Wide awake surgery for flexor tendon primary repair: A literature review

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Abstract

Flexor tendon injuries are extremely challenging conditions to manage for hand surgeons. Over the last few years enormous progress has been made for the treatment of these lesions with new surgical approaches being performed. One of these is the wide-awake local anesthesia no tourniquet (WALANT) technique, also known as Wide Awake Technique that allows tendon repair under local anesthesia, enabling the tendon to move actively during surgery. Dynamic movement of the tendon during surgery is crucial for the orthopedic surgeon in order to understand if the tendon has been correctly repaired before leaving the operatory table. An electronic literature research was carried out on Pubmed, Google Scholars and Cochrane Library using ((Flexor tendon injury) OR (flexor tendon) OR (injury muscle tendon) OR (flexor pollicis longus tendon) AND ((wide awake repair) OR (wide awake) OR (wide awake hand surgery))as search terms. Authors believe that WALANT is an enormous add-on in the management of patients with flexor tendon injuries mainly because it allows direct visualization of the repair during flexion and extension movement of the fingers and also because it avoids general anesthesia or brachial plexus being more cost effective. The aim of these review was therefore to sum up the evidences available so far on the wade awake technique as an emerging treatment for patients with flexor tendon injuries.

Introduction

Managing flexor tendon ruptures is one of the most challenging task of hand surgeons. Although true progress has been made in the lost decades, primary repair of flexor tendon hand injurys remaning even so one of the most difficult orthopedic condition to treat.[1,2]

Flexor tendons of the hand are activated by flexor pollicis longus for the flexor of the first digit, and by flexor digitorum superficialis (FDS) and flexor digitorum profundus (FDP) for the other digits. In those fingers, flexor tendons are surrounded by five annular pulleys, thicker to keep the tendons close to the bone, and three cruciate pulleys, more flexible in order to allow digital flexion. The thumb presents two annular pulleys and one cruciate pulley that is important to prevent bowstringing of flexor pollicis longus.[3] The hand has been divided by Verdan in five zones in order to diversify treatment depending on the location of the rupture:[4]

- Zone I: from the FDS insertion to the FDP tendon
- Zone II: from the proximal aspect of the A1 pulley to the FDS insertion
- Zone III: from the distal transverse aspect of the carpal ligament to the A1 pulley
- Zone IV: the carpal tunnel
- Zone V: from the proximal border of the transverse carpal ligament to the musculotendinous junction in the proximal forearm.

Zone I injuries mostly include lacerations or avulsions. Depending on the type of lesion,[5] either suture anchors and pull-out button technique can be used with no significant difference between them.[6] Complications encountered in this zone[2] are site gapping, uncomplete distal joint flexion, distal interphalangeal flexion contractures and decreased tendon glide.

Zone II injuries, firstly described by Bunnell,[7] is considered "no man's land" for the high rate of complications such as tendon rupture, due to poor vascular supply,[8] and adhesion formation because of the tight tunnel in which two tendons must pass.

Injuries in zone III[9] usually have, when not linked to a neurovascular trauma, a good prognosis because of the absence of a sheath.

In zone IV most of tendons lesions are combined to median or ulnar nerve injury, and pure tendon injuries are rare because of the protection of the flexor retinaculum. Direct tendon repair is gold standard management.

Flexor tendons lesions in zone V usually involve nerve or vascular trauma. The most important factor of reparation will be strength of the suture.

Main goals in flexor tendon repair,[10] obtained with the combination of surgery and well-led rehabilitation[11] are optimization of functional outcomes,[12] differential tendon gliding, minimization of adhesions, and most importantly prevention of tendon gapping and tendon rupture.

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Different factors have been taken in consideration regarding the strength of the repairing bowstringing,[13] and the execution of a digital extension-flexion test during surgery.[14] Up to a decade ago this surgery was performed under general anesthesia, brachial plexus block or local anesthesia with sedation, and the flexion-extension test was performed passively by the surgeon. With the advent, in 2009, of wide-awake local anesthesia no tourniquet (WALANT) in tendon repair surgery,[15] the test is directly performed by the patient that can actively move the tendon during surgery, before skin suture.

WALANT allows to perform a vast number of hand surgeries without sedation nor tourniquet, injecting locally tumescent ("injection of large enough volumes of dilute local anesthetic solution containing epinephrine so that all tissues to be dissected are slightly firm to the touch"[15]) lidocaine and epinephrine respectively used for anesthesia and hemostasis. Different studies[16,17] have proved it use safe in the fingers.

Authors strongly believe that WALANT applied to flexor tendon surgery, with the possibility to perform extension-flexion test

actively during surgery, improved results of flexor tendon repair especially regarding tendon gapping and tendon rupture; the aim of this literature review is to verify this improvement.

Materials and Methods

An internet-based literature research was performed on Pubmed, Google Scholars and Cochrane Library search engine. To find relevant studies, the following search-terms were used: ((Flexor tendon injury) OR (flexor tendon) OR (injury muscle tendon) OR (flexor pollicis longus tendon) AND ((wide awake repair) OR (wide awake) OR (wide awake hand surgey))

Searches were updated to March 2020.

Rewies, editorials, letters to the editor, cadaveric studies as well as publications in other than the English language were excluded.

The reference lists of all manuscripts were screened for identify further suitable articles.

The following criteria of eligibility were used:

1. The treatment for the sustained injuries should include an operative intervention.
2. The outcome variables examined should concern post surgery data.
3. The surgery performed should be clearly described.

At the end of the screening of abstracts and full-text papers 28, 14 manuscripts were included in our review, since they met our inclusion criteria.

Results

In 2010, Higgins *et al*.[18] published first results on use of WALANT for flexor tendon repair. Of 102 consecutive patients operated with this technique, they had a follow-up on 68 patients for a total of 122 tendons. They reported a 3.3% flexor tendon rupture rate at 3 months follow up, but in all the inauspicious cases there was an identifiable violent jerk movement responsible of the rupture. Those encouraging results can be attributed to the possibility to perform intraoperative total active movement examination during WALANT, as it was demonstrated in this same series of 102 patients undergone WALANT flexor tendon repair, in which the intraoperative testing revealed that 7 patients developed gapping of the suture which was detected and repaired intraoperatively and did not rupture postoperatively.

Woo *et al*.[19] performed 36 flexor tendon primary repair in 2016 and 75 in 2017, representing respectively 13.4% and 23.5% of all flexor tendon primary repair they performed in those two years. They believe that WALANT increased surgeon confidence as it allowed to observe and repair gapping of the sutured tendons with an active range of motion test. They also truly believe that it reduces tendon rupture rates although they have not proved it with evidence-based data.

In China, Tang *et al*.[5] approached more than 12.000 hand surgery cases in 8 years using WALANT technique with very satisfying results. Of these, 92 cases were emergency primary flexor tendon repair and 77 patients were electives; no complication was described.

Within this wide cohort, WALANT surgery was found very useful in emergency procedures. Moreover, in cases of open trauma (multiple or large wounds)

Tang and colleagues revised the Wide-Awake technique applying a temporary tourniquet for 5 minutes to decrease both bleeding and epinephrine wash out.[19]

Discussion

Even if the WALANT surgery for flexor tendons is becoming very popular all over the world, there is still lack of randomized trials able to quantify advantages, in terms of intraoperative and post-operative complications, of the new technique compared to traditional general anesthesia, sedation or regional anesthesia (brachial plexus).

Once the repair is concluded, WALANT permits to visualize the full fist flexion and full finger extension intraoperatively, allowing not only to revise the suture in case of gapping, but also to work on the pulleys in case the repair does not easily glide through, reducing the need for tenolysis after flexor tendon repair.[21] This means that the surgeon knows that the repair will work before closing the skin. Most of the surgeons, advise early active motion from 3 to 5 days after the procedure, but avoiding full range of active flexion until 2-3 weeks after surgery. 4 Full range of motion should start at week 4. When the patient starts to move (not use) the operated finger, he or she should be off all pain killers. [21-22]

The use of WALANT in primary repair of flexor tendon injuries, a allows direct visualization of the repair during the operation itself and avoid anesthesiological procedures more cost effective.

Conclusions

We found consensus in the literature about the numerous advantages of WALANT compared to other techniques:[23] reduced costs, no tourniquet needed, no need to sedate the patient and no anesthesiologist involved, intraoperative education of the patient about postoperative therapy, direct visualization of the repair during flexion and extension movement of the fingers.

Despite of these technical advantages we have to conclude that actually there are no evidence, in the literature about effective positive outcome on the results of surgical repair of flexor tendon injuries between Walant anesthesia and traditional anesthesiological technique.

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