Case Report

Alternative to Vein Grafts for Arterial Repair in Avulsion Amputations of Thumb: Case Series

Abstract

The first reimplantation of a complete thumb amputation using microvascular anastomosis in a human was successfully conducted by Komatsu in 1968. Avulsion amputations of the thumb at the level of metacarpophalangeal joints pose a tedious task for direct arterial repair, even with adequate bone shortening. Owing to the short length of princeps pollicis from the deep arch, tight working space in the first web under microscope, and the associated intimal injuries, we advise transposing the radial indices artery in such cases which gives adequate length and noninjured artery for a tension-free repair. Using this method, surgeons can avoid the tedious task of vein grafts for arterial repair, reduce the operating time, and improve successful outcomes in thumb reimplantations.

Keywords: *Amputation, avulsion, princeps pollicis artery*

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Introduction

Outcomes of reimplantations have improved drastically over the years owing to improved microsurgical techniques.[1] However, the nature of injury impacts the outcome for successful reimplantation. Avulsion type of injuries are associated with poorer outcomes owing to intimal injuries and large shortening of healthy repairable vessels.[2-4] Thumb avulsions in particular are difficult to reimplant owing to the pronated position, reduced working area under microscope in the first web space once bone is fixed and relatively fixed position of princeps pollicis after it originates from the deep arch.

Interposing vein grafts are often necessary in avulsion type amputations of thumb.[5] However, what we encountered was that the princeps pollicis artery suffers major intimal damage extending proximally, the extent of which is difficult to detect. Hence, we present this case series where we transposed the ipsilateral uninjured radialis indicis artery for direct repair to the ulnar digital artery of the thumb distally to reestablish circulation.

Case Series

Details of the cases of thumb amputations are presented in Table 1. All presented to the emergency and were taken up for reimplantation within 30 min. Allen's test was performed on the ipsilateral index finger. After thorough saline wash and preliminary debridement, the distal amputated part was dissected, and the structures tagged in the usual fashion [Figure 1]. K wires were introduced in a retrograde manner after bone trimming.

All the dead and crushed muscles were debrided from the proximal stump. Bruner incision was used for exploring the first web space. Flexor and extensor tendons were retrieved, and a grasping 3-0 prolene suture was done for later repair once bone was stabilized. Avulsed distal part was stabilized to the first metacarpal with two 1-mm K wires. Tendons repaired with additional 5-0 epitenon stitch. The princeps pollicis artery was dissected which was invariably found to have intimal damage. Dissection was carried proximally till the radial indicis artery was visible branching out to the index along the radial aspect [Figure 2]. This artery was further dissected depending on the length required to reach the ulnar digital artery of the avulsed distal thumb. A vascular clamp was applied to it to assess the adequacy of arterial perfusion of index finger before dividing the artery for transfer. Epineural neurorrhaphy of the digital nerves dissected simultaneously with 10-0 nonabsorbable suture was done. Direct arterial repair was done under microscope

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Table 1: Details of cases where radial indicis artery was anastomosed to ulnar digital artery in avulsed amputations of the thumb

Case	Age	Sex	Mode of injury	Follow up in months	Complication	Sensibility in terms of 2-point discrimination (mm)
1	24	Male	Avulsion	12	None	8
2	29	Female	Rodeo avulsion	14	None	9
3	21	Male	Avulsion	12	None	7
4	36	Male	Avulsion	11	None	8

Figure 1: Distal avulsed part after preliminary debridement. Note the avulsed ulnar digital artery indicated by the forceps, with intimal injury which was resected

Figure 2: Radial indicis artery dissected ipsilaterally depending on the length required

with 10-0 nonabsorbable suture (radial indicis artery to ulnar digital artery in avulsed distal part), but we delayed opening the proximal vascular clamp till at least one dorsal vein was repaired. Then, the vascular clamps released and circulation reestablished. Additional vein was repaired after releasing the clamp which allowed for easy visualization. Skin was closed loosely and a bulky dressing applied [Figure 3]. Standard postoperative protocols were followed.

All four cases of avulsed thumbs survived and were followed up for a period of 12 months. K wires were removed at 5 weeks and put on physiotherapy. Patients regained a useful protective sensation with good range of movements and ability to write in two cases where dominant hand was involved and were able to oppose the thumb to little finger [Figure 4].

Discussion

Avulsion amputations are associated with poorer outcomes.[2-4] Survival rates drop drastically to 66% when amputations are associated with crushing avulsion-type injuries.[6] Intimal damage from avulsion injury and stretching causes development of long segment thrombus postoperatively even if there was immediate patency of the repair. Successful perfusion depends on the reestablishment of circulation by means of resection of injured vessels and a tension-free repair. This resection invariably warrants the need for a vein graft from the forearm or other donor area which adds to operating time and makes the surgery tedious.

Doi earlier described a technique of transposing the common digital artery to middle and ring for an avulsion-type amputation of the thumb.[7] Adani *et al*. and Ozaksar *et al*. described transferring adjacent finger artery in avulsion-type amputations to improve outcome.[8,9]

Deep branch of radial artery continues into the hand to form the deep palmar arch which gives off the princeps pollicis artery to supply for thumb and the radial indicis artery for the index. By describing this technique of transposing the radialis indicis artery for direct arterial repair to ulnar digital artery of the avulsed distal part of the thumb, we can drastically reduce the operating time. As the radialis indicis artery is situated in the same anatomical area, it can be dissected all the way till the index metacarpophalangeal joint for a direct tension-free repair. Tension-free repair also decreases the chances of developing long segment thrombus, which is generally seen when a direct arterial repair is done especially in the first web. Vascularity of the index finger is not jeopardized; however, it is always necessary to a preoperative Allen's test on index. The additional free length of this healthy radial indicis artery makes the anastomosis to ulnar digital artery under microscope easy as it allows the first web to be stretched adequately for ease of operating the microinstruments.

Our cases are never exposed to cold environments, and hence, we cannot comment whether transfer of radialis indicis artery caused any cold intolerance in the index finger. In the occurrence of radialis indicis artery originating

Figure 3: Immediate postoperative picture depicting reestablishment of circulation

Figure 4: Followup at 11 months showing opposition to little finger

from the superficial palmar arch distal to the level of injury, this method may not be feasible as the length may not be sufficient, and we will have to do the conventional vein graft for arterial repair.

Conclusion

We suggest that this method of arterial transfer helps in achieving a direct repair in avulsion amputations of thumb. Although avoiding vein grafts appears prudent in terms of saving operative time, it is less prudent to harvest a healthy artery from the index finger and also possibly to jeopardize the index finger in future injuries. However, readers should exercise adequate caution in using this technique as outlined, and vein grafts are still recommended when there is a gap.

Declaration of patient consent

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

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Conflicts of interest

There are no conflicts of interest.

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