Amputations of the Upper Extremity: A Review of Techniques, Complications, Prosthetics, and Subjective Patient Experience

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BACKGROUND

- More than 130,000 upper extremity amputations are performed each year for varied indications, with an estimated 2.1 million patients afflicted nationwide
- Common surgical techniques are well described and have a profound impact on residual limb functionality and ability to successfully, and painlessly, use a prosthetic
- Prosthetics can be passive, body-powered, myoelectric, hybrid, or task-specific, each with different indications, advantages, disadvantages, and complications
- The subjective experience of a Certified Peer Visitor, and bilateral trans-radial amputee, are included in this review

OBJECTIVE

- To develop a comprehensive guide of available prosthetics for different amputation levels and techniques
- To give evidence-based practical pearls and pitfalls for prosthetic use to optimize outcomes
- To provide the unique perspective of a bilateral trans-radial amputee employed in our clinic

METHODS

- A comprehensive literature review was performed to identify common amputation sites, levels, techniques, and their associated prosthetics
- The data was analyzed to determine favorable and unfavorable characteristics of different types of prosthetics at common amputation levels to guide clinical decision making
- The perspective of a bilateral trans-radial amputee working as a Certified Peer Visitor at our hand center includes his perspective on patient outcomes and unique challenges with upper extremity amputees

RESULTS

- Full or partial hand amputation is the most common upper extremity amputation with trauma being the most common indication
- Amputation at higher levels is incrementally less common with a predilection for oncologic indication
- There are commonly described techniques for amputation at each level with a focus on length preservation and stability of soft tissue envelope
- Prosthetics should ideally be fit within 30 days of amputation, and should not be delayed until stump “maturity”
- Residual stump length and the soft tissue envelope play a significant role in the ability for patient to tolerate prosthetic use and to have meaningful function
- Despite advances in surgical technique and prosthetic technology, the prosthetic rejection rate remains high – up to 38%
- Many patients require multiple prosthetics for different activities, and hybrid prosthetics can be very beneficial, especially for amputations adjacent to the elbow
- Passive prosthetics are more common distally as a static post, but more functional myoelectric and hybrid prostheses are providing improved dexterity
- Targeted muscle reinnervation [TMR] is an emerging area of interest that has potential to decrease pain, improve intuitive control of myoelectric prostheses, and thereby increase functionality and decrease rejection of prosthetics
- Sensory feedback remains a key deficit in current prosthetics and limits functional use for patients
- Amputee care remains a multidisciplinary effort between patient, surgeon, prosthetist, and rehabilitation team

DISCUSSION

- Amputation of the upper extremity is unfortunately common and impactful for many patients in the United States
- Despite advances in surgical techniques and prosthetic technology, many patients suffer from persistent pain and suboptimal function of their prosthetics, often leading to abandonment
- The topic and results of the study were discussed with a bilateral trans-radial amputee who now works in the Hand and Upper Extremity Center at The Ohio State University as a Peer Visitor, certified through the Amputee Coalition of America. The following points are his perspective:
  - “Many of the patients I encounter require amputation after use of vasopressors during the treatment of sepsis. While sepsis survival rates improve, I have found this to be an unfortunate sequela”
  - “When possible, I have found that preoperative involvement of an experienced prosthetist and peer support greatly improves coping and subjective outcomes”
  - “While all prosthetists are certified, they are not all equal. It is critical to find a prosthetist well versed in upper extremity amputation. I recommend interviewing multiple providers to find the right fit”
  - “TMR has been a great development for relief and prevention of phantom limb pain and sensation. I have seen the best outcomes with TMR performed at the time of amputation”
  - “TMR has exciting potential for the use of more intuitive and more functional myoelectric prostheses”

Disclosure

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