The Usefulness of Performing Extensive Debridement to Prevent Infections in Open Flexor Tendon Injuries of the Hand

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ABSTRACT

Background. Infection after flexor tendon repair in the hand is uncommon but may cause debilitating problems if not prevented. In centers where delayed presentation after injury happens often, early bacterial colonization is assumed and an initial debridement is indicated ensuring a clean environment for subsequent repair. Preference for the type of initial debridement differ from surgeon to surgeon.

Objective. This paper aims to compare limited and extensive initial debridement in preventing post-operative infection in patients treated more than 24 hours after open tendon injury.

Methods. A retrospective review of records for demographics, the type of debridement and occurrence of infection was performed. Statistical comparison of proportions of post-operative infection was done.

Results. Of thirty-one records included, twenty-four patients underwent extensive debridement while 7 had limited. Two patients from each group developed infections resulting to 8.3 % infection in the extensive group and 28.6 % in the limited group. The difference is not statistically significant.

Conclusion. The trend for a higher infection rate in the limited group supports the need for aggressive debridement in managing delayed presenting patients with open tendon injuries. While the non-significant difference potentially supports the less cumbersome option, a better powered study is recommended to confirm.

Key Words: tendon transection, debridement, infection

Introduction

Flexor tendon transection from deep lacerations remain to be one of the more common injuries seen in the emergency room.[1] Early repair is preferred to facilitate healing and early return to function.[1,2] The open nature of the injury, however, presents a concern for developing infection especially in situations where there is extensive tissue damage and gross contamination. In these situations, delayed repair remains acceptable.[2] This is an occasional reason for surgeons to recommend initial debridement before performing the repair and closing the wound.

Infection, as a complication of the injury, is relatively uncommon but may cause debilitating problems if not prevented.[3] The prevention of post-operative infection in open flexor tendon injuries is multifactorial. Early initiation of antibiotics and prompt removal of contamination by early surgery are some of the modifiable factors emphasized in previous studies.[1] Timing is particularly concerning as patients usually procrastinate consulting for the often seemingly innocuous injuries.

A delay of as little as 4 hours has previously been considered reason enough not to proceed with repair and to just perform careful cleansing of the wound, debridement, and closure of the subcutaneous tissues and skin.[4] A "golden period" after which primary repair of open wounds should not be attempted was set at 4-6 hours by several early studies.[5,6,7]

Other authors argued that the likelihood for infection in open injuries of the hand are much less and can tolerate longer delays. More recent studies presented results showing that a delay of up to 18 hours does not necessarily increase the risk of post-operative infection.[8,9] Early initiation of treatment does not necessarily mean a formal debridement in the operating room. Antibiotic prophylaxis, while with limited evidence, is generally recommended for open wounds in the upper extremity.[10] The evidence is stronger in support of prophylaxis for grossly contaminated wounds.[11] Schneider et al treated open flexor tendon injuries, after cleansing, by skin edge excision and closure on the day of the injury.[12] Tendons were repaired 1-3 days post-injury. No post-operative infections were found in their study. Stone and Davidson treated all wounds initially with irrigation and rinsing with a sterile saline solution only. The wound edges were reapproximated with simple sutures or covered with a sterile gauze dressing then immobilized with a splint. Their results showed no significant differences in the post-operative infection rates between those who underwent early and late repair of open flexor tendon injuries.[8]

Despite the assumed resilience of the hand to infection, significant delay in initiating medical and surgical management remains to be an important concern in settings

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where patients do not reach the hospital promptly. There are limited recent publications on issues concerning infection prevention since patients in most settings publishing their results are able to follow early administration of antibiotics and at least wound irrigation.

Proper debridement of contamination and necrotic tissues remain to be a mainstay of treatment and should still be performed as early as possible. If the patient is brought to the operating room more than a day after injury, it is common practice in local institutions to just debride and go back for a second look. The definitive repair of tendon injuries requires an infection-free wound, and so if there is a threat of infection, a preliminary stage of debridement(s) is required until the wound is "clean enough" to perform definitive repair.

On that first surgery, there is still a lack of consensus on what needs to be done. Proponents of limited debridement prefer not to cause more damage to the soft tissues and rely on copious irrigation to wash away the contaminants. Surgeons who promote extensive debridement emphasize the importance of cleaning areas that came in contact with the offending object. This includes tendon edges which often requires enlarging the wound and dissecting surrounding synovium. Commonly associated neurovascular injuries further complicate the problem.

There is currently not one protocol on the treatment and management of open flexor tendon injuries of the hand. In the authors' institution's treatment protocol, open flexor tendon injuries which are treated 24 hours after injury should undergo debridement first before definitive tendon repair. Only when the risk of infection is minimal after a single or multiple debridement can tenorrhaphy and concomitant repair/reconstruction of adjacent tissues like nerves, be done. There is no controversy in following the current protocol except for the type of debridement recommended for patients who had their first surgery more than 24 hours post-injury. At present, this decision is based on the personal preferences of individual orthopaedic hand surgeons. Whether an extensive debridement with wound exploration is superior in preventing infection, versus a simpler but generous washing or limited debridement procedure, has yet to be proven, and is the source of repeated discussion.

Objective

This paper aims to compare the proportions of post-operative infection in extensive and limited wound debridement of open flexor tendon injuries of the hand who underwent initial treatment 24 hours post-injury.

Methods

The following patients were considered for inclusion:

1. Patients who are diagnosed with open flexor tendon injuries of the hand (Flexor zones I to IV) treated at UP-PGH by the Hand Section of the Department of Orthopedics
2. Initial debridement done more than 24 hours post-injury, necessitating an initial debridement
3. Minimum follow-up of at least 4 weeks (or until with signs of infection)

Patients presenting with the following were excluded:

1. Presenting with other concomitant injuries (amputations, fractures, crush and bite injuries) or with infection anywhere in the body.
2. With known systemic co-morbidities (such as hypertension and diabetes).

The authors reviewed the medical records of patients from November 2010 - October 2015 with open flexor tendon injuries that underwent initial debridement more than 24 hours post-injury. Patient and treatment details collected include age, gender, injury environment, mechanism of injury, instrument causing the injury, location of injury on the hand, number of tendons injured, associated nerve and vessel injuries, antibiotic/s given, and debridement technique. Written operative techniques and intra-operative photos were the bases for classifying patients to the type of initial debridement done. Irrigation with or without wound size extension, without dissecting the neurovascular structures and tendons were considered limited. Dissection and debridement of tendon edges and neurovascular structures were classified under extensive debridement. Infection as the main outcome of interest was diagnosed based on a simple clinical description adapted from Platt which defined wound infection as the presence of any of the following: wound redness, tenderness and edema, wound dehiscence and the presence of pus.[11] Records were reviewed for follow-up up to 30 days after the final surgery.

Results

From a total of 119 patients in the census treated beyond 24 hours, 34 records were available for retrieval. From the charts retrieved, there were 3 charts that had missing or incomplete outcome data.

Of the 31 patients, 24 underwent extensive debridement, while 7 were initially treated with limited debridement. The demographic and clinical characteristics of the patients are summarized in Table 1.

Mean ages of patients for both groups were both at 30 years. There were more males than females for both groups (79.1 % and 85.7% for extensive and limited groups, respectively). The most common mechanisms of injury were lacerations for the extensive debridement group (45.8%), and stab wound for the limited debridement group (57.1%). Majority of the patients for both groups also had multiple tendon involvement (75% and 71.4%) and associated nerve and vessel injuries (87.5% and 100%).

All the patient and clinical characteristics studied, namely age (p=-0.69), gender (p=1), mechanism of injury

(p=0.3887), number of tendons involved (p=1), and associated nerve/vessel injury (p=1), showed no statistically significant difference for the two groups of patients given a 0.05 level of significance, indicating that the two study groups are similar.

Four out of the 31 patients (12.9%) had post-operative infection. A summary according to the type of wound debridement and presence or absence of post-operative infection is presented in Table 2.

There was a higher percentage of infection among the limited debridement group (28.6%) as compared to 8.3% for the extensive debridement group. Fisher's exact test revealed that there is no significant difference in the incidence of infection between the group that underwent extensive debridement compared to the group that underwent limited debridement (two-tailed p value =0.2120, > 0.05).

Using the relative risk, the incidence of infection for patients who underwent extensive debridement, compared to those who underwent limited debridement is 0.2917. The 95% confidence interval is 0.0497 to 1.7123, indicating that the value is not clinically significant because the range includes the value of 1.

Table 1. Distribution of subjects according to demographic and clinical characteristics

	Extensive debridement (n = 24)	Limited debridement (n = 7)	p-value
Age (years)			
Mean	30.17	30.86 years	
Standard Deviation	14.11	12.44	p^1 =- 0.69
Range	69 (6 to 75)	37 (19 to 56)	
Gender			
Male	19	6	p^3 = 1
Female	5	1	
Mechanism of Injury			
Fall	1	0	
Laceration	11	1	
Self-inflicted	2	1	p^2 = 0.3887
Stab	1	4	
Hacking	6	1	
Crushing	3	0	
Number of tendons involved			
Single	6	2	p^3= 1
Multiple	18	5	
Associated Nerve / Vessel injury			
Yes	21	7	p^3 = 1
No	3	0	

Legend: [1] t- test for means, [2] t -test for proportions, [3] Fisher's Exact test

Table 2. Distribution of patients according to type of wound debridement and incidence of post-operative infection

	With post-operative infection	Without post-operative infection	Total
Extensive debridement	2 (8.3%)	22 (91.7%)	24
Limited debridement	2 (28.6%)	5 (71.4%)	7
Total	4	27	31

Discussion

The results of this preliminary study presented with an overall infection rate of 12.9%. This infection rate is slightly higher compared to 1-10% previously reported for wound lacerations managed in the acute setting.[11,13,14,15] Several reasons could explain the discrepancy. The first reason is that the basis for diagnosing infection differ from paper to paper. Robert and Teddy defined infection as a clear collection of pus compared to more stringent criteria adapted for this study.[13] Another important possible explanation is that this subgroup of patients are already presenting with delay in medical and surgical treatment. More severe injuries have presented infection rates as high as 20%.[16] None of the previous studies specifically looked into the same subgroup. Poor chart retrieval also accounts for possible overestimating the actual infection rate.

The trend for a higher incidence of infections in the limited debridement group points to the need for more aggressive approach in doing the initial debridement in patients presenting delayed with open tendon injuries. This may be due to colonization already starting under the often small wounds because of contamination, extent of injury and delay in giving prophylactic antibiotics. Inadequate exposure may also limit removal of possibly contaminated tissues.

Statistically, however, the difference did not reach significance. The limited number of retrieved data may not accurately reflect the real incidence. A better powered study will help validate or reverse this finding. If it would be confirmed in better proportioned studies that the infection rates are the same, this will potentially support not needing a formal debridement of these injuries before repair. Irrigation under minimal anesthesia might be adequate to prevent occurrence of significant infection.

The authors recommend a randomized controlled trial to better compare the outcomes between similar groups with the least bias. Furthermore, other patient and treatment variables may also be analyzed to account for other factors that may be leading to infection.

References

1. Griffin M, Hindocha S, Jordan D, Saleh M, Khan W. An overview of the management of flexor tendon injuries. Open Orthop J. 2012; 6:28–35.
2. Tang JB. Tendon injuries across the world: treatment. Injury. 2006; 37(11):1036-42.
3. Lilly SI, Messer TM. Complications after treatment of flexor tendon injuries. J Am Acad Orthop Surg. 2006; 14(7):387-96.
4. Miller H. Acute open flexor tendon injuries of the hand. Clin Orthop. 1959; 13:135-54.
5. Robson MC, Duke WF, Krizek TJ. Rapid bacterial screening in the treatment of civilian wounds. J Surg Res. 1973; 14(5):426-30.
6. Mason ML. Primary and secondary tendon suture. Surg Gynecol Obstet. 1940; 70:392-402.
7. Koch SL. Division of the flexor tendons within the digital sheath. Surg Gynecol Obstet. 1944; 78:9-22.
8. Stone JF, Davidson JSD. The role of antibiotics and timing of repair in flexor tendon injuries of the hand. Ann Plast Surg. 1998; 40:7-13.

9. Nylen S, Carlsson B. Time factor, infection frequency and quantitative microbiology in hand injuries. Scand J Plast Reconstr Surg. 1980; 14:185-9.
10. Cassell OC, Ion L. Are antibiotics necessary in the surgical management of upper limb lacerations? Br J Plast Surg. 1997; 50(7):523-9.
11. Platt AJ, Page RE. Post-operative infection following hand surgery. Guidelines for antibiotic use. J Hand Surg Br. 1995; 20(5):685-90.
12. Schneider LH, Hunter JM, Norris TR, Nadeau PO. Delayed flexor tendon repair in no man's land. J Hand Surg Am. 1977; 2(6):452-5.
13. Roberts AH Teddy PJ. A prospective trial of prophylactic antibiotics in hand lacerations. Br J Surg. 1977; 64(6):394-6.
14. Morgan WJ, Hutchinson D, Johnson HM. The delayed treatment of wounds of the hand and forearm under antibiotic cover. Br J Surg. 1980; 67(2):140-1.
15. Grossman JA, Adams JP, Kunec J. Prophylactic antibiotics in simple hand lacerations. JAMA. 1981; 245(10):1055-6.
16. Hudson DA, de Jager LT. The spaghetti wrist. J Hand Surg Br. 1993; 18(2):171-3.

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