Replantation of Multi-Level Amputations of the Hand and Wrist

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Introduction

In cases of multi-level amputation of the hand, unsuccessful replantation leads to the severe loss of hand function, as well as psychological sequelae resulting from the physical appearance of the hand. The ultimate goal of replantation is a satisfactory long-term functional recovery. In this paper, we report on our operative experience of replantation of multi-level amputations of the hand and wrist.

Patients and Methods

- Retrospective review of the case records of eight patients who underwent replantation of multi-level amputation of the hand and wrist between June 2006 and December 2016.
- M : F = 7 : 1
- The surgery was performed by two orthopedic surgeons.
- Analysis of the cases by the level of amputation (Table 1)

To evaluate the results 1 year after surgery, the grip strength (%), static two-point discrimination (cm), and total active motion minus extension deficit (TAM) were analyzed, and the functional outcomes were evaluated using the criteria of Chen.

Table 1. Summary of patient data

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Sex</th>
<th>Involvement</th>
<th>Hospital Arrival Time (minutes)</th>
<th>Cut No</th>
<th>Cut Interval (cm)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>39</td>
<td>M</td>
<td>Wrist, MC, PP MP</td>
<td>180</td>
<td>6</td>
<td>3</td>
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<tr>
<td>2</td>
<td>42</td>
<td>M</td>
<td>Wrist, MC, PP MP</td>
<td>150</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>23</td>
<td>M</td>
<td>Wrist, PP</td>
<td>90</td>
<td>6</td>
<td>15</td>
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<tr>
<td>4</td>
<td>36</td>
<td>M</td>
<td>Wrist, PP</td>
<td>100</td>
<td>6</td>
<td>12</td>
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<tr>
<td>5</td>
<td>60</td>
<td>F</td>
<td>Carpal, PP</td>
<td>110</td>
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<td>6</td>
<td>54</td>
<td>M</td>
<td>MC, PP</td>
<td>90</td>
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<td>7</td>
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<td>MC, PP</td>
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<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MC, DP</td>
<td>80</td>
<td>6</td>
<td>6</td>
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<td></td>
<td>All</td>
<td>117.5</td>
<td>4.3</td>
<td>7.1</td>
</tr>
</tbody>
</table>

Case I

A. Hand amputated at the wrist and the index, middle, ring, and little fingers following an injury by a press machine.

B. A radiographic image of the distal radio-ulnar fracture and 2, 3, and 4 proximal phalanx fractures and 5 middle phalanx fractures.

C. Surgical replantation starting from the proximal amputated segment. D. Photo following surgery with circulation confirmed and finger replanted. E. Radiograph following surgery with fracture fixed with a plate and k-wire.

F. Picture one year post surgery: the static two-point discriminator test was 5 cm at the palm and 3 cm at the finger. G. One-year post surgery, with bone union observed.

Case II

A. Hand amputated at the index, middle, ring, and little fingers and at the palm level while using a cleaning machine. B. Pre-operative radiograph with a fracture of multiple middle phalanges and at the carpal level.

D. E. Post-surgical replantation of five parts. We confirmed that the distal finger vessel circulation was satisfactory. F. Post-surgery fracture in ten segments, which were fixed with a plate and k-wire.

G. H. One year post surgery: the patient showed an intact touch sensation and the static two-point discriminator test was 5 cm at the palm and 3 cm at the finger. Motor function showed the ability to grasp large objects. I. Picture one year after surgery showing bone union.

Discussion

- The definition of a multi-level amputation of the hand is when more than two parts are amputated at the same time, involving multiple digit amputations in many cases.
- The authors started the replantation from the proximal segment as it was easier to observe the blood volume after replantation, which helped in the identification of blood vessels for the vessel anastomosis at the amputated part. Also, starting from the distal segment would mean proceeding to the replantation without confirming the blood circulation, which in turn would make it difficult to check the status of every blood vessel.
- The bone fixation technique is therefore important in reducing the ischemic time of the amputated part. Issues to be considered in bone fixation include the fixation stability to enable anatomical reduction, while performing vessel anastomosis without tension.
- Artery anastomosis should be performed using extravagat sutures to avoid intimal injury. In a multi-level amputation of the hand, the amputated vessel is short and can easily be pulled out of the amputated segment. Thus, it is necessary to use techniques that avoid tension on the vessel and intimal injury.
- The common feature before replantation of a multi-level amputation of the hand and replantation of a multiple digit amputation is that several parts require replantation. In order to ensure success, the number of parts to be replanted, the ischemic time, the level of amputation, and the technical skills of the surgeons need to be taken into consideration.
- The replantation of a multi-level amputation in the hand is complicated and challenging with a long surgical duration; however, a good understanding of the surgical procedure can produce good results.

Conclusion

- Replantation of a multi-level amputation in the hand has favorable results if the surgeon has sufficient experience and if the ischemic time is reduced as much as possible. In addition, the distance between the amputated parts, fewer amputated parts, clean-cut amputated parts, amputated parts avoiding the joint facet, simple fracture of amputated parts, and adequate remodeling surgery allow for a good result.
- The replantation of a multi-level amputation in the hand is complicated and challenging with a long surgical duration; however, a good understanding of the surgical procedure can produce good results.

Reference