

Case Report

Considerations for double-hand replantation in a resource-constrained healthcare facility

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ABSTRACT

Bilateral-hand amputation is extremely rare and double-hand replantation is even rarer. Only one case of successful double replantation at arm level has been reported from India. We present a case of double-hand replantation at proximal palmar level in a young adult executed in a small nursing home. The patient presented 5 h after injury with limbs preserved well in ice. There were difficulties in executing such an unusual case in a small nursing home set-up. The patient is performing his activities of daily living and basic functions independently. We share our experience of this double-hand replantation with special emphasis on problems encountered.

KEY WORDS

Amputation; ischaemia; replantation

INTRODUCTION

The value of replantation of parts of upper extremity is well established,^[1-5] but replantation of bilateral upper extremities is rare, and only one such case has been reported from India.^[6] However, publications on double-hand transplantation exists worldwide.^[7-11] The nature of injury leading to bilateral amputation often precludes the possibility of replantation. Bilateral-hand amputation requires efforts of huge magnitude for successful replantation. Ideally, it requires a set-up with all backup facilities with services of multiple teams. Unfortunately, availability of multiple teams in

emergency hours may be a problem in majority of places. We report our experience of performing a task of double replantation in a centre with limited resources.

CASE REPORT

A 20-year-old right-handed male had accidentally amputated both hands in a paper cutting machine [Figure 1]. The patient was declined by two major hospitals before reporting to us. The relatives were counselled about the complexity of the case, its outcome, and our limitations in a small nursing home set-up. Consent was taken accordingly both from the patient and relatives. Emphasis was given to replant the dominant right hand on priority.

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10.4103/0970-0358.182233

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How to cite this article: Nayak BB, Mohanty N, Patnaik AP, Bal PK. Considerations for double-hand replantation in a resource-constrained healthcare facility. *Indian J Plast Surg* 2016;49:81-5.

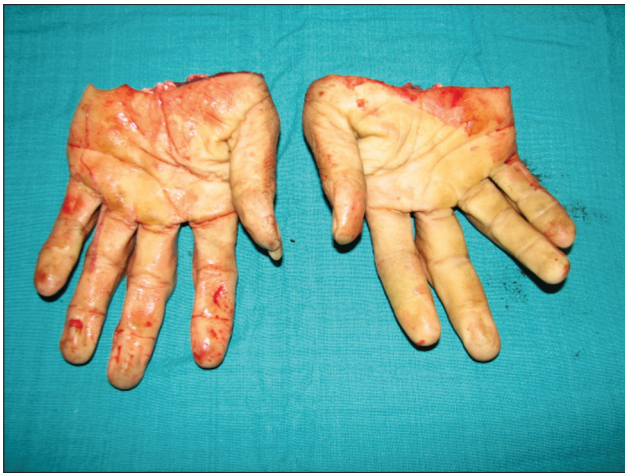


Figure 1: The bilateral amputated hands at proximal third of palm

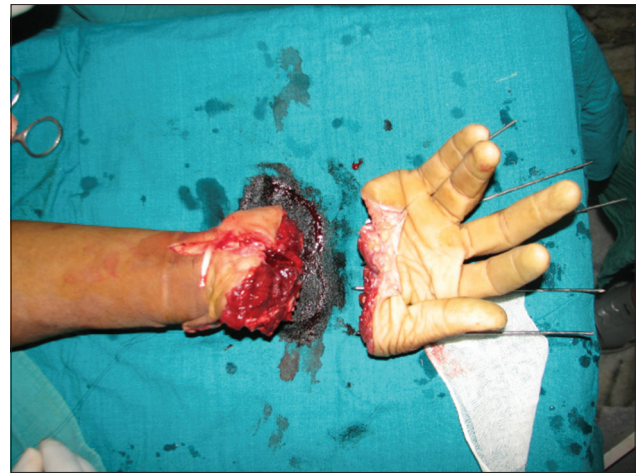


Figure 2: Replantation of the right hand in progress

Surgical details

Replantation of the right hand was started first while the left hand was kept preserved in the cooling chamber of the fridge. Dissection of the amputated right hand was started in the sequence of skeletal fixation with axial K-wires, repair of ulnar artery in the Guyon's canal, radial artery, three dorsal veins, nerves and flexor tendons [Figure 2]. The second surgical team to assist the senior author joined the procedure and carried out debridement, skeletal fixation and vessel preparation. The ulnar artery, first dorsal metacarpal artery and 3 dorsal veins were repaired on the left hand. Because of severe blood loss during and after amputation, the patient was haemodynamically unstable and was resuscitated with Ringers lactate and plasma expanders. Due to haemodynamic instability and unavailability of blood during surgery, the repair of the tendons and nerves on the left hand was deferred. The patient was stabilised postoperatively with 3 units of blood. The entire procedure was done under bilateral brachial block, which lasted for 14 h.

Secondary surgery

The patient had some amount of tissue necrosis from the left thenar region which took about a month to heal, and the patient was lost to follow-up. He however reported back after two months. There was minimal flexion in the right hand and all the joints in both the hands had become stiff. After physiotherapy for 1 month, the patient underwent secondary surgery for the unrepaired tendons and nerves.

By the end of 6 months, the patient was able to perform his activities of daily living. After 15 months, he had good sensory recovery. He was able to wear clothes, perform

toilet activities, write [Figures 3-6], lift heavy weights, ride bicycle and harvest paddy in the field and perform the activities of daily living [Video 1].

Functional recovery

The functional outcome was assessed by using the Chen's criteria which includes - Grade I (excellent), Grade II (good), Grade III (fair) and Grade IV (poor).

The details of sensory and motor recovery in our case are as follows:

According to Chen's criteria, the patient had excellent function in the right hand and good function in the left hand [Table 1].

DISCUSSION

Double-hand replantation is a difficult proposition in a resource-constrained small centre or nursing home. Most small microvascular centres are tuned for a single microvascular procedure at a time. To carry out two prolonged microvascular procedures simultaneously is extremely difficult. Manpower, both skilled and unskilled in addition to the equipment and resources need to be doubled. Sequential vascular repair is necessary when only a single microscope is available. Alternatively, magnifying loupe could be considered for larger vessel anastomosis to minimize ischaemia time. Organising another team in the middle of night was a problem, which delayed the surgery on the left hand by 4 h. This could be a problem in more proximal injuries where ischaemia time could be the deciding factor.^[12] Fortunately, the muscle mass at this level is not significant to cause systemic effects of



Figure 3: The patient able to eat



Figure 4: The patient able to write



Figure 5: Well-settled scar at the volar aspect of hands



Figure 6: Well-settled scar at the dorsal aspect of hands

reperfusion injury. However, due to prolonged ischaemia time thenar muscle of the left hand suffered ischaemic necrosis. Non-availability of blood bank facilities is another limiting factor. Since the patient was young with good physiological reserve, he could withstand a blood loss of 800 cc during surgery. Since it was a distal level amputation, and due to less muscle bulk in the hand, longer ischaemia time was permissible.^[13]

The outcome of primary surgical repair is better compared to delayed tendon repair.^[14] In our case, the repair of tendons and nerves was delayed taking patients safety into consideration.

Trivedi *et al.*^[15] have described head and neck cancer reconstruction with microvascular free flaps in a resource-constrained environment in rural India. We agree that single microvascular procedure can be taken up with relative ease in a small set-up. However, the

situation is vastly different when you have two major microvascular procedures to be taken up simultaneously.

There should be a stock of two sets of microvascular instruments. Keeping two operating microscopes consumes lot of space and not a viable option in a small set-up. There should be an additional surgical loupe. Staggering the procedure by couple of hours allows minimal overlap of procedures thus maximising utilisation of limited resources.

CONCLUSION

Getting an opportunity of double-hand replantation may be once in a lifetime experience even though bilateral critical hand injuries and multiple digital replantations are more common. Every small microvascular centres should remain prepared to deal with such cases. Involvement of more microvascular surgeons intermittently so that they are not unfamiliar to the set-up is worth considering. They could be the resource persons in such situations. Hence, building up a good team and having cooperation among

Table 1: Extent of Sensory and Motor recovery

	<i>Right</i>	<i>Left</i>
Sensory recovery in both hands		
Touch sensation		
Crude touch	Present distal to amputation	Present distal to amputation
Fine touch	Present distal to amputation	Present distal to amputation
Pain sensation	Present	Present
Temperature		
Hot	Present	Present
Cold	Present	Present
Vibration	Present	Present
Two-point discrimination (mm)		
Thumb	4	6
Index finger	4	6
Middle finger	4	6
Ring finger	5	5
Little finger	5	5
Motor recovery in both hands		
Power of the muscles at different joint levels		
Wrist flexors	MRC Group V	MRC Group V
Wrist extensors	MRC Group V	MRC Group V
Finger movements		
EPL	MRC Group V	MRC Group III
APL	MRC Group IV	MRC Group II
Adductor pollicis	MRC Group IV	MRC Group II
FPL	MRC Group IV	MRC Group III
Dorsal interossei	MRC Group III	MRC Group III
Palmar interossei	MRC Group IV	MRC Group III
FDS of all fingers	MRC Group IV +	MRC Group IV +
FDP of index and middle finger	MRC Group III +	MRC Group III
FDP of ring and little finger	MRC Group III	MRC Group III
Flexion movements at different joints		
MP joint	90° in all fingers	90° except index finger (80°)
PIP joint	90° in all fingers	Little finger - 90°
		Index, ring and middle finger - 80°
CMC joint	Normal range	Normal range
Thumb MP joint	45°	20°
Thumb IP joint	90°	30°
Abduction and adduction movement of different fingers		
Abduction	30° - index and ring finger	20° - little and ring finger
	20° - little finger	30° - index finger
	20° - on either side	10° - on either side
Adduction	Normal range	10° - deficit in little finger
Active extension movements at different joints		
IP joint (thumb)	30° restriction	20° restriction
PIP joint	Middle, ring and little finger - 20° restriction	90° except index finger (80°)
	Index finger - 30° restriction	All fingers 45° restriction
Active extension movements at different joints		
MP joint (thumb)	Normal	20° restriction
MP joint	Middle, ring and little finger - 20° restriction	All fingers 45° restriction
	Index finger - 30° restriction	
Passive extension movements at different joints		
MP joint (thumb)	30° restriction	10° restriction
MP joint	Middle, ring and little finger - 10° restriction	Little finger 30° restriction
	Index finger - 20° restriction	All other fingers 45° restriction
Abduction and adduction movement of different fingers		

Contd...

Table 1: Contd...

	Right	Left
Abduction	30° - index and ring finger 20° - little finger 20° - on either side	20° - little and ring finger 30° - index finger 10° - on either side
Adduction	Normal range	10° - deficit in little finger
Active extension movements at different joints		
IP joint (thumb)	30° restriction	20° restriction
PIP joint	Middle, ring and little finger - 20° restriction Index finger - 30° restriction	90° except index finger (80°) All fingers 45° restriction
Active extension movements at different joints		
MP joint (thumb)	Normal	20° restriction
MP joint	Middle, ring and little finger - 20° restriction Index finger - 30° restriction	All fingers 45° restriction
Passive extension movements at different joints		
MP joint (thumb)	30° restriction	10° restriction
MP joint	Middle, ring and little finger - 10° restriction Index finger - 20° restriction	Little finger 30° restriction All other fingers 45° restriction
PIP and DIP of all fingers	30-45° restriction in extension	30-45° restriction in extension

FPL: Flexor pollicis longus, EPL: Extensor pollicis longus, APL: Abductor pollicis longus, DIP: Distal interphalangeal, PIP: Proximal interphalangeal, IP: Interphalangeal, CMC: Carpometacarpal, MP: Metacarpophalangeal, MRC: Medical Research Council, FDP: Flexor digitorum profundus

colleagues may bail us out in such difficult situations. This successful replantation was possible because of the team effort.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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