



POSNA

The Core Curriculum

Amputations

Objectives

1. Discuss differences between the child amputee and the adult amputee
2. List causes for amputation in children
3. Discuss technical principles of amputations in children
4. Discuss the advantages of a Boyd amputation over a Symes amputation. Discuss the advantages of a Symes amputation over a Boyd amputation
5. Discuss the role of lengthening of the residual limb
6. Describe a strategy for managing stump overgrowth in the juvenile amputee

Discussion

The surgery for and management of amputations in children is very different from the adult. The majority of amputations in adults are performed for complications of peripheral vascular disease. The most common cause of amputation in children is congenital limb deficiency, followed by trauma, infections, and neoplasms. There are a number of ways in which the juvenile amputee differs from the adult. The limb continues to grow. There is appositional bone growth, especially of through-bone amputations. The functional demands on the residual limb and prosthesis are very different for the playful, active child than those for the more sedentary adult. The psychological factors of incorporating the amputation and prosthesis into body image are critical. The incidence of multiple limb amputations is much more frequent in the child, with their resulting complexity of decision-making. Finally, the juvenile amputee very rarely experiences phantom limb pain.

Principles of amputations in children include 1) preserve all length possible 2) preserve growth plates 3) use disarticulations when possible 4) preserve the knee joint when possible and 5) stabilize the proximal limb. Some examples of this type of planning for amputations in children are the Van Nes procedure for proximal focal femoral deficiency or following limb salvage for sarcoma of the distal femur. The tibia is fused to the short femur, producing what is essentially the femoral segment. By means of a tibial osteotomy, the foot is rotated 180 degrees from its normal orientation so the ankle joint functions as a knee joint and the foot becomes the functional below knee segment. The energy expenditure for gait is dramatically less for below knee amputees than above knee amputees, and the quality of gait is better. On the other hand, the child must prepare to deal with the peculiar appearance of having the "foot on backward". Another way of applying the surgical principles would be to remove a femoral segment in a limb affected with purpura fulminans to preserve the distal femoral physis, and salvage the functional advantages of a knee disarticulation when there is inadequate soft tissue to cover the femur at its normal length. For bilateral upper limb amputations, prosthetic fitting is contraindicated for functional reasons as these

children learn to use their feet for prehensile activities. There may still be reasons to have an upper limb prosthesis for social purposes later in life.

The Syme amputation is essentially an ankle disarticulation in a child. It provides an excellent weightbearing stump, and allows room for a prosthetic foot when the residual limb is normal length, for example following trauma. A complication of Syme amputation is migration of the heel pad, which is not firmly fixed to the tibia. The Boyd amputation preserves the calcaneus, and the calcaneus is fused to the tibia. This obviates the problem of migration of the heel pad, but a longer waiting period before prosthetic fitting is usually necessary, and the extra length of the residual limb can sometimes make prosthetic foot fitting difficult.

Lengthening of the residual limb can occasionally be of great value in the very short below elbow or below knee amputee, providing better leverage for prosthetic fitting, and improved function. Lengthening a short humerus may allow the child to cradle objects against the trunk, again a major functional gain.

Davids and associates, recognizing the contribution of Marquardt in utilizing a biological cap on over the transected bone to prevent overgrowth, modified Marquardt's choice and used a tricortical iliac crest graft, which has functioned handsomely for management of stump overgrowth.

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