Reconstruction of Chronic Boutonniere Deformity with Wide Awake Local Anesthesia and No Tourniquet in a Patient with Upper Type Brachial Plexus Injury: A Case Report

Emmanuel P. Estrella, MD, MSc[1,2] and Nathaniel S. Orillaza, Jr., MD[2]

[1]*ASTRO Study Group, Institute of Clinical Epidemiology, National Institutes of Health, University of the Philippines Manila*
[2]*Microsurgery Unit, Department of Orthopedics, Philippine General Hospital, University of the Philippines Manila*

ABSTRACT

Reconstruction of chronic boutonniere deformity remains to be a challenging procedure especially when combined with other debilitating injuries in the same extremity. The balance to properly tension the reconstruction with active motion is often prevented by the need to perform the procedure under sedation of block to tolerate the use of tourniquet. We present a case of a young patient who successfully underwent restoration of active proximal interphalangeal (PIP) extension with a Palmaris longus graft while wide awake under local anesthesia and no tourniquet (WALANT) before subsequently having nerve transfers for upper type brachial plexus injury.

Keywords: WALANT, boutonniere, finger reconstruction, concomitant brachial plexus injury

INTRODUCTION

Boutonniere deformity of the finger results from inadequacy of the central slip combined with often adaptive extension of the distal interphalangeal (DIP) joint. It is often a sequela of central slip injury and requires reconnecting the tendon to regain PIP extension and balancing of the extensor mechanism to reverse the deformity while restoring active motion. Tenotomy, tightening the central slip with dorsalization of the lateral bands combined with early mobilization is advisable for boutonniere without osteoarthritis.[1,2]

While Hand Surgery as a specialty does many procedures wide-awake under local anesthesia, a tourniquet is necessary for better visualization of the field. The main concern with its use in a wide-awake patient is the pain that starts right after inflation of the tourniquet, and becomes less and less tolerable minutes into the procedure. It is for this reason why reconstructions even of the fingers traditionally require a regional block or general anesthesia to facilitate unrushed meticulous dissection and repair of tissues. Some reconstructions, however, may also benefit from having a fully awake patient to better evaluate soft tissue balancing and strength of repair. This is more commonly preferred for procedures on tendons as poor tensioning may adversely affect outcome.[3]

The use of epinephrine mixed with the local anesthesia to control bleeding has been employed in the past but was generally avoided, especially for the finger, for fear of causing

Corresponding author: Emmanuel P. Estrella, MD, MSc
Institute of Clinical Epidemiology
National Institutes of Health
University of the Philippines Manila
623 Pedro Gil St., Ermita, Manila 1000, Philippines
Email: epestrella@up.edu.ph

ischemia. The increasing reports of safe use in simple to complex procedures in the upper extremity led to increased use in the last decade, challenging the indications to procedures that are usually performed under general anesthesia.

The objective of this paper was to present a case of a Boutonniere deformity reconstruction that required careful soft tissue balancing performed wide awake, under local anesthetic with no tourniquet (WALANT) for a patient with concomitant brachial plexus injury of the same extremity.

CASE PRESENTATION

The patient is a 26-year-old, male, left-handed employee who consulted 7 months after a motorbike accident sustaining a previously open joint injury of the middle finger with central slip avulsion (Figure 1), closed fracture of the femur and a traumatic Brachial Plexus injury, C5-6 complete, all on the right side. The patient had intramedullary nailing during his first admission 7 months prior and is already united on recent x-ray. On physical examination he had 0/5 shoulder abduction, external rotation and elbow flexion. Distal movements are intact with a grip of 70% compared to the other side. The disability using FIL-DASH was 75% on presentation with pain rated as 6 using the Visual Analogue Scale. He was subsequently advised to have surgical reconstruction of the injuries.

Figure 1. Pre-operative view of the deformity.

The planned surgical procedures were: central slip reconstruction using palmaris tendon graft under WALANT. Then conversion to general anesthesia for the brachial plexus reconstruction which included: brachial plexus exploration, neurolysis, nerve transfers for shoulder and elbow function. The procedures were planned on successive fashion, with the first part to be done awake to take advantage of active motion in the proper tensioning and assessment of the strength of the tendon reconstruction. To prepare a bloodless field without the need for a tourniquet, the patient was injected with a total of 30 cc of 1% Lidocaine with 1:100,000 epinephrine on the volar forearm along the palmaris longus. Five cc was administered on the dorsum of the proximal phalanx and three cc on the middle phalanx was injected. Three cc on each side of the middle finger were given as digital block. The injection of the local anesthetic was well tolerated by the patient.

A slight modification of the technique originally described by Hou et al.[1] using a tendon graft was utilized. A curvilinear longitudinal incision was made along the dorsum of the middle finger to expose the PIP joint and the extensor mechanism. There was a gap of 2 cm between the central slip proximally to its insertion and this was occupied by disorganized scar (Figure 2).

After removal of fibrous tissues, a 15 cm palmaris longus tendon graft was harvested percutaneously from the same side (Figure 3).

A tunnel was drilled connecting the medial and lateral cortices of the base of the middle phalanx (along the flare, approximately 0.5 cm from the joint line), slightly dorsal to the mid-lateral line at the level of the central slip attachment (Figure 4). The graft was inserted through the tunnel, crossed dorsally, and passed underneath the proximal

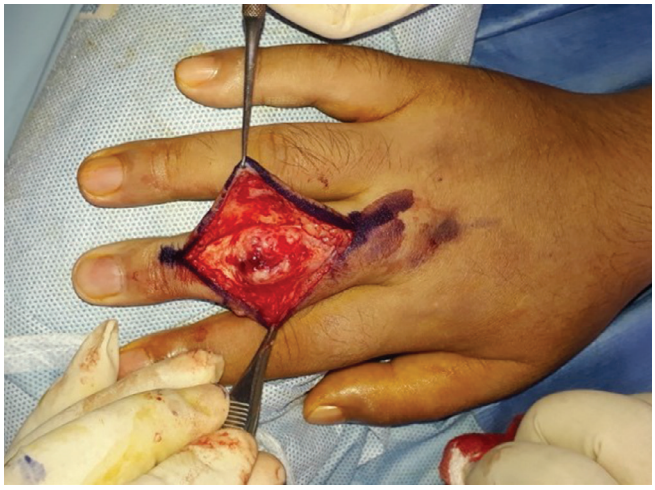

Figure 2. Intraoperative view of the central slip gap of 2 cm.

Figure 3. Percutaneous Palmaris longus graft harvest.

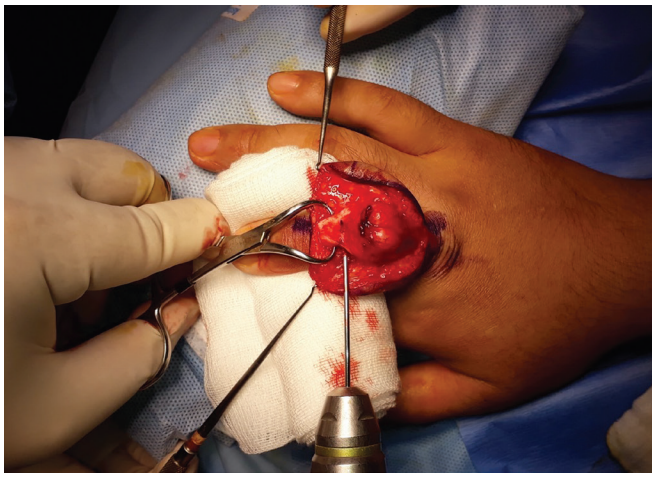

Figure 4. A bone tunnel was drilled at the base of the middle phalanx, 0.5 cm from the jointline where the Palmaris longus tendon was passed.

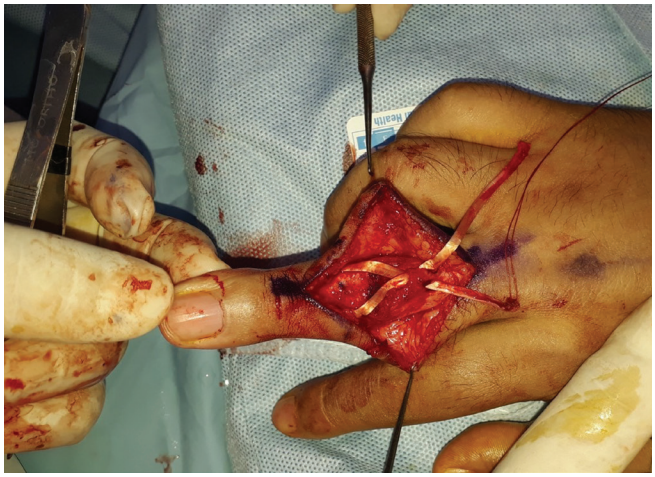

Figure 5. The Palmaris longus tendon was passed through the bone tunnel, crossed over the PIPJ (proximal interphalangeal joint) and passed underneath the proximal stump of the central slip to exit on the sides of the tendon.

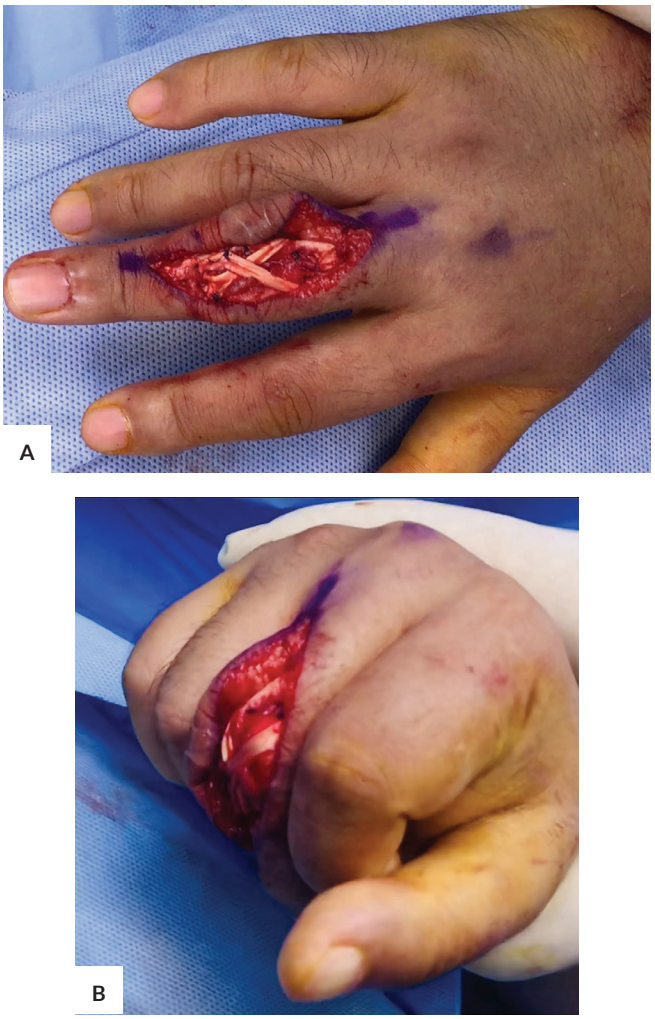

Figure 6. The finished reconstruction with the palmaris tendon graft after exiting the sides of the central slip, passed under the lateral bands, folded and sutured to itself. **(A)** with PIPJ in extension and **(B)** with the PIPJ in full flexion.

stump of the central slip, exiting on its borders (Figure 5), passed through the lateral bands, folded, and sutured to itself (Figures 6 and 7). Proper tensioning was decided by asking the patient to try to extend and flex the PIP joint and make a fist. Intraoperatively, the patient was able to reach full active extension and flexion of the PIP joint with full extension of the DIP and limited flexion which was accepted and maintained.

For the brachial plexus, the patient was shifted to general anesthesia and underwent a double nerve transfer for elbow flexion using partial ulnar nerve to the biceps branch of the musculocutaneous nerve and partial median nerve to the brachialis branch of the musculocutaneous nerve. This was combined with a double nerve transfer for shoulder abduction and external rotation with a cranial nerve XI transfer to the suprascapular nerve and partial radial nerve transfer (branch to the long head of the triceps) to the axillary nerve.

The patient was started on rehabilitation protocol after 5 weeks of splinting in extension of the DIPJ and PIPJ. Gradual passive-assistive PIPJ flexion-extension and independent DIPJ flexion-extension was done. Buddy taping was started on the 6th week post-op with night splinting of the PIPJ. During the first 2-3 weeks of physical therapy, the PIPJ was very stiff, but with gradual passive-assistive PIPJ and DIPJ flexion, full flexion of the PIPJ was achieved in 12-14 weeks post-op. There was however the occurrence of a mallet finger during the course of the therapy, which we believed was secondary to the partial rupture of the terminal tendon. Splinting was advised.

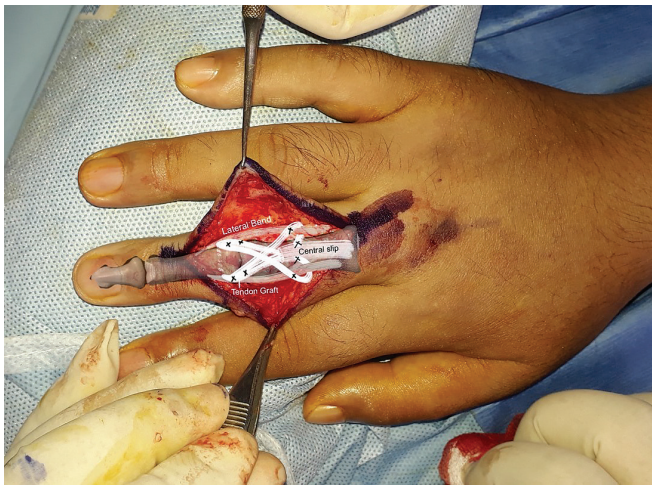

Figure 7. An illustration of the palmaris tendon central slip reconstruction of the PIPJ.

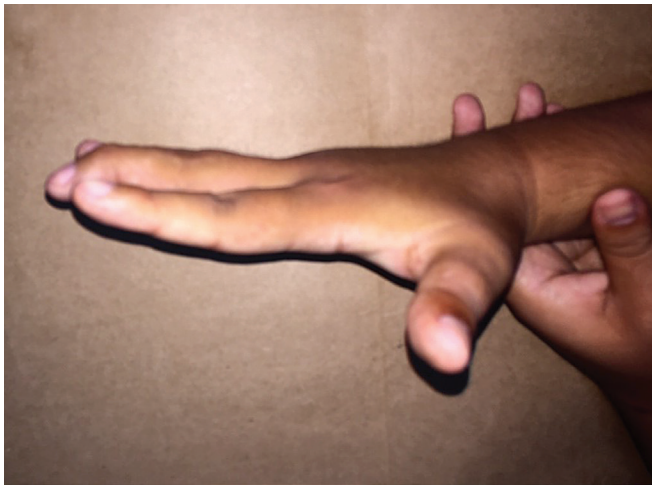

Figure 8. Post-operative outcome shows full PIPJ extension with extension lag on DIPJ.

Figure 9. Full flexion of the PIPJ post-op.

At two years after surgery, the patient presented with full flexion and extension of PIP joint with 30 degrees extension lag of the DIP joint (Figures 8 and 9).

For the proximal joints, he was able to reach 0- 145° elbow flexion, 90° supination and 4/5 elbow flexion and supination with 5/5 elbow extension. Active shoulder abduction was up to 90° and external rotation up to 100° both with 4/5 muscle strength. The patient is pain-free and reports a 35% disability using FIL-DASH. There was persistence of an extension lag of the DIPJ (30°), which was acceptable to the patient, and splinting was still advised for the DIPJ.

DISCUSSION

Many of the procedures described for Boutonniere deformity are presented in small series of cases, mostly requiring at least a regional anesthesia for effective performance of the procedure.[1,2,4,5] This may present potential uncertainties in the adequacy of tensioning and resilience of the suturing to allow early motion. Lee and colleagues recognized the potential advantages of doing boutonniere surgery under WALANT[5] and has suggested the use of this technique in future Boutonniere reconstructions. The present technique used a palmaris tendon graft crossed over the dorsum similar to that reported by Hou et al.[1] However, in this case, the graft was sutured over to itself to reinforce the construct, which theoretically thickens the graft. Hou et al.[1] and Duzgun et al.[4] demonstrated the advantage of enabling the patient to demonstrate the effectiveness of the reconstruction with active motion prior to skin closure. In the case series of seven patients by Duzgun et al.,[4] they used an axillary block with tourniquet control during their reconstructions. Hou et al. were able to test their reconstruction by asking the patients to flex and extend their fingers, presumably under local anesthesia. However, their type of anesthesia was not mentioned.

The occurrence of the mallet finger after the reconstruction during the rehabilitation period was probably from the attenuation of the terminal tendon during physical therapy. The DIPJ was tight preoperatively and intraoperatively and remained tight during first few weeks postoperatively. The passage of the tendon graft underneath the lateral bands was probably too tight, and further adjustments to loosen the graft may have prevented the DIPJ tightness.

In a combined proximal and distal injury of the upper extremity, the impact of a single finger deformity may be amplified. The need to correct and restore active motion may also provide significant contribution to the patient's function. While the marked decrease in disability, could not be attributed solely to the finger improvement, it is likely that the near normal motion aids in the performance of many tasks of daily living. This is especially true in cases of brachial plexus injuries.

CONCLUSION

In a setting of a multiple reconstruction, especially those requiring long operative times, performing some stages under local anesthesia may decrease the anesthetic requirement and cost. This also allowed the surgeons to immediately evaluate the stability of the reconstructive procedure intra-operatively and make the necessary adjustments as needed. This may in turn facilitate early rehabilitation and early return to function.

Statement of Authorship

Both authors contributed in the conceptualization of work, acquisition of data, drafting and revising, and final approval of the version to be published.

Author Disclosure

Both authors declared no conflicts of interest.

Funding Source

None.

REFERENCES

1. Hou Z, Zhao L, Yu S, Xiao B, Zhou J. Successful surgical repair of central slip rupture in finger extensor tendon. In Vivo. 2014 Jul-Aug;28(4):599-603.
2. Dubois E, Teboul F, Bihel T, Goubier JN. Chronic boutonniere deformities, supple, or stiff: a new surgical technique with early mobilization in 11 cases. Tech Hand Up Extrem Surg. 2017 Jun;21(2):37-40. doi: 10.1097/BTH.0000000000000152.
3. Gao LL, Chang J. Wide Awake Secondary Tendon Reconstruction. Hand Clin. 2019 Feb;35(1):35-41. doi: 10.1016/j.hcl.2018.08.004.
4. Duzgun S, Duran A, Keskin E, Yigit AK, Buyukdogan H. Chronic boutonniere deformity: cross-lateral band technique using palmaris longus autograft. J Hand Surg Am. 2017 Aug;42(8):661.e1-661.e5. doi: 10.1016/j.jhsa.2017.04.010.
5. Lee JK, Lee S, Kim M, Jo S, Cho JW, Han SH. Anatomic Repair of the Central Slip with Anchor Suture Augmentation for Treatment of Established Boutonniere Deformity. Clin Orthop Surg. 2021 Jun;13(2):243-51. doi:10.4055/cios20170