Multidisciplinary Care of Upper Limb Amputations

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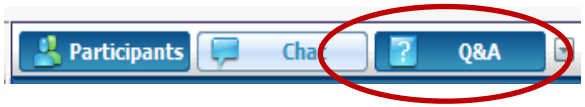
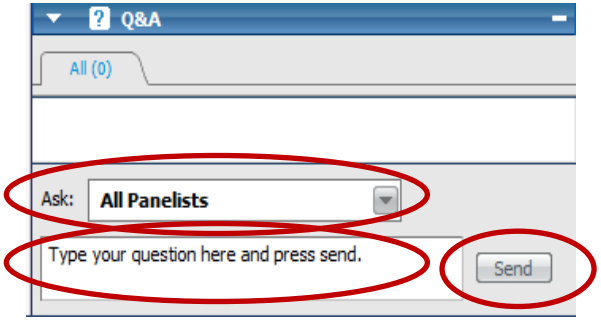
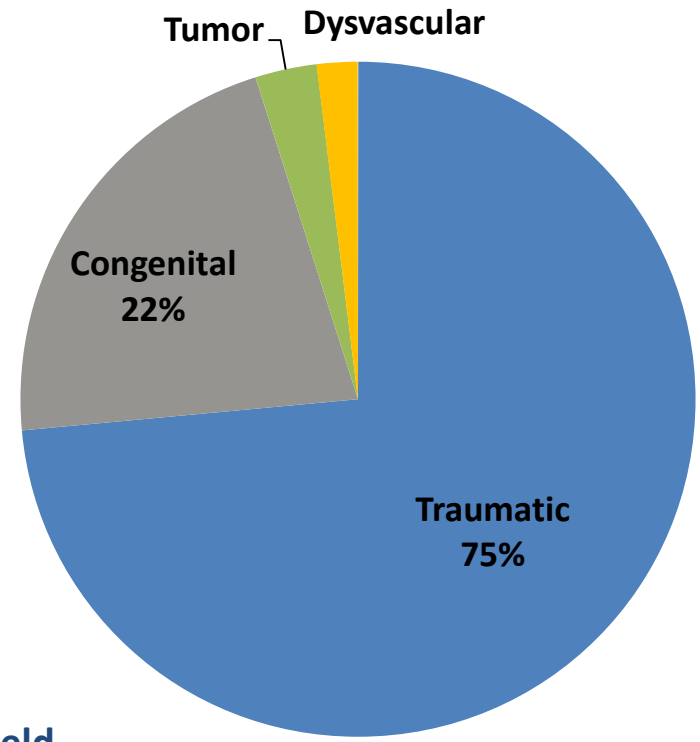




Upper Limb Amputee Rehabilitation

What are the facts?

- **Incidence of UL Amputation***
  - 6% of all amputations: 11,000 new UL amputations/year in US
  - 2/3 of all traumatic amputations involve UL
- **Prevalence of UL Amputation***
  - 34% of all amputations: 500,000 in US
- **Etiology of UL Amputation**
- **Gender Inequity**
  - 72% Male vs. 28% Female
- Advances in limb salvage techniques prolonging acute medical/surgical management
- Technical advances in prosthetics => **Dynamic, evolving field**



*Source: Amputee Coalition, 2012 data

Today's Webinar Objectives

Our conversation centers on four primary goals.

- Identify the epidemiology of upper limb amputations, including classification of levels of amputation and corresponding functional potential with and without prosthetic fitting and training
- Cite medical concerns and complications after amputation, including pain issues and summarize appropriate interventions
- Outline the phases of amputee care and rehabilitation, extending from initial surgical intervention to pre-prosthetic training, prosthetic prescription and fitting and rehabilitation with functional prosthetic training
- Assess need for and appropriate timing of psychological and vocational counseling for IW amputees

Our Presenter

Dr. Gary Clark

- Paradigm Medical Director
- Director of Amputee Rehabilitation at the MetroHealth Rehabilitation Institute
- Residency program director, professor and vice chair in the Department of Physical Medicine & Rehabilitation at Case Western Reserve University
- Associate chief medical officer for Education for the MetroHealth System in Cleveland, Ohio
- MD with specialty in amputee, stroke and geriatric rehabilitation, as well as multiple trauma and brain injury

Multidisciplinary Care of Upper Limb Amputations

Dr. Gary Clark

Limb Trauma Surgery

What is feasible versus advisable?

- **Limb Salvage and Reconstruction: Unknown Outcome & Timeframe**
  - Debridement, skin/muscle flaps, skin/bone grafts
  - Neurovascular repair
  - Multiple surgeries, frequent early/late complications
  - Major functional, psychological, marital, vocational impact
  - Unknown outcomes/timeframes for healing/function
- **'Therapeutic' Amputation: Predictable Outcome & Timeframe**
  - Removal of painful/unstable/infected/non-functional body part
  - Predictable time frame and functional outcome post-amputation
- **Perspective: A "Bad Hand" with limited function/sensation is typically still better than a "good amputation and prosthesis."**

Amputation Surgery

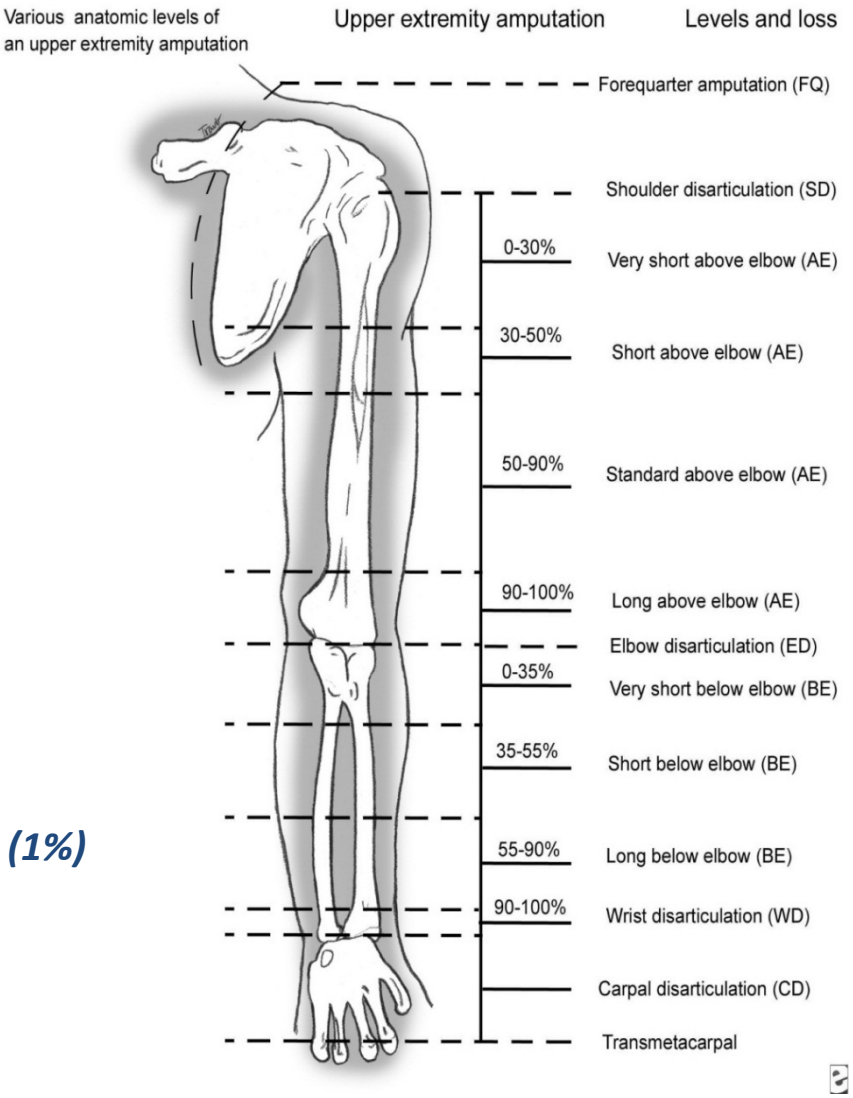
What are the goals?

- Preservation of **functional** length
- **Durable** skin/soft tissue coverage
- Ensure viable circulation/soft tissue for **healing**
- **Preservation** of useful sensation
- **Prevention** of symptomatic neuromas
- **Stabilization** of adjacent weight-bearing structures
- **Controlled** short-term morbidity
- **Facilitate** early prosthetic fitting/function
- **Early** patient return to work and play

Upper Limb Amputee Rehabilitation

What are the levels of amputation?

- **Levels of Amputation**
  - **Fingers** – DIP, PIP, MCP joint
    - Most common ***(80%)****
    - May not need prosthesis for function
  - **Thumb** – IP, MCP joint ***(10%)***
    - Thumb most important for function
  - **Partial Hand/Wrist Disarticulation** ***(1%)***
    - Functional/Cosmetic limitations
    - May be more functional w/o prosthesis
  - **Transradial** (TRA or BEA) ***(4%)***
  - **Elbow Disarticulation** ***(1%)***
  - **Transhumeral** (THA or AEA) ***(3%)***
  - **Shoulder Disarticulation/Forequarter amputation** ***(1%)***



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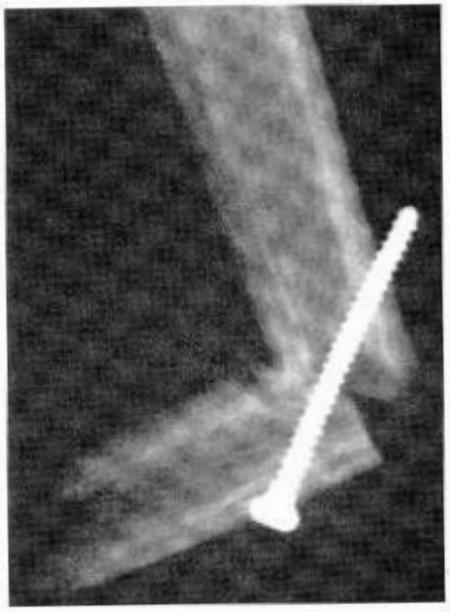
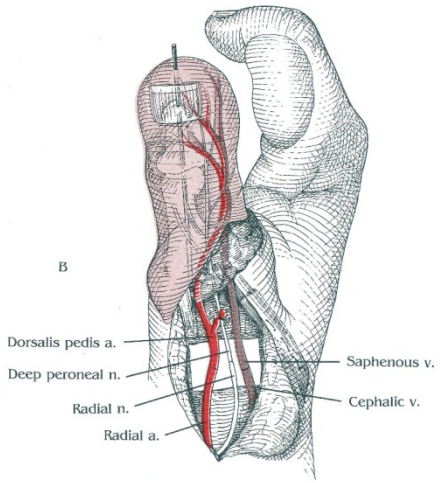
Special Amputation Surgical Procedures

What are the options?

- **Myoplasty vs Myodesis**
- **Tenodesis, Tendon Transfer**
- **Skin Graft (STSG) – need soft tissue base**
- **Rotational/Regional Flap**
  - Skin + soft tissue mobilized, rotated for coverage/healing
- **Free Flap**
  - Intact skin/fat/fascia/muscle/nerve/vascular supply dissected free and reattached over wound for coverage/healing
- **Replantation**
  - "Fillet" Flap: free flap preserved/replanted from amputated limb
- **Marquardt Procedure**– osteotomy of distal humerus
  - Enhances socket pronation/supination
- **Great Toe Transplant to thumb**
  - Restores post for pinch grip, opposition





Amputation Rehabilitation

What are the clinical steps?

- **Amputee Clinic Team Approach**
  - Surgeon (Trauma, Ortho, Vascular, Plastics)
  - Physiatrist
  - Occupational/Hand Therapist
  - Prosthetist
  - Rehab Psychologist
  - Patient/Family
- **Initial Evaluation**
  - Patient/family education
  - Clarify patient goals
  - Engage therapy for pre-prosthetic program
  - Identify prosthetic Rx, timing
- **Frequent Follow-up Initially (q 4-6 weeks)**
  - Evaluate fit and function of prosthesis
  - Track functional progress – update therapy program
  - Assess need for socket modification, alignment change, etc.
  - Monitor for complications
- **Periodic Long Term Follow-up (q 3-6 months)**
  - Socket modifications/replacement
  - Prosthetic maintenance/repair/replacement
  - Vocational needs, Driving, etc.

Amputation Rehabilitation

Pre- and post-operative considerations.

- **Medical Stability and Comorbidity**
  - Associated injuries/conditions (other trauma, burns, etc.)
  - Infection/antibiotics, lines
  - Co-morbid conditions
    - Cardiopulmonary, neurological, arthritis ***=> Endurance, Activity Tolerance***
- **Cognitive Status**
  - Comprehension, cooperation, motivation ***=> Ability to Learn***
- **Psychological/Emotional Status**
  - Anxiety/depression/PTSD ***=> Education, Counseling, Medications***
  - Patient goals
- **Pain Management**
  - PCA progressing to ATC long acting + prn opioids for breakthrough pain; anxiolytics?
  - Time IR opioids for one hour prior to therapy to facilitate active participation
  - Work to stabilize/taper analgesic regimen

Amputation Rehabilitation

Pre- and post-operative considerations.

- **Musculoskeletal/Neurological Status**
  - Upper 'intact' limb function => ROM/strength/sensation/grip/coordination
    - Dominant vs non-dominant hand
  - Upper amputated limb => proximal ROM/strength/sensation
- **Functional Status**
  - Mobility
  - Self care skills (ADL)– eating, bathing, toileting, dressing, grooming
- **Rehabilitation Considerations**
  - Living setting
  - Premorbid functional status (work, home & leisure)
  - Family support
  - Realistic patient/family expectations (functional goals, timeframes)
  - Proximity to experienced prosthetist/therapist

Amputation Rehabilitation

Pre-prosthetic training.

- **Patient & Family Education**
  - Attitude: therapeutic, function-enhancing
  - Stages of amputation rehabilitation/time frames
  - Phantom sensation awareness
- **Residual Limb Examination**
  - Length, shape (cylindrical)
  - Skin
    - Incision healing – staples/sutures (vs secondary intention)
    - Skin grafts, scars, vascular grafts, erythema, blisters, open wounds
    - Distal soft tissue padding
    - Distal skin mobility
    - Edema
  - Proximal joint stability, ROM
  - Proximal muscle strength
  - Areas of focal tenderness, bony prominences

Amputation Rehabilitation

Pre-prosthetic training.

- **Desensitization**
  - Massage, tapping, heat/cold, ace wrap/shrinker sock => sensory input
- **Soft Tissue Mobility**
  - Massage
- **Skin Care**
- **Strengthening**
  - Proximal residual limb
  - Intact limb
- **Functional Training**
  - One-handed techniques; use residual limb to stabilize/support as able
  - Change of dominance as appropriate
  - ADL/self care
  - IADL (Instrumental ADL), community survival skills

A Successful Prosthesis

What characteristics make for the best prosthesis?

Characteristics	
Comfortable to wear	(If socket doesn't fit well, nothing else matters…)
Easy to don and doff	
Lightweight	
Durable	
Cosmetically pleasing/acceptable	
Improves function	("Tool")
Reasonable maintenance	
Customization	

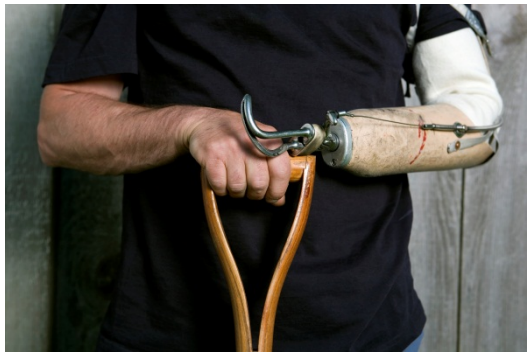
Prescribing a Prosthesis

What must be considered when determining the prosthetic prescription?

Considerations
Amputation level
Contour/length of the residual limb
Skin/soft tissue mass, mobility, tenderness
Cognitive function
Functional goals
Cosmetic importance
Single vs multiple prostheses (e.g., work prosthesis, home/hobby prosthesis)
Early fitting/training
Expertise of/proximity to prosthetist
Expertise of/proximity to hand therapist

Body-Powered vs Myoelectric Prosthesis?

What are the pros and cons of each to consider when determining prosthetic Rx?



Body-Powered Prosthesis

- More durable (light to heavy duty)
- Weather/water-proof
- Lighter weight
- Shorter training time for function
- Less maintenance
- Less frequent modifications
- Greater sensory feedback (kinesthetic + visual)
- Hook and/or hand TD
- Limits of functional control
- Poor cosmesis (hook TD, visible cables/harness)
- Cables/harness get caught in clothes, chafe skin
- Lower cost ($15K to $20K)

Myoelectric Prosthesis

- Variable durability (limited to light duty)
- Must protect from water
- Heavier weight (electronics, battery)
- Longer training time for function
- Frequent maintenance
- More frequent modifications
- Limited sensory feedback (esp. visual)
- Multiarticulating hand and/or hook TD
- Limits of functional control
- More cosmetically acceptable
- Can wear under clothes
- Higher cost ($45K to $100K+)

Prosthetic Training

What training is involved with a new upper limb prosthesis?

Typically Outpatient OT/Hand Therapy

- Shrinker sock
- Dynamic/functional vs passive/cosmetic prosthesis
- Ideal: fit within 30 days => “Golden Period”
- Body-powered vs myoelectric prosthesis (vs both)
- Multiple terminal devices (hook, hand)
- Prosthetic proper donning technique
- Progressive wearing & functional use tolerance
- Functional training
- General strengthening & conditioning
- Joint conservation strategies
- Care & cleaning of prosthesis, liners, socks

Post Amputation Complications

There are many possible complications.

Skin Complications

- Incision Healing
  - Delayed healing
  - Wound dehiscence
- Hyperhidrosis, maceration, heat rash
  - Antiperspirants
    - Drysol (20% aluminum chloride)
  - Botox injections
    - Inject every square cm
    - Need to repeat q 3-6 months
- ST adherence + shear/pressure => erythema, blister, ulcer
- Scar Tissue/STSG: pressure/shear tolerance
- Flesh roll, redundant distal residual limb ST
- Folliculitis/Furuncle (Boil)/Epidermoid Cysts
  - Proper hygiene (hibiclens)
- Contact Dermatitis
  - Lotion, detergent, alcohol
  - Allergies
  - Poor skin & liner hygiene
- Cellulitis
- "Choke Syndrome" => verrucous hyperplasia
- Edema - CRF/HD, CHF, post-DVT
- Opposite Limb Status

Post Amputation Complications

There are many possible complications.

- **Ulcer Status & Therapeutic Interventions**
  - **Red** = Clean granulation tissue => warm, moist environment
  - **Yellow** = Exudative => absorb + mechanically debride
  - **Black** = Eschar => debride (sharp vs enzymatic)

Type of Dressing	Example
Nonadherent gauze	Telfa, Vaseline Gauze, Xeroform
Absorptive	Gauze, Kerlix, Alginates
Occlusive	Tegaderm and Op-Site
Hydrocolloids	Duoderm and Tegasorb
Hydrogels	Hydrogel, Intrasite Gel
Biologic occlusive	Auto/Homo/Xenograft, Amnion, Synthetic
Creams, ointments, solutions	Saline, Topical Abx (Silvadene, Bacitracin)
Enzymes	Collagenase, Accuzyme

Post Amputation Complications

There are many possible complications.

Pain Complications

- **Phantom Sensation (75% to 90+%)**
  - Reassure & educate
  - Paresthesias (tingling, itching, pulling)
  - Telescoping over time
- **Residual Limb Pain (70+%)**
  - Correlate location with socket
  - Timing, aggravating/relieving factors
  - Inflammation: skin/ST/bursa/tendon
  - Pressure vs shear stress
  - Painful neuroma
- **Phantom Limb Pain (60% to 80%)**
  - Burning, shooting, electric shock-like
  - Often episodic, varying duration
  - Prevention: massage, shrinker, prosthesis
  - Therapeutic heat/cold, vibration, TENS
  - Acupuncture, mirror therapy
  - Relaxation, self-hypnosis, visual imagery
  - Membrane stabilizers
    - Gabapentin (neurontin)
    - Pregabalin (lyrica)
  - Augmentative medications
    - TCA's, SSRI's, anticonvulsants
  - Opioids, muscle relaxers
  - Capsaicin, lidocaine

Post Amputation Complications

There are many possible complications.

MSK/Neurological/Other Complications

- Bursitis, Traumatic Bursa
- Bone Spurs, Heterotopic Bone
- Carpal Tunnel, Epicondylitis, Rotator Cuff
  - Overuse syndrome
- Joint Contractures
  - Shoulder, elbow
- Joint Arthritis & Instability
  - Shoulder, elbow
  - Same and/or opposite side
- Brachial Plexopathy, Compression Neuropathies
  - Impact on proximal stabilization, control of TD
  - Importance of sensation to maximize function
- Prosthetic Fit & Alignment Problems
  - Socket fit
- Prosthetic Component Failure
  - High end users, inappropriate activities
  - Normal wear and tear
- Poor Functional Outcome
  - Inadequate training/practice
- Prosthetic Non-User
  - Rejection (0% to 50%)
    - Weight, socket discomfort
    - Inconvenience, cosmesis
    - Lack of functional benefit

Post Amputation Complications

Psychological issues must be monitored and addressed.

Mourning the Loss
- Feelings can be overwhelming
- All aspects of life changed
- Gradual perspective
- ⬆ function => ⬇ sense of loss

Depression
- Upper limb > lower limb
- Vicious cycle
- Recognize & treat
- Gradual adjustment

Body Image & Disfigurement
- Staring at empty place
- Feelings such as low self esteem & disappointment
- Hope limb will grow back
- Cosmetic vs functional prosthesis

Adjustment to Disability
- "I am still me"
- Time and perspective
- Strategies: preparation & encouragement; peer amputees
- Help others be at ease

Vocational Rehab & Counseling

What is there to consider for Upper Limb Amputees when returning to work?

Factors Contributing to Successful RTW

- Length of premorbid employment
- Type of premorbid work: “cognitive” activities vs manual labor
- Pre-morbid job satisfaction, level of education
- Employer support/flexibility: potential for part time/limited duty work
- Stable medical status (esp. pain management)
- Functional independence (with or without prosthesis)
- “Successful” adaptation to disability, coping mechanisms
- Functional Capacity Evaluation
  - IW + employer confidence in ability to RTW
- Job coaching, training & education (33% Change of Occupation)

Additional Rehab Considerations

What are the absolute principles to abide by?

- **Fundamental for function**
  - Socket fit, comfort and alignment
  - Appropriate training and practice
- **Prosthetic componentry**
  - Focus on functional needs
  - Often tradeoff between function and cosmesis
  - Tradeoff of lightweight vs durability of components
  - Consider practical issues of battery life, recharging
  - Newer technology not always better
- **New Technology**
  - ***Usually*** heavier (e.g., electronics, batteries)
  - **Always** costs [*a lot]* more
  - ***Usually*** requires more frequent maintenance
  - Often ***uncertain*** durability
  - ***Constantly evolving => moving target***

Bottom line: The aim should be **realistic**

Case Management Considerations

Laurie Anderson

Case Management Considerations

What should case managers and claims professionals consider?

- Limb salvage and reconstruction – is the injured worker a candidate?
- Goals of the amputation
- Managing complications
- Treatment team
  - Have the appropriate medical, rehabilitation and prosthetic professionals been identified?
- What's the right prosthetic?
- Rapidly evolving prosthetic technology
- Outcomes and Return to Work

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Dr. Gary Clark

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