

Strategic Microsurgical Management of Major Multilevel Upper Extremity Amputations : A Regional Trauma Center Experience

Purpose: Multilevel upper extremity amputation is one of the most challenging and complex tasks in reconstructive microsurgery due to extensive muscle damage and the "double-jeopardy" of cumulative ischemia time. This study aims to review the clinical significance and strategic approaches for multilevel replantation based on three specific cases: two cases involving double-level amputations and one case involving a triple-level amputation.

Methods: Replantation was performed on three patients who suffered multilevel traumatic amputations of the upper limb. Under the guiding principle that **"Time is Muscle,"** the primary goal was to minimize the "Golden Time" and reduce the detrimental effects of warm ischemia. Contrary to traditional "inside-out" surgical sequences, we prioritized **early arterial anastomosis** to re-establish blood flow to the muscle bellies as quickly as possible and prevent reperfusion injury or systemic complications.

Results: In all three cases, the proximal replanted segments successfully survived, whereas the most distal segments (e.g., the hand) ultimately succumbed to necrosis. This outcome illustrates the biological limits of distal tissues that must endure the total cumulative ischemia time required to reconstruct every preceding proximal level. Furthermore, the deceptive "zone of injury" in crush and avulsion mechanisms likely contributed to the eventual failure of the most distal parts.

Conclusion: While the total survival of all amputated parts was not achieved, the **salvage of the proximal segments** remains highly significant as it preserves limb length and offers a higher functional potential compared to a high-level prosthetic. Multilevel upper extremity replantation is a high-risk procedure, but a swift, **artery-first revascularization strategy** makes it a challenge worth undertaking for the patient's long-term functional recovery and psychological well-being.

Keywords: Multilevel amputation, Replantation, Golden time, Artery-first anastomosis, Double-jeopardy, Macroreplantation