Pain Therapy and Acupuncture

41

Alessandro Ingardia, Laura Rossini, and Battista Borghi

41.1 Introduction

The elbow is a complex joint that enables forearm flexion/extension on the arm and forearm pronation/supination (Loeser 2003).

It consists of three smaller articulations:

– humeroulnar,
– humeroradial, and
– proximal radioulnar joint.

The elbow joint is stabilized by the articular capsule, which is attached superiorly to the humerus and inferiorly to the radius and ulna.

The capsule is reinforced anteriorly and posteriorly by a fibrous layer, whereas the external and internal collateral ligaments make up its lateral and medial portions.

Two muscle groups originate from the elbow:

– the epicondylar muscles, which allow finger and wrist extension, and
– the medial epicondylar muscles, which enable finger and wrist pronation and flexion.

Three muscles insert into the elbow joint:

– the biceps and the brachialis muscle, which enable forearm flexion and forearm supination on the arm, and
– the triceps muscle, which allows forearm extension on the arm.

A. Ingardia (✉) • L. Rossini
UO Anestesia, Rianimazione, AUSL della Romagna, PO Riccione e Cattolica, Cattolica, Italy
e-mail: aingardia@libero.it

B. Borghi
Anaesthesiology, Bologna University, Rizzoli Institute, Bologna, Italy

Inflammatory nociceptive pain involving the tendons of these muscle groups is the main indication for pain treatment, especially with intra-articular injection therapy.

However, since elbow pain is not due exclusively to mechanical causes, it is amenable to a multidisciplinary approach.

Mechanical pain is commonly localized to the joints. The pain radiating to the mid-arm, forearm, and hand compartment may be due to nerve compression (mixed or neuropathic pain).

The elbow joint receives motor and sensory innervation by nerves originating from the brachial plexus:

- musculocutaneous,
- median,
- ulnar, and
- radial nerve.

The dermatome map of the arm is shown in Fig. 41.1.

41.2 Causes of Elbow Pain

41.2.1 Nociceptive Pain

ACUTE

Extra-articular causes (the most common causes of elbow pain)

- Lateral epicondylitis (tennis elbow)
- Medial epicondylitis/epitrochleitis (golfer's elbow)
- Olecranon bursitis

Intra-articular disorders

- Arthritis (septic, autoimmune, and seronegative arthritis, osteomyelitis)
- Loose bodies
- Radial head fracture
- Osteochondritis dissecans

G. Porcellini et al. (eds.), *The Elbow*, https://doi.org/10.1007/978-3-319-27805-6_41

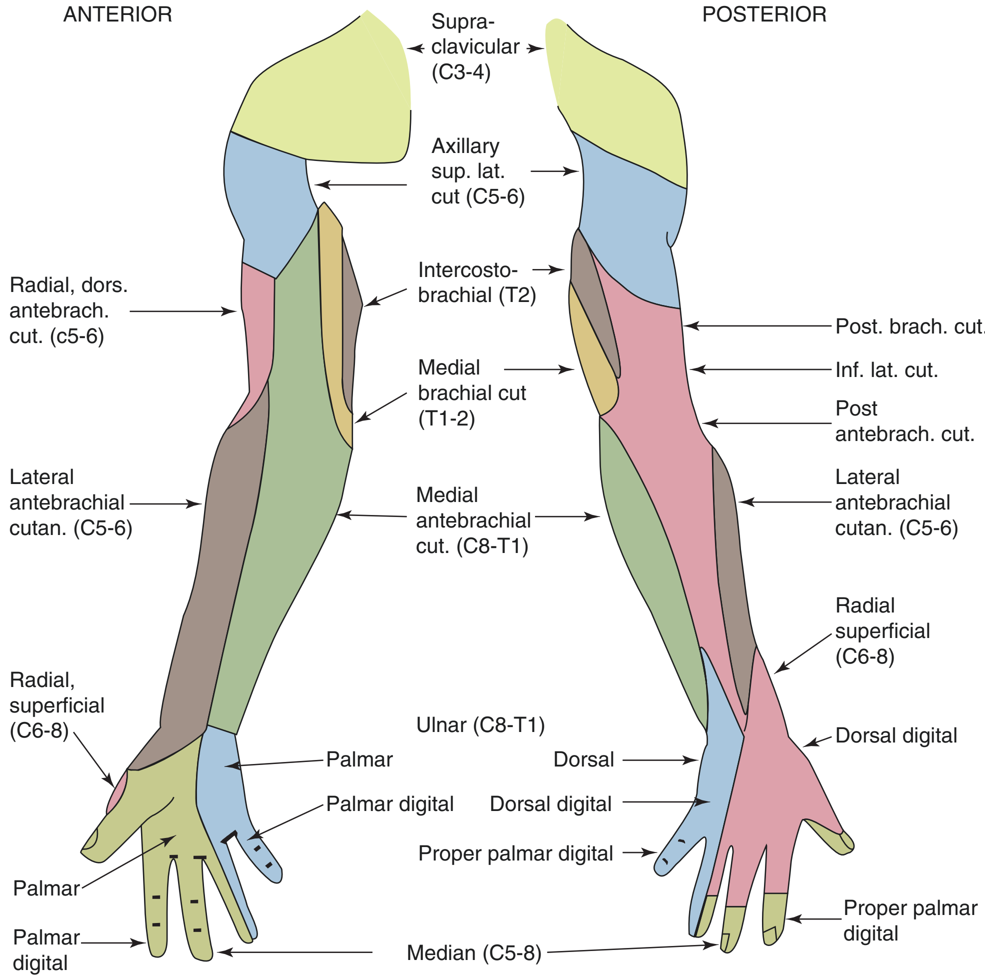

Fig. 41.1 Dermatome map of brachial plexus nerves

Postoperative pain

- Elbow arthroscopy
- Elbow arthrotomy

CHRONIC (degenerative arthropathies)

- Rheumatoid arthritis
- Primary arthritis (functional wear)
- Secondary arthritis (e.g. trauma, crystal deposits).

41.2.2 Neuropathic Pain

- Peripheral nerve injury (trauma, wounds, tumours)
- Entrapment syndromes:
  - median nerve compression at the elbow
  - anterior interosseous nerve compression
  - radial nerve compression at the elbow
  - ulnar nerve compression at the elbow: cubital tunnel syndrome; this is the second most common compression syndrome of a peripheral nerve after carpal tunnel syndrome; even though the ulnar nerve may be compressed at several sites along its course, the elbow accounts for the majority of cases.

41.2.3 Mixed Pain

- Cervicobrachial pain
- Complex Regional Pain Syndromes (CRPS) types I and II (formerly algodystrophic syndrome, reflex-sympathetic dystrophy syndrome, causalgia).

41.2.3.1 Cervicobrachial Pain

Cervicobrachial pain is notoriously resistant to traditional oral and systemic pain medications (Borghi et al. 2015). In these patients, blind or ultrasound-guided periradicular infiltration is more effective.

The drugs that can safely be administered by this route are substantially those used for intramuscular injections:

- NSAID
- corticosteroids
- local anaesthetics
- adjuvants.

41.2.3.2 Complex Regional Pain Syndromes (CRPS) Types I and II

CRPS are pathological entities where pain—the key symptom, either spontaneous or induced—is disproportionate to the event that has caused it. CRPS involve a number of variously combined autonomic and motor disturbances (International Association for The Study of Pain, IASP, 1994) (Bruehl et al. 1999).

They have been divided into:

- type I (formerly reflex-sympathetic dystrophy syndrome and similar disorders), involving trauma that does not entail nerve injury, and
- type II (formerly causalgia), involving lesion of a peripheral nerve.

A number of different causes contribute to CRPS development; some, like swelling, autoimmune response, abnormal cytokine production and release, sympathetic-sensory disorders, changes in local circulation, and central cortical causes (Borchers and Gershwin 2014; Harden 2012), are non-specific and lack a clear explanation.

41.3 Treatment

Multimodal treatment is currently considered as the gold standard for all types of pain, including elbow pain (Chou et al. 2016; Kehlet et al. 2002).

However, regional analgesia with local anaesthetics (or local anaesthetics combined with opioids) is more effective than systemic analgesia (i.e. opioids alone) in controlling postoperative pain and prevents the development of hyperalgesia and central sensitization (Wu 2011).

41.3.1 Drug Treatment

The treatment of elbow pain is based on its intensity (mild, moderate, severe), temporal profile (acute, chronic, persistent), and type (nociceptive, neuropathic). The safe pain medications used most often are as follows:

- paracetamol: mild, moderate, acute, and chronic pain
- NSAID/selective COX-2 inhibitors: mild, moderate, and acute pain (Jayanthi et al. 2016)
- tramadol: moderate, acute, and chronic pain (Lozada et al. 2015)
- tapentadol: moderate, severe, acute (not in Italy), and chronic pain (Hartrick et al. 2009)
- opioids: moderate, severe, acute, and chronic pain
- adjuvants (antiepileptics, tricyclic antidepressants/SSRI, dietary supplements): they help manage mixed pain in the framework of multimodal treatment by raising the pain threshold and stabilizing neuronal membranes
- bisphosphonates: besides being used for the treatment of osteoporosis, they have recently been promoted for use in osteoarthrosis (Spector 2003) and CRPS (Varenna et al. 2014; Varenna et al. 2013) according to precisely defined doses.

41.3.2 Invasive Pain Treatment

41.3.2.1 Single-Shot and Continuous Nerve Blocks (Wheeler et al. 2016; Tognù 2013; Fanelli 2007)

- supraclavicular brachial plexus block (Fig. 41.2)
- infraclavicular brachial plexus block
- axillary brachial plexus block.

According to the literature none is superior to the others (Frederiksen et al. 2010). The ultrasound-guided approach, though not required by any guideline, reduces the rate of adverse events (Fenten et al. 2015).

Indications:

- acute postoperative pain
- early postoperative pain
- joint release in patients with acute or chronic stiff elbow.

Fig. 41.2 Continuous supraclavicular brachial plexus block

41.3.2.2 Ultrasound-Guided Intra-Articular Injection

41.3.2.3 Peripheral Nerve Stimulation (PNS): NEUROMODULATION (Soloman et al. 2010)

Mechanism of action

Several hypotheses have been advanced to explain the pain relief provided by this approach:

1. a block of nociceptive afferents induced by peripheral electrical stimulation;
2. prolonged inhibition of spinothalamic neurons (gate control theory)(Chung et al. 1984).

Indications

1. neuropathic pain in the territory of a single nerve (ulnar, radial, median) after the failure of non-invasive treatments, in the absence of psychological contraindications and of positivity on screening tests
2. neuropathic pain in the territory of a single injured nerve (CRPS II)
3. effective nerve blockade does not ensure PNS success, whereas the ineffectiveness of a technically correct block often compromises it (Shetter et al. 1997).

Advantages

1. PNS does not involve peripheral or central nervous system injury and is better tolerated than neurotomy.
2. unlike spinal cord stimulation (SCS), PNS is highly selective and is not influenced by spinal movements.

Disadvantages

1. stimulation of a mixed nerve may induce secondary motor stimulation (rare)
2. perineural scarring may induce neurapraxia (rare)
3. implantation of the PNS electrode requires knowledge of the surgical technique, unlike the application of the percutaneous electrode in SCS.

Screening tests include:

1. preoperative percutaneous stimulation of the relevant nerve, to evaluate its territory and assess the motor response
2. when preoperative stimulation is not feasible, an electrode may be implanted provisionally, before implanting the device for chronic stimulation.

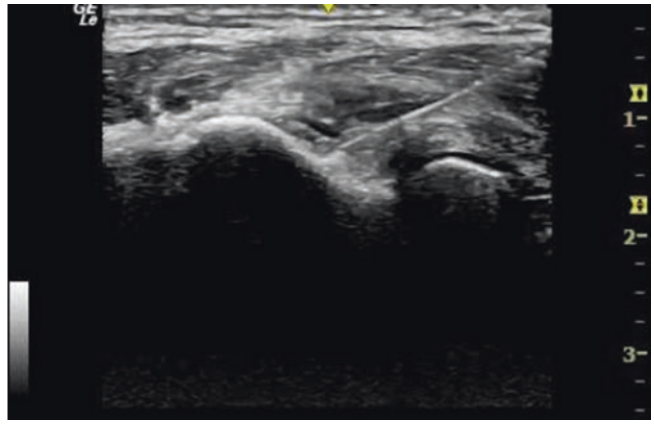

Fig. 41.3 Ultrasound-guided injection by Dr. ChiKai You© (torn radial collateral ligament)

41.3.2.4 Radiofrequency Neurotomy: DENERVATION

Unlike the neuromodulation approaches, which are reversible and reproducible, denervation involves irreversible nerve lesion and is definitive (Fig. 41.3).

41.3.3 Alternative Treatments

- Acupuncture (see paragraph 41.3.3.1)
- Physical therapy
- Physiokinesitherapy.

41.3.3.1 Acupuncture and Elbow Pain

Acupuncture, a mainstay of Traditional Chinese Medicine (TCM), has been used in China for 5000 years to treat a variety of conditions. TCM also includes phytotherapy, diet therapy, and medical gymnastics in a comprehensive medical system (see Chap. 42).

Acupuncture focuses on illness prevention rather than treatment, but is also used for a broad range of medical purposes that include pain relief as well as surgical anaesthesia.

Over the past few decades, acupuncture has gained wide recognition as a pain management approach. Support for its efficacy in several different conditions, like chronic low back pain, from evidence-based studies has led to its inclusion as a treatment option of clinical relevance in international recommendations such as those of the American Pain Society and the National Institute for Clinical Excellence (NICE Clinical Guidelines 2009; APS Guidelines 2007; Levis et al. 2010; Berman et al. 2010).

According to current evidence, acupuncture can be harnessed for the first-line treatment of migraine and tension headache, as a complement to other non-pharmacological treatment options. It is at least as effective as prophylactic drug therapy (but has longer-lasting effects), it is safe, it appears to be cost-effective, and it allows reducing the intake of drugs that may have severe unwanted effects (Diener et al. 2006; Linde et al. 2009; Yang et al. 2011; Wang et al. 2011).

Other conditions where it has documented value include dysmenorrhoea, labour pain, knee osteoarthritis (Scharf et al. 2006), neck pain (Trinh et al. 2006; Vas et al. 2006; Trinh et al. 2007; Trinh et al. 2010), shoulder pain (Molsberger et al. 2010; Vas et al. 2008), elbow pain (Ahmad et al. 2013; Bisset et al. 2005; Fink et al. 2002; Green et al. 2002; Johnson et al. 2007; Salvi et al. 2011; Schleicher et al. 2010; Shiri and Viikari-Juntura 2011; Smidt and van der Windt 2006; Trinh et al. 2004; Trudel et al. 2004), and acute postoperative pain.

Of the 40 odd studies of elbow pain that have been published over the past 10 years, 14 (which include reviews, systematic reviews, and meta-analyses) have concluded that acupuncture is a useful treatment for epicondylitis (Ahmad et al. 2013; Shiri and Viikari-Juntura 2011; Schleicher et al. 2010; Bisset et al. 2005; Trinh et al. 2004; Trudel et al. 2004), while other investigations have called for additional high-quality studies to define its role (Green et al. 2002; Johnson et al. 2007; Salvi et al. 2011). In the review by Trinh et al. (2004), six high-quality (3–5 on the Jadad scale) randomised controlled studies involving heterogeneous treatment approaches (control group, sham acupuncture, outcomes) reported the efficacy of acupuncture in relieving short-term elbow pain. According to Fink et al. (2002), the beneficial effects of acupuncture continued for 1 year after the end of treatment (Ahmad et al. 2013; Bisset et al. 2005; Fink et al. 2002; Green et al. 2002; Johnson et al. 2007; Salvi et al. 2011; Schleicher et al. 2010; Shiri and Viikari-Juntura 2011; Smidt and van der Windt 2006; Trinh et al. 2004; Trudel et al. 2004).

Data demonstrating the effectiveness of acupuncture for conditions such as visceral pain syndromes, vascular ischaemic pain, phantom limb pain, and chronic postoperative and post-traumatic pain syndromes are less abundant, but they are continuously evolving as new, well-designed, high-quality studies with a suitable follow-up become available.

TCM is based on ancient knowledge, not on Western scientific empiricism. In this system, two opposing and complementary forces, Yin and Yang, coexist and interact with each other to regulate the flow of "vital energy", or Qi.

In a healthy individual Yin and Yang are in balance and the Qi is strong.

Qi is believed to circulate in the whole body through invisible channels called meridians or Jing Luo.

There are 12 major channels (six Yin and six Yang) and numerous minor channels that form a network of energy channels throughout the body.

Meridians do not correspond with anatomical structures, even though each is closely related to an internal organ or function. The main meridians include lung, heart, pericardium, kidney, spleen, liver, small intestine, large intestine, triple warmer, urinary bladder, stomach, and gallbladder. Their designation can be understood only in the context of TCM.

Along the meridians are more than 400 acupuncture points, each with its own function, which have also been classified by the World Health Organization. They are identified by name, number, and the meridian to which they belong. Other types of acupuncture points, which are located outside the meridians, are "extra" and Ashi points (Fig. 41.4).

The patient's pulse and tongue provide key diagnostic information on internal organs and functions.

Notably, TCM definitions and terms do not reflect Western physiological tenets, but are based on notions that have been formulated long before modern physiological knowledge became available.

TCM views the human body as a whole rather than a complex of symptoms. This is an important aspect that is sometimes lost in Western technical medicine—which tends to fragmentation—and is one of the reasons why TCM is gaining increasing popularity among patients and physicians.

There is currently a strong tendency to integrate the biopsychosocial model in modern pain management, which is what TCM does, since two individuals with the same disease may be treated in different ways, whereas different disorders may give rise to the same syndrome and be treated in a similar way.

The acupuncture points used for treatment are local, regional, and distant.

Fig. 41.4 Treatment of cervicobrachial pain with acupuncture

The mechanisms underpinning acupuncture-induced analgesia are still not completely clear. Modern physiological research has demonstrated that acupuncture exerts a neuromodulation effect on parts of the CNS and peripheral nervous system as well as on neurotransmitters.

Experimental work by Pomeranz (1987) has demonstrated that acupuncture stimulation activates A-δ and C afferent fibres in muscle, and that transmission of these stimuli to the spinal cord results in local release of dynorphin and enkephalins. These afferent pathways propagate to the midbrain and trigger a cascade of excitatory and inhibitory signals in the spinal cord, leading to release of serotonin, dopamine, and norepinephrine, suppression of pain transmission, and activation of the hypothalamus and pituitary gland with secretion of ACTH and endorphins.

Evidence from electroacupuncture (EA) studies indicates that low-frequency EA induces release of enkephalin and β-endorphins, whereas high-frequency EA leads to release of dynorphin. Moreover, EA at different frequencies has been reported to result in different gene expression in some CNS areas (Wang et al. 2008).

Over the past 10 years, studies employing advanced neuroimaging techniques, such as SPECT and functional MRI, have suggested that acupuncture stimulation and pain share similar central pathways involving the limbic system and adjacent structures (Wang et al. 2008). These areas also seem to participate in the modulation of the cognitive and affective dimensions of pain, and it has been proposed that the analgesic and anxiolytic effect of acupuncture, as well as other acupuncture-induced regulatory effects, may be mediated by the deactivation of these limbic, paralimbic, and neocortical circuits (Wang et al. 2008).

Further work is required to clarify the mechanism by which acupuncture exerts its analgesic effects.

Research into the anti-inflammatory effect of acupuncture has provided evidence suggesting the involvement of the hypothalamus–pituitary–adrenal axis, sympathetic pathways, and possibly parasympathetic cholinergic pathways.

Other important effects of acupuncture stimulation include antihistamine effects, down-regulation of proinflammatory cytokines (e.g. TNF-α, IL-1β, IL-6, and IL-10), proinflammatory neuropeptides, and neurotrophins, and suppression of COX-1, COX-2, and iNOS. Modulation of glutamate and aspartate receptors has also been implicated in the anti-inflammatory effect of acupuncture (Wang et al. 2008).

Pain specialists are trying to include acupuncture as a complementary technique in pain management together with manual therapy, physical exercises, psychotherapy, and pharmacotherapy within a therapeutic, rehabilitative, and preventive management framework.

Acupuncture may also offer a reasonable alternative to treat polypharmacy patients, like older patients, who are at risk of drug interactions, have contraindications to various drugs, or are intolerant to the side effects of their medications.

Cost is another major issue: the cost of acupuncture should be evaluated in relation to the savings accruing from a more limited/shorter use of drug therapy.

Although acupuncture is not completely risk-free, the risk is very low in expert hands.

It has been estimated that the incidence of major complications related to acupuncture treatment is 1:10,000–1,100,000(White et al. 1997).

Importantly, a survey of 574 acupuncturists and ca. 34,000 treatments has reported no serious adverse events, the most common events being nausea and fainting (1.3 per 1000 treatments)(MacPherson et al. 2001). According to another survey involving 10,000 treatments, there were 14 significant adverse events involving fainting, nausea, drowsiness, and anxiety, and 671 minor events involving puncture site bleeding and discomfort (White et al. 2001). Such low risk should be compared with the adverse effects of conventional treatments; for instance, NSAIDs are associated with considerable side effects that are dose-related and increase with rising age (Tramer et al. 2000).

References

Ahmad Z, Siddiqui N, Malik SS, Abdus-Samee M, Tytherleigh-Strong G, Rushton N (2013) Lateral epicondylitis: a review of pathology and management. Bone Joint J 95-B(9):1158–1164

APS Guidelines (2007) Low back pain

Berman BM, Witt CM et al (2010) Acupuncture for chronic low back pain. N Engl J Med 363:454–461

Bisset L, Paungmali A, Vicenzino B, Beller E (2005) A systematic review and meta-analysis of clinical trials on physical interventions for lateral epicondylalgia. Br J Sports Med 39(7):411–422. discussion 411-22

Borchers AT, Gershwin ME (2014) Complex regional pain syndrome: a comprehensive and critical review. Autoimmun Rev 13(3):242–265

Borghi B et al (2015) Treatment of chronic cervicobrachial pain with periradicular injection of meloxicam. Minerva Anestesiol 3. Epub ahead of print

Bruehl S, Harden RN et al (1999) External validation of IASP diagnostic criteria for complex regional pain syndrome and proposed research diagnostic criteria. Pain 81(1-2):147–154

Chou R et al (2016) Management of postoperative pain: a clinical practice guideline from the American Pain Society, the American Society of regional Anesthesiologists' Committee on Regional Anesthesia, Executive Committee, and Administrative Council. J Pain 17(2):131–157

Chung JM, Lee K, Hori Y, Al e (1984) Factors influencing peripheral nerve stimulation produced inhibition of primate spinothalamic tract cells. Pain 19:277–293

Diener HC, Kronfeld K, Boewing G et al (2006) Efficacy of acupuncture for the prophylaxis of migraine: a multicentre randomised controlled clinical trial. Lancet Neurol 5:310–316

Fanelli G (2007) Ecografia per i blocchi nervosi periferici. EDIMES, Edizioni Medico Scientifiche, Pavia

Fenten MGE et al (2015) Effect of local anesthetic concentration, dose and volume on the duration of single-injection ultrasound-guided axilllary brachial plexus block with mepivacaine. BMC Anesthesiol 15:130

Fink M, Wolkenstein E, Luennemann M, Gutenbrunner C, Gehrke A, Karst M (2002) Chronic epicondylitis: effects of real and sham acupuncture treatment: a randomised controlled patient and examiner-blinded long-term trial. Forsch Komplementarmed Klass Naturheilkd 9(4):210–215

Frederiksen BS, Koscielniak-Nielsen ZJ, Al e (2010) Procedural pain of an ultrasound-guided brachial plexus block: a comparison of axillary and infraclavicular approaches. Acta Anaesthesiol Scand 54:408–413

Green S, Buchbinder R, Barnsley L, Hall S, White M, Smidt N, Assendelft W (2002) Acupuncture for lateral elbow pain. Cochrane Database Syst Rev 1:CD003527

Harden N (2012) The diagnosis of CRPS: are we there yet? Pain 153(6):1142–1143

Hartrick C et al (2009) Efficacy and tolerability of tapentadol immediate release and oxycodone HCl immediate release in patients awaiting primary joint replacement surgery for end-stage joint disease: a 10-day, phase iii; randomized, double-blind, active- and placebo-controlled study. Clin Ther 31(2):260–271

Jayanthi N et al (2016) Patient information: elbow tendinopathy (tennis and golf elbow) (Beyond the Basics). www.uptodate.com. UptoDate®

Johnson GW, Cadwallader K, Scheffel SB, Epperly TD (2007) Treatment of lateral epicondylitis. Am Fam Physician 76(6):843–848

Kehlet H et al (2002) Multimodal strategies to improve surgical outcome. Am J Surg 183:630–644

Levis K et al (2010) Acupuncture for low back pain: a review. Clin J Pain 26:60–69

Linde K, Allais G, Brinkhaus B et al (2009) Acupuncture for migraine prophylaxis. Cochrane Database Syst Rev 1:CD001218

Loeser JD (2003) Bonica's—trattamento del Dolore, III Edizione Italiana. Antonio Delfino Editore, Roma

Lozada CJ et al (2015) Osteoarthritis: practice essentials, background, anatomy. http://emedicine.medscape.com/article/330487-overview. Updated 27 Mar 2015

MacPherson H et al (2001) The York acupuncture safety study: prospective survey of 34,000 treatments by traditional acupuncturists. BMJ 323:486–487

Molsberger AF, Schneider T, Gotthardt H, Drabik A (2010) German randomized acupuncture trial for chronic shoulder pain (GRASP). A pragmatic controlled, patient-blinded, multicentre trial in an outpatient care environment. Pain 151:146–154

NICE Clinical Guidelines (2009) Low back pain

Pomeranz B. Acupuncture neurophysiology. In: Encyclopedis of Neuroscience. Birkhauser Boston.

Salvi AE, Donini MT, Campochiaro G, Corona M, Dakovic I (2011) Epicondylitis: etiology, pathogenesis and therapy. Tunis Med 89(4):320–325

Scharf HP, Mansmann U, Streitberger K et al (2006) Acupuncture and knee osteoarthritis: a three-armed randomized trial. Ann Intern Med 145:12–20

Schleicher I, Szalay G, Kordelle J (2010) Treatment of epicondylitis - a current review. Sportverletz Sportschaden 24(4):218–224

Shetter AG, Racz GB, Lewis R et al (1997) Peripheral nerve stimulation. In: North RB, Levy RM (eds) Neurosurgical management of pain. Springer-Verlag, New York, pp 26–270

Shiri R, Viikari-Juntura E (2011) Lateral and medial epicondylitis: role of occupational factors. Best Pract Res Clin Rheumatol 25(1):43–57

Smidt N, van der Windt DA (2006) Tennis elbow in primary care. BMJ 333(7575):927–928

Soloman M et al (2010) Radiofrequency treatment in chronic pain. Expert Rev Neurother 10(3):469–474

Spector TD (2003) Biphosphonates: potential therapeutic agents for disease modification in osteoarthritis. Aging Clin Exp Res 15:413–418

Tognù A (2013) Tecniche ecoguidate in anestesia e terapia del dolore. LSWR Srl, Milano

Tramer M et al (2000) Quantitative estimation of rare adverse events which follow a biological progression: a new model applied to chronic NSAID use. Pain 85:169–182

Trinh KV, Phillips SD, Ho E, Damsma K (2004) Acupuncture for the alleviation of lateral epicondyle pain: a systematic review. Rheumatology (Oxford) 43(9):1085–1090

Trinh KV, Philips SD et al (2006) Acupuncture for neck disorders. Cochrane Database Syst Rev. First published 19 July 2006. https://doi.org/10.1002/14651858.CD004870.pub3

Trinh K et al (2007) Acupuncture for neck disorders. Spine 32:236–243

Trinh K, Graham N, Gross A et al 2010 Acupuncture for neck pain. Cochrane Rev. 17 Mar 2010

Trudel D, Duley J, Zastrow I, Kerr EW, Davidson R, MacDermid JC (2004) Rehabilitation for patients with lateral epicondylitis: a systematic review. J Hand Ther 17(2):243–266

Varenna M et al (2013) Treatment of complex regional pain syndrome type I with neridronate: a randomized, double-blind, placebo-controlled study. Rheumatology (Oxford) 52(3):534–542. https://doi.org/10.1093/rheumatology/kes312. Epub 30 Nov 2012

Varenna M et al (2014) Biphosphonates in complex regional pain syndrome type I: how do they work? Clin Exp Rheumatol 32:451

Vas J, Perea-Milla E, Mednez C et al (2006) Efficacy and safety of acupuncture for chronic uncomplicated neck pain: a randomized control study. Pain 126(1-3):245

Vas J, Ortega C, Olmo V et al (2008) Single-point acupuncture and physiotherapy for the treatment of painful shoulder: a multicentre randomized controlled trial. Rheumatology (Oxford) 47:887–893

Wang SM et al (2008) Acupuncture Analgesia: the scientific basis. Pain Med 106(2):602

Wang LP, Zhang XZ, Guo J et al (2011) Efficacy of acupuncture for migraine prophylaxis: a single-blinded, double-dummy, randomized controlled trial. Pain 152:1864–1871

Wheeler AH et al (2016) Therapeutic injections for pain management: types of therapeutic injections, guidelines for therapeutic application, technical application. http://emedicine.medscape.com/article/1143675-overview. Updated 21 Mar 2016

White A et al (1997) Survey of adverse events following acupuncture. Acupunct Med 15(2):80–83

White A et al (2001) Adverse events following acupuncture: prospective survey of 32.000 consultations with doctors and phisiotherapists. BMJ 323:485–486

Wu C (2011) Treatment of acute postoperative pain. Lancet 377: 2215–2225

Yang CP, Chang MH, Liu PE et al (2011) Acupuncture versus topiramate in chronic migraine prophylaxis: a randomized clinical trial. Cephalalgia 31:1510–1521