

studies can accurately localize lesions to the nerve roots, brachial plexus, or peripheral nerves.

For further discussion of peripheral nerve disorders, see Chap. 459.

## SHOULDER

Pain arising from the shoulder can on occasion mimic pain from the spine. If symptoms and signs of radiculopathy are absent, then the differential diagnosis includes mechanical shoulder pain (tendonitis, bursitis, rotator cuff tear, dislocation, adhesive capsulitis, or rotator cuff impingement under the acromion) and referred pain (subdiaphragmatic irritation, angina, Pancoast tumor). Mechanical pain is often worse at night, associated with local shoulder tenderness and aggravated by passive abduction, internal rotation, or extension of the arm. Pain from shoulder disease may radiate into the arm or hand, but focal neurologic signs (sensory, motor, or reflex changes) are absent.

## TREATMENT NECK PAIN WITHOUT RADICULOPATHY

The evidence regarding treatment for neck pain is less complete than that for low back pain, but the approach is remarkably similar in many respects. As with low back pain, spontaneous improvement is the norm for acute neck pain. The usual goals of therapy are to promote a rapid return to normal function and provide symptom relief while healing proceeds.

The evidence in support of nonsurgical treatments for whiplash-associated disorders is generally of limited quality and neither supports nor refutes the common treatments used for symptom relief. Gentle mobilization of the cervical spine combined with exercise programs may be beneficial. Evidence is insufficient to recommend for or against the routine use of acupuncture, cervical traction, TENS, ultrasound, diathermy, or massage. Some patients obtain modest relief using a soft neck collar; there is little risk or cost.

For patients with neck pain unassociated with trauma, supervised exercise with or without mobilization appears to be effective. Exercises often include shoulder rolls and neck stretches. The evidence for the use of muscle relaxants, analgesics, and NSAIDs in acute and chronic neck pain is of lower quality and less consistent than for low back pain.

Low-level laser therapy directed at areas of tenderness, local acupuncture points, or a grid of predetermined points is a controversial approach to the treatment of neck pain. A 2009 meta-analysis suggested that this treatment may provide greater pain relief than sham

therapy for both acute and chronic neck pain, but comparison to other conservative and less expensive treatment measures is needed.

Although some surgical studies have proposed a role for anterior discectomy and fusion in patients with neck pain, these studies generally have not been rigorously conducted. A systematic review suggested that there was no valid clinical evidence to support either cervical fusion or cervical disk arthroplasty in patients with neck pain without radiculopathy. Similarly, there is no evidence to support radiofrequency neurotomy or cervical facet injections for neck pain without radiculopathy.

## TREATMENT NECK PAIN WITH RADICULOPATHY

The natural history of neck pain with acute radiculopathy due to disk disease is favorable, and many patients will improve without specific therapy. Although there are no randomized trials of NSAIDs for neck pain, a course of NSAIDs, acetaminophen, or both, with or without muscle relaxants, is reasonable as initial therapy. Other nonsurgical treatments are commonly used, including opioid analgesics, oral glucocorticoids, cervical traction, and immobilization with a hard or soft cervical collar. However, there are no randomized trials that establish the effectiveness of these treatments. Soft cervical collars can be modestly helpful by limiting spontaneous and reflex neck movements that exacerbate pain.

As for lumbar radiculopathy, epidural glucocorticoids appear to provide short-term symptom relief in cervical radiculopathy, but rigorous studies addressing this question have not been conducted. If cervical radiculopathy is due to bony compression from cervical spondylosis with foraminal narrowing, periodic follow-up to assess for progression is indicated and consideration of surgical decompression is reasonable.

Surgical treatment can produce rapid pain relief, although it is unclear whether long-term outcomes are improved over nonsurgical therapy. Indications for cervical disk surgery include a progressive radicular motor deficit, functionally limiting pain that fails to respond to conservative management, or spinal cord compression.

Surgical treatments include anterior cervical discectomy alone, laminectomy with discectomy, or discectomy with fusion. The risk of subsequent radiculopathy or myelopathy at cervical segments adjacent to a fusion is ~3% per year and 26% per decade. Although this risk is sometimes portrayed as a late complication of surgery, it may also reflect the natural history of degenerative cervical disk disease.

## SECTION 2 ALTERATIONS IN BODY TEMPERATURE

# 23

## Fever

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Body temperature is controlled by the hypothalamus. Neurons in both the preoptic anterior hypothalamus and the posterior hypothalamus receive two kinds of signals: one from peripheral nerves that transmit information from warmth/cold receptors in the skin and the other from the temperature of the blood bathing the region. These two types of signals are integrated by the thermoregulatory center of the hypothalamus to maintain normal temperature. In a neutral temperature environment, the human metabolic rate produces more heat than is necessary to maintain the core body temperature in the range of 36.5–37.5°C (97.7–99.5°F).

A normal body temperature is ordinarily maintained despite environmental variations because the hypothalamic thermoregulatory center balances the excess heat production derived from metabolic activity in muscle and the liver with heat dissipation from the skin and lungs. According to studies of healthy individuals 18–40 years of age, the mean oral temperature is 36.8° ± 0.4°C (98.2° ± 0.7°F), with low levels at 6 A.M. and higher levels at 4–6 P.M. The maximal normal oral temperature is 37.2°C (98.9°F) at 6 A.M. and 37.7°C (99.9°F) at 4 P.M.; these values define the 99th percentile for healthy individuals. In light of these studies, *an A.M. temperature of >37.2°C (>98.9°F) or a P.M. temperature of >37.7°C (>99.9°F) would define a fever.* The normal daily temperature variation is typically 0.5°C (0.9°F). However, in some individuals recovering from a febrile illness, this daily variation can be as great as 1.0°C. During a febrile illness, the diurnal variation is usually maintained, but at higher, febrile levels. The daily temperature