardo Luchetti, MD, Andrea Atzei, MD, Francesco Brunelli, MD, and Tracy Fairplay, LPT
Hand Surgery
Ancona University
Department of Plastic and Reconstructive Surgery and Hand Surgery
Torrette Hospital
Ancona, Italy

ABSTRACT

The use of the anconeus muscle in the treatment of chronic lateral epicondylitis (CLE), recurrences, and infection is presented. In chronic lateral epicondylitis, a wide degenerative area of epicondyle tendon is not frequently found, but when it occurs, its treatment is quite difficult. Recurrences of CLE and superficial or articular infections of the radiohumeral joint after surgical treatment or cortisone infiltrations are 2 more major conditions in which the use of anconeus muscle transposition demonstrated to be a promising technique. The procedure is widely described based on personal experience of 13 cases, 8 of which were CLE (group 1), and 5 recurrences and infection (group 2). Rotation of this muscle close to the epicondyle makes it possible to cover the epicondyle bone and the exposed radiohumeral joint in all cases. Additional surgical time usually requires only an extra 15 minutes. At the mean follow-up of 74 and 55 months, all the patients of the first group were painless, and the patients of the second group showed a decrease in pain from 9 to 3. Patients of the 2 groups returned to their previous work with a complete recovery of elbow range of motion and grip strength.

Keywords: chronic lateral epicondylitis, anconeus muscle, recurrence, infection

HISTORICAL PERSPECTIVE

The use of the anconeus muscle as a cutaneous covering in an exposed elbow region was first described by Cardany et al[1] in 1981, who referred to its use as a myocutaneous flap for posteriorly exposed cutaneous elbow coverage. This technique was later described by Mathes and Nahai,[2] Lamberty and Cormack[3] and Vasconez.[4] The same muscle flap was used and interposed to prevent proximal radioulnar synostosis by Bell and Benger in 1999[5] and later used as a spacer in radial–capitular resection by Morrey and Schneeberg.[6]

The use of this same muscle flap for epicondylar region coverage in chronic lateral epicondylar (CLE) syndromes was first presented at the 47th Annual ASSH meeting in 1992[7] and more recently has been published in 1998.[8] This study reported its comparative results in 3 surgical procedures for the treatment of chronic epicondylitis, for a total of 61 surgical patients and 42 follow-ups, with a 4-year follow-up control. The first chronic epicondylitis group was treated by conventional means: resection of the epicondyle tendons and partial resection of the epicondyle itself. The second chronic epicondylitis group was treated by an anconeus muscle transfer in association with the traditional method. The third chronic epicondylitis residual group, was treated with an anconeus muscle transfer only after they had undergone a traditional treatment program. For the most part, the follow-up control parameters that were taken into consideration were pain and return to work. The 3 groups rendered positive results for the pain parameters in 62%, 87%, and 52%, respectively, and for the return to work parameters in 84%, 96%, and 88%. The only limiting factors reported occurred in the third group, in which there was a lack of complete elbow extension. When the first 2 groups were compared, it was evident that the anconeus muscle transposition, in association with an epicondyle resection, renders positive percentile results in comparison to the use of only traditional surgical techniques. The use of this muscle flap in successive surgical treatments permits a discrete recovery for painful symptoms (52% pain reduction) and an optimal percentage for return to work (88% cases). In the second group, where these

Address correspondence and reprint requests to Dr. Riccardo Luchetti, Ancona University, Department of Plastic and Reconstructive Surgery and Hand Surgery Torrette Hospital, Ancona, Italy. E-mail: rluc@adhoc.net.

cases were immediately treated with this technique, pain reduction was 87%, and return to work was 96% of the cases.

This technique has been adopted by other authors[9–12] and used for the same surgical indications that have been proposed by Almquist et al.[8]

INDICATIONS/ CONTRAINDICATIONS

The appropriate surgical candidate for the application of this technique usually has chronic (longstanding) epicondylitis in which various physical therapy treatments and pharmaceutical treatments have not been successful. The majority of patients had already undergone a series of cortisone infiltrations with progressive onset of symptoms after treatment. These patients have constant lateral elbow pain that is exacerbated with activity. Whatever type of medical therapy that they have tried has not reduced their painful symptoms. These patients also have a reduction in wrist extension and elbow extension strength when a resistance is applied at the wrist level. In addition, they usually present with dyschromia and muscle atrophy around the elbow extensor muscles as a result of repetitive cortisone infiltrations into the elbow area.

Other surgical candidates that are appropriate for undergoing this procedure are patients who have residual epicondylar symptoms that have not responded to conventional surgery and have had an increase in painful symptoms without responding to any conservative therapy treatment.

The most important surgical indication for this technique is the presence of a fistula or an articular infection postoperatively or postinfiltration. This clinical condition requires an ample area for surgical exposure and thus necessitates nearby muscle or cutaneous-muscle flap coverage.

In summary, the indications for muscle flap use are reported below and can be divided into major and minor indications.

Major indications include the following:

1. wide excision of degenerative extensor tendon pathology with or without radiohumeral joint exposure
2. recurrence of CLE
3. chronic articular fistula
4. superficial or deep infection after traditional surgery for CLE

A minor indication would be dystrophic and/or hypotrophic subcutaneous skin caused by steroid injection.

It must be mentioned that a predominant contraindication to this procedure is an absent or devitalized anconeus muscle, which may occur during surgical dissection.

TECHNIQUE

The operation consists of the transfer of the anconeus muscle (Figs. 1, 2) onto the lateral epicondyle and/or the radiohumeral articulation to cover and protect the joint (Fig. 3) or the epicondyle bone. Anconeus muscle has recently been studied by Almquist et al[8] and Schmidt et al.[12] It has 2 pedicle vessels, the more important of which is the distal one, the recurrent posterior interosseous artery (RPIA); the proximal one is the medial collateral artery (MCA) (Figs. 4, 5). The innervation is derived from a branch of the radial nerve that follows the lateral portion of the medial head of the triceps muscle.

Surgery is performed under brachial plexus anesthesia with a tourniquet placed most proximally on the arm to guarantee ischemia of the entire extremity. The elbow is placed in a flexed position, and the epicondyle is the reference point. A skin incision is made 3 cm proximal to the epicondyle, passing anteriorly and extending distally for 8–10 cm along the anterior border of the anconeus muscle (Fig. 6). The dorsal antibrachial fascia must be longitudinally sectioned to expose the epicondyle tendons, which are transversally sectioned about 1 cm from their insertion. The type of tendon injury and its severity must be well documented in association with the eventual exposure of the radiohumeral articulation after the removal of pathologic tendon tissue (Fig. 7). Continuing on, a tangent resection of the epicondyle is performed up until the point where there is evidence of good bone vascularization, which can also be checked by perforating the bone itself.

The anconeus muscle transfer is done by sectioning its compartment fascia and isolating the distal portion

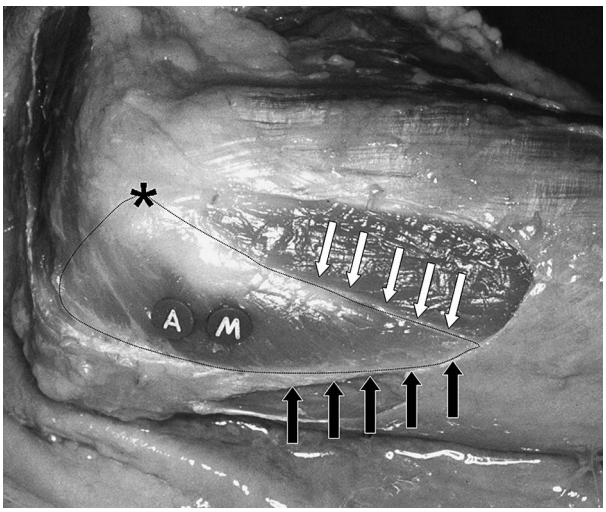

FIGURE 1. Anatomic dissection of anconeus muscle (AM). White and black arrows show the anterior and dorsal distal profiles of the muscle. Black asterisk shows the lateral epicondyle.

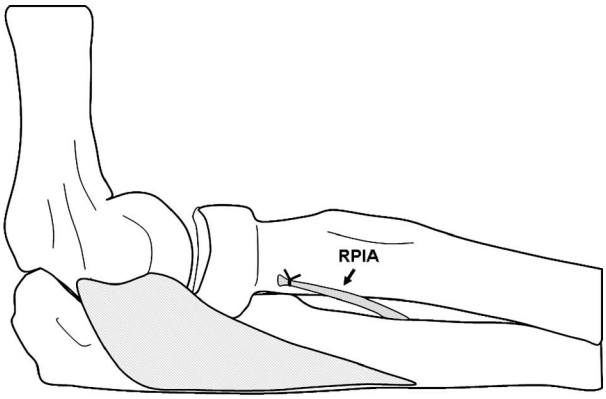

FIGURE 2. Schematic of the elbow location of the anconeus muscle. The distal pedicle vessel (RPIA) was legated to permit its rotation.

of the muscle (Fig. 8). The flap is raised up in a distal–proximal and ulnoradial direction until the vascular pedicle is exposed and its distal pedicle vessel (RPIA) is identified proximal to the surgical site (Fig. 4). This pedicle vessel is always sacrified (Fig. 2) because it is otherwise impossible for the muscle to be transferred. The arterial pedicle on the deep surface of the anconeus muscle must be carefully preserved. The muscle flap remains vascularized by the anastomosis that come from the proximal pedicle vessel (MCA). The anconeus muscle must be mobilized in order to rotate it 90 degrees onto the epicondyle and to cover the treated area (Fig. 9). The proximal part of the muscle should not be mobilized, nor should the nerve pedicle that comes off the radial nerve. As soon as the muscle is thoroughly mobilized, one can see its ample capacity to cover the epicondyle site where it is being transferred and positioned via reabsorbable sutures (Fig. 10). The flap should not be pulled or excessively tensioned; otherwise, damage could occur to the vascular pedicle. Accurate hemostasis is performed at

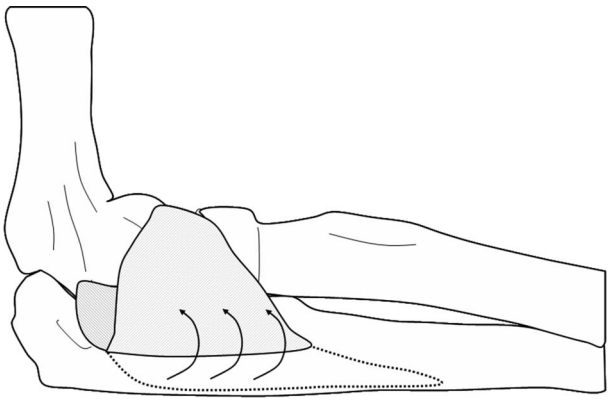

FIGURE 3. Schematic of the rotation of the anconeus muscle on the radiohumeral joint.

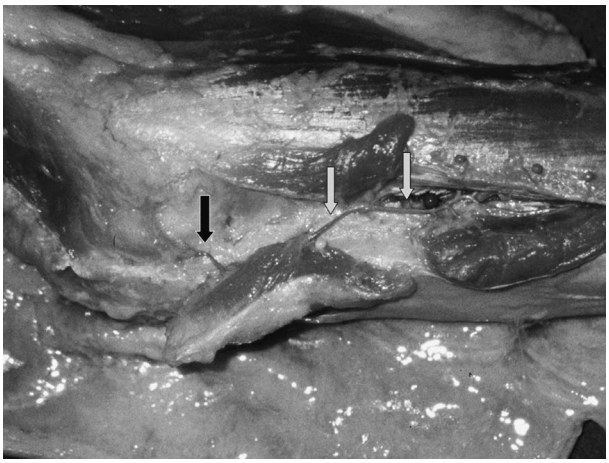

FIGURE 4. Anatomic dissection of anconeus muscle (AM). Proximal (black arrow) and distal (white arrows) vascular pedicles of the muscle.

the harvest site, and an aspiration drain is inserted prior to flap closure to aid in the drainage of hematic liquids (Fig. 11). The fascia will be used to cover the donor anconeus muscle site, but it should never be completely sutured above the transferred muscle to avoid development of secondary iatrogenic compartment syndromes.[13] A primary skin closure is always possible.

The elbow must be immobilized in a flexed position and the wrist in a neutral position, leaving the fingers free to move, for 15 days. Medication changes should be performed daily, and the aspiration drain is removed 48 hours from the time of surgery.

PERSONAL EXPERIENCE

From 1992 to 2003, 13 patients affected by CLE (8 cases: 6 male and 2 female) (group 1) or recurrence and

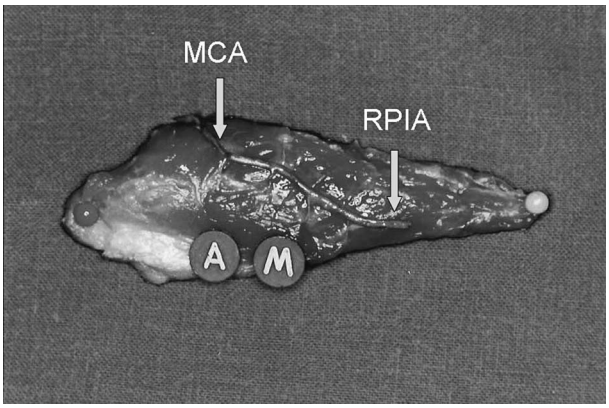

FIGURE 5. Dissection of the anconeus muscle with their vascular pedicle. MCA, medial collateral artery; RPIA, recurrent posterior interosseous artery.

FIGURE 6. Surgical approach to the lateral aspect of the elbow. Skin incision starts 3 cm proximal to the epicondyle and continues distally for 8–10 cm.

FIGURE 8. The anconeus muscle is harvested from distal to proximal, and the distal vascular pedicle is sacrificed.

complications (5 cases: 2 male and 3 female) (group 2) were operated on by the same surgeon (L.R.). The mean age of the patients of the first group was 45 years (range 33–59 years) and 48 years (range 37–60 years) for group 2.

All the patients were clinically evaluated both pre- and postoperatively according to pain, elbow ROM, grip strength, and work status. Patient's pain perception was evaluated by using a Visual Analogue Scale (VAS) (0 to 10), elbow ROM using a goniometer, and grip strength using a Jamar dynamometer. Work status and return to work after surgery were documented both in the pre- and postoperative evaluation.

The instrumental evaluations, pre- and postoperatively, were comprised of an elbow x-ray and an epicondylar ultrasound. An electromyography (EMG) evaluation of the transferred anconeus muscle was performed only postoperatively to verify its functional activity.

RESULTS

All the patients were reviewed at a mean follow-up of 74 months in group 1 (7–102 months) and 55 months in the group 2 (12–89 months). In the first group, the dominant side was affected in 65% of the cases. In the group 2 the affected side was always dominant (Table 1).

In the first group, pain was absent in all cases. Elbow ROM was almost normal without any differences from the contralateral side (Fig. 12A–H). Grip strength increased from 26 kg to 32 kg postoperatively.

In group 2 (Fig. 13A–I) there was an average decrease in pain from 9 preoperatively to 3 postoperatively (VAS). One of the fistula patients was satisfied with

FIGURE 7. Exposure of the radiohumeral articulation after excision of the lateral fascia and the degenerative epicondyle tendon.

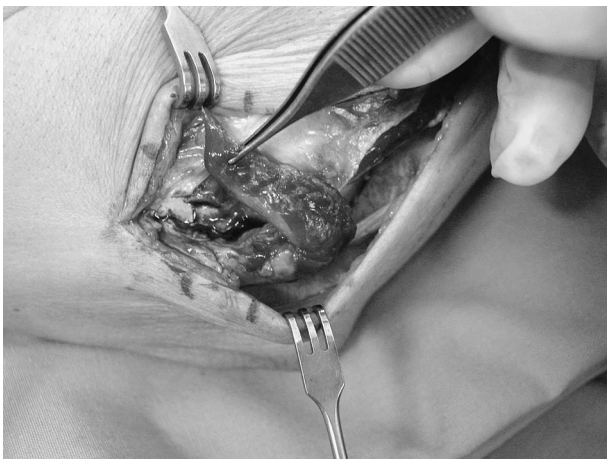

FIGURE 9. The anconeus muscle flap is rotated proximally to cover the radiohumeral articulation.

FIGURE 10. The anconeus muscle flap is positioned and sutured over the joint.

FIGURE 11. The skin is sutured, and a drain is positioned to prevent hematoma at the level of the donor site.

postoperative results but referred to their pain as being at level 8 because of radiohumeral instability. Elbow ROM and grip strength recovered without significant difference from the contralateral side.

All the patients of group 1 and group 2 returned to their previous work 47 and 81 days after operation, respectively.

The x-ray evaluation demonstrated tangent signs of the resected epicondyle in all cases and the disappearance of intratendinous calcifications. The ultrasound evaluation confirmed the presence of normal echogenic muscle tissue and normal contractile function in 91% of the cases. In these same cases, the EMG demonstrated normal contractile function.

The reduction of grip strength remained in 1 of the cases of residual pain (group 2). In this same case the ultrasound evaluation demonstrated the presence of abnormal echogenic muscle, and the EMG demonstrated a partial reduction of muscle contractile function in addition to the presence of denervation potential with a trace of single waves voluntary muscle fiber reclutment.

The subjective results were optimal in 12 cases (92%). Even the patient whose outcome was not considered satisfactory was able to return to the previous work.

In 1 case a hypertrophic surgical scar was present, but the patient did not report functional disability that compromised work activities.

COMPLICATIONS

Possible complications (Table 2) from this type of surgery can be caused by muscular necrosis from the vascular pedicle injury (RPIA) and from injury to the nerve branch of the anconeus muscle with muscle atrophy. Loss of anconeus muscle does not represent a functional problem for the elbow because it assists the triceps muscle in extension of the elbow.[6,14] In our experience, the above-mentioned complication has occurred only once, and the functional recovery was sufficient for the patient to return to work.

Postoperative infections or residual epicondylitis have not occurred among our operated cases.

The loss of range of motion or reduction in complete elbow extension that has been cited by Necking and Almquist,[7] Almquist et al,[8] and Mackenney et al[11] are quite possible. In our experience, this never occurred.

Hypertrophic scarring can be cited as one of the minor complications that can occur in association with this surgery, although rare in its occurrence, many times it depends on the subject's predisposition.

Cutaneous dyschromia from previous steroid infiltrations is another minor complication that occurs with this type of surgical patients. Usually its improvement is seen over time.

Muscle bulging also can occur from the presence of the transferred anconeus muscle around the epicondyle,

TABLE 1. *Summary of patient characteristics*

	Chronic lateral epicondylitis		*Recurrences and complications*	
Parameters	*Preop (mean)*	*Postop (mean)*	*Preop (mean)*	*Postop (mean)*
Pain (VAS)	8	0	9	3
Elbow ROM (deg)	140	142	132	133
Grip strength (kg)	26	32	19	24
Return to work (days)		47		81

FIGURE 12. Clinical case (female, 45 years old, right dominant) with recurrence of chronic lateral epicondylitis at the right elbow. A, Incomplete elbow extension 2 months after operation. B, Elbow flexion is complete. C, Scar of the previous surgery and painful area of the lateral aspect of the elbow. D and E, X-ray images of the elbow. F, Ultrasonographic image of the epicondyle tendon showing lack of normal tissue density. Surgery corresponds to Figures 6 to 10. Clinical result 6 months after operation. G and H, Patient was completely pain-free with normal flexion–extension ROM of the elbow, and she returned to previous heavy work a month after surgery.

but this too diminishes with time. This minor complication is much more evident in male patients and has been found and confirmed by ultrasound and EMG.

On the contrary, there usually is a slight superficial muscle indentation at the site where the anconeus muscle has been harvested. This indentation permanently remains over time.

REHABILITATION

The elbow should be immobilized for only 15 days, and rehabilitation should be initiated immediately afterward to recuperate entire upper extremity function. Passive elbow and wrist mobilization is initiated immediately and performed for both flexion/extension and pronosupination

FIGURE 13. Clinical case (male, 60 years old, right dominant) with infection of the radiohumeral articulation following previous treatment of chronic lateral epicondylitis. As the infection became evident, patient was operated on to clean the joint infection. A, Scar incision with fistula. B, Exposition of the radiohumeral joint after removal of the degenerated and infected tissues. Anconeus muscle flap is distally harvested (C) and rotated to cover the joint (D). Radiologic (E and F) and clinical result (G) after a year; patient was pain-free, and his elbow had complete flexion–extension ROM (H and I).

movements during the daily medication changes. In cases in which there is a significant amount of edema, the patient is sent to a physical therapist to perform lymph-drainage massage to increase venous return. The elbow splint is removed after 15 days, and the patient is educated on performing flexion/extension and pronosupination exercises autonomously. Both elbow and wrist exercises can be performed either in or out of water. Progressive resistive grasping exercises are performed to increase forearm muscle strength and can be introduced into the rehabilitation program once range of motion exercises are performed without pain. The entire rehabilitation program should last about 20 days. Both return to work and sports activities are dependent on the type and physical intensity of the activity performed. In our experience, it is advisable that the patient who has undergone an anconeus muscle transfer for chronic lateral epicondylitis should wait 40 days from the time of

TABLE 2. *Complications*

1.	Elbow stiffness
2.	Residual epicondylitis
3.	Infection
4.	Muscle necrosis
5.	Muscle paralysis
6.	Cutaneous dyschromia
7.	Hypertrophic scar
8.	Bulging muscle

surgery to begin moderate to heavy labor or sports activities, and patients who have had residual problems that required second surgeries, fistulas, or infections wait at least 80 days before beginning resistive forearm muscle activities.

Additional or secondary surgical procedures for associated epicondylar pathologies can easily be performed without ulterior contraindications. In 3 cases the posterior interosseous nerve at Fröhse arch was decompressed, without minimally affecting the immobilization time, clinical improvement, or final surgical results. Other procedures that have been performed are carpal tunnel release in 2 cases and a palmar fasciectomy for Dupuytren syndrome.

CONCLUSIONS

Based on our obtained results, we feel that this surgical technique that can render enormous help in treating conditions where the radiohumeral articulation is exposed after removal of severely degenerated tendinous structures, residual epicondylitis is present because of osteoarticular pathologies that have not been treated, subcutaneous adhesions at a capsular-articular level, and cutaneous and subcutaneous tissue atrophy conditions are present because of repetitive cortisone infiltrations associated with chronic epicondylitis. Additional surgical time can be well managed and usually requires only an extra 15 minutes. Microvascular surgical experience is not required to perform this technique, but the surgeon should not underestimate that the muscle dissection requires an extreme amount of caution specifically in regard to the vascular pedicle.

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