Surgical Treatment of Hand and Wrist Injuries

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There are multiple surgical treatment options available for common hand and wrist injuries, such as carpal tunnel syndrome (CTS), epicondylitis, and osteoarthritis (OA) of the hand. However, some techniques are not supported by data from well-designed trials, and others have high complication rates. This session provided an overview of surgical techniques used in the treatment of common hand afflictions.

The current treatment options for CTS were discussed by Dean G. Sotereanos, MD, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania, USA. Options include open carpal tunnel release (CTR), mini-open CTR, limited-incision techniques (ie, 2-incision mini-open and distal [1-incision] mini-open), and endoscopic techniques. Delaying treatment >3 years after symptom onset can have a negative effect on treatment outcomes, stated Dr Sotereanos.

Open CTR is the gold standard for the treatment of CTS. An important advantage to the open CTR technique is that there is no blind knife passage. However, there are also several advantages for limited-incision techniques. These include less scar tissue formation and pillar pain compared with open release, as well as an earlier return to work. However, disadvantages include the potential for nerve damage and postoperative neurapraxia.

According to Dr Sotereanos, up to 32% of patients will experience a recurrence of CTS. Pain after the initial procedure can be defined as persistent, recurrent, or new onset. Current treatment options for recurrent CTS include repeated decompression, neurolysis, tissue interposition flaps, nerve wrapping, and a combination of these techniques. Dr Sotereanos stated that as a general rule, repeated decompression should be used in combination with an ancillary technique.

Dr Sotereanos currently favors the nerve-wrapping techniques with hypothenar fat flap. The advantages of vein wrapping include preventing scar adhesion to the nerve and improving nerve gliding and function [Varitimidis SE et al. *J Hand Surg Am.* 2001; Sotereanos DG et al. *Microsurgery*. 1995]. In addition, histopathologic analyses indicate that neovascularization of the vein graft and structural transformation of the vein endothelium occurs. Other wrapping techniques include the use of extracellular matrix products made from porcine small intestinal submucosa or bovine collagen. These materials have been shown to isolate the nerve from the surrounding tissues and improve pain, grip strength, and electromyogram and nerve conduction results without complications or adverse reactions [Kokkalis ZT et al. *J Reconstr Microsurg.* 2011]. Dr Sotereanos recommended that xenograft wrapping be used in patients with moderate scar tissue, whereas vein wrapping should be used in patients with excessive scar tissue, an inadequate tissue bed, or multiple prior surgeries.

For nerve repair, Dr Sotereanos recommended end-to-end repair if there is loss of continuity of the nerve without a defect or tension. If there is a nerve gap or tension, then the repair should be made with autografts, allografts, or conduits. Conduits permit regenerating nerve fibers to find the optimum path via neurotrophism and are recommended in patients with a nerve gap <3 cm. Clinical outcomes of collagen conduits are outlined in Table 1. If the nerve lesion is not repairable, then nerve transfers or an end-to-end coaptation is an option.

Dr Sotereanos concluded that future advances with impregnated growth factors could lead to improved outcomes.

Craig S. Williams, MD, Illinois Bone & Joint Institute, Highland Park, Illinois, USA, discussed the treatment of epicondylitis. Nonsurgical therapies include pain control using a wrist splint, stretching, friction massage, ice and heat, ultrasound, stimulation, and corticosteroid injections. However, Dr Williams pointed out that many patients do not receive adequate education about epicondylitis. As a result, after a corticosteroid injection, patients may return to full activities too soon, contributing to a high incidence of recurrence [Coombes BK et al. *JAMA*. 2013].

Surgical treatment of epicondylitis may be indicated in patients who have not achieved relief after ≥6 months of nonsurgical treatment and who have symptoms that prevent daily activates or return to work. The surgical techniques include release via percutaneous, open, or arthroscopic procedures; debridement or repair; and complex procedures (ie, anconeus flap). However, results vary, seemingly regardless of the technique used. Dr Williams noted that he finds surgical outcomes unpredictable. Since treatment failures of traditional methods are not uncommon and many patients wish to avoid surgical treatment whose results may be inadequate, there is an unmet need for additional nonoperative treatment options.

Alternative options for the treatment of epicondylitis include autologous blood injection. In a 2003 study, in a series of 28 patients, 79% experienced complete relief. Another option is platelet-rich plasma (PRP) because platelets are important in the initiation and modulation of the healing response. In addition, platelets contain alpha granules that, after wounding, release a variety of growth factors and numerous types of proteins that play a role in

Table 1. Clinical Outcomes in Studies Assessing Collagen Conduits

Study	Clinical Outcomes		
	Digital Nerve Repairs	Nerve Gap, mm	Sensory Recovery Rate, %
Bushnell BD et al. *J Hand Surg Am.* 2008	12	10-12	89
Lohmeyer JA et al. *J Reconstr Microsurg.* 2009	12	12.7 (mean)	33, excellent; 42, good
Taras JS et al. *J Hand Surg Am.* 2011	22	12 (mean)	59, excellent; 14, good

Table 2. Effect of Hardware Type on Complication Rates of Carpometacarpal Fusion

	Plate Fixation[a]	Pin Fixation[b]
Satisfaction rate*	81	98
Nonunion rate	8	7
Pain score	1.8	1.5
Hardware malposition	23	3
Infection	4	7
Secondary surgery*	27	3
Radial sensory neuritis	8	0
Continued pain	8	2

Results based on a sample size of 26 trapeziometacarpal arthrodeses for the plate fixation group and 59 arthrodeses for the pin fixation group. Values presented in percentages, except for pain score.

[a]Forseth MJ, Stern PJ. *J Hand Surg Am*. 2003.

[b]Fulton DB, Stern PJ. *J Hand Surg*. 2001.

*$P < .05$.

healing. Data from clinical studies are mixed, with some showing a positive benefit of PRP [Mishra AK et al. *Am J Sports Med*. 2014; Creaney L et al. *Br J Sports Med*. 2011; Gosens T et al. *Am J Sports Med*. 2011; Peerbooms JC et al. *Am J Sports Med*. 2010] and others showing no benefit [de Vos RJ et al. *Br J Sports Med*. 2014; Krogh TP et al. *Am J Sports Med*. 2013; Shiple BJ. *Clin J Sport Med*. 2013]. Further, interpretation of the studies is complicated by poor trial design and a wide variance in the procedures used for preparing and injecting the PRP.

The postinjection protocol involves splinting the wrist and limiting lifting to < 1 lb for 3 weeks. Patients are then weaned from the splint, and stretching exercises are started. Gentle strengthening exercises are initiated at 6 weeks postinjection. Improvement in epicondylitis is typically not observed until 8 to 10 weeks postinjection.

Richard A. Bernstein, MD, Yale University School of Medicine, New Haven, Connecticut, USA, discussed the treatments of hand OA. The surgical treatment of thumb carpometacarpal (CMC) OA in the early stages includes arthroscopic debridement, first metacarpal osteotomy, and Eaton-Littler stabilization. For more advanced cases, surgical treatment includes trapeziectomy with or without tendon interposition, ligament reconstruction and tendon interposition (LRTI) arthroplasty, silicone arthroplasty, hemiarthroplasty of the trapeziometacarpal (TMC) joint, total joint implant of the TMC joint, and TMC arthrodesis.

Trapeziectomy using the hematoma distraction arthroplasty method achieves pain relief and improvement in grip strength, key pinch, and tip pinch. Long-term mean follow-up of 88 months of 22 thumbs of 22 patients found that 18 remained pain-free and most had full abduction and opposition [Gray KV et al. *J Hand Surg Am*. 2007].

The gold standard for thumb CMC OA is LRTI, which has been demonstrated to provide pain relief; most patients also experience grip and pinch improvement. However, in a 2006 study, LRTI for the entire flexor carpal regalis in 39 patients found that the control (nonsurgically treated) wrist demonstrated greater wrist flexion-to-extension ratio and better wrist flexion fatigue resistance. In a mean follow-up of 11 years, CMC fusion demonstrated improved pain, grip, and pinch but did not improve abduction or range of motion [Rizzo M et al. *J Hand Surg Am*. 2009]. However, a 2001 retrospective study found that complications of fusion included need for a distal radius graft, nonunion, and pan trapezial arthritis, as well as hardware malposition and need for a second procedure. Hardware type—pin vs plate fixation—influenced complication rates (Table 2). A 2001 retrospective study that compared LRTI with fusion found that LRTI led to better opposition and a flatter hand, whereas fusion led to a stronger lateral and chuck pinch but had a higher complication rate.

Treatment of proximal interphalangeal joint OA includes silicone arthroplasty, which was shown in a 2004 study to provide some pain relief and improve extension, but no improvement in total arc of motion was found. In addition, complications included cystic changes, implant fractures, and the need for revision. Another option is surface replacement arthroplasty; however, earlier studies found no improvement in arc of motion, and one found a decrease in the distal interphalangeal arc of motion. Complications include loosened components, squeaking, dislocations, and need for revision. Dr Bernstein also noted that arthrodesis is the gold standard for the treatment of proximal interphalangeal joint OA and will likely remain so because it provides pain relief with a low risk of complications.

For metacarpophalangeal joint OA, pyrolytic carbon surface replacement and silicone replacement arthroplasty have been demonstrated to provide pain relief and improve range of motion [Namdari S, Weiss APC. *J Hand Surg Am*. 2009; Parker WL et al. *J Hand Surg Am*. 2007].