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Happy Holidays to you and your family!

In addition to celebrations with family, friends, and colleagues; this time of year also precipitates a forum for reflection and review of changes, growth, and accomplishments that have occurred in the last 12 months. With that in mind, since this winter issue launches my second year as the Journal Editor, I want acknowledge those who took part to make the Journal issues shine.

Through the collective efforts and unwavering support of the immediate past Co-Chairs Jenn Craigmyle and Kelly Campbell, the Journal Committee members, and Kamo the Journal’s production crew; pertinent articles and information were disseminated that aligned with the Journal’s vision:

"To provide interesting, timely, and scholarly peer-reviewed articles as a vehicle which furthers a collegial exchange of theoretical and didactic discussions aimed at engaging, enlightening, and expanding the knowledge and skill set of our Nurse Life Care Planning community and readership."

As the saying goes, it takes “teamwork to make the dreamwork” (Maxwell, 2002). So to each of you who were actively engaged in the team effort to make the Journal a success this past year, thank you!

To better meet member’s needs and requests, the Journal added two new departments in the Summer issue: Dear Carole, and Aging and (the issue focus) Resource List. These reoccurring informational pieces provide answers to common life care planning practice questions and aging related resources, respectively. Therefore, please continue to submit your inquiries to DearCaroleColumn@gmail.com.

I am pleased to announce that Laura Stajduhar has stepped in to lead the Journal Committee as the Journal Chairperson. I encourage you to contact her if you have ideas for future issue themes, potential authors, or other ideas to best meet our readership needs. She can be reached via email at laura.stajduhar@gmail.com.

I hope you enjoy reading this issue on mobility and extremity function. Two of the articles stem from presentations that were part of the 2016 International Association of Rehabilitation Professionals Conference: Upper Limb Prosthetic Rehabilitation and Life Care Planning Considerations by Ms. Hsu and Mr. Waryck, and Major Limb Replantation by Dr. Lubahn and Dr. Phillips. The dystonia article builds on three previous deep brain stimulation publications from 2012, 2014, and 2016 by Zhang, Sperry, and Shahlaie. Ms. Luckett’s Upper Extremity Impairment and Interventions article provides practical assessment and coding information for life care planning consideration.

As always, the Journal Committee welcomes your feedback and input. Please send your comments to the Editor.

May you have a wonderful Holiday Season and a prosperous and healthful New Year!


Mariann F. Cosby, DNP, MPA, RN, PHN, CEN, NE-BC, LNCC, CLCP, CCM, MSCC
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Information for Authors

AANLCP® invites interested nurses and allied professionals to submit article queries or manuscripts that educate and inform the Nurse Life Care Planner about current clinical practice methods, professional development, and the promotion of Nurse Life Care Planning within the medical-legal community. Submitted material must be original. Manuscripts and queries may be addressed to the Editorial Committee. Authors should use the following guidelines for articles to be considered for publication. Please note capitalization of Nurse Life Care Plan, Planning, etc.

Text
Manuscript length: 1500 – 3000 words
- Use Word© format (.doc, .docx) or Pages (.pages)
- Submit only original manuscript not under consideration by other publications
- Put the title and page number in a header on each page (using the Header feature in Word)
- Use Times New Roman 12 point font
- Place author name, contact information, and article title on a separate title page, so author name can be blinded for editorial review
- Use APA style (Publication Manual of the American Psychological Association 6th Ed)

Art, Figures, Links
All photos, figures, and artwork should be in JPG or PDF format (JPG preferred for photos). Line art should have a minimum resolution of 1000 dpi, halftone art (photos) a minimum of 300 dpi, and combination art (line/tone) a minimum of 500 dpi. Each table, figure, photo, or art should be on a separate page, labeled to match its reference in text, with credits if needed (e.g., Table 1, Common nursing diagnoses in SCI; Figure 3, Time to endpoints by intervention, American Cancer Society, 2003) Live links are encouraged. Please include the full URL for each.

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All authors must disclose any relationship with facilities, institutions, organizations, or companies mentioned in their work. All accepted manuscripts are subject to editing, which may involve only minor changes of grammar, punctuation, paragraphing, etc. However, some editing may involve condensing or restructuring the narrative. Authors will be notified of extensive editing. Authors will approve the final revision for submission. The author, not the Journal, is responsible for the views and conclusions of a published manuscript. Submit your article as an email attachment, with document title articlename.doc, e.g., wheelchairs.doc

Manuscript Review Process
Submitted articles are peer reviewed by Nurse Life Care Planners with diverse backgrounds in life care planning, case management, rehabilitation, and the nursing profession. Acceptance is based on manuscript content, originality, suitability for the intended audience, relevance to Nurse Life Care Planning, and quality of the submitted material. If you would like to review articles for this journal, please contact the Editor.

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A CORE CURRICULUM for NURSE LIFE CARE PLANNING

American Association of Nurse Life Care Planners

Dorajane Apuna-Grummer
Wendie A. Howland
Editors
Season’s Greetings!

December is one of my favorite times of the year, and not just because of the many activities surrounding the holiday season. As one year ends and another begins, I appreciate taking time to reflect on past accomplishments while anticipating the achievement of future goals.

Less than a year ago, I assumed the role as your President. The most rewarding part of this opportunity remains the same - the ability to work with a member organization with common goals. These goals support and advance the association through sound leadership, educational events, trusted resources, and opportunities to serve the association through committee participation.

I am thankful to our members, sponsors, businesses and partners for your support of our wonderful association, the leadership of the Executive Board, and our committees. It has been a great year for the association. We kicked off 2017 with a successful membership drive, which affords us the opportunity to offer premium benefits to the many Nurse Life Care Planners who are part of the association.

We energized participants at our annual educational conference last March in Scottsdale, Arizona. The inspiring keynote speaker, J.R. Martinez, an actor, best-selling author, motivational speaker, and an advocate and wounded U.S. Army Veteran, set the tone for four days of dynamic learning and networking to advance our practice. Our 2018 conference committee members are now working as Picassos, painting final brush strokes for the next conference - “The Art of Life Care Planning” - which is scheduled for March 16-19 in St. Petersburg, Florida. The conference agenda, which features many educational and networking opportunities, can be viewed on the conference website. We invite you to register today to save your seat and be part of the excitement in St. Petersurg! (https://www.aanlcpconference.com/register)

AANLCP continues to work toward our goal of educating healthcare professionals and society about the value of nurse life care planning. This advocacy work included developing strong partner relationships in 2017 with a number of organizations, including the International Association of Rehabilitation Professionals (IARP), The American Association of Legal Nurse Consultants (AALNC), the Case Management Society of America (CMSA), and the National Association of Medicare Set Aside Professionals (NAMSAP).

Our association has a lot to celebrate, and we are proud to recognize our 20th anniversary in 2018! We are so grateful to our founder, Kelly Lance, whose vision for applying the nursing process to life care planning has set the standard for our profession. The first Standards of Practice for the Nurse Life Care Planner were published in 1998 in the Journal of Nurse Life Care Planning. Throughout the coming year, AANLCP will reflect on its history and celebrate early accomplishments, from the first journal and conference to other work facilitated by Ms. Lance, and the initial Executive Board and committees.

In the coming weeks, as we prepare for 2018, the role of AANLCP President will be transitioning to Lori Moore Dickson, who served as President-Elect in 2017. We look forward to sharing her insight and plans for the association through current and ongoing work, and by her leadership and the contributions of the Executive Board, as we continue to grow in the new year and beyond.

Best wishes to each of you, to our management company Kamo, and to AANLCP, for a prosperous 2018!

Denise W. Wrenn

Denise W. Wrenn, MSHA, BSN, RN, CCM, COHN-S, CWCP, CMSP, CLCP, ALNC
President, AANLCP dwrenn@denisewrenn.com
Show Them The Evidence
Evidenced-based practice begins with research.
If you write life care plans you already do research.
No fear! Lighten the load! Strengthen the practice!
Come join us as we find the evidence to support our practice!

Are you...

... curious about how and why the nursing process supports our specialty practice of Nurse Life Care Planning? Are you in a formal education/practice program and need ideas for a research project and paper? Let’s talk!

Your Research Committee is currently studying how and why Nurse Life Care Planners put case management services into life care plans. We need help doing literature reviews and identifying tools to determine variables in using case management services.

... already working on research in a formal advanced education/practice program? Did you know that AANLCP would love to know about your research project?! Tell us about it!

~ Colleen Manzetti, DNP, RN, CNLCP, CNE
Chair, AANLCP Research Committee

Together we can learn the scoop
share knowledge
build a body of evidence
by life care planners
for nurse life care planners

Participate:
email cmanzetti@aol.com
Phone 732-261-1761
C. Janice Hsu joined Advanced Arm Dynamics in April 2013, as clinical therapy specialist for the Great Lakes Center of Excellence in Cleveland, Ohio. Previously, she conducted research in Washington University's Human Performance Lab, and was a research assistant in the Washington University Psychology Department and at Vanderbilt University Medical Center. She graduated magna cum laude from Washington University in St. Louis, Missouri, where she earned a Bachelor of Arts in Psychology and a Master of Science in Occupational Therapy. She is a member of Pi Theta Epsilon national honor society for occupational therapy students and alumni. Ms. Hsu is certified by the National Board for Certification in Occupational Therapy, a member of the Ohio Occupational Therapy Association and is a licensed occupational therapist in Ohio and Texas. She is also a member of the American Academy of Orthotists and Prosthetists.

Karen Luckett obtained her Bachelor of Science degree in occupational therapy in 1980 from Wayne State University in Detroit. She has worked as an occupational therapist for 37 years in school settings, hospitals, out-patient clinics, and extended care facilities.

In 1983, Ms. Luckett moved to Jerusalem Israel for 3 years where she worked with traumatic burn patients at the Hadassah Medical Center. After returning to the US, Ms. Luckett moved to California. She worked at UCLA before opening a clinic in Beverly Hills, California which offered Speech, OT, PT, Acupuncture, and Vocational Rehab services.

Ms. Luckett has been doing forensic work since 1994. In 2006, she became certified as a life care planner. In addition to testifying in court as a life care planner, she has also been called on several occasions to testify as a standard of care expert.

Ms. Luckett has also published two journal articles in the Journal of Life Care Planning on the long term needs, physical therapy, and speech therapy in life care plans.

Dr. John Lubahn is the Orthopedic Surgery Residency program director at University of Pittsburgh Medical Center (UPMC) Hamot as well as the Hand Surgery Fellowship program director at UPMC Hamot. He served as the president of the American Foundation for Surgery of the Hand from 2001-2003. He trained at the Kleinert Hand Fellowship at the University of Louisville under some of the early pioneers of hand microsurgery in the United States and has trained decades of residents and fellows both general orthopedics as well as Hand microvascular surgery.

Dr. Phillips received his medical degree from Lake Erie College of Osteopathic Medicine in Erie, Pennsylvania, in 2011. Dr. Phillips completed a five-year orthopedic surgery residency through Mercy Health at St. Elizabeth Health Center and St. Joseph’s Heath Center in Youngstown, Ohio, and Warren, Ohio, respectively. Dr. Phillips then completed a one-year hand and upper extremity fellowship at University of Pittsburgh Medical Center - Hamot in Erie, Pennsylvania. He completed that training at the end of July 2017. The orthopedic residency training was completed at the end of June 2016.

During his residency through Mercy Health, he trained in general orthopedic surgery, sports medicine, joint replacement, spine surgery, foot and ankle surgery, hand and upper extremity surgery, trauma fracture care, and arthroscopic surgery.

Dr. Phillips is in his first year of practice with Pennsylvania Orthopedic Associates and currently has staff privileges at Holy Redeemer Hospital Medical Center in Huntingdon Valley, Pennsylvania, and the Huntingdon Valley Surgery Center. In addition to his clinical appointments, Dr. Phillips maintains memberships in the following professional organizations: American Osteopathic Academy of Orthopedics, American Academy of Orthopaedic Surgeons, Pennsylvania Orthopaedic Society, American Osteopathic Association, and the American Society for Surgery of the Hand. Dr. Phillips is also one of the team physicians for La Salle University.
KIARASH SHAHLAIE
MD, PHD

Kiarash Shahlaie is an Associate Professor in the Department of Neurological Surgery and the co-Director of the Deep Brain Stimulation Program at the University of California, Davis Health in Sacramento, California. Dr. Shahlaie’s philosophy of care is minimizing surgery risk and facilitating rapid recovery with minimally invasive surgical techniques; providing innovative surgical treatment options for Parkinson’s disease, essential tremor, dystonia, and other movement disorders; and certain psychiatric and pain conditions; and closely involving the families and caretakers of patients with severe traumatic brain injury during acute and chronic stages of recovery. He is the Bronte Endowed Chair of Research and conducts ongoing laboratory and clinical trials of neuromodulation and neurorestoration therapies.

LAURA SPERRY
MSN, ANP-C

Laura Sperry is an Adult Nurse Practitioner and the Clinical Coordinator for the Deep Brain Stimulation (DBS) Program at the University of California, Davis Medical Center in Sacramento, California. She guides patients and families through the surgical evaluation process and participates with the mapping and test stimulation of the DBS systems intraoperatively. Once the DBS systems are implanted, Ms. Sperry assists with the programming and patient care. She co-facilitates a class called “Staying Healthy with Deep Brain Stimulation” and runs a monthly class on Deep Brain Stimulation for prospective surgical candidates. She has been the guest speaker at several continuing education events and frequently speaks at regional support groups regarding DBS and the management of Parkinson’s disease.

BRIAN WARYCK
CP/L

Mr. Waryck is the Clinical Manager of Advanced Arm Dynamics (AAD), Great Lakes Center of Excellence in Cleveland, Ohio. Mr. Waryck received a Bachelor of Science in Mechanical Engineering at Western New England College and earned his certificate in prosthetics at the Newington Certificate Program. He is an American Board for Certification certified prosthetist, and a member of the American Academy of Orthotists & Prosthetists Upper Limb Prosthetics Society.

LIN ZHANG
MD, PHD

Lin Zhang is a Professor in the Department of Neurology and the co-Director of the Deep Brain Stimulation Program at the University of California, Davis Health in Sacramento, California. He is a fellowship-trained movement disorder specialist with clinical and research interests primarily focused on Parkinson’s disease (PD), including its epidemiology and the association between past nutritional deficiency and current prevalence of the disease. He has participated in studies and clinical trials in PD and dystonia and their related disorders for over 15 years, and has authored and co-authored more than 30 peer-reviewed articles in the field of movement disorders. He is testing new drugs with neuroprotective properties that may slow down the progression of Parkinson’s. He also is investigating the clinical manifestation of the disease in patients with atypical Parkinson’s disease, and those with a family history of permutation for Fragile X Syndrome, a genetic disorder that typically affects children. Additionally, Dr. Zhang specializes in botulinum toxin (Botox) treatments for a variety of conditions, including, but not limited to, dystonia, spasticity and tremor.
Aging and Mobility and Extremity Function Resource List

Compiled by:
Kelly K. Campbell, RN, BSN, CP, CLNC, CLCP
Jenn Craigmyle, RN, BSN, CLNC, LNCP-C, CLCP

1. Grip Strength Values Stratified by Age, Gender, and Chronic Disease Status in Adults Aged 50 Years and Older
   Yorke, Amy M. PT, PhD, NCS; Curtis, Amy B. PhD, MPH; Shoemaker, Michael PT, DPT, PhD, GCS; Vangsnes, Eric PhD, PA-C
   Research Reports
   [Link]

2. Shoulder Symptoms and Function in Geriatric Patients
   Burner, Todd MD; Abbott, Daniel MD; Huber, Karri DO; Stout, Monica BS; Fleming, Raymond PhD; Wessel, Bambi MS; Massey, Ellen; Rosenthal, Ann MD; Burns, Edith MD
   [Link]

3. Optimizing footwear for older people at risk of falls
   [Link]

4. Aging & Health: Foot Problems: Causes & Symptoms
   [Link]

5. Examination of Factors Affecting Gait Properties in Healthy Older Adults: Focusing on Knee Extension Strength, Visual Acuity, and Knee Joint Pain
   [Link]
6. Acute Effects of Muscle Fatigue on Anticipatory and Reactive Postural Control in Older Individuals: A Systematic Review of the Evidence

Papa, Evan V. PT, DPT, PhD, MA; Garg, Hina PT, MS; Dibble, Leland E. PT, PhD, ATC

doi: 10.1519/JPT.0000000000000026

Systematic Reviews
http://journals.lww.com/jgpt/Fulltext/2015/01000/Acute_Effects_of_Muscle_Fatigue_on_Anticipatory.6.aspx

7. The Impact of Cognitive Impairment on Rehabilitation Outcomes in Elderly Patients Admitted with a Femoral Neck Fracture: A Systematic Review

Muir, Susan W. BScPT; Yohannes, Abebaw M. PhD, MSc, MCSP, SRP


Systematic Reviews

8. Hip resurfacing: An alternative to conventional hip replacement?


9. Thumb Arthritis

http://www.assh.org/handcare/Anatomy/Details-Page/ArticleID/26803/Arthritis-Base-of-the-Thumb

10. Osteoporosis and Your Spine

https://www.nof.org/patients/fracturesfall-prevention/exercisesafe-movement/osteoporosis-and-your-spine/
Dear Carole

The Journal of Nurse Life Care Planning continues to solicit inquiries for this question and answer column. Keep sending your questions to DearCaroleColumn@gmail.com so that we provide information that benefits all members.

The following question was recently posed:

**How Does One Get a Comfort Level with Testimony?**

So many life care planners have commented that they enjoy the work of life care planning but they are uncomfortable testifying. In many applications of the life care planning process, testimony is a part of the required work. Getting comfortable with testimony takes time, practice, and experience. The stress will decrease with that investment of effort.

Here are as few ideas to make this event less painful. Follow a plan to prepare for testimony. Start early and be consistent in the approach as this brings a certain level of comfort that there is an end in sight. Have a set of documents not related to the specific file you are testifying on for review before each testimony. This will make the stress more manageable. First and foremost know the code of conduct and ethical standards for any certification you hold. Secondly, know the nurse practice act in your specific state. Your curriculum vitae (CV) is a document that needs the greatest scrutiny ever given to a document. Read it for typos, spacing and sentence structure. Screen it for bluster, bragging or other superlatives that will lead your credibility down the wrong path. Many years ago I was offered some recognition as a rehabilitation expert by some agency that now is unimportant to this column. I still remember the day it was brought into question at a deposition. It was without solid foundation and had no business being on my CV. Lessons are learned fast in depositions.

Know your CV inside and out and think of it in terms of practice focus not single events. For example, when looking over your CV give some thought to how it reads from a stranger’s vantage point. Have you held any academic positions? Have you done clinical nursing that fits the description of the case in question? At all costs avoid puffery in your CV. Ask yourself how the past academic and clinical practices you have experienced make you an expert as a life care planner? Know the major focus areas of your professional writing. It will afford you a position of strength to feel assured in your expertise. Without fail it is important to speak from a position of neutrality and try not to sound annoyed by any of the questions posed by the attorney conducting the testimony.

Know the background details about a case and prepare a timeline for dates of initial contact, client interview, record review, report preparation etc. The timeline provides a structure for reference while being deposed.
One tip a mentor gave me years ago was that there is no clock running at a deposition. The record does not reflect the time you take to mentally construct the best response to a specific question. Take time and repeat the question to yourself to be sure you understand what question is being asked. Don’t be bashful; ask the court reporter to read the question back to be sure you are “hearing” the right question. Don’t hesitate to say you don’t understand a question. It is also ok to ask that it be posed a different way. Understand the content to the point of having no question as to what details the attorney is trying to gather. Remember you are not being compensated for your testimony. You are being compensated for your time.

When in doubt do not speculate. We can’t know every answer to every question we are asked. Our personal need may be to give some answer or any answer. Don’t do it. Admit what you don’t know and that will keep your credibility intact. Your comfort with testimony will increase with your testimony experience. Don’t be embarrassed that you don’t have a lot of experience. None of us did in the beginning.

While in deposition it is easy to be distracted by objections offered by the attorney who retained your services on the case. An objection can be a signal to you to repeat the question to yourself and assess where there is a problem or why there was an objection made. Another idea shared by another life care planner recently is to start your answer to the question with the nature of the objection offered by the attorney. For example, if the attorney objection is “asks for speculation” you can state “I would be speculating to answer that question but these are my thoughts. Additionally, it is helpful to not look around the room while being deposed as that can be perceived as looking to others for answers.

Review and sign each deposition and learn from that review how you can do better in future depositions. Remember no one is there to demean you, insult, or threaten you. It is important to understand that your anxiety might make any comment feel like an insult. Use caution and don’t judge the comment for more than it is intended to mean.

And lastly, smile and copy your file for deposition so that the chart you have constructed is not taken completely apart as that will increase your anxiety before you start the testimony. Don’t be bashful...and remember you are the expert. You did your homework and you know your plan and the case better than anyone in the room.

DISCLAIMER: The content of this column is intended as a brief introduction to general business concepts and has no legal or accounting expertise implied or suggested. The members of the journal committee and the invited contributors recommend the readers seek their own legal counsel and financial advice for guidance on their business requirements.

Please keep the questions coming to: DearCaroleColumn@gmail.com

CAROLE UPMAN, RN, MA, CCM, CRC, CDMS/R, CNLCP®

Carole is a registered nurse and master prepared rehabilitation counselor. She founded and managed Chesapeake Disability Management, an outcome driven medical and vocational rehabilitation company in 1991 at her dining room table. That organization eventually grew to a staff of 20 in multiple states on the East coast. In the past she served as a board member and chaired the Commission for Certification of Case Managers (CCMC). She currently serves on the Book of Knowledge editorial board for CCMC and held a board member position on a charter school in Baltimore City, Maryland in the past. She loves the ocean, her husband and life.
Coming!
Summer 2018

Core Curriculum for Nurse Life Care Planning
2nd edition

To contribute, contact
AANLCP
801-274-1184
Abstract
Deep brain stimulation provides a less invasive, adjustable surgical option for many patients with dystonia who are no longer maximally responsive to pharmacotherapy. This article is intended to build upon the previously published general introduction to deep brain stimulation and provide an update on functional neurosurgery in treating dystonia. The readers are expected to understand the scientific rationale of this procedure, the importance of proper patient selection, and the clinical protocols to maximize the postoperative benefits and minimize the surgical risks for the patient.

Keywords
Deep brain stimulation (DBS), dystonia, surgery, indication complications, Globus pallidus internus (GPI)

An international consensus panel has defined dystonia as “a movement disorder characterized by sustained or intermittent muscle contractions causing abnormal, often repetitive movements, postures, or both. Dystonic movements are typically patterned, twisting, and may be tremulous” (Jinnah & Albanese, 2014, para 2). Dystonia is often intensified or exacerbated by physical activity and symptoms may progress into adjacent muscles. Dystonia can vary from focal adult-onset dystonia impacting the hand (e.g., writer’s cramp), neck (e.g., cervical dystonia (CD), spasmodic torticollis), or face (e.g., cranial dystonia, blepharospasm) to generalized childhood-onset dystonia due to genetic mutation (e.g., DYT1 mutation). Dystonia can be secondary to a brain insult such as stroke or trauma, an adverse medication effect (tardive dystonia), or may be a symptom of another disease such as Wilson’s or Parkinson’s disease (PD) (Fox & Alterman, 2015). Cervical dystonia is the most common type of isolated dystonia, with an estimated prevalence of 28 to 183 cases per million people (Defazio, Jankovic, Giel, & Papapetropoulos, 2013).

Available pharmacologic therapies only provide modest relief from symptoms and often have limiting side effects. While botulinum toxin injections can provide relief for specific muscle groups, therapy requires recurrent injections, can be expensive, and has side effects such as focal muscle weakness. In addition, therapy is impractical if the dystonia impacts many muscles and involves multiple areas (Fox & Alterman, 2015). Some will also note a reduction in therapeutic response after their initial injection. Proper muscle selection, injection technique (with or without evoked motor response guidance),
and titration of the neurotoxin dose over time are required to target the various symptoms (Hauser, 2010).

Deep brain stimulation (DBS) is an established and effective treatment option for patients who have failed current medical therapies and neurotoxin therapeutics. Currently, the U.S. Food and Drug Administration (FDA) has approved DBS for dystonia under a humanitarian device exemption (HDE). When combined with all indications, Medtronic reports over 125,000 individuals have been implanted with a DBS device since 1995 (Medtronic Inc., 2016). While DBS is used to supplement therapy where current medical treatments become ineffective, the majority of patients with dystonia will continue benefiting from neurotoxin treatments after their DBS surgery with reduced injection dosage and/or frequencies. The combination of DBS and neurotoxin therapeutics can improve clinical outcomes and patients’ quality of life.

This article is intended to build upon the introductions to DBS in the management of movement disorders previously published by Zhang, Sperry, and Shahlaie (2012, 2014, 2016). Readers are expected to have a fundamental understanding about the patient selection process, procedure, and risks and complications as reviewed in these articles.

**Surgical History of Dystonia**

Throughout the 1950s and 1960s, techniques for ablative procedures were refined with much focus on identifying the ideal targets (Das, Benzil, Rovit, Murali, & Couldwell, 1998; Rezai et al., 2008). Ablative surgeries for dystonia were primarily limited to pallidotomy and thalamotomy (Rezai et al., 2008; Sironi, 2011). Prior to the introduction of botulinum toxin therapy, rhizotomy (a neurosurgical procedure which uses an electrical current to selectively destroy problematic nerve roots in the spinal cord, thus decreasing transmission of pain signals) and myotomy were the surgical procedures used to target CD (Hauser, 2010). While these procedures can offer immediate symptom improvement, they are essentially irreversible and are associated with potentially serious complications including but not limited to hemiparesis, spasticity, ataxia, dysphasgia, and dystarthis. Thus, the less-invasive, adjustable and potentially reversible DBS is now the surgical procedure of choice for these disorders (Rezai et al., 2008). Bilateral DBS is safer than bilateral ablative procedures and has less permanent speech, swallowing, and cognitive complications (Marks, 2011).

**Principles of DBS Therapy**

Deep brain stimulation is a neurosurgical procedure that implants an externally programmable brain pacemaker device to deliver high-frequency electrical stimulation to targets in the brain (Marks, 2011; Pandey & Sarma, 2015). While the exact mechanisms behind DBS therapy remain elusive, stimulation acts similar to ablation therapy and appears to cause a functional blockade at the target site. Improvement appears to be related to replacement of abnormal neural activity by a more tolerable pattern of activity. It is currently hypothesized that the chronic high frequency electrical stimulation of the target nucleus acts as a brain pacemaker, entraining irregular neuronal firing patterns and desynchronizing pathological hypersynchronization within sensorimotor circuits. Deep brain stimulation is “local” therapy and affects only local circuits and brain regions within the basal ganglia or the thalamus (Hauser, 2010; Marks, 2011; Pandey & Sarma, 2015). Continued stimulation has been shown to gradually restore the normal plasticity within the sensorimotor loop leading to long-lasting effects in patients with generalized DYT1 dystonia (Albanese, 2014).

The Globus pallidus internus (GPI) has traditionally been the target of choice to treat dystonia (Fox & Alterman, 2015; Pandey & Sarma, 2015; Volkmann et al., 2014). The limited reports of thalamic DBS show disappointing results. Deep brain stimulation targeting the subthalamic nucleus (STN) is currently being explored for some dystonia subtypes (Ostrem et al., 2011; Pandey & Sarma, 2015). Even though DBS suppresses symptoms, it does not alter disease progression (Marks, 2011).

**Patient Selection**

The goal of DBS is to intervene before disability becomes debilitating, maintaining motor function and quality of life (Marks, 2011). In general, DBS is recommended when pharmacotherapy stops providing adequate symptom relief. Prior to qualifying for DBS, patients must have their medication regimen optimized and/or fail to respond to reasonable attempts to control dystonia with medical management. Patients with primary generalized dystonia should have tried anticholinergic, antiepileptic, benzodiazepine, and baclofen medications. Patients often have minimal response to these therapies and find the side effects to be intolerable. If patients with focal or segmental dystonia fail to get symptom relief after botulinum toxin injections with appropriate muscle selection and dosing, it is reasonable to consider DBS therapy (Marks, 2011). Studies suggest that tremor-dominant CD and complex forms of dystonia involving deep neck muscles may be better treated with GPI DBS, whereas posture-dominant forms may be better treated with botulinum toxin treatment (Albanese, 2014).

Patients should be experiencing some level of disability from their dystonia prior to surgery related to impaired movements, pain, social isolation, or a combination of these issues. Prospective surgical candidates undergo an extensive workup prior to surgery including consultations with neurology, neurological surgery, and neuropsychology (Zhang, Sperry, & Shahlaie, 2012). A videotaped clinical evaluation using standardized dystonia rating scales to establish a clear baseline of symptom distribution and severity is an important component of the DBS surgical evaluation. The scales most commonly used are the Burke-
Fahn-Marsden Dystonia Rating Scale (BFMDRS) and the Toronto Western Spasmodic Torticollis Rating Scale (TWSTRS) (Marks, 2011; We Move, 2002). The BFMDRS and TWSTRS disability subscales are helpful in documenting the level of disability (Marks, 2011).

A detailed understanding of a patient’s cognitive status is essential. Pre-surgical cognitive impairment may worsen after surgery and may result in a diminished motor response in addition to difficulty cooperating with the awake surgical procedure and post-surgical programming. There is also concern that mood disorders (e.g., depression and anxiety) can worsen following surgery. Patients with severe, unresolved psychotic symptoms should be excluded. While most patients with dystonia don’t have significant cognitive dysfunction or psychotic symptoms, depression or anxiety are not uncommon. Thus, an evaluation by a neuropsychologist or psychiatrist to evaluate mood symptoms prior to surgery is essential (Marks, 2011).

Identifying which patients will respond to DBS is challenging as there have been few controlled studies looking at predictors of outcome following DBS in dystonia patients. Nevertheless, it is known that some forms of dystonia respond better than others. Patients with secondary dystonia are less likely to benefit from DBS. Thus, it is important to characterize and classify the type and cause of dystonia prior to referring a patient for DBS evaluation (Fox & Alterman, 2015; Marks, 2011) (see Figures 1 and 2). In 2008, Isaiahs, Alterman, and Tagliati found that patients with primary generalized dystonia who underwent pallidal DBS had better outcomes if they had a shorter duration of disease. They recommended that patients should undergo surgery prior to onset of fixed skeletal deformities which may limit functional improvement even when dystonia symptoms are ameliorated.

Patients and their families must thoroughly understand the expected outcomes for this procedure and have reasonable expectations (Hariz, 2002). Symptom improvement will take time as the patient and management team work to optimize stimulator settings and pharmacologic therapy. This will require multiple clinic visits following the surgical procedure. Ideal candidates have no medical contraindications, few comorbidities, and no cognitive impairment or behavioral disorders.

### Risks/Complications

While DBS is supposed to be minimally invasive and nonablative, it is associated with several concerning complications, some of which are irreversible. Frequent side effects following DBS include falls, gait disturbances, depression, dystonia, and surgical site pain and infection. In patients with PD, STN DBS is associated with worsening verbal fluency post-surgery, increased postural instability, and gait dysfunction. Patients with GPi DBS seem to be relatively resistant to these deficits (Pandey & Sarma, 2015).

It is important for the surgical team to be aware of the risk of dystonic storm when patients with pre-existing dystonia undergo a stressful situation such as surgery. This is a potentially fatal condition with acute onset of generalized and persistent dystonic contractions that can involve vocal cords or laryngeal muscles leading to airway obstruction. Such patients are treated in an ICU setting as rhabdomyolysis with renal failure may occur. Spasms can be difficult to control and anesthesia with muscle paralysis may be required (Hauser, 2010).

There is little known about the impact of cognitive status, mood, and psychotic symptoms for dystonia patients who undergo DBS surgery and how these factors should influence DBS candidacy (Marks, 2011). Meoni

### Figure 1. Types of Dystonia (Marks, 2011)

<table>
<thead>
<tr>
<th>Type of Dystonia</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generalized</td>
<td>Affects trunk &amp; at least 1 leg</td>
</tr>
<tr>
<td>Segmental</td>
<td>Affects 2 adjoining body regions</td>
</tr>
<tr>
<td>Focal</td>
<td>Affects 1 body region</td>
</tr>
<tr>
<td>Hemidystonia</td>
<td>Affects 1 side of the body</td>
</tr>
</tbody>
</table>

### Figure 2. Causes of Dystonia (Marks, 2011)

<table>
<thead>
<tr>
<th>Cause</th>
<th>Description</th>
<th>Response to DBS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>No underlying cause or from a known DYT1 mutation</td>
<td>Responds better than secondary dystonia</td>
</tr>
<tr>
<td>Secondary</td>
<td>From known cause or result of underlying brain injury</td>
<td>Tardive dystonia is an exception as seems to respond very well to DBS</td>
</tr>
</tbody>
</table>
et al. (2015) followed 57 patients with primary and secondary dystonia post-GPi DBS and evaluated them for changes in Axis 1 psychiatric disorders. While the evidence suggested psychiatric stability of patients with primary and secondary dystonia treated with GPi DBS, the authors noted that the high psychiatric morbidity in the dystonia population does warrant psychiatric assessments before and after surgery. Studies have shown an increase in depression following STN DBS over GPi DBS (Pandey & Sarma, 2015).

### Surgical Outcomes

Dystonia has a wide range of outcomes following DBS surgery. Childhood/juvenile-onset primary generalized dystonia has the best outcome with a commonly achieved 50% to 70% improvement measured by BFMDRS movement score. Adult-onset cranial/cervical and tardive dystonias improve 35% to 80% as measured by standardized dystonia scales. While secondary dystonia may only illicit a 10% to 20% reduction in dystonia scores, this reduction can still be clinically meaningful for patients. Results are better in young patients with shorter disease duration. Unlike other diseases, the beneficial effect of DBS in dystonia is delayed by weeks or months after the procedure (Pandey & Sarma, 2015).

A retrospective study of 30 patients with primary cervical dystonia who underwent GPi DBS evaluated age, disease duration, dystonia direction, movement types, employment status, relevant life events, and neuropsychological examinations with respect to clinical outcomes following GPi DBS. The only significant factor affecting clinical outcomes was movement type (phasic or tonic). Phasic-type CD was found to be more favorable than that of tonic-type CD following GPi DBS (Brüggemann et al., 2015).

To identify predictors for favorable surgical outcomes, Brüggemann et al. (2015) conducted a retrospective, multicenter study of 55 patients with DYT6, DYT1 and isolated dystonia without known monogenic cause (non-DYT). Patients with DYT1 and non-DYT dystonia had a greater mean reduction of dystonia severity at early follow-up than patients with DYT6 dystonia; however, at late follow-up all three groups had comparable improvement in dystonia scores. Interestingly, patients with DYT6 dystonia had less predictable effects than the other groups suggesting that pre-DBS genetic testing and counseling for known dystonia gene mutations could be indicated. Regardless of the phenotype, Brüggemann et al. (2015) found that patients with a shorter duration from onset of dystonia to surgery had a better outcome postoperatively.

While DBS has primarily been used for primary dystonia in the pediatric population, there is a need for surgical therapy to treat childhood dystonic cerebral palsy (CP). A retrospective review of five cases found that all postoperative dystonia rating scale scores improved with the best improvement in those targets that were stimulated greater than 23 months, suggesting that DBS may be a viable option for children with dystonic CP. This study also showed an improvement in speech on the BFMDRS, a finding that had not previously been reported (Keen, Przekop, Olaya, Zouros, & Hsu, 2014). Another study on dyskinetic CP (Koy et al., 2014) evaluated eight patients with GPi STN DBS and found that while the patients did not appear to have benefitted from DBS on formal testing (BFMDRS) for gait, speech or swallowing, subjectively they reported a significant improvement.

While primary and secondary generalized dystonia, axial dystonias (tardive dystonias) and idiopathic CD are known to be responsive to GPi DBS, there is little known about the impact of DBS on adult-onset axial dystonia. Shaikh et al. (2014) assessed the efficacy of GPi DBS in four patients with adult-onset axial dystonia and found GPi DBS to significantly improve BFMDRS and TWSTRS scores as well as quality of life measures.

While secondary dystonia often does not respond as well to DBS surgery as primary dystonia, several multicenter studies found improvements in disease severity and functional improvement post-surgery (Miquel, et al., 2013; Pretto, Dalvi, Kang, & Penn, 2008; Timmermann et al., 2010; Vidailhet, 2009). These findings suggest that the benefits of DBS therapy should be considered sufficient enough to warrant offering DBS surgery when medical therapy and botulinum toxin injections are insufficient.

It is imperative that the patient and family have a clear understanding of the procedure, potential risks, and realistic expectations of this procedure. They must understand that the goal of DBS is suppression of motor symptoms and optimization of motor function and quality of life and that it will not “cure” the disease or alter disease progression. It often takes three to six months and multiple visits to optimize therapy. Patients will then return to their neurologist for ongoing management. Once optimized, they will require a minimum of one to two visits each year to monitor their settings and battery status (Marks, 2011, Medtronic Inc., 2016). The medical team should still continue to incorporate supportive treatments such as

### Nursing Diagnoses To Consider

1. **Impaired swallowing (Domain 2, Nutrition, Class 1, Ingestion)**
2. **Impaired physical mobility (Domain 4, Activity/Rest, Class 2, Activity/Exercise)**
3. **Impaired mood regulation (Domain 9, Coping/Stress Tolerance, Class 2, Coping Responses)**
4. **Impaired comfort (Domain 12, Comfort, Class 1, Physical Comfort)**
physical therapy and education as part of the treatment regimen for all dystonia patients.

Conclusions
Many candidates experience a delay in obtaining a referral for DBS evaluation resulting in delayed disability, diminished quality of life, and impaired function. In addition, poor surgical candidates are often referred for DBS evaluation as a final therapeutic option when their neurological team is out of treatment suggestions. This sets up inappropriate patient expectations (Marks, 2011). Successful surgical outcomes require appropriate patient selection by a multidisciplinary team, reasonable expectations of surgical outcome by patient and family, accurate surgical implantation of DBS leads, optimal programming of the DBS equipment, and medical management and long-term management addressing disease progression and troubleshooting device issues (Albanese, 2014; Marks, 2011). With these items in mind, DBS can be a beneficial therapeutic option for patients suffering from dystonia.

Resources
For additional information on reimbursement for deep brain stimulation please refer to:

Materials


Boston Scientific Reimbursement: (coming soon for Vercise DBS, approved December 2017)

REFERENCES


We Move (2002). Toronto Western Spasmodic Torticollis Rating Scale (TWSTRS).


We Move (2002). Toronto Western Spasmodic Torticollis Rating Scale (TWSTRS).


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Amputation, or the loss of a limb or portion of a limb, is estimated to affect two million people in the United States (Ziegler-Graham, MacKenzie, Ephraim, Travison, & Brookmeyer, 2008). It is widely known that upper limb loss is less prevalent than lower limb loss. Lower limb loss has been estimated to be 15 to 40 times more common. While over half of lower limb cases are the result of dysvascular disease, 70% or more of upper limb amputations are due to trauma-related causes (Dillingham, Pezzin, & MacKenzie, 2002; Ziegler-Graham et al., 2008). A small percentage of people who seek upper limb prosthetic rehabilitation were born with a congenital limb difference, such as a shortened arm or the absence of a hand or fingers (Makhoul, Goldstein, Smolkin, & Magnus, 2003).

Levels of upper limb amputation range from the tips of the fingers to above the shoulder, and presentations of the residual limb are diverse and often unique. This niche patient population is best served by a team of clinicians specializing in upper limb prosthetic rehabilitation. Key considerations for optimal care include recognizing the significance of the hand in daily life, providing an array of prosthetic options and components, integrating occupational/physical therapy interventions into each phase of prosthetic rehabilitation, and providing resources and support for lifelong prosthetic care. The content of this article informs and supports life care planners in developing more effective plans for people with upper limb amputation or congenital limb difference.

Challenges with Upper Limb Loss and Prosthetics

Beyond the relative infrequency of upper limb loss, this level of amputation presents unique challenges to the individual, their family and the care team. Its traumatic nature is often unpredictable and can necessitate the involvement of multiple disciplines to address concomitant injuries, post-traumatic stress symptoms, and other complications. Additionally, in the cortical homunculus; or the brain's physical representation of the human body; a disproportionately large area of the cortex is dedicated to the hands (Cunningham & Arends, 2016; Penfield & Boldrey, 1937). This is due in part to the importance of fine motor skills and the extensive innervation in the upper limb. The hands and arms are muscle-rich, and their loss means a loss of the complex and primary means of interaction with the environment and the ability to care for oneself.

If a person with upper limb loss or congenital limb difference elects to pursue prosthetic care, considerations are different from someone with a lower limb loss (Cordella et al., 2016). An upper limb prosthesis can be more difficult to hide under clothing, especially when the wearer is interacting with others or gesturing during communication. As an individual engages in activities throughout the...
day, the person may be responsible for lifting, carrying, pulling, and pushing objects. These actions require the prosthesis to be securely suspended on the residual limb, without the benefits of the weight-bearing nature of walking or running.

Additional considerations include the variety of upper limb prosthetic options and componentry, the unique capabilities of each option, and the need for device-specific training to enable the user to be successful. Lastly, due to the high ratio of lower to upper limb loss cases, prosthetic providers often focus on lower limb care and rarely provide upper limb care. These factors make collaboration with upper limb prosthetic specialists valuable when working with this limited patient population.

Upper Extremity Amputation Rehabilitation

In 2014, the Department of Veterans Affairs and the Department of Defense formulated the Clinical Practice Guideline (CPG) for the Management of Upper Extremity Amputation Rehabilitation (The Management of Upper Extremity Amputation Rehabilitation Working Group, 2014). In this comprehensive resource, publications in the field of upper limb amputation rehabilitation were reviewed and recommendations for care were developed. The framework for rehabilitation and management of patients with upper limb amputation is categorized into four phases that may overlap to accommodate a patient’s recovery process. The four phases are perioperative, pre-prosthetic, prosthetic training, and lifelong care. Throughout each phase of rehabilitation, the importance of an interdisciplinary care team cannot be understated. The team is led by a physician with specialized knowledge in upper limb amputation care, and made up of individuals from multiple disciplines including medical, surgical, case management, psychological, rehabilitation, and prosthetic. Each team member lends their expertise, while focusing on the patient to provide the highest quality holistic care and maximize outcomes following upper limb amputation.

The Perioperative Phase

The perioperative phase of rehabilitation begins when the patient has undergone an upper extremity amputation, or the decision has been made to proceed with an amputation. Due to the traumatic nature of upper limb loss, many cases require urgent care. However, all surgical decisions should be based on standards of care that would result in the highest level of postsurgical functional outcome.

When possible, consulting and collaborating with other members of the care team; for example, the prosthodontist; can contribute to the discussion of an amputation that could optimize the residual limb for function with or without a prosthesis. These conversations may also involve emerging and advanced surgical techniques. These include targeted muscle reinnervation (TMR) for potential improved neuroma pain or prosthetic control, or bone procedures, such as angulation osteotomy to assist with prosthetic suspension and rotational stability (Cheesborough, Smith, Kuiken, & Dumanian, 2015).

The perioperative phase also encompasses post-operative recovery, including assessment of the individual’s functional level, and informing the person about the role of care team members, overuse syndromes, wound healing, and safety. This education should be reinforced at each phase of rehabilitation. Pain management is also crucial, as most people with limb loss experience one or more types of amputation-related pain, such as phantom pain, residual limb pain, or back pain (Ephraim, Wegener, MacKenzie, Dillingham, & Pezzin, 2005).

For people with upper limb loss, starting rehabilitation may enhance their range of motion, strength, and endurance; and address functional independence. An occupational therapist can provide support and training for maximizing independence in activities of daily living (ADLs). The first treatment sessions should focus on basic ADLs, such as self-feeding, oral hygiene, and toilet hygiene, to help the individual reduce feelings of helplessness by improving self-sufficiency (Smurr et al., 2009). This can involve assessment for appropriate durable medical equipment (DME), hand dominance training, and learning one-handed techniques. Throughout all activity, the patient should be encouraged to use good body mechanics and sound posture, and educated on the increased risk of cumulative trauma and overuse injuries that persons with an amputation face (Biddiss & Chau, 2007a).

Individuals with various etiologies of limb loss have been reported to experience symptoms of depression and anxiety at higher rates than the general population (Damal et al., 2005). Because these challenges can negatively affect the rehabilitation process in chronic conditions, it is crucial to provide psychosocial support to patients. This can include referral to a psychologist, and connection to amputee support groups and other individuals who have gone through similar situations. Additional resources pertaining to upper limb loss and prosthetic rehabilitation can be found.

Nursing Diagnoses To Consider

1) Impaired physical mobility (Domain 4, Activity/Rest, Class 2, Activity/Exercise)
2) Dressing self-care deficit (Domain 4, Activity/Rest, Class 5, Self-Care)
3) Risk for situational low self-esteem (Domain 6, Self-Perception, Class 2, Self-Esteem)
4) Disturbed body image (Domain 6, Self-Perception, Class 3, Body Image)
5) Ineffective sexuality pattern (Domain 8, Sexuality, Class 2, Sexual Function)
The care team also begins to provide education on prosthetic options, which helps transition the person into the next phase of rehabilitation (see Figure 1).

**The Pre-Prosthetic Phase**

In the pre-prosthetic phase, interventions started perioperatively are continued as needed and the patient begins to explore prosthetic fitting. This commences with a comprehensive assessment with the care team to determine the most appropriate prosthetic option(s) to prescribe. Factors determining the options that are appropriate for an individual include: patient presentation, goals, motivation, cognitive ability, priorities, social support, and functional and vocational requirements.

Although it is not possible to replace all the functions of a missing upper limb, a prosthesis can be a tool the person uses to help achieve various goals, including function, comfort, protection, suspension, cosmesis, and ease of use.

Each person’s goals and priorities are different so it is important to gather information about their objectives during the evaluation, and set accurate expectations for the capabilities of the prosthesis. This helps reduce the risk of prosthesis rejection (Biddiss & Chau, 2007b).

**Prosthetic Options**

There are a range of prosthetic options, and the individual should be made aware of each so they understand what is available, and why they may or may not be a candidate (Bowers, 2014). Following education and evaluation, the person may decide not to proceed with prosthetic care at that time, or may decide that multiple prosthetic options would be most beneficial.

The first option is one all people with limb loss are familiar with, no prosthesis. While this means the person has the potential to retain sensation and does not have the added burden of device maintenance, this option can result in limited grasp and function in bimanual activities, which can also increase the potential for overuse injuries. For individuals with a sensitive or an insensate residual limb, not wearing a prosthesis can expose the person to environmental hazards.

Passive prostheses have no active moving parts and are usually designed to be lightweight, with a finish that restores the appearance, the useful length, and surface area of the limb or finger. Passive prostheses are relatively low maintenance when used appropriately and can contribute to a positive body image. While passive devices can be used to assist in stabilizing objects during tasks, they tend to have limited grasp and function.

Body-powered prostheses are durable devices that can be used in a variety of environments. However, they require a restrictive harness for control, and the grip force exerted by the terminal device is dependent on rubber bands whose tension must be overcome by movement of the remaining joints and musculature. This design has a limited functional envelope due to the harness and cables, and can also be difficult to control for people with high level amputations. The mechanical appearance of these devices may not appeal to someone who considers cosmesis (natural/lifelike appearance) to be an important goal.

Electrically powered prostheses are devices that are powered by battery sources and use components that can move actively through muscle signals or other inputs. There are multiple factors that will influence the clinical team to recommend an electrically powered prosthesis. These factors are diverse, and include therapeutic screening, psychological screening, physiological screening, precise measurements to determine what types of control inputs are ideal, and what types of components fit best with the person’s unique presentation. An electrically powered prosthesis may eliminate the need for a harness or enable the use of a reduced harness. This creates a wider functional envelope for using the prosthesis and more stable grasp than other options. Advanced electric hands can imitate multiple grasp patterns to more closely approximate...
human prehension, and allow for better efficiency and body mechanics during functional activities. The prosthesis can be covered with a cosmetic glove or custom silicone for people who prefer cosmesis. Clear gloves and black gloves are popular options for those who like the high-tech appearance of advanced electric hands.

*Hybrid prostheses* combine two or more prosthetic designs and can be helpful for individuals with high level amputations requiring multiple components (Billock, 1985). For example, a transhumeral prosthesis may combine a body-powered elbow with an electrically powered wrist rotator and terminal devices.

Lastly, *activity-specific prostheses* are designed for specific tasks that are important to the person, but hard to achieve with other options. These devices are often designed for use in sports, recreation, and hobbies; but may also include work-related tasks such as using hand tools (Edge, 2015) (see Figure 2).

**Determining Prosthetic Costs**

The best method for determining accurate costs related to upper limb prosthetic rehabilitation is for the nurse case manager or life care planner to partner with an experienced team of upper limb prosthetic specialists. This team will analyze the unique goals, needs and functional requirements of each client, and determine which of the previously described prosthetic options are most applicable. They will work with the client to select appropriate prosthetic components, such as fingers, terminal devices, wrist units and elbow units.

This careful analysis of the person’s needs will ultimately lead to the development of clear and accurate pricing. In the United States, coding and pricing are currently based on a somewhat archaic Medicare Healthcare Common Procedure Coding System (HCPCS) that has not made frequent or timely updates in coding and pricing options to reflect the level of treatments, technologies, and material science that is available to the modern upper limb prosthetic patient (Fairley, 2008; Phillips Otto, 2008). For this reason, coding and pricing vary widely depending on the provider. As it relates to establishing accurate cost estimates, it is most advantageous for the nurse case manager or life care planner to create a meaningful working partnership with a trusted and experienced specialist in comprehensive upper limb prosthetic rehabilitation.

**The Prosthetic Training Phase**

The prosthetic training phase begins when the patient is fitted with a prosthesis and is ready to learn how to wear and use it. In many cases, the first device that a person receives is a preparatory prosthesis. The use of a preparatory prosthesis has been standard practice for decades to prepare, evaluate, and train new users (Brenner & Brenner, 2008). It is made of materials that allow the prosthetist to make modifications in response to issues that may arise as a person progresses through prosthetic training. These can include changes in limb volume, or irritation or discomfort with increased wear time, or participation in dynamic activities.

In an ideal situation, the prosthetic user works with an occupational or physical therapist who is trained in upper limb prosthetics. Training begins immediately after fitting of the prosthesis regardless of whether it is a preparatory or definitive device. The initial stage of training involves familiarizing the person with the components and operation of the new device, and independence with putting on and taking off the prosthesis. With a new device, a wear schedule is encouraged to promote a gradual increase in limb tolerance, and to reduce the risk of skin irritation or breakdown.

Prior to engaging in functional, multi-stepped tasks, the person will first learn how to operate the individual components of the prosthesis in space before progressing to training tasks to improve consistency in control. The prospective user is also trained in optimal use of the prosthesis to complete tasks efficiently, avoid frustration, and minimize compensatory body movements. This is especially important for new users, as these individuals have often adapted to one-handed living and must now create new motor patterns to complete...
ADLs bimanually with a prosthesis. Additionally, the person must learn to rely on visual feedback while using the prosthesis due to the device’s lack of sensory feedback (see Figure 3). As controls training progresses, the therapist introduces functional tasks that are meaningful to the individual (see Figure 4).

**Figure 3. Training**
Training begins with familiarization of components and progresses to prosthetic usage in functional tasks. *(Photo courtesy of Advanced Arm Dynamics.)*

Throughout the prosthetic training phase, adjustments are made to optimize the function and fit of the prosthesis. Ongoing communication between the new prosthesis user, therapist, and prosthetist is crucial. It is ideal to make all significant adjustments prior to fabrication and delivery of the definitive prosthesis.

**Lifelong Care**
Lifelong care is the last phase of prosthetic rehabilitation. It begins when the initial prosthetic fitting and functional prosthetic training are completed. For those individuals with amputations who choose to not pursue prosthetic care, this phase commences after the completion of acute rehabilitation. In all cases, the individual has reached a desired level of function and stability. The care team should follow up at least once every 12 months regardless of the person’s chosen prosthetic status. Case managers are especially vital to successful lifelong care with their involvement in planning, implementing and monitoring resources, services, and follow-up care.

**Life Care Planning Considerations**

**Maintaining Independence**
Maintaining independence during aging requires special consideration for those with limb loss. It is appropriate to conduct an annual assessment of functional performance, the need for adaptive equipment, modifications to home or vehicle, and prosthetic care requirements to maximize independence.

**Vocational Services**
For people with upper limb loss, the mean age at amputation is between 20 and 36 (Østlie, Skjeldal, Garfelt, & Magnus, 2011). Vocational assessment, training, and case management will likely be required over the lifetime of an individual whose goals include returning to work following amputation (see Figure 5).

**Medical Care**
Medical complications may arise over the lifetime of a person with an amputation. Overuse injuries, cumulative trauma disorders, residual limb breakdown and the formation of neuromas are some examples. While these issues can be difficult to predict or project, it is important to assess medical status and address comorbidities at follow-up contact.

**Prosthetic Care**
Prosthetic devices have limited lifespans and need to be evaluated regularly for repairs or replacement. Changes in a person’s lifestyle may lead to the discovery of additional prosthetic needs. Working with upper limb prosthetic specialists can ensure that patients and their care teams get accurate information on what is available, and stay up-to-date on the most modern technologies and fitting methods. Extended warranties may help with prolonging the lifespan of a device.

**Continued Psychosocial Support**
Planning for psychological services by professionals with experience in trauma care is imperative for people who have experienced amputation. Peer support resources such as the Amputee Coalition annual conference can also be valuable opportunities for people to network, volunteer, learn new skills, and find and offer support. Emotional support for family or caregivers is also important to consider.

**Figure 4. Training Progression**
Training progresses to prosthetic usage in functional tasks. *(Photo courtesy of Advanced Arm Dynamics.)*

**Figure 5. Return to Work**
A person who wants to return to work may require worksite assessment and training to determine effective ways to incorporate the prosthesis into job duties. *(Photo courtesy of Advanced Arm Dynamics.)*
New technologies and surgical procedures

The field of upper limb prosthetics is ever-changing, and care team members should keep current with advances in technologies, treatment options, surgical techniques, and even research studies that patients may want to participate in. Technologies and surgical interventions undergoing continuous research and improvement include targeted muscle reinnervation (TMR), pattern recognition, osseointegration, and sensory feedback (Butkus, Dennison, Orr, & St. Laurent, 2014). Ensuring that people with upper limb loss have access to clinicians who are knowledgeable about new advancements, can significantly improve long-term outcomes. Most importantly, listening to the needs and desires of prosthesis users can increase the ability of future prosthetic designs to “bridge the gap between research lab and clinic, clinic and home” (Biddiss & Chau, 2007b, p. 254).

Conclusion

Comprehensive upper limb prosthetic rehabilitation serves a small, specialized patient population with acquired amputation or congenital limb difference. Optimal outcomes are achieved with a multidisciplinary care team comprised of the patient, his or her physician, a prosthetist, an upper limb clinical therapy specialist, a mental health professional, and a nurse case manager or social work professional. Prosthetic options include a range of body-powered and electrically powered prosthetic components, each with different functional advantages. Ideally prosthetic training begins immediately after fitting of the preparatory prosthesis. Ongoing adjustments are made to improve both fit and function. Successful upper limb prosthesis users will need lifelong prosthesis care from a team that keeps them apprised of new technologies and other key resources. By understanding the specific challenges faced by this patient population, life care planners can be an extension of this team, developing more effective plans for people with upper limb loss or congenital limb difference.

REFERENCES


C. JANICE HSU, MSOT, OTR/L

C. Janice Hsu joined Advanced Arm Dynamics in April 2013, as clinical therapy specialist for the Great Lakes Center of Excellence in Cleveland, Ohio. Previously, she conducted research in Washington University’s Human Performance Lab, and was a research assistant in the Washington University Psychology Department and at Vanderbilt University Medical Center. She graduated magna cum laude from Washington University in St. Louis, Missouri, where she earned a Bachelor of Arts in Psychology and a Master of Science in Occupational Therapy. She is a member of Pi Theta Epsilon national honor society for occupational therapy students and alumni. Ms. Hsu is certified by the National Board for Certification in Occupational Therapy, a member of the Ohio Occupational Therapy Association and is a licensed occupational therapist in Ohio and Texas. She is also a member of the American Academy of Orthotists and Prosthetists.

BRIAN WARYCK, CP/L

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He joined the AAD team at Walter Reed National Military Medical Center in June 2010 as an upper limb prosthetic specialist. He spent more than two years providing prosthetic services and rehabilitation to military personnel who were injured in Iraq and Afghanistan. Previously, Mr. Waryck was a prosthetist and practice manager with Hanger Prosthetics & Orthotics in Cleveland, Ohio. He has also managed a clinical prosthetics and orthotics office for New England Brace Company (NEBCO), and began his career as a prosthetist with Shriners Hospitals for Children.

Mr. Waryck received a Bachelor of Science in Mechanical Engineering at Western New England College and earned his certificate in prosthetics at the Newington Certificate Program. He is an American Board for Certification certified prosthetist, and a member of the American Academy of Orthotists & Prosthetists Upper Limb Prosthetics Society.
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Major limb replantation has come a long way in the United States. Much of the credit can be given to the efforts of talented surgeons such as Dr. Harold E. Kleinert and Dr. Joseph E. Kutz. They pioneered the challenges of replanting limbs. Through research and anecdotal experience they provided the foundation for the progress of other surgeons in this specialty area.

When considering major limb replantation, there are several important areas to consider along the continuum. Included is the initial evaluation of the person who sustained an injury that may require replantation, through the post-operative course, and the long term follow-up. The areas covered in this article include the following: critical points with initial evaluation, team work to replantation, post-operative monitoring and management, microsurgery in pediatric patients, contraindications to microsurgery and attempted major limb replantation, and the use of prosthetics in individuals with amputations. It is important for a life care planner to understand these concepts and how sustaining such a severe injury requires a multidisciplinary approach to patient care. The amputation injury is a life-changing event whether or not the person is a candidate for limb replantation.

Initial Evaluation
When an individual sustains an injury there are several factors to consider that are critical to the initial evaluation to determine whether the individual may be a candidate for successful replantation. The primary indicators for replantation after trauma include: thumb at any level, multiple digits; through the palm, wrist level or proximal to the wrist; and almost all parts in children (See Figures 1 and 2). The timing of the injury in relation to when the individual presents to the facility capable of performing microvascular replantation is the first item to consider. Muscle necrosis begins to take place after 6 hours of ischemia to the tissue. Depending on the level of the injury within the upper extremity and whether the limb has been transported wrapped in a
saline soaked cloth and submerged in ice is also important with the initial evaluation. Cold ischemia time refers to tissue transported that has been submerged in ice. Warm ischemia time is transportation of the amputated tissue without the ice submergence. Amputations distal to the wrist are considered viable for replantation if the warm ischemia time has not exceeded 12 hours and if the cold ischemia time has not exceeded 24 hours. For amputations proximal to the wrist, viability for replantation with warm ischemia time is not exceeding 6 hours and for cold ischemia time is not exceeding 12 hours. Therefore, rapid transportation to a facility capable of performing microsurgical replantation is critical.

At the facility, the experts must evaluate the nature of the injury and the viability of the soft tissue structures both in the proximal segment and the amputated limb. There are cases where the amputated segment is too mangled from the injury to expect a successful replantation. The level of contamination is important in determining whether the limb should be replanted. Surgeons must also plan on potentially shortening the bone in the upper extremity by as much as 6 inches depending on the pattern of injury with contamination, soft tissue, and bone loss. The facility should have an appropriate surgical intensive care unit where the patient can be monitored post operatively after performing a replantation for signs of adequate or inadequate perfusion to the revascularized limb (Weiss, 2013).

**Team Work Approach**

The team approach to performing major limb replantation involves the utilization of two teams. One team takes the amputated upper extremity to the operating room. In the operating room this team is responsible for preparing the limb for replantation. They will shorten the bone if necessary depending on the injury pattern to both the bone and the soft tissues. The team also will apply fixation usually with plates and screws to the amputated part. This step is critical to select a hardware plate that has several holes still available for fixation to the proximal residual limb segment (see Figure 3). The team will also thoroughly examine and identity all of the soft tissue structures that will require repair to proximal residual limb segment including the arteries, veins, nerves, and muscle tendinous structures. The second team is responsible for helping to stay with the patient and trauma service to work toward stabilizing the patient for transportation to the operating room. The patient should be adequately stabilized for the expectation of being under general anesthesia for several hours with the chance to returning to the operating room should signs of perfusion be inadequate within the first few hours after the initial replantation and revascularization attempt. Depending on the pattern of injury to the residual limb soft tissue and bone, planning must take place to potentially shorten this segment as well. The soft tissue structures in this segment should also be identified including the arteries, veins, nerves, and muscle tendinous structures (see Figure 4). Injuries requiring replantation and revascularization may have injuries to...
the native arteries that do not allow for direct repair and necessitate the use of a vein graft. The amount of skin injury and loss must be examined to determine whether a local flap or free flap of tissue will be required in the reconstructive process. Both must be evaluated and discussed between the teams. The sequence of performing replantation depends on whether the level of the amputation and whether there are large areas of muscle mass involved in the replantation. For proximal amputations with large muscle mass, consideration is given to first performing a vascular shunt to the amputated part to minimize warm ischemia time. After that consideration, the replantation should involve first bone fixation with potential shortening followed by arterial and venous repair, extensor tendon and flexor repair, nerve repair, and finally skin repair with consideration of a fasciotomy to prevent compartment syndrome from occurring (Goldner, 2011).

**Post-Operative Monitoring and Management**

During the post-operative course it is vital to have a surgical intensive care unit capable of monitoring the patient and regulating the conditions of the patient’s room. The room should be kept warm around 75 degrees F. The risk of replantation failure is monitored hourly during the days after replantation for signs of failure. Should the replantation show signs of failure, the decision is made by the surgeon to attempt a second revascularization versus salvage amputation depending on the overall time after the first surgery. The patient needs to maintain an adequate level of hydration with either lactated ringers or normal saline. The selection of antibiotics will vary depending on the amount of contamination of the wound and the mechanism of injury. Anticoagulation during the revascularization process helps to ensure that there are no clots developing within the revascularized extremity.

Thrombosis due to vasospasm is the most common cause of early replant failure. The extremity should be put in a position at about the heart level so that it is not elevated and lead to arterial inflow insufficiency and not too low and lead to venous congestion. Examining the color of the replanted extremity is prognostic in both the inflow and outflow of oxygenated blood. Signs of poor inflow include poor tissue turgor, decreasing oxygen saturation, a drop in skin temperature, and a color of pallor or cyanosis. Signs of poor outflow include tissue congestion with swelling, a fast capillary refill, and a red or reddish blue appearance.

The early post-operative protocol should involve some early passive and active range of motion exercises. Stimulation of the muscles with range of motion exercises will benefit both the inflow and outflow of blood to the replanted extremity. Leeches are another part of the post-operative protocol that can be utilized in cases where there is venous congestion (see Figure 5). They produce hirudin which is a powerful anticoagulant. Patients that have leech treatment must be given either bacterium or ciprofloxacin antibiotics to prevent from developing a Aeromonos hydrophila infection. The dressing should be changed that was placed at 48 to 72 hours after replantation. One of the causes of arterial insufficiency is from either a dressing that is too tight or from the drainage after surgery creating constriction around the replanted extremity. Therefore, the initial 48 to 72 hours post-operative assessments and monitoring for signs of inflow or outflow insufficiency are ideally facilitated by one-to-one nursing care by those trained to monitor the replanted extremity.

Follow-up after a successful replantation is multidisciplinary with the utilization of occupational therapists, prosthetists, the surgeon, and potentially psychiatric professionals to help the patient adjust to the change. The amount of work provided by the team is case specific for each patient. Subsequent surgeries for patients with replantation are also case dependent. Further procedures performed such as amputations of the replanted extremity.

![Figure 5. Leech Application](image-url)

**Figure 5.** Demonstrates the application of leeches in a patient with venous congestion after a replantation. *(Photo courtesy of Dr. Lubahn).*
parts of the upper extremity or scar tissue contracture releases ultimately depend on both limb function and pain. Long term complications from replantation include cold hypersensitivity, delayed wound healing of the replanted segment, and stiffness. These variables factor into whether subsequent procedures are performed, if the patient no longer feels the cosmetic and functional outcome is worth retaining the replanted segment (Weiss, 2013).

**Microsurgery in Pediatric Patients**

Microsurgery in pediatric patients poses several challenging aspects to consider. Replantations have less contraindication in general with children when considering phalangeal amputations. The technical difficulty with pediatric replantation first and foremost is the size of the vessels and nerves that make the repairs more technically challenging. With pediatric replantation, additional efforts are made to maintain or reconstruct a tendon sheath to allow for improved range of motion. The amount of bone shortening should be much less compared to adults where all attempts should be made to retain all bone or shorten less than 0.5mm with procedures. With pediatric injuries it is also important to retain the epiphysis for continued growth after management of the injury (Goldner, 2011). In children, the post-operative management is stricter with regard to immobilization needs and compliance issues once the replantation is deemed successful, due to the risk of injuring the revascularized segment (Abzug, 2013).

**Contraindications to Limb Replantation**

There are contraindications to considering replantation of amputated segments in the upper extremity. A patient must be medically stable. Since more serious life threatening injuries must be addressed first prior to consideration of replantation, a patient may remain too unstable during the window of opportunity for replantation.

The overall mental health must first be considered when evaluating a candidate for replantation. Mentally unstable patients that have contributed to the injury requiring potential replantation are likely to have compliance problems following the post-operative protocols. The type of injury can also be a relative contraindication.

Sharp mechanisms of injury to the extremity are less likely to produce severe injury as compared to crush and mangle injuries to the amputated part. Segmental injuries of the amputated extremity pose another relative contraindication that makes success of the repairs less likely and functional outcomes less as compared to a single level injury.

Thermal injuries to the tissue must be considered when attempting to perform replantation. Soft tissue that has undergone irrecoverable damage from thermal injury is a contraindication to replantation. Less severe thermal injuries may still be considered for replantation. The age and overall health and comorbidities are important when considering candidates for replantation. Older and sicker patients are less likely to have survival of the replantation and a reasonable function outcome (Goldner, 2011).

**Nursing Diagnoses To Consider**

1) Impaired physical mobility (Domain 4, Activity/Rest; Class 2, Activity/Exercise)
2) Disturbed personal identity (Domain 6, Self-Perception; Class 1, Self-Concept)
3) Risk for disuse syndrome (Domain 4, Activity/Rest; Class 2, Activity/Exercise)
4) Risk for delayed development (Domain 13, Growth/Development; Class 2, Development)
5) Chronic pain (Domain 12, Comfort; Class 1, Physical Comfort)

above the elbow, prosthetic devices have advanced to where there is stimulation of functions lost by activating and firing the remaining muscles. These devices will provide for elbow flexion and extension as well as hand opening and closing by actively contracting the residual biceps or triceps.

**Conclusion**

Major limb replantation to this day is a challenging procedure that requires expertise by the surgeons, team, and facility evaluating the patient and monitoring the patient post-operatively. Each case must be evaluated while considering the multiple variables. Of utmost importance is communicating with the patient about the expectations should the replantation be successful. It is best to keep an open dialogue and do our best as clinicians to ensure that patients are informed about the expectations and course after undergoing a replantation. Life care planners are part of the team helping these patients deal with the challenges of a life-changing injury and move forward in life.

**Prosthetic Usage in Patients with Amputations**

A last consideration with amputations is providing those that are not appropriate for replantation with a favorable extremity for prosthetic fit. It is ideal to maintain the elbow joint if possible with traumatic amputations to the upper extremity to allow for fitting of the prosthesis. The amputated ends of bone should be well padded at the time of wound closure to provide for comfort. For more proximal amputations...
REFERENCES


JOHN LUBAHN, MD, FACS

Dr. John Lubahn is the Orthopedic Surgery Residency program director at University of Pittsburgh Medical Center (UPMC) Hamot as well as the Hand Surgery Fellowship program director at UPMC Hamot. He served as the president of the American Foundation for Surgery of the Hand from 2001-2003. He trained at the Kleinert Hand Fellowship at the University of Louisville under some of the early pioneers of hand microsurgery in the United States and has trained decades of residents and fellows both general orthopedics as well as Hand microvascular surgery.

NICHOLAS A. PHILLIPS, DO

Dr. Phillips received his medical degree from Lake Erie College of Osteopathic Medicine in Erie, Pennsylvania, in 2011. Dr. Phillips completed a five-year orthopedic surgery residency through Mercy Health at St. Elizabeth Health Center and St. Joseph’s Heath Center in Youngstown, Ohio, and Warren, respectively. Dr. Phillips then completed a one-year hand and upper extremity fellowship at University of Pittsburgh Medical Center - Hamot in Erie, Pennsylvania. He completed that training at the end of July 2017. The orthopedic residency training was completed at the end of June 2016.

During his residency through Mercy Health, he trained in general orthopedic surgery, sports medicine, joint replacement, spine surgery, foot and ankle surgery, hand and upper extremity surgery, trauma fracture care, and arthroscopic surgery.

Dr. Phillips is in his first year of practice with Pennsylvania Orthopedic Associates and currently has staff privileges at Holy Redeemer Hospital Medical Center in Huntingdon Valley, Pennsylvania, and the Huntingdon Valley Surgery Center. In addition to his clinical appointments, Dr. Phillips maintains memberships in the following professional organizations: American Osteopathic Academy of Orthopedics, American Academy of Orthopaedic Surgeons, Pennsylvania Orthopaedic Society, American Osteopathic Association, and the American Society for Surgery of the Hand. Dr. Phillips is also one of the team physicians for La Salle University.
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The performance of normal functional tasks in doing work or activities of daily living (ADLs) requires the use of the upper extremities. Normal use involves adequate physical mobility, ROM, (range of motion), strength, sensation, and coordination. In addition, one must have adequate cognitive awareness, physical endurance, and be pain free or have a pain tolerance to perform tasks.

Able-bodied persons don’t give much thought to the use of their upper extremities in the performance of tasks or ADLs. But once injured, performing what was once a simple task becomes much more complex requiring more time, effort, and planning; and sometimes assistance is needed from others. This article addresses injuries of the upper extremity and the resulting impairments that can affect the performance of normal functional life activities. Functional upper extremity testing and observation techniques proposed interventions, adaptive devices, and billing code information are reviewed and conveyed for life care plan (LCP) development consideration.

**Shoulder Injuries**

**Types of Shoulder Injuries**

Shoulder injuries include gleno-humeral instability, rotator cuff tears, impingement syndromes, tendinitis, etc.

**Figure 1. Shoulder Motions**

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**Figure 1. Courtesy of Clinical Gate**

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KAREN LUCKETT, OTR, CLCP, CCM, CDMS
fractures, arthritis, or contractures that limit motion. The motions of the shoulder include flexion, extension, abduction, horizontal adduction and horizontal abduction, external and internal rotation, and circumduction (American Academy of Orthopedic Surgery, 1991) (See Figure 1). Loss of shoulder motion can affect a person’s ability to reach up and forward such as to retrieve clothing from a closet, take cans from a grocery shelf, dishes from a cupboard, wash and brush one’s hair, put an arm in a sleeve, or work activities that involve reaching. During the life care plan assessment interview, query the client regarding activities that may be difficult to do, and if possible, observe the person trying to perform the activity. If appropriate, with the client’s and attorney’s permission, it may be helpful to include a picture or video of the client attempting to perform the task.

Life Care Planning for Clients with Shoulder Injuries

Life care planning interventions for shoulder injuries may include: follow-up physician visits, medications, periodic injections, physical therapy (PT) and/or occupational therapy (OT), surgical interventions to repair the injury, or a shoulder joint replacement. Some common adaptive equipment may include long handled reachers and hair brushes. Home modifications may be needed to lower clothes closet rods, shelves, and kitchen cupboards for better access. If the client is wheelchair dependent, a motorized wheelchair may be necessary if the shoulder cannot be used to propel a chair manually. Home assistance also may be required in some instances. Vocational rehabilitation and/job modifications may also be indicated.

Elbow Injuries

Types of Elbow Injuries

Elbow injuries include birth deformities, traumatic fractures, bicep ruptures, arthritis, contractures, soft tissue injuries like crush injuries, tendonitis, ligamentous tears, and chronic pain. Normal elbow range of motion is 0 to 150 degrees, from an extended straight elbow (0 degrees) to full elbow flexion, touching the hand to the shoulder, (150 degrees) (Cocchiarella & Anderson, 2004). Functional ADLs affected may include one’s ability to push off a bed or chair, bring the hand to the face to feed or groom oneself, carry objects, and drive. Work activities impacted may include the ability to reach and carry objects.

Life Care Planning for Elbow Injuries

Life care planning for elbow injuries may include physician follow-up, injections, surgical interventions for contracture releases or a joint replacement, OT or PT, and orthotic or braces. Adaptive equipment may include long handled utensils to feed, or long handled devices to groom or bathe, and long handled reachers. Job modifications and/or vocational retraining may also be indicated.

Forearm and Wrist Injuries

Types of Forearm and Wrist Injuries

Forearm and wrist injuries can be a result of traumatic fractures of the forearm or wrist, ligamentous tears, crush injuries, traumatic arthritis, or chronic pain. Forearm injuries can limit forearm supination, (palm up), and pronation (palm down) motions, and wrist motions of flexion and extension. Normal range of motion for supination and pronation averages 80 degrees for both (Cocchiarella & Anderson, 2004). These motions are used to hold items such as underneath a box or to support a baby, to face wash, bring utensils with liquids to the mouth, and to hold one’s palm out to receive coin change. Wrist injuries resulting in bony deformities can also limit both active wrist motions and hand strength.

Since the wrist forms the stable ‘basement’ of the hand, injuries to the wrist can sometimes significantly impair hand grasp strength. Wrist injuries can especially impact a person’s ability to do manual labor in the construction or mechanic trades where tool use requires a strong grip, such as with hammers and wrenches. Chronic pain with grasp can also accompany a wrist injury. Functional ADLs affected can include the ability to open doors, hold a steering wheel, twist open containers, and lift and carry heavy baskets or bags.

Life Care Plan Interventions for Forearm & Wrist Injuries

Life care planning interventions may include physician follow up, future surgery, therapy, orthoses, or braces, and a need for tool modification. Assistive devices may include a swivel spoon, twisted utensils, and adaptive handles. Vocational retraining and or work modifications may also be indicated if functional use impairs work performance.

Hand Injuries

Types of Hand Injuries

Hand injuries include loss of a digit, a joint deformity or ligamentous instability, tendonitis, tendon or nerve lacerations, nerve compressions, loss of sensation, circulatory problems, scar adhesions, traumatic arthritis, bony contractures, and chronic pain. The hand is composed of 34 major muscles, 29 joints, and 3 major nerves, which divide into 24 sensory branches, and 21 muscular branches (E-Hand.com, n.d.). The fine motor skills of the hand

Nursing Diagnoses To Consider

1) Impaired physical mobility (Domain 4, Activity/Rest, Class 2, Activity/Exercise)
2) Dressing self-care deficit (Domain 4, Activity/Rest, Class 5, Self-Care)
3) Risk for situational low self-esteem (Domain 6, Self-Perception, Class 2, Self-Esteem)
4) Disturbed body image (Domain 6, Self-Perception, Class 3, Body Image)
5) Ineffective sexuality pattern (Domain 8, Sexuality, Class 2, Sexual Function)
operate like a puppet marionette on strings such that when one mechanical element in the hand is altered then every other movement is affected. The hand performs gross movements of grasp (see Figure 2) and finer precision pinch movements (Strickland, 2006). The types of precision pinch include: lateral key pinch, (see Figure 3), palmar pinch or 3 jaw chuck, (see Figure 4), and 2-point tip pinch, (see Figure 5). Holding a ketchup bottle (power grasp) is different than unscrewing a bottle top (precision lateral pinch). Picking up a penny (2-point tip pinch) is different than buttoning a shirt (bi-manual palmar pinch).

**Nerve Injuries and Palsies**

Nerve injuries and palsies pose a significant impairment to the functional use of the upper extremities. Injuries such as Erb’s palsy, brachial plexus injuries, spinal cord injuries, nerve compressions, or nerve lacerations not only affect motor movements and strength, but also sensation. Following a nerve injury, severe muscle atrophy is often observed. Due to lack of movement, contractures can result. Sensation deficits pose a problem that can result in the client getting burned by hot objects, or become punctured or lacerated by sharp objects. A client may not feel the injury and therefore must be taught to make constant visual inspection of the extremity in all surroundings to compensate for the lack of sensation.

The delicate fine motor movements of the hand are controlled by both intrinsic (inside the hand) and extrinsic muscles (forearm). They are innervated by the median nerve and the ulnar nerve. When both nerves are lacerated or compressed, such as in an elbow fracture injury resulting in a Volkmann’s contracture, the hand begins to posture abnormally into what is called an “intrinsic minus” position or claw hand. The hand muscles become severely atrophied and can result in a major functional hand impairment (see Figures 6 and 7). When a client has a severe injury or palsy of the upper extremity or hand, the hand becomes non-functional and dominance retraining and/or compensatory training may be indicated. In some cases, complex muscle transfer surgeries are indicated to try to make the hand somewhat more functional.

**Functional Testing of the Hand**

Grasp strength testing is usually done using either a manual or hydraulic Jamar Dynamometer manufactured by Lafayette Instruments. Included in the Jamar Dynamometer instruction manuals are the standardized norms for grasp strength, divided by age, male and female, and dominant versus non-dominant hands (see Table 1 for grasp strength norms). Pinch gauges are used to measure the three types of pinch. The first norms published for grasp and pinch were based on testing done on 628 subjects ages 20 to 94 (Mathiowetz, Kashman, Volland, Weber, & Dowe, 1986).

Both grasp and pinch strength and dexterity declines with age as muscle mass declines. Decreased hand strength is significantly associated with decreased dexterity (Martin, Ramsay, Hughes, Peters, & Edwards, 2015). Dominant versus non-dominant
grasp strength can vary from 11% to 33%. Pinch strength differences between dominant and non-dominant can vary by 28% (Incel, Ceceli, Durukan, Erdem, & Yorgancioglu, 2002). An injury to a dominant hand will impair ADLs to some degree at least initially. Strength, range of motion, and coordination are important factors, but the most important areas to assess are a client's functional ability to perform the tasks necessary for daily life. See text box for some functional hand activities that can be used to test a client with a hand impairment during an assessment.

Table 1: Grasp Strength Norms

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<th>Males Mean</th>
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</table>

Note: Courtesy of Lafayette Instruments

In addition to testing and observing a client, it is helpful to include the client's specific deficits of range of motion, strength, and coordination from the most recent orthopedic...
reports or a therapist’s measurements into the narrative LCP report. These measurements can add to the foundation of need for why certain ADLs are difficult to do or can’t be performed, and why certain equipment and/or assistance may be needed. With permission from the attorney and clients, video-taping the performance of difficult tasks can also be used to explain the impairment in reports or depositions.

Life Care Plan Interventions for Hand and Nerve Injuries

Interventions may include physician follow up, surgery for release of contractures or muscle transfers, acute post-surgical rehab with orthoses or braces, and OT/PT for exercise and equipment upgrades as needed. A vocational evaluation and retraining may be indicated if there is a possibly of the client returning to work. Recommended adaptive equipment and tool modifications include built up handles for a better grasp, a Velcro bathing mitt to hold soap, a rocker knife for cutting meat, an adaptive cutting board that holds vegetable for paring, a dish washing suction holder, a universal cuff device, key holders, and devices to help with opening cans and bottles. Coordination problems may be assisted with weighted wrist cuffs or weighted utensils. Rehabilitation catalogs or on-line adaptive equipment companies are good sources for locating adaptive devices.

In addition, a client with a severely injured hand may need psychological counseling especially in the case of amputations, burns, nerve lacerations, or other catastrophic hand injuries. In the case of severe hand injuries, home assistance may be needed if the client lacks adequate grasp to perform the normal ADLs.

Observation of ADLs

In the bedroom: The first place to start an ADL observation is in the client’s bedroom. Have the client lie in bed. Ask the client to roll to each side, and then come from lie to sit. Note if the client has mobility problems or pain. Are the movements done slowly or smoothly? Does the client moan or grimace? Where does the client feel pain? Is the client able to push off the bed with an extended elbow and bear weight through the shoulder, elbow, and wrist? Does the client compensate in any way? Does the client need a support to pull up on?

In the bathroom: Have the client sit on and rise from the toilet. Observe whether the client can get up independently or needs to pull up. Does the client need toilet side rails? Is the client able to enter the tub or shower? Is the clients balance adequate or is a bath seat and safety rails needed? Can the head and feet be reached to cleanse, or does the client need a long-handled sponge? Can the client reach and manipulate the faucet handles, or are lever handles needed? Can the client hold a hand-held shower and a bar of soap or is a soap mitten needed? At the sink, can the client turn the faucets, and pick up and use the hair brush/toothbrush? Does the client need lever handles on the faucet? Does client need built-up handles or universal cufs for brushes? Does the client need a long-handled brush?

Dressing: Can the client don and doff clothing? Can the client open drawers and reach into closets? Can the client put on a pull over shirt? Is the client able to pull up on? In any way? Does the client need a long-handled or curved bath holder, long handled or curved bath rails needed? Can the client reach down to don and doff socks and shoes and tie shoes, or are Velcro closures, elastic shoelaces, or slip on shoes needed? Does the client need a sock aid or dressing stick?

In the kitchen: Can the client bend down and reach up to retrieve pots and dishes? Does the client need modified shelving, or pots/dishes relocated? Can the client lift and carry a pot of water from the sink to the stove? Can the client carry a plate of food to the table or is a wheeled cart needed? Can the client wash dishes or is a large suction plate holder needed to hold the cooking utensil stable in the sink? Can the client cut meat or is a rocker knife needed? Can the client spoon liquid to their mouth or is a swivel spoon or long handed utensils needed?

Assistive Devices

During the interview and assessment, the client may describe the impairment but not mention how it affects the ability to perform ADLs. It sometimes becomes obvious during an ADL observation just exactly how the impairment affects the client’s task performance. Frequently, the client may compensate or go without necessities such as putting on socks, or trimming nails because the client just can’t do it. This is where a life care planner’s knowledge of assistive devices can be utilized. When possible, consulting with an OT or PT regarding the client’s impairment can also add to the list of assistive devices that may be appropriate for the client. Some common assistive devices to help clients be more independent are listed below by ADL category. These devices can be found on-line or in rehabilitation catalogs.

Dining Aides: Built up handles, universal cuff holders, 14 in. long flexible utensils, weighted utensils, rocker knives, swivel spoons, scoop dishes or food guards, ergonomic cups, non-spill cups, weighted cups, two handled cups, and adaptive long straws. For the very impaired, there are electric feeders.

Kitchen Aides: One handed paring board, uni-knob turner, suction fruit and veggie scrubber, wheeled counter top pot roller, adaptive jar and bottle openers, pouring assist devices, and a one-handed kitchen food prep board with nail prongs.

Bathing Aides: Bathing mitt soap holder, long handled or curved bath brushes, feet scrubbers, and a shower chair with rails.

Dressing Aides: Long handled shoe horn, reachers, sock aid, dressing stick, elastic shoe laces, bra assists, zipper pulls, and button hooks.
Upper Extremity Orthotics

Many upper extremity injuries involve needing orthotics or bracing temporarily or permanently. Orthotics can be pre-fabricated or custom made. Custom orthotics fabricated by OTs and PTs usually last for a short duration of up to a year. They are often made of low temperature melting thermoplastics. Devices that require more durability and heavy use are often made by prosthetists. A description of the various types of orthoses are listed below. A full detailed description of orthoses can be found at the American Society of Hand Therapists Coding website.

Prefabricated/Off-the-Shelf: Orthoses that require minimal self-adjustment and do not require expertise in trimming, bending, molding, assembling or customizing to fit the patient.

Custom Fitted: A prefabricated device, which is manufactured in quantity without a specific patient in mind. The device may require some assembly and/or fitting an adjustment, or a device requiring trimming, bending, molding (with or without heat) or otherwise modified by an individual with expertise in customizing the item to fit and be used by a specific patient.

Custom Fabricated: A custom-fabricated orthosis is made for a specific patient. It is fabricated based on clinical castings, tracings, or measurements of the body part. It involves substantial work such as vacuum forming, cutting, bending, molding, sewing, drilling and finishing prior to fitting on the patient. Orthotics are categorized as either static (resting) orthoses or dynamic (moving) orthoses. A dynamic orthosis has a part that moves, has a joint, or applies tension, and can be adjusted as needed. The determination of whether to use a prefab, custom fitted, or custom fabricated orthosis depends on the patient’s injury, the doctors order, and the therapist’s clinical judgement.

Orthotic Fabrication & Device Billing Codes

A therapist’s time during the orthotic fabrication process is billed as current procedural terminology (CPT) code 97760 for orthotic management and training. For prosthetics, CPT code 97761 is used. Both these codes are billed in 15-minute increments. Depending on the type of orthosis or prosthesis, an hour or more of billing time may be needed for custom fabrications. These codes are also used for modifying and repairing the orthotic or prosthetic. In addition, CPT codes 29105 to 29131 are added to include the application and training in the use of the orthotic. Application CPT codes used can be used for upper extremity orthosis application depending on the type of orthotic issued (see text box). Dynamic orthotics are normally billed out at a higher cost due to the complexity of moving parts using the HCPCS “L” codes (L3650 to L3995). The HCPCS ‘L’ codes are billed to cover the actual orthosis’ material costs. These three codes can be used to bill a single orthotic fabrication session (see Table 2). In the case of temporary casting, done by a doctor, post surgically or for fractures, the cast application codes 29049-29425 are used, with the HCPCS “Q” codes used for the type of cast instead of the orthotic L codes. Note: “Q” codes are divided into two age groups, 0 to 10 years old, and 11 years old and older.

TABLE 2: ORTHOTIC CODES

Coding For a Dynamic Hand Orthosis

<table>
<thead>
<tr>
<th>Coding for a Dynamic Hand Orthosis</th>
<th>CPT/HCPCS Codes</th>
<th>Time Unit</th>
<th>Comments</th>
</tr>
</thead>
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<tr>
<td>Fabrication process for Dynamic arm/wrist/hand</td>
<td>97760</td>
<td>60 min</td>
<td>4-(15 min) units to fabricate the orthosis</td>
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<td>Application of Dynamic arm/wrist/hand orthosis</td>
<td>29126</td>
<td>no time unit</td>
<td>Application &amp; training in use of orthosis</td>
</tr>
<tr>
<td>HCPCS Level II ‘L’ code for dynamic arm/wrist/hand</td>
<td>L3806</td>
<td>n/a</td>
<td>Actual orthosis price for materials/parts</td>
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</table>

Coding For a Static Finger Orthosis

<table>
<thead>
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<th>Coding for a Static Finger Orthosis</th>
<th>CPT/HCPCS Codes</th>
<th>Time Units</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
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<td>97760</td>
<td>15 min</td>
<td>1 (15 min) unit to fabricate</td>
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<tr>
<td>Application of finger orthosis</td>
<td>29131</td>
<td>no time unit</td>
<td>Application &amp; training in use of orthosis</td>
</tr>
<tr>
<td>HCPCS Level II ‘L’ code for finger orthosis</td>
<td>L3933</td>
<td>n/a</td>
<td>Actual price of orthosis materials</td>
</tr>
</tbody>
</table>
replacement needs or maintenance schedules is recommended. A therapist’s recommendation can be a helpful in determining additional adaptive equipment needs and can add to the foundation of needs in the life care plan. Life care plans may also need to include costs for broken prosthetics and projected considerations for a child’s growth needs. The prosthetist can be of assistance with these projected costs.

**Therapy Treatment Interventions**

Depending on the injury, therapy needs can vary from short term to life-long. For a catastrophic or chronic type injury, an annual evaluation and exercise therapy upgrades sessions may be indicated. Also, orthotics may need to be refabricated or modified at least annually, if not more frequently. Therapy evaluations can vary from 20 minutes to 60 minutes (see Table 3 for OT and PT evaluation codes). Therapy treatment sessions can vary in time from 30 to 60 minutes (see Table 4 for common treatment codes).

**Conclusion**

Upper extremity injuries can vary in complexity of need from short term interventions to life-long. An assessment that incorporates the observation of the client’s movements, strength, and coordination while performing tasks including ADLs is helpful to determine the functional impairment of the extremity on a client’s daily life. The assessment process can also assist to determine if an orthosis or an assistive device is needed. Knowing the impact of an upper extremity impairment on a client’s task performance and ADL can assist the life care planner in developing a life care plan. The life care plan may include recommendations from the physician for future surgical intervention, medication, and procedural interventions. The upper extremity client may also require future therapy, and adaptive and assistive equipment. The assessment observation process can also be helpful in determining whether any home assistance may be needed. Consulting with a vocational rehab counselor can assist in determining return to work possibilities. When an observation of the client cannot be done in person or by Skype, reliance on medical records of another unbiased medical professionals’ assessment of the client’s task performance and ADL abilities and/or a vocational assessment can help the life care planner to determine the future needs of a client with an upper extremity injury.

**Resources**


HCPCS Level II Orthotic Codes: [https://hcpcs.codes/l-codes/?page=9](https://hcpcs.codes/l-codes/?page=9)

For ADL Assistive Devices:

Performance Health Rehabilitation Catalog [https://www.performancehealth.com/#Alimed](https://www.performancehealth.com/#Alimed) [www.alimed.com](http://www.alimed.com) North Coast Medical [https://www.ncmedical.com](https://www.ncmedical.com)


For Therapy Codes: [https://hmsa.com/portal/provider/MM.09.003_Occupational_Therapy_010117.pdf](https://hmsa.com/portal/provider/MM.09.003_Occupational_Therapy_010117.pdf)

---

**TABLE 3: OT AND PT EVALUATION CODES**

<table>
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<tr>
<th>Coding for Occupational Therapy</th>
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<td>Low Complexity Evaluation</td>
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<td>30 min</td>
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<tr>
<td>Moderate Complexity Evaluation</td>
<td>97166</td>
<td>45 min</td>
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<tr>
<td>High Complexity Evaluation</td>
<td>97167</td>
<td>60 min</td>
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<tr>
<td>Re-evaluation of Established Patient</td>
<td>97168</td>
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**TABLE 4: OT AND PT TREATMENT CODES**

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<td>Therapeutic Exercise</td>
<td>Ultrasound</td>
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<td>Neuro muscular Education</td>
<td>Electrical Stimulation</td>
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<td>Manual Therapy</td>
<td>Whirlpool</td>
<td>97140</td>
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<tr>
<td>Therapeutic Activities</td>
<td>Iontophoresis</td>
<td>97530</td>
<td>97033</td>
</tr>
<tr>
<td>Self-care training</td>
<td>Laser</td>
<td>97535</td>
<td>97039</td>
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</table>

Note: *This above list is only a partial list of therapy CPT codes. All codes represent a 15-minute unit of time. Therapy sessions are usually billed in 1, 2, 3, or 4 combined codes for a time unit of 30, 45 or 60 minutes.*
REFERENCES


KAREN LUCKETT, OTR, CLCP, CCM, CDMS

Karen Luckett obtained her Bachelor of Science degree in occupational therapy in 1980 from Wayne State University in Detroit. She has worked as an occupational therapist for 37 years in school settings, hospitals, out-patient clinics, and extended care facilities.

In 1983, Ms. Luckett moved to Jerusalem Israel for 3 years where she worked with traumatic burn patients at the Hadassah Medical Center. After returning to the US, Ms. Luckett moved to California. She worked at UCLA before opening a clinic in Beverly Hills, California which offered Speech, OT, PT, Acupuncture, and Vocational Rehab services.

Ms. Luckett has been doing forensic work since 1994. In 2006, she became certified as a life care planner. In addition to testifying in court as a life care planner, she has also been called on several occasions to testify as a standard of care expert.

Ms. Luckett has also published two journal articles in the Journal of Life Care Planning on the long term needs, physical therapy, and speech therapy in life care plans.
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XII.2 Electrical Stimulation Technology
XII.3 Preconference / Brain Injury
XII.4 Veterans Administration

2013
XIII.1 LCP for Motor and Developmental Disorders
XIII.2 Ethical Topics in LCP
XIII.3 Preconference / Exemplars in NLCP
XIII.4 Home Modifications

2014
XIV.1 Technology Updates
XIV.2 LCP Across All Ages
XIV.3 Psych topics in LCP
XIV.4 LCP and the ACA

2015
XV.1 Topics in Transplantation
XV.2 Updates in Spinal Cord Injury
XV.3 Burns
XV.4 Perinatal / Childhood

2016
XVI.1 Pain
XVI.2 GI issues
XVI.3 International LCP
XVI.4 Home Care

2017
XVII.1 Brain Injury
XVII.2 The Business of Life Care Planning
XVII.3 Back and Spine
XVII.4 Mobility and Extremity Function