

# Releasing the Tourniquet in Carpal Tunnel Surgery

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**Abstract** The purpose of this study was to determine if letting down the tourniquet prior to closure after carpal tunnel release decreases the amount of post-operative ecchymosis and subsequent post-operative pain. We prospectively studied 18 consecutive patients who were undergoing bilateral open carpal tunnel releases. The side done first was randomized and the tourniquet was released to obtain hemostasis prior to closure on this side only. The second side was completed, closed, and dressed prior to letting the tourniquet down. The patients' pre-operative and post-operative pain scores were recorded, as was an ecchymosis score at the 10-day follow-up visit. The results showed no significant difference between the two groups in either pain or ecchymosis. We conclude that the added surgical time required for letting the tourniquet down and obtaining hemostasis prior to closure in a carpal tunnel is unnecessary.

**Keywords** Carpal tunnel · Post-operative pain · Ecchymosis · Tourniquet

## Introduction

Despite the fact that carpal tunnel release is probably the most common procedure performed by hand surgeons today, there remains no consensus on exactly how to manage the tourniquet. A survey of ASSH members by Duncan in 1987 [2] revealed that 51% let the tourniquet

down before closure and 49% left it up until the dressing was applied. The reason quoted for favoring tourniquet release was to obtain better hemostasis. Others argue that a pressure dressing placed before tourniquet release does a better job of stopping small bleeding vessels. The purpose of our study was to investigate, in a randomized prospective manner, which method provided better hemostasis, and if post-operative pain correlated to that hemostasis.

## Materials and Methods

We prospectively studied 18 consecutive patients undergoing bilateral simultaneous open carpal tunnel release (36 hands). There were ten women and eight men with an average age of 47 years, (range 23–72). Each patient served as their own control, as one side was done with the tourniquet left up until the final dressing was applied, while on the other side the tourniquet was released to obtain hemostasis prior to closure, followed by application of the exact same dressing. The patient's medical record number was used in the randomization process to determine whether the left or right side was operated on first (six right, 12 left). The first side was always done with the tourniquet released and the wound packed and wrapped prior to closure, while the other side was completed through application of the dressing while the tourniquet was still up. During skin closure of the second hand, the attending surgeon returned to the first side where the dressing and packing were removed, the wound irrigated, and hemostasis obtained as much as possible using a bipolar cautery. The wound was then closed and the same dressing applied. Forearm tourniquets were used in every case, as was either intravenous regional anesthesia with Lidocaine, or sedation and local anesthesia using Marcaine and Lidocaine, both

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without epinephrine. The surgical procedure was identical from one side to the other and included approximately a 2.5–3 cm incision in line with the fourth ray that did not cross the wrist crease. The palmar fascia was incised in line with the skin incision, as was the transverse carpal ligament, with no attempts to explore the canal, look for the recurrent motor branch, or reconstruct the transverse carpal ligament. Simple skin closure was done in all cases with non-absorbable 4-0 or 5-0 nylon. The dressings were identical and included Xeroform, 4×4's, kling, a small 3×6 in. fiberglass splint and a 3 in. ace bandage.

Finger range of motion was encouraged during the entire post-operative time. After 4 days, the dressings could be removed. At that point, the wounds were allowed to get wet and the patients were encouraged to gently flex and extend their wrists. Simple wrist support splints, used pre-operatively in every case, were then placed and utilized at the patients' discretion.

Data collected included the dominant side, pre-operative pain/discomfort using a visual analog scale (VAS), and post-operative pain/discomfort VAS at 7–10 days (first post-operative visit for suture removal). In an effort to measure hemostasis (using the presence of ecchymosis in the palm and forearm), we graded each hand as a "0" (none), "1" (trace), "2" (mild), or "3" (moderate) at the time of suture removal. This observation was done by the surgeons, both of whom were blinded as to which technique had been performed on which side as the incisions were identical. Although this rating scale was subjective and could not be exactly controlled from patient to patient, it was primarily used to compare right to left hands of the same patient at the same time. Diagrams of the ecchymosis were also sketched and the relative ratings were verified by both authors looking at all 36 sketches at one time.

Statistical correlations were then done using Chi-squared test to determine if there was a relationship between post-operative discomfort, ecchymosis, and the method of tourniquet use.

## Results

All patients were fully satisfied with their surgery as they had complete relief of their numbness by the first post-operative visit. There were no wound problems, hematomas, or other post-operative complications. Simultaneous bilateral surgery proved not to be a hardship for the majority of the patients [6]. In the hands in which the tourniquet was deflated and hemostasis obtained prior to closure, the average VAS pain/discomfort scores decreased from 6.34 pre-operatively to 1.96 post-operatively. These hands had an average ecchymosis score of 1.11. In the

patients where the tourniquet was left up (until after closure), the average VAS pain/discomfort scores decreased from 6.68 pre-operatively to 2.02 post-operatively, and the average ecchymosis score was 1.39. The average ecchymosis score therefore was slightly higher for the hands in which the tourniquet was left up until after closure, but there were no statistically significant differences in either ecchymosis or post-operative pain between the two groups ( $p=0.46, 0.69$ ).

The surgeons' qualitative observations at the time of the surgery included that the side with the tourniquet let down always had some bleeding, usually in the subcutaneous layer just beneath the skin's surface. This was after packing for approximately 10 min while the second side transverse carpal ligament was released. Bipolar coagulation was utilized to stop any bleeding, but it was felt difficult to completely obtain hemostasis despite the fact that the hyperemia and shunting common after tourniquet release should have been over at this time. Invariably, while the skin was being sutured, bleeding would be occurring from within the wound despite the cauterization attempt. Tourniquet times for the first side, in which the tourniquet was released, averaged 10 min, whereas the second side tourniquet time averaged 18 min.

## Discussion

Carpal tunnel release usually results in excellent pain/discomfort relief and patient satisfaction whether it is done on one side or bilaterally [5, 6]. Post-operative pain and secondary inability to use the hand for normal use are the main variables that surgeons try to modify to return the patient to work and play as soon as possible. Different suturing techniques and incisions, endoscopic versus open techniques, the use of drains, post-operative steroids, bulky dressings and splints, reconstruction of the transverse carpal ligament, variable anesthetics, and post-operative hand therapy are all ways surgeons have attempted to modify this post-operative pain [1–4]. A huge amount of literature regarding the pros and cons of endoscopic carpal tunnel release alone has been written over the last 15 years with post-operative pain and function being the focus.

Whereas it is likely that increased post-operative bleeding is to be avoided due to its ability to cause pain and wound problems, there is no data that says the method of tourniquet utilization affects that bleeding. Some feel that letting the tourniquet down to coagulate bleeders in the skin and subcutaneous area logically decreases subsequent bleeding, while others believe a good pressure dressing, placed prior to tourniquet deflation, is more effective. There is little doubt that letting the tourniquet down, even though it may have been up for only 10 min, causes a temporary

shunting of blood and a secondary decreased ability to coagulate bleeders until some time has elapsed [7]. Therefore, this method does come at a “cost” of increased surgical time. Our study utilized patients undergoing bilateral simultaneous carpal tunnel release in order to have controls that would eliminate variables such as hand size, skin thickness, age, pain tolerance, vessel friability, and other co-morbidities, all of which could affect post-operative bleeding, pain, and its detection. Because the dominant hand is usually the most painful pre-operatively, we randomized the side treated first to eliminate this possible bias. When the patients came back for stitch removal, our observations on pain and ecchymosis were essentially blinded to the tourniquet technique, as both sides’ wounds were identical. We acknowledge that measuring pain and ecchymosis only one time post-operatively certainly has its disadvantages for a study like this, but it was also important to have measurements for all patients at the same point in time relative to the surgery. We felt, and the patients confirmed, that the relative pain and ecchymosis we were seeing at the 7–10-day visit was similar to that experienced by the patient at home the entire week before.

An appropriate further criticism of our paper is the fact that 10 min on average elapsed between the time of letting the tourniquet down and closure on the one side, during which the wound was packed and wrapped. Whereas 1 min would be more clinically relevant, we chose to minimize our overall surgical time by closing both sides simultaneously and felt the added packing time would only potentially benefit our patients. This method also maximized our ability to obtain good hemostasis prior to closure

creating a theoretically greater difference between the two methods.

In conclusion there was no significant evidence to demonstrate a difference between methods, but we cannot deny the possibility of Type II error. However, we do feel there are no obvious advantages of letting the tourniquet down in terms of pain or hemostasis. Our practice therefore is to leave the tourniquet up to decrease overall operative time.

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