Review of Previous Lecture

You are teaching your patient about their total hip precautions (for a posterior approach) and the patient is sitting in a wheelchair. Is “Don’t turn your foot/toes inward” an appropriate instruction?

Rehab Terminology

- **STUMP**: Residual Limb
- **Artificial Limb**: Prosthesis
- **Stump sock**: Sock
- **Stump shrinker**: Shrinker
**Cause of LE amputation**

- The major cause of LE amputation continues to be PVD, especially when associated with smoking and diabetes.
- Second leading cause is trauma (MVA or GSW)

**Risk Factors**

**Factors that Influence Vascular Disease**
- Hypertension
- Age
- Diabetes mellitus
- Infection
- Poor nutrition
- Cigarette smoking

**Risk Factors for Amputation**
- Vascular disease
- Malignancy/tumor
- Congenital deformities
- Infection
- Trauma

**Study #1: DM & exercise**

- DM commonly leads to peripheral neuropathy, which causes motor and sensory deficits, often resulting in mobility-related dysfunction, balance impairments, lower gait velocity, decreased cadence, shorter stride length, increased stance time, decreased ankle strength and mobility, postural instability & increased risk of injurious falls
Study #1: DM & exercise

Fall-related injuries are often assumed to trigger vicious cycles b/c of their detrimental influence on physical activity.

Which treatment strategies can improve gait and balance, thereby reducing the risk of falls?

RCT = 71 subjects put into control and intervention groups. Control group received nothing

Intervention group received 60 minutes, 2X/week X 12 weeks of: stance on heels/toes, tandem stance, SLS, different kinds of walking, sit to stand, walk up/down slope, stair climbing, mini-hops, interactive game such as badminton.

Gait, balance, fear of falls, muscle strength and joint mobility were measured at baseline, after 12 weeks and 6 month f/u

Results: Significant improvements for intervention group for increased habitual walking speed, balance, performance-oriented mobility, degree of concern re: falling, hip and ankle plantarflexor strength, and hip flexion mobility.

After 6 months, all remained significant except Biodex sway index and ankle PF strength
Study #1: DM & exercise

Specific training can improve gait speed, balance, muscle strength and joint mobility in patients with diabetes.

LEVELS OF AMPUTATION

Usually identified by anatomical considerations/body region
What are the gait implications?

Toe Disarticulation

Gait Implication:
The hallux affects propulsion during fast ambulation
Can use toe fillers in the shoe
Transmetatarsal

Gait Implications:
- Problems with propulsion
- Problems with later part of stance phase
- The knee flexes too quickly

Syme's Amputation

- Everything distal to the tib/fib is amputated
- Gait Implication:
  - have LLD
  - Can stand & walk without prosthesis for short time

Below Knee - Transtibial

- Gait Implications:
  - ambulatory
**Above Knee - Transfemoral**

- **Gait Implications:**
  - can be ambulatory

**Hip Disarticulation**
- femur removed if shorter than gr. troch
- ambulatory with Canadian hip disarticulation prosthesis (very energy consuming)

**Hemipelvectomy**
- removal of LE & ½ the pelvis
- can walk with Canadian hip dis. Prosthesis, but may be better off in a W/C

**Hemicorporectomy**
- Amputation through the lumbar spine
- patient in a sitting bucket

**SURGICAL PROCESS**
- Specific length of amputation is determined by the status of the extremity at the time of amputation
- Considerations:
  - conservation of residual limb length
  - wound healing
**Closure**
- Primary: the skin is closed after surgery
- Tertiary: the surgical site is left open
  - If infected
  - May see these patients for whirlpool
  - Important to maintain skin traction so there will be adequate skin for later closure/coverage

**Ideal Surgery**
- Skin flaps: are as broad as possible. The scar should be pliable, painless, and nonadherent.
- Skin flaps: skin shouldn’t be too tight or loose
- Edges of suture lining should be smooth
- Nerve should be protected well
- Rounded, well beveled end of bone
- Muscles attachment

**HEALING PROCESS**
- Factors that may affect wound healing
  - Post-op infection
  - Smoking is a major deterrent to wound healing
  - Other factors
    - Severity of vascular problems
    - Diabetes
    - Renal disease
    - Cardiac disease
Post-operative Dressings

It is important for some sort of edema control to be used post operatively because excessive edema in the residual limb can compromise healing and cause pain.

### Post-Op Dressings

**Rigid dressing**
- Greatly limits post-op edema
- Can attach a pylon for early ambulation (Plaster of Paris socket in the configuration of definitive prosthesis)
- Requires close supervision during the early healing stage
- Does not allow for daily wound inspection

**Semi-rigid dressing**
- Applied in OR or recovery room
- Adheres to skin
- Allows slight joint movement
- Made of compounds: zinc oxide, gelatin, glycerin & calamine

**Soft dressing**
- Inexpensive
- Lightweight
- Most commonly seen in acute care setting
- Two types: Elastic wrap and shrinkers

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PT ASSESSMENT

- ROM
- Strength
- Sensation
- Skin assessment

- Balance
- Endurance
- Mobility skills

PT ASSESSMENT

- Residual limb assessment
  - Color
  - Shape
  - Pulses
  - Edema (circumferential measurements)
  - Length
  - Skin condition
  - Sensation
  - Joint proprioception

PT ASSESSMENT

- Pain
  - Phantom limb sensation: sensation of the limb that is no longer there. NORMAL to occur
  - Phantom limb pain: cramping, burning, shooting pain perceived "in" the amputated limb.
Phantom Limb Sensation

- Phantom Limb Sensation: This is any sensation of the missing limb except pain. Sensations include pins and needles, tingling and prickling. Awareness of movement and positional orientation of the limb are widely reported. (Casale et al 2009, Chapman 2010)

Residual Limb Pain

- Residual Limb (RL) pain is pain experienced in the residual portion of the limb (Prantl et al 2006)
- Causes of RL pain may include neuromas – scarred nerve endings or nodules that may cause abnormal ectopic firing of nerves (Bloomquist, 2001) as well as bony spurs in the residual stump, localized skin disease and infection (Prantl et al 2006)

Phantom Limb Pain

- Often the temperature in the residual limb is lower, which is correlated to the burning sensation that may be experiences as part of phantom pain (Schug 2008)
- Muscle tension in the residual limb can increase the cramping associated with phantom pain (Chapman, 2010)
- Risk factors proposed for the development of phantom limb pain include the severity of pre-amputation pain and post-operative pain (Nikolajsen and Jensen 2001), older age (Schug 2008), and catastrophising and passive coping styles (Richardson et al 2007)
**Phantom Limb Pain continued**

- Catastrophising refers to a coping style characterized by excessively negative thoughts and emotions in relation to pain (Vase et al 2010)

**REHABILITATION GOALS**

**Short Term Goals**
- Edema reduction
- Prevent contractures
- Regain strength in both LE
- Independence in basic residual limb exercises, positioning, bandaging, & care
- Learn proper care of remaining extremity
- Promote as high a level of independent function as possible (bed mobility, transfers, self care, supervised or independent mobility with walker or crutches)
- Decrease hypersensitivity

**Long Term Goal**
- To help the patient regain the pre-surgical level of function
Rehab Interventions

- Residual Limb Care
- Residual Limb Wrapping
- Pain Management
- Positioning
- Exercise
- Mobility
- Temporary Prostheses
- Patient Education
- Nonprosthetic Management

Residual Limb Care

- Edema Control
  - limb wrapping
  - shriners
- Proper hygiene and skin care
  - Clean & dry
  - Scar massage (TFM)
  - Visual inspection
  - Early handling by the patient

Residual Limb Wrapping

- Never wrap in a circular, tourniquet fashion which creates a bulbous end and compromises healing
- Effective wrapping should:
  - be smooth and wrinkle free
  - emphasize angular turns
  - provide pressure distally
  - encourage proximal joint extension
Residual Limb Wrapping

1. Apply firm, even pressure to decrease post-op edema
2. Residual limb should be completely covered
3. Semicircular turns are made posteriorly to align the wrap to cross anteriorly in an angular line
4. Cross wraps by 1/2”
5. Use tape/Velcro to secure. NEVER clips

Pain Management

*Chan et al (2007) demonstrated that mirror therapy reduced phantom limb pain in patients who had undergone lower limb amputation.*

*Patients attempt to perform movements of the phantom limb while viewing the reflected image of the movement of the intact limb.*

*http://www.youtube.com/watch?v=YL_6O_MPvwnQ*
**Pain Management continued**

MacIver et al (2008) used a mental imagery technique with a group of 13 people with upper limb amputation. The participants had 6 weeks of intensive training in mental imagery, which included a “body scan” exercise and imagined movement and sensation in the phantom limb. They showed changes in cortical reorganization using functional MRI with a corresponding reduction in some aspects of phantom limb pain.

**Pain Management continued**

Transcutaneous electrical nerve stimulation may also be considered to relieve pain. However, current evidence is conflicting and a recent Cochrane review found no studies met the eligibility criteria for inclusion in the review and recommended that a large multicenter RCT is needed (Mulvey et al 2010).

**POSITIONING**

- **Major goal is to prevent post-op contractures**
- **BKA**: must prevent hip & knee flexion contractures; full extension necessary for proper prosthetic use
- **AKA**: must prevent hip flexion, abd, & ER contractures; full hip extension crucial for prosthetic function (prone lying)
EXERCISE

The exercise program needs to be individualized & should include strengthening, balance (in sit & stand), coordination, & function

Depends on the patient’s pre-op status

Need to focus on trunk and upper body for ambulation

Early mobility is essential
   - resumption of independent activities (self-care, bed mobility, transfers)

Strengthening

BKA:
   - Strengthen the Quads!!
   - Active patients – strengthen Hamstring too
   - Strengthen proximal muscles around the pelvis (glut med)

AKA:
   - Strengthen the hip extensors!!
   - Strengthen glut med

Exercise

Specific exercises for both BKA & AKA will be reviewed and practiced in Lab
Decreasing Hypersensitivity

- Don’t confuse it with a neuroma or phantom limb pain
- How to decrease hypersensitivity?
  - TENS
  - Massage
  - Slapping the residual limb
  - Using various materials

MOBILITY

- Gait training can begin early on in rehab using a swing through 3 point gait pattern and crutches.
  - Will improve general fitness (CV & muscular endurance)
  - All individuals with an amputation need to learn some form of mobility without a prosthesis for use at night or when the prosthesis is not worn for some other reason.

TEMPORARY PROSTHESIS

- A temporary prosthesis can be fitted as soon as the wound has healed
- Advantages to using a temp prosthesis:
  - Allows for early bipedal ambulation
  - May allow patients to return to full active daily life
  - Some patients can return to work
  - Positive motivating factor
  - Shrinks the residual limb more effectively than wrapping
PATIENT EDUCATION

As with all pts, education is crucial. With these patients, it is essential that they are instructed in:
- care of the residual limb
- proper care of the uninvolved extremity
- positioning
- exercises
- diet

Patient Education cont...

- Skin Inspection:
- Foot Care:
- Foot Wear:

Bilateral Amputation

- The post surgical program is similar to the one for unilateral amputation, except ambulation
- These patients will need a wheelchair on a permanent basis
- Mat activities to regain a sense of body position & balance
- Functional mobility stresses independence in bed mobility, transfers & W/C use

May, 2002
Bilateral Amputation

- These patients spend a considerable amount of time sitting
- Stubbies: shortened prosthesis (no knee joint, modified rocker bottoms to prevent falling backwards)

Nonprosthetic Management

- There are some patients who, for any number of reasons, are not fitted with a prosthesis (and will not be fitted in the future)
Study #1

- 21 participants with lower limb amputations who were ambulatory with prostheses and 20 age-matched healthy individuals as the control group.
- Postural stability and balance were studied using computerized dynamic posturography.

Results:

- 1. equilibrium scores were significantly reduced in persons with amputations as compared to those without.
- 2. equilibrium scores were significantly reduced in persons with amputations due to vascular problems as compared to persons with amputations due to trauma.
- 3. no significant differences were found in equilibrium scores between BKA & AKA.

Looking Ahead

Prosthetics

Review

You are instructing a patient in w/c mobility. To have them turn to their right, which wheel of the w/c should be held still and stabilized?

A. Right
B. Left
C. Both
D. Neither
References


References Continued


References Continued


References continued
