Section 4

Amputation

WORKBOOK

The Knowledge of Human Healing

FIG
Nursing Education and Consultancy
OBJECTIVE 1: Explain the different classifications of amputations. Identify levels of impairment based on severity of a traumatic amputation.

OBJECTIVE 2: Describe acute and chronic complications of a traumatic amputation. Identify long term treatment and outcomes of a traumatic amputation.

OBJECTIVE 3: Apply and demonstrate the nursing process as a life care planning foundation for a traumatic amputation client.

Overview
Incidence (HANDOUT ACA Statistics) (HANDOUT - Amputation)
- 1.7 million people living with limb loss
- 1 out of every 200 people in US has had amputation
- Majority of amputees are above age 65
- Incidence higher in males
- Lower limb amputations - commonly related to disease
- Upper limb amputations - commonly related to trauma
**Dysvascular**
- Majority of amputations due to complications with vascular system - dysvascular amputation
- Lower limb amputations mainly due to vascular disease
- Incidence of dysvascular amputations on rise

**Cancer**
- Majority amputations related to cancer were lower limb
- Incidence of cancer related amputations on decline

**Trauma**
- Trauma-related amputations were majority upper limb
- Incidence of trauma-related amputations on decline
- Risk of traumatic amputations increases steadily with age

**Congenital**
- Congenital limb anomalies in newborns were 26 per 100,000 live births
- Congenital limb anomalies were mostly upper limb
- Incidence of congenital anomalies leading to amputations remain stable

**Etiology**
- **Peripheral Vascular Disease (PVD)**
  - Most common cause in adults
  - Major factors - hypertension and diabetes
  - 1/2 of amputations related to diabetes
  - Classic indicators - intermittent claudication and loss of one or more extremity pulses
  - Increased risk of further amputation due to PVD

- **Trauma**
  - 2nd most common cause in adults
  - Primarily due to bleeding and tissue damage
  - Surgical intervention required within 12 hours
  - Increased risk of infection due to torn tissue
• Burns
  • Thermal or electrical injury may necessitate amputation
  • Extent of full tissue damage may not be apparent in initial presentation
  • Aggressive debridement of devitalized tissue, fasciotomies, wound management & repeat debridement/grafting
  • Low voltage results in amputation of digits
  • High voltage results in amputation of extremity

• Frost bite
  • Actual freezing of tissue in extremities with or without central hypothermia
  • Heat loss exceeds body's ability to maintain homeostasis blood flow to extremities
  • Formation of ice crystals in extracellular fluid or ischemia injury from damage to vascular endothelium/clot formation/increased sympathetic tone
  • Amputation delayed for 2 to 6 weeks

• Infection
  • Acute or chronic infection that is unresponsive to antibiotics or surgical intervention
  • Most worrisome infections are gas forming organisms
  • Other infections include non-healing ulcer, chronic osteomyelitis, and infected non-union
  • Open & serial amputations
  • Long term antibiotic therapy

• Tumors
  • Advances in diagnostic imaging, chemotherapy, radiation therapy and surgical technique improve limb salvage
  • Long term survival from osteosarcoma has improved

• Non-union of bone
  • Long course of orthopedic management and failed methods to heal bone
• Pathological fractures
  • Metastatic or metabolic bone disease
  • More often in elderly
  • Attributed to decreased mobility and fragile health
  • Common in spine, hips, pelvis, and lower extremities

• Children
  • 60% of childhood amputations are due to congenital limb deficiencies
  • Most common for older children - MVA, gunshot wounds, and power tools
  • Most common for younger children - power tools (lawnmowers) and household accidents
  • Bone cancer has higher incidence in children than adults

Classification
• International Organization for Standardization (ISO) classification

ISO classification
Upper extremity
  Partial hand amputation
  Wrist disarticulation
  Transradial amputation
  Elbow disarticulation
  Transhumeral amputation
  Shoulder disarticulation
  Forequarter amputation

Lower Extremity
  Ankle (Syme) disarticulation
  Transtibial amputation
  Knee disarticulation
  Transfemoral amputation
  Hip disarticulation
  Transpelvic amputation
Other types of amputations
Below-the-knee (BKA)
Above-the-knee (AKA)
Amputation of foot and ankle (Syme’s)
Amputation of foot between metatarsus and tarsus (Hey’s or Lisfranc’s)
Hip disarticulation - removal of limb from hip joint
Hemicorporectomy - removal of half of body from pelvis and lumbar area
Amputation of hand or partial (specific digits)
Amputation of arm - above elbow (A/E) or below elbow (B/E)
Shoulder disarticulation - removal of limb from shoulder joint

Acute Care (HANDOUT - First Step 1-6 (Amputee Coalition of America))

Primary concern to control bleeding, minimize infection, and prevent shock

Objective of amputation to preserve healthy tissue with sufficient blood flow, maintain functional length of extremity, and remove infected/ischemic tissue

Physical exam - determine level of amputation vs. limb salvage

Diagnostic studies - x-rays, MRI or CT scans

Initial treatment - control bleeding, maintain adequate blood pressure, immediate surgical intervention (amputation), management of postoperative pain, prevent infection, wound care/dressing changes, support all body systems

Surgical intervention - irrigation/debridement, open wound management, amputation, advancement flap/skin graft

Surgical procedures
- Open amputation
- Closed amputation
- Cineplastic amputation
- Guillotine amputation
- Disarticulation
- Syme amputation
- Stump revision
Hospital stay averages 3 to 10 days

Rehabilitation - control swelling/stump wrapping, mobility/functioning, education on prosthesis, rehabilitation

Pathophysiology of dysvascular amputation and traumatic amputation are different; however, rehabilitation strategies and prosthetic component for both should be goal oriented and maximize function and quality of life

Comprehensive rehabilitation - multi-disciplinary team, prevention/early recognition of complications, range of motion, positioning, early introduction of prosthesis & stump care, establish goals & equipment needs for maximizing function, interdisciplinary approach, individualized rehab program with consideration of unique barriers and facilitators, inclusion of patient in rehab program, inpatient & outpatient care with goal of community re-integration

Outpatient rehabilitation programs provide support, training, and education

Acute Complications  (HANDOUT - VA Traumatic Amputation & Prosthetics)

Edema
Neuroma
Wound necrosis
Infection
Contracture
Hematoma
Dermatological
Limb pain/Phantom limb pain (HANDOUT - Pain after Amputation)
Psychological

Loss of Function - Upper Extremity

Fingers
• Loss of 1 to 2 fingers does not hinder hand function, no functional prosthesis, only cosmetic prosthesis
• Loss of 3 or more fingers hinders hand function, functional prosthesis fitting difficult, only cosmetic prosthesis
• Difficulty with grasping
Thumb
- Lost ability to grasp
- Transplantation of toe or next digit to create thumb

Hand
- Loss of wrist joint and ability to grasp causes difficulties with ADLs, school, and work
- If dominant hand, training necessary to perform writing tasks and use of non-dominant hand
- Cosmetic prosthesis serves to balance or hold items with both hands
- Conventional vs. myoelectric prosthesis

Forearm (below elbow)
- Amputation between wrist and elbow
- Loss of wrist joint and ability to grasp causes difficulties with ADLs, school, and work
- If dominant hand, training necessary to perform writing tasks and use of non-dominant hand
- Conventional vs. myoelectric prosthesis

Upper arm (above elbow)
- Amputation between shoulder and elbow
- Loss of wrist joint and ability to grasp causes difficulties with ADLs, school, and work
- If dominant hand, training necessary to perform writing tasks and use of non-dominant hand
- Conventional vs. myoelectric prosthesis

Shoulder
- Major alteration in body
- Altered balance
- Difficult to fit prosthesis
- One handed functioning without prosthesis
- Conventional vs. myoelectric prosthesis
Loss of Function - Lower Extremity

Toes
- Loss of 1 to 2 toes does not normally affect function of foot or leg to major degree
- If great toe, balance affected
- Loss of 3 or more toes, balance affected

Metatarsals
- Lisfranc procedure - tarsometatarsal amputation
- Chopart procedure - midtarsal disarticulation
- Able to balance with heel

Ankle
- Syme procedure - rear foot amputation (*removes talus and calcaneus bones*)
- Balance affected
- Smooth gait pattern affected
- Ambulation more difficult

Below knee
- Amputation between knee and ankle
- Foot prosthesis or mobility device required for ambulation

Knee
- Loss of two joints (*ankle and knee*)
- Prosthesis or mobility device required for ambulation

Above knee
- Amputation from knee to hip
- Loss of two joints (*ankle and knee*)
- Prosthesis or mobility device required for ambulation
Hip
- Amputation at hip or hip joint to preserve life of individual
- Loss of two or three joints (ankle, knee, and hip)
- Prosthesis or mobility device required for ambulation

Hemi-pelvectomy
- Loss of bony case to support abdominal contents
- Urinary and gastrointestinal systems can be initially affected
- Prosthesis or mobility device required for ambulation

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(HANDOUT - Prosthetic FAQ for New Amputee) (HANDOUT - Prosthesis Use and Abandonment) (HANDOUT - Expert Opinions on success factors for upper-limb prosthesis) (HANDOUT - Multivariate prediction of upper limb prosthesis acceptance or rejection)

Prosthesis Options
Reasons for wearing prosthesis
- Cosmetic - normalcy, self esteem, body image
- Therapeutic
- Independence
- Recreation/sports

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Prosthesis stages
Immediate
Preparatory
Definitive
- Endoskeletal - components of prosthesis are inside, cosmetically looks like arm or leg
- Exoskeletal - prosthesis is hollow on inside with strength built into outside plastic surface

Prosthesis options
- Cosmetic
- Conventional - body powered, hook/cable with harness/strap, adaptive devices available
- Electronic - adaptive devices available
  - Switch controlled
    - Myoelectric - electrodes, sensors placed inside of socket for muscle to generate stimulation
    - Hybrid - combination (body powered & switch controlled elbow & myoelectric wrist/fingers)
Components to prosthesis
1. Cuff/strap
2. Sleeve/silicone liner
3. Sock
4. Liner/socket
5. Joint
6. Hand/foot

Pediatric considerations
Consider child's developmental readiness for prosthesis
Prosthesis becomes more complex as child grows/develops
Consider durability of prosthesis in comparison with child's activity level (sand box)
Most children will outgrow prosthesis within 1 to 2 years
Inner sockets can allow for growth & extend life of prosthesis
Frequent re-evaluations of lower limb length & adjustments for growth

Nurse Life Care Planning Process
Assessment
FIM-FAM Scale (Functional Independence Measure & Functional Assessment Measure)
• FIM scale assesses eating, grooming, bathing/showering, dressing (upper and lower body), toileting, bladder management, bowel management, bed/chair/wheelchair transfer, toilet transfer, tub/shower transfer, walking/wheelchair locomotion, stairs, comprehension, expression, social interaction, problem solving, & memory
• FAM scale assesses swallowing, car transfer, community access, reading, writing, speech intelligibility, emotional status, adjustment to limitations, employability, orientation, attention, & safety judgment
• FIM -FAM Scale to be completed by trained healthcare professional through direct observation
• Scores range from total assistance (1) to complete independence (7)

Nurse Life Care Plan Assessment
Muscloskeletal
Neurologic
Integumentary
Psychosocial
FIM-FAM
  Bathing/showering/hygiene
  Grooming
  Dressing
  Feeding
Mobility
Nursing Diagnosis

Impaired skin integrity
Altered body function
Alteration in self perception
Disturbed body image
Impaired adjustment
Anticipatory grieving
Impaired physical mobility
Knowledge deficit
Self-care deficit
Social isolation
Impaired Home Maintenance

Outcomes

Collaboration

Physiatrist/specialist
Physicians
Therapists (OT, PT, orthotist, prosthetist)
Care providers
Equipment vendors

Medical Research

Veterans Administration/Department of Defense Clinical Practice Guideline for Rehabilitation of Lower Limb Amputation (*HANDOUT - VA CPG for Rehabilitation of Lower Limb Amputation*)

Defense Advanced Research Projects Agency (DARPA)

Rehabilitation Institute of Chicago

John Hopkins University
Chronic Complications  *(HANDOUT - Quality of Life and Related Factors)*
Triple loss - loss of function, loss of sensation, and loss of body image

Edema and volume control
- *Cause majority of problems with prosthesis and affected limb*
- *Shrinker applied during early stages of healing process*

Skin breakdown
- *Allergic reactions to products*
- *Contact dermatitis*
- *Hematoma*
- *Infection*

Musculoskeletal
- *Contractures*
- *Degenerative changes*
- *Arthritis*
- *Heterotrophic ossification*
- *Overuse syndrome/repetitive strain of opposing limb*

Neurological
- *Phantom limb pain - neuropathic pain*
- *Neuroma*
- *Treatment - medications (anti-convulsant, or anti-depressant), de-sensitization therapies*

Pain  *(HANDOUT - Amputee with Chronic Pain)*
- *Consider secondary diagnosis*
- *Musculoskeletal pain*
- *Treatment - pain management specialist, medications (analgesic or anti-inflammatory), massage, heat/ice, relaxation/biofeedback, blocks, TENS unit, or dorsal column stimulator*

Prosthesis
- *Neuroma*
- *Skin breakdown*
- *Adhesions*
- *Overcompensation of opposite extremity*
Psychosocial  
*(HANDOUT - Intimacy as an Amputee)*

- Mood disorders (depression, anxiety)
- Adjustment disorder
- Post-traumatic stress disorder
- Sexuality issues
- Treatment - counseling, relaxation/biofeedback, or medications

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**Planning**

**Treatment Recommendations in Nurse Life Care Plan** *(HANDOUT - Journal of Nurse Life Care Planning/Amputations)*

**Medical**

**Physician appointments/evaluations**
- Physiatrist
- Orthopedist
- Neurologist
- Pain Management
- Plastic Surgeon

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**Surgeries/Procedures (invasive vs. non-invasive)**
- Re-amputation
- Stump revision
- Injections/blocks
- Dorsal column stimulator

**Hospitalizations**
- Infection

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**Therapeutic evaluations** *(HANDOUT - Comparison of upper limb amputees/DASH Scale)*
- Prosthetist
- Orthotist
- OT
- PT
- Nutrition
- Psychological
Therapeutic modalities  (HANDOUT - OT Protocol for Amputees)

Prosthetist
Orthotist
OT
PT
Nutrition
Psychological (individual & family)

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Diagnostic studies
Musculoskeletal - x-rays (amputated extremity or secondary diagnosis), MRI/CT scan, bone scan, Doppler ultrasound (wound healing/DVT)
Neurological - EMG/NCV studies

Lab work
Comprehensive metabolic panel

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Medications
Analgesic - musculoskeletal, neuropathic, phantom limb
Non-steroidal anti-inflammatory
Mood disorders

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Medical supplies
Skin care
Wound care/dressing changes

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Prosthesis
Cosmetic
Conventional
Electronic
Hybrid

Prosthetist evaluation/re-evaluation
Prosthesis training
Prosthesis
Maintenance/repair - liners/sockets are replaced more frequently than prosthesis
  Socket
  Socks
  Sleeve/Liner
  Supplies
  Adaptive devices
Replacement - based on level of function, use of prosthesis, and age of individual
Warranty - limitations


Mobility
Wheelchair evaluation

Manual wheelchair (standard vs. customized)
Power assist wheelchair
Power wheelchair
Scooter

Wheelchair maintenance/replacement

Wheelchair accessories - back pack, gloves
Durable medical equipment/Aids for independent function  *(HANDOUT - Grooming, Bathing & Safety Tips)*

Specifics of DME dependent on level of physical/functional ability, and secondary issues related to amputation
Promote independence and self esteem
Promote mobility for lower limb amputee
Replicate gross/fine motor skills for upper limb amputee

- Examples of DME
  - Hospital bed vs. electric bed & mattress/overlay
  - Patient lift (manual vs. electric)
  - Transfer bench
  - Shower chair
  - Elevated toilet seat with rails
  - Adaptive clothing
  - Dressing/grooming aids
  - Assistive technology
  - Household aids
  - Computer & computer controls
  - Voice activated software

Non-medical
Home care/living arrangements

Present options *(present pros & cons)*
- Home - apartment, renovate home vs. purchase home
- Assisted living
- Skilled nursing facility

Heavy house cleaning, home maintenance, lawn care

Home health care vs. Respite care  *(HANDOUT - Caregivers Survival Guide)*
Levels of home care
- Skilled (RN or LPN)
- Unskilled (Certified Nursing Assistant/Home Health Aide, Personal Care Attendant, or Companion)

Level of skilled or unskilled care dependent on nursing board in state of residence
Architectural renovations

- Safety
- Barrier free
- Wheelchair accessible design
- Assistive technology
- OT home evaluation
- Contractor home evaluation

Transportation (HANDOUT - Traveling with Disability)

- Driver evaluation

  - Wheelchair accessible transportation
  - Personal vehicle
    - Handicap driver evaluation
    - Handicap driver training
    - Handicap parking permit
    - Vehicle modifications
  - Public transportation
  - Private transportation

Educational/Vocational

- Vocational evaluation
- Vocational case management
- Vocational retraining
- Vocational modifications

Restrictions for amputations with prosthesis - avoid hot, humid environment which can cause skin breakdown or contribute to deterioration of prosthesis, dirt/grit can be abrasive to skin, exacerbate skin problems, and interfere with function of prosthesis

Restrictions for amputee (upper limb) - gross motor skills, fine motor skills, lifting/pushing/pulling/carrying/reaching, repetitive motion, vibration, safety, sedentary/light physical demand level, one handed work, consider overuse syndrome, cosmesis - public’s reaction

Restrictions for amputee (lower limb) - mobility, walking/standing/stairs, lifting/pushing/pulling/carrying/reaching, repetitive motion, vibration, safety, sedentary/light physical demand level, wheelchair accessible environment, consider increased energy expenditure to operate prosthesis & overuse syndrome
Other *(HANDOUT - Resources for Wounded Warriors)*

- Case management
- Support group
- Fitness
- Recreational modifications
Case Study

Name: Mr. John AMP

DOB: 10/09/74, Age 36

DOI: 12/21/06

Brief description of injury/accident: (only focus on amputation, exclude electrical shock)
- Electrical shock, contact points were left & right hands
- 3rd degree burn to right hand (between thumb and index finger)
- Subsequent left arm amputation below elbow
- Fell sustained a T12 vertebrae fracture
- Complications requiring extended hospital stay

Initial Diagnoses:
- Status post (S/P) electrical shock
- S/P left below elbow amputation
- S/P fractured T12 vertebrae
- S/P decompression left median nerve
- S/P Adult Respiratory Distress Syndrome (ARDS), phantom limb pain, and chronic pain

Acute Care:
- Life threatening compartment syndrome
- Escharotomies and fasciotomies
- Skin debridement
- Skin grafting
- Ventilator support for ARDS
- Left below elbow amputation

Complications:
- Compartment syndrome/escharotomies and fasciotomies
- Adult Respiratory Distress Syndrome (ARDS)
- Rhabdomyolysis
- Pneumonia
- Difficulty weaning from ventilator
Current Care:
Evals with Mr. Jones/Prosthetist annually and as needed for adjustments of prosthesis

Primary Care Physician - seeing prn

Has not established with physiatrist or orthopedist - has been recommended by PCP

Wife & adult children providing assistant care

Medical supplies/DME - see below

Medications
OTC Advil (2-4 pills/day for a few days)

Medical Supplies/DME/Aids for Independent Function:
Hand held shower & shower head with anti-scald valve
Home adaptive equipment & kitchen aids
Right hand glove (anti-vibration gel glove)
Dragon Naturally Speaking voice recognition computer program

Prosthesis:
i-LIMB Pulse (left below elbow prosthesis)
Conventional left below elbow prosthesis
Maintenance/repair & component replacement
Prosthesis re-evaluation
Initial prosthesis training for i-LIMB Pulse
Prosthesis retraining
Prosthesis adapters for recreational activities (hunting, fishing, yard work, car maintenance)

Symptoms/Limitations:
Left below elbow amputation
Extreme sensitivity at stump site
Slightest touch/pressure sends numbness/tingling radiating into arm
Constant throbbing sensations
Constant cold/wet sensations
Phantom limb pain
Feels like “fingers are clenched/drawn up,” attempts to mentally relax the fingers

Symptoms increase with cold weather/temperature
Symptoms relieved with rest/sedentary activity and wearing shrinkage/compression sock
Wears shrinkage/compression sock in evenings to reduce edema and provide comfort/protection
Wears wool stump sock when outside in cold weather
Bone protruding thru stump, sensitive to touch/pressure
Left shoulder weakness due to muscle atrophy and prosthesis wear
Compensates with right upper extremity
Loss of balance
Easily off balance when kneeling/squatting and attempting to stand up, unable to hold onto surface and push up
Difficulty with getting in/out of vehicles, unable to hold onto surface and push up with right hand

Other
Right hand decreased grip strength
Right hand decreased fine motor coordination
Right hand decreased gross motor coordination
Right hand decreased sensation
Right hand numbness/tingling
Uses right forearm, instead of right hand, to push up from seated position
Right wrist soreness
Unable to differentiate temperatures (hot or cold) in right hand
Unable to type on computer keyboard, pecks with right fingers
Unable to tolerate vibration in right hand
Discolored and deformed finger nails
General aches/pains increase with activity and weather changes
Easily fatigued
Prolonged activity increases fatigue
Takes longer to complete tasks, frequent rest/breaks
Decreased stamina/endurance
Overall weakness
Overall limited range of motion, mainly upper extremities
Overall limited strength, mainly upper extremities
Overall symptoms increase with activity and weather changes
Overall symptoms decrease with rest/medication/climate controlled environment/sedentary lifestyle
Cognitive deficits
Forgetful
Short term memory loss
Searches for words or thoughts
Difficulty with verbalizing thoughts

Psychosocial:
somewhat independent for ADLs (except buttons/zipper/shoe laces)
short term memory loss: interferes with daily living
concerned re: attention/stares from strangers
fear of injuring his only hand (right)
relies heavily on his wife and children with daily grooming and chores
forgets simple tasks
frustrating to find proper words or express thoughts
unable to remember recent conversations
enjoys using i-limb; especially in public; due to decreased stares from strangers
uses i-limb in small time increments due to muscle spasms and fatigue in shoulder
family situation changed; stressed since accident
stay-at-home dad
wife works full time during the day
2 children at home ages 8 and 11; perform assistance and chores
Right hand dominant

**Educational/Vocational:**
High school graduate 1993
Few semesters at technical school
Owned/operated landscape business
Supervised other employees and performed same duties
Attempted to return to work part time
Unable to continue working due to physical requirements
Turned business over to family member
Uncertain of his physical and cognitive abilities to work full time
Receiving SSDI
Works part time at family hardware store approximately 12 hrs per week (2 days per week)
Takes a day between to recover after working part time

**Collaboration (communication with treating providers):**
Discussions held with Dr. Primary Care Physician & Prosthetist:

Dr. Primary Care Physician noted: specialty physician care/consultations, therapeutic evaluations and modalities, diagnostic studies and lab work, medications, durable medical equipment/aids for independent function, prosthesis, home care assistance, transportation aids, and supportive services

Prosthetist noted: In May 2007, Mr. Amp received a left below elbow body powered prosthesis. He had a hook attachment and a harness strap. He also wore a gel sleeve and two stump socks for proper fitting of the prosthesis. He was last evaluated in late 2007. He was to return for repairs/replacements on an as needed basis. It is understood this particular prosthetic company is no longer located in Mr. Amp's home town. On 03/23/09, Mr. Amp was evaluated by Mr. Tom Jones of Alternative Orthotics & Prosthetics, Inc. (AOPI) with recommendations of a conventional and electronic prosthesis. Mr. Amp has expressed interest in these recommendations and transferring his prosthetic care to AOPI.

On 03/23/09, Mr. Amp was evaluated by Mr. Jones of AOPI. (Nurse Life Care Planner was present.) The purpose of this evaluation was to assume prosthetic care and address future prosthesis recommendations. Mr. Amp expressed interest in a more advanced prosthesis. Following a muscle function test and assessment, Mr. Jones explained Mr. Amp would best benefit from a customized myoelectric type prosthesis (i-LIMB) to enhance the functioning and cosmesis of the left upper extremity. An i-LIMB would allow fine and gross motor coordination of the left upper extremity which would improve his quality of life and independence. Mr. Jones indicated Mr. Amp would be involved in several months of prosthesis training for the i-LIMB. Because of the complexity of the i-LIMB and cost of maintenance/repair, a conventional prosthesis was also recommended for more labor intensive tasks. Also, assistive devices/accessories could be attached to the conventional prosthesis for hobbies, such as hunting, fishing, or golfing. Mr. Amp was quite pleased with the prosthesis options and thoughts of regaining some of his independence.

On 11/19/10, this Nurse Life Care Planner met with Mr. Jones to review/update the prosthetic recommendations in the Nurse Life Care Plan. Mr. Jones shared Mr. Amp was placed in an i-LIMB electronic prosthesis on 08/27/10. He has quickly learned and transitioned well to the i-LIMB prosthesis. Unfortunately, the current i-LIMB prosthesis model is
being phased out and replaced with a newer version, the i-LIMB Pulse. Because of the recent purchase, Touch Bionics has agreed to replace Mr. Amp’s i-LIMB prosthesis for an i-LIMB Pulse at no charge. Mr. Jones is awaiting delivery of the new i-LIMB Pulse, which is anticipated to be late November. Mr. Jones noted the i-LIMB Pulse has advanced technology which also increases the purchase price. Mr. Amp will be scheduling a return appointment for transition/training of the i-LIMB Pulse. Mr. Jones anticipates several hours of prosthesis training as the i-LIMB Pulse is Blue Tooth compatible with a home/personal computer. The Blue Tooth compatibility will allow Mr. Amp to change various settings on the prosthesis at home from his computer, assuming he has Windows 7 on his home computer. The i-LIMB Pulse allows an EKG signal to be sent to the prosthesis which prompts certain movements of the prosthesis. The EKG signal is produced by specific muscle twitching or pulse sensation. Mr. Jones explained the i-LIMB Pulse has more functions than the i-LIMB. The i-LIMB Pulse allows simultaneous power movement of the fingers and thumb instead of manually setting the thumb. The i-LIMB Pulse allows slight individual movement of each finger and thumb. Mr. Amp will have better gross and fine motor coordination for tasks with the i-LIMB Pulse. However, Mr. Jones shared there are still drawbacks to an electronic prosthesis. For example, the electronic prosthesis does not replace a natural arm/hand/fingers. Mr. Amp is still unable to feel sensation, such as human touch or hot/cold temperatures. He has no tactile sensation with the electronic prosthesis. The prosthesis does not resolve Mr. Amp’s phantom limb pain. There is no rotation of the thumb which has to be manually set. Mr. Amp is unable to individually maneuver each finger. There is no rapid maneuvering of the fingers. For example, he is unable to play a musical instrument or type on a keyboard. He must still use one finger to peck on the keyboard. He cannot produce rapid movement of the electronic prosthesis. His movements are planned and not involuntary like the natural hand. There is a delayed response and loss of reflex. There is no wrist flexion/extension. There is no nerve/thought process of manipulate the electronic prosthesis. The military is currently researching nerve/thought process manipulation through the DARPA (Defense Advanced Research Projects Agency) project. It is anticipated this advanced technology (nerve/thought process) will be available for purchase within the next few years. An estimated cost cannot be determined due to the advanced technology. Mr. Jones noted prosthetic treatment recommendations and complications related to an amputation do not drastically vary from an electrical shock amputation versus a traumatic amputation. He also indicated safety factors are involved with the use of an electronic prosthesis. The electronic prosthesis is not waterproof and should not be used around water or during water activities. The electronic prosthesis is contra-indicated with driving, including motor vehicles, motorcycles, and four wheelers, due to the slowed response of the prosthesis. A conventional prosthesis is recommended for these type activities. Mr. Jones recommended an electronic griefer adapter which interchanges with the i-LIMB Pulse to allow for more strenuous manual tasks. Unlike a conventional prosthetic, the electronic prosthesis allows above-shoulder or overhead functioning, such as changing a light bulb or reaching for something off the top shelf. Mr. Jones further explained a 3 year warranty is available with the purchase of an electronic prosthetic. The warranty is limited to the electronic hand. The warranty does not cover the lithium ion batteries. There are 2 batteries in Mr. Amp’s electronic prosthesis. These batteries should be changed at least yearly. The wholesale cost for 2 lithium ion batteries is $500. Prosthetic supplies and batteries can only be purchased through special order by a board certified prosthetist. The warranty also does not cover the socket, forearm, internal charger, and electrodes which are typically replaced between interim prosthesis replacements. A customized silicone glove produces a life-like version of the hand. This customized silicone glove is recommended to be worn for cosmesis and not functionality of the prosthesis. There are limited companies which provide this service. Mr. Jones recommended Art Tech in Texas. When the customized silicone glove is not worn, a skin glove is worn to cover the prosthesis. The skin glove is exposed to elements and general wear/tear on a daily basis. Typically, the skin glove is replaced on a monthly to bi-monthly basis with an average cost of $900. Mr. Jones noted the most current technology is the i-LIMB Pulse. However, technology continues to rapidly advance with research. Mr. Jones noted the upper extremity prosthesis costs are generally under-funded in a Life Care Plan. Prosthetists, such as Mr. Jones, are unable to accurately estimate the increased costs with advanced technology. Upper extremity prostheses are more intricate as to the design, detail, and attempt to mimic the functions of the natural hand. In 2011, the i-LIMB Pulse will be obsolete and replaced with the next prototype, the Michelangelo. The Michelangelo will have additional functions, such as wrist flexion/extension and minimal replacement of the skin covering. Unfortunately, Mr. Jones explained there is no prosthetic device available that will fluctuate or accommodate for normal body changes, such as swelling, muscle mass, muscle atrophy, or aging, and allow for advanced technology to reduce the replacement frequency. The timeframe and
length of prosthesis wear is dependent upon a person’s activity level. In preparation for the Nurse Life Care Plan, Mr. Jones recommended care be established with an upper extremity specialist, periodic physician consultations be conducted to address secondary diagnosis/complications, consideration of surgical neuroma excision and stump revision, periodic therapeutic evaluations and projected therapies due to overuse syndrome/complications/additional expended energy to operate an electronic prosthesis, upper extremity diagnostic studies, durable medical equipment/aids for independent function, an electronic and conventional prosthesis/maintenance/replacement/accessories, assistance with home maintenance/yard work, assistance with activities of daily living, transportation modifications, and supportive services.