The Role of Debridement Type on Infection Rates in Open Flexor Tendon Injuries of the Hand: A Retrospective Cohort Study

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Tendon Injuries of the Hand

- 2nd most common injury of the hand (29%)
- Next to fractures (42%)
- Majority require surgery and involve open flexor tendons

Management of Open Flexor Tendon Injuries

- No single approach currently being followed
- Different treatment approaches based on:
  - Surgeon experience
  - Medical evidence
  - Limited funds and resources

- UP-PGH Setting: Most cases arrive >24 hours post injury
Surgery Time

Contaminated

<24h post injury

>24h post injury

Debridement Only

Tendon Repair

Infection

Yes

No

Yes

No

Treatment of Open Flexor Tendon Injuries in Government hospitals in Metro Manila
Definition of Terms

- **Extensive Wound Debridement** – complete debridement which involves the removal of both necrotic and injured tissue, leaving all healthy uninjured tissue

- **Limited Wound Debridement** – incomplete debridement of a wound from which not all necrotic material has been removed

Extensive Debridement

- More thorough means of removing contamination
- More tedious method
- Longer operative time
- Bunnell (1944): Among the conditions that must be present for primary repair of flexor tendons injuries is **thorough and careful debridement**

Limited Debridement

- Schneider (1977): Treatment of open flexor tendon injuries
  - **Cleansing, irrigation, and simple skin closure** on the day of the injury
  - Limited dissection
  - Antibiotics not used routinely
  - Tendons were repaired 1-3 days post-injury
  - No post-operative infections found in their study

Limited Debridement

- Stone and Davidson (1998)
  - Treated all wounds initially with **irrigation and rinsing** with a sterile saline solution
  - Wound edges were re-approximated with simple sutures or covered with a sterile gauze dressing
  - Results: No significant differences in the post-operative infection rates between those who underwent early and late repair of open flexor tendon injuries

Research Question

Among patients presenting with open flexor tendon injuries of the hand at the UP-PGH Department of Orthopedics between 2010 and 2013, who underwent surgery 24 or more hours post-injury, is there a significant difference in the post-operative infection rates of those who initially underwent extensive wound debridement as compared to those who underwent limited wound debridement?
Research Hypothesis

Extensive wound debridement on open flexor tendon injuries of the hand has the same post-operative infection rates as compared to limited wound debridement for these patients who underwent delayed initial surgery (24 hours or more post-injury).
General Objective

To compare the post-operative infection rates of extensive and limited wound debridement of open flexor tendon injuries of the hand of patients who underwent initial surgery ≥24 hours post-injury
Specific Objectives

1) To determine the distribution of patients with open flexor tendon injuries of the hand according to type of debridement (extensive or limited) ≥ 24 hours post-injury

2) To determine and compare the incidence of post-operative infection among patients with open flexor tendon injuries of the hand who underwent extensive or limited wound debridement ≥ 24 hours post injury
Specific Objectives (con’t)

4) To determine the association of the following factors with the incidence of post-operative infections in open flexor tendon injuries which underwent debridement ≥ 24 hours post-injury
   a. Age
   b. Gender
   c. Mechanism of injury
   d. Number of tendons injured
   e. Associated nerve and vessel injury
Methods

Study design: Retrospective cohort
Inclusion Criteria

1) Diagnosed with open flexor tendon injuries of the hand (Flexor zones I to V)

2) Underwent debridement 24 hours or more post-injury and with a minimum follow-up of at least 1 month (or until with signs of infection)

3) Surgically treated by the UP-PGH Department of Orthopedics Hand Section from November 2010 - October 2013
Exclusion Criteria

1) With other concomitant injuries (amputations, fractures, crush and bite injuries)

2) With uncontrolled systemic co-morbidities (Hypertension and diabetes)
Methods

- Database sources:
  - Dept. of Orthopedics Hand Section OCIS (Orthopedic Computerization Integrated System)
  - Dept. of Orthopedics Hand Section patient records database
  - Dept. of Orthopedics Hand Section MIS (Management Information System)
  - Patient charts from the Medical Records Section of the UP-PGH OPD
Methods

Open flexor tendon injury s/p debridement ≥ 24 hrs post-injury

- Extensive debridement
  - With post-operative infection
  - Without post-operative infection
- Limited debridement
  - With post-operative infection
  - Without post-operative infection

Possible risk factors
- Age
- Gender
- Injury mechanism
- # of tendons injured
- Nerve/vessel injury
Diagnosis of Post-Operative Infection

- Presence of purulent drainage
- Fever (>38°C)
- Localized pain or tenderness
- Localized swelling
- Redness

## Results: Demographic Characteristics of Subjects

<table>
<thead>
<tr>
<th></th>
<th>Extensive debridement (n=24)</th>
<th>Limited debridement (n=7)</th>
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<tbody>
<tr>
<td><strong>Age (years)</strong></td>
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<td>Mean ± SD</td>
<td>30.17 ± 14.11</td>
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Results: Frequency Distribution According to Type of Debridement & Mechanism of Injury

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<thead>
<tr>
<th>Type</th>
<th>Extensive</th>
<th>Limited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stab</td>
<td>4.2%</td>
<td>57.1%</td>
</tr>
<tr>
<td>Laceration</td>
<td>45.8%</td>
<td>14.3%</td>
</tr>
<tr>
<td>Hacking</td>
<td>25.0%</td>
<td>14.3%</td>
</tr>
<tr>
<td>Self-inflicted</td>
<td>8.3%</td>
<td>14.3%</td>
</tr>
<tr>
<td>Crushing</td>
<td>12.5%</td>
<td>0%</td>
</tr>
<tr>
<td>Fall</td>
<td>0%</td>
<td>4.2%</td>
</tr>
</tbody>
</table>

p = 0.3887
Results: Frequency Distribution According to Type of Debridement & Number of Tendons Involved

- **Multiple**
  - Extensive: 75.0%
  - Limited: 71.4%

- **Single**
  - Extensive: 25.0%
  - Limited: 28.5%

$p = 1$
Results: Frequency Distribution According to Type of Debridement Associated Nerve/Vessel Injury

- Yes: Extensive 87.5%, Limited 100%
- No: Extensive 12.5%, Limited 0%

p = 1
## Results: Frequency Distribution According to Debridement Type and Incidence of Infection

<table>
<thead>
<tr>
<th>Debridement Type</th>
<th>With post-operative infection</th>
<th>Without post-operative infection</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extensive debridement</td>
<td>2 (8.3%)</td>
<td>22 (91.7%)</td>
<td>24</td>
</tr>
<tr>
<td>Limited debridement</td>
<td>2 (28.6%)</td>
<td>5 (71.4%)</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4 (12.9%)</strong></td>
<td><strong>27</strong></td>
<td><strong>31</strong></td>
</tr>
</tbody>
</table>
Results: Comparison of Incidence of Infection Among Extensive and Limited debridement

Extensive debridement:
- 8.3% with infection
- 91.7% no infection

Limited debridement:
- 28.6% with infection
- 71.4% no infection

p = 0.2120 > 0.05
## Results: Logistic regression coefficients and p-values

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.2756</td>
<td>0.1512</td>
<td>0.0684</td>
</tr>
<tr>
<td>Gender</td>
<td>-4.2378</td>
<td>3.5296</td>
<td>0.2299</td>
</tr>
<tr>
<td>Mechanism of Injury</td>
<td>1.6997</td>
<td>1.2066</td>
<td>0.1589</td>
</tr>
<tr>
<td>No. of tendons injured</td>
<td>-4.9837</td>
<td>3.5213</td>
<td>0.1570</td>
</tr>
<tr>
<td>Presence of nerve/vessel injury</td>
<td>7.8132</td>
<td>5.3493</td>
<td>0.1440</td>
</tr>
<tr>
<td>Intercept</td>
<td>0.9671</td>
<td></td>
<td></td>
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</table>

**Overall Model Fit**

Chi Square=10.0601; df=5; p = 0.0736 > .05
# Discussion: Infection Rates

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Infection Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Platt et al. (1995)</td>
<td>9.8% (Emergency hand operations)</td>
</tr>
<tr>
<td>Stone et al. (1997)</td>
<td>3.2% (Flexor tendon injuries)</td>
</tr>
<tr>
<td>Rizvi et al. (2007)</td>
<td>1.4% (Upper extremity surgery by Kleinert et al.)</td>
</tr>
<tr>
<td></td>
<td>0% (Delayed flexor tendon repair by Schneider et al.)</td>
</tr>
<tr>
<td><strong>THIS STUDY</strong></td>
<td><strong>12.9% (Open flexor tendon injuries) &gt; 24 hours post-injury</strong></td>
</tr>
</tbody>
</table>
## Discussion: Type of Debridement & Post-operative Infection

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>Findings</th>
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<tbody>
<tr>
<td>Schneider et al. (1977)</td>
<td>No postoperative infection after debridement on day of injury and repair 1-3 days after</td>
</tr>
<tr>
<td>- Case series, n=31</td>
<td></td>
</tr>
<tr>
<td>Stone et al. (1998)</td>
<td>No differences in infection rates among patients with or w/o antibiotics undergoing repair before or after 12 hours after injury</td>
</tr>
<tr>
<td>- Retrospective cohort, n=140</td>
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## Discussion: Type of Debridement and Post-operative Infection

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<tr>
<td>Nylen et al. (1980)</td>
<td>Prolongation of time interval between injury and operation (up to 18 hours) not associated with increased infection rate</td>
</tr>
<tr>
<td>THIS STUDY</td>
<td>Higher proportion of patients who underwent limited debridement &gt; 24 hours post-injury with postoperative infection (28.6% vs. 8.3%, (p=0.21) &gt;</td>
</tr>
</tbody>
</table>
## Discussion: Risk factors for Post-operative Infection

<table>
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</table>
| Stone et al. (1998) | Antibiotic use:  
  • No diff. accdg. to age, gender, mechanism, location  
  • With diff. accdg to environment (industrial) and severity of injury (multiple tendons) |
| THIS STUDY       | Similar age and gender distributions, multiple tendons injuries and with associated nerve and vessel injuries |
Summary

- 31 patients > 24 hours post-injury
- 24 (77%) underwent extensive debridement
- 7 (23%) underwent limited debridement
- Overall post-operative infection = 12.9%
- Incidence of infection:
  - Limited (28.6%) > Extensive (8.3%)
Summary

- Most common mechanisms of injury: Stab wounds (57.1%) and Lacerations (45.8%)
- Multiple tendon involvement for both groups (75% and 71.4%)
- Associated with nerve and vessel injuries for both groups (87.5% and 100%)
Study Limitations

- Retrospective study’s preliminary results as early phase for future **prospective** Randomized Clinical Trials
- Improved record keeping for better description of results
- Expanding from single-center to multicenter study for increase power of the study
Recommendation

Further studies to describe the nature of these injuries and the appropriate approach to treatment for government hospitals in 3rd world countries.