Magee

ORTHOPEDIC PHYSICAL ASSESSMENT

SECOND EDITION

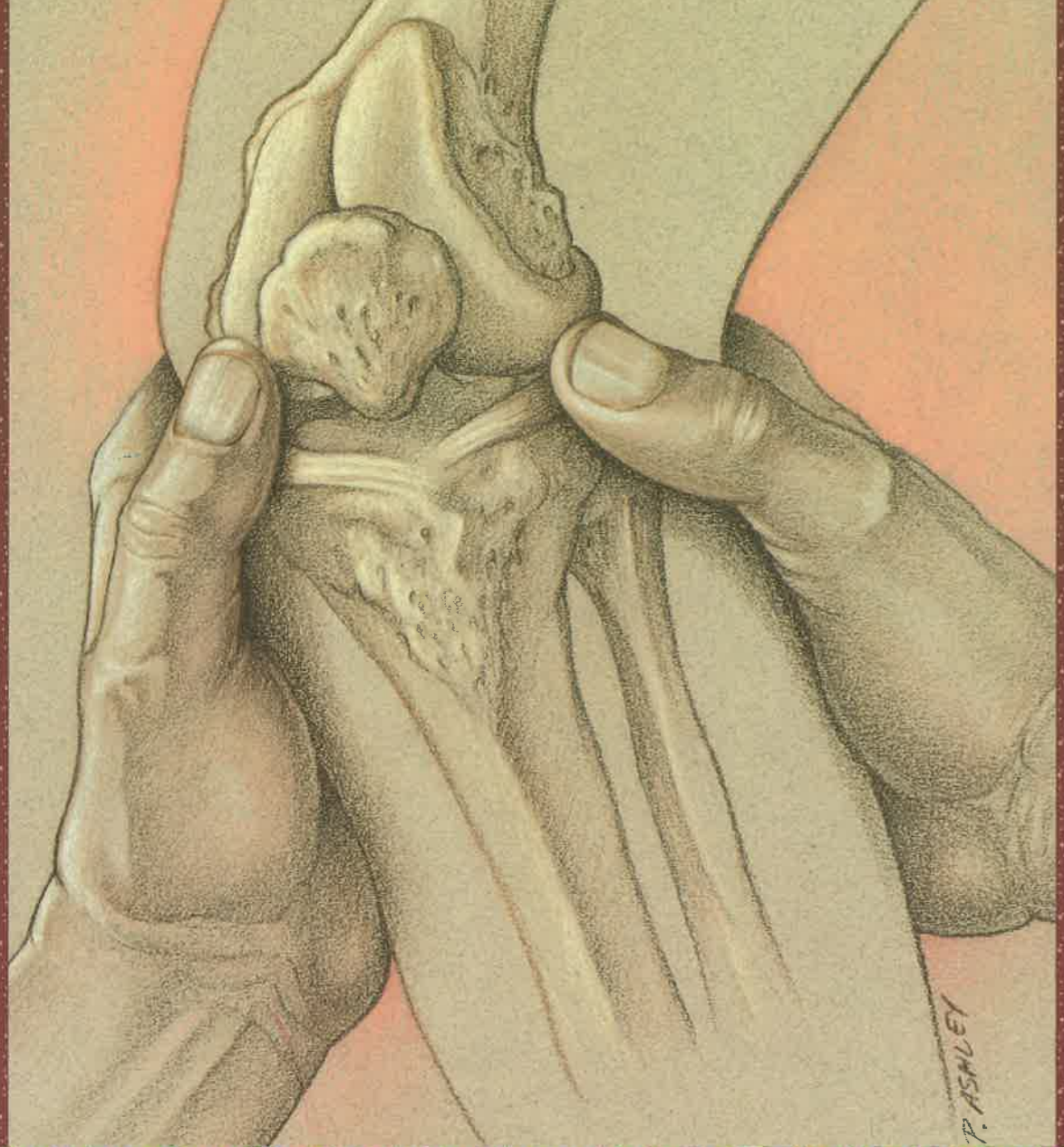

TABLE 1–2. Nerve Root Dermatomes, Myotomes, Reflexes, and Paresthetic Areas

Nerve Root	Dermatome*	Muscle Weakness (Myotome)	Reflexes Affected	Paresthesias
C1	Vertex of skull			
C2	Temple, forehead, occiput			
C3	Entire neck, posterior cheek, temporal area, prolongation forward under mandible			Cheek, side of neck
C4	Shoulder area, clavicular area, upper scapular area			Horizontal band along clavicle and upper scapula
C5	Deltoid area, anterior aspect of entire arm to base of thumb	Supraspinatus, intraspinatus, deltoid, biceps	Biceps, brachioradialis	
C6	Anterior arm, radial side of hand to thumb and index finger	Biceps, supinator, wrist extensors	Biceps, brachioradialis	Thumb and index finger
C7	Lateral arm and forearm to index, long, and ring fingers	Triceps, wrist flexors (rarely, wrist extensors)	Triceps	Index, long, and ring fingers
C8	Medial arm and forearm to long, ring, and little fingers	Ulnar deviators, thumb extensors, thumb adductors (rarely, triceps)	Triceps	Little finger alone or with two adjacent fingers; *not* ring or long fingers, alone or together (C7)
T1	Medial side of forearm to base of little finger	Disc lesions at upper two thoracic levels do not appear to give rise to root weakness. Weakness of intrinsic muscles of the hand is due to other pathology (e.g., thoracic outlet pressure, neoplasm of lung, and ulnar nerve lesion). Dural and nerve root stress has T1 elbow flexion with arm horizontal. T1 and T2 scapulae forward and backward on chest wall. Neck flexion at any thoracic level.		
T2	Medial side of upper arm to medial elbow, pectoral and midscapular areas			
T3–T12	T3–T6, upper thorax; T5–T7, costal margin; T8–T12, abdomen and lumbar region	Articular and dural signs and root pain are common. Root signs (cutaneous analgesia) are rare and have such indefinite area that they have little localizing value. Weakness is not detectable.		
L1	Back, over trochanter and groin	None	None	Groin; after holding posture, which causes pain
L2	Back, front of thigh to knee	Psoas, hip adductors	None	Occasionally anterior thigh
L3	Back, upper buttock, anterior thigh and knee, medial lower leg	Psoas, quadriceps, thigh atrophy	Knee jerk sluggish, PKB positive, pain on full SLR	Medial knee, anterior lower leg
L4	Medial buttock, lateral thigh, medial leg, dorsum of foot, big toe	Tibialis anterior, extensor hallucis	SLR limited neck flexion pain, weak or absent knee jerk, side flexion limited	Medial aspect of calf and ankle
L5	Buttock, posterior and lateral thigh, lateral aspect of leg, dorsum of foot, medial half of sole, first, second, and third toes	Extensor hallucis, peroneals, gluteus medius, dorsiflexor, hamstring and calf atrophy	SLR limited one side, neck flexion painful, ankle decreased, crossed-leg raising—pain	Lateral aspect of leg, medial three toes
S1	Buttock, thigh, and leg posterior	Calf and hamstring, wasting of gluteals, peroneals, plantar flexors	SLR limited, Achilles reflex weak or absent	Lateral two toes, lateral foot, lateral leg to knee, plantar aspect of foot
S2	Same as S1	Same as S1 except peroneals	Same as S1	Lateral leg, knee, and heel
S3	Groin, medial thigh to knee	None	None	None
S4	Perineum, genitals, lower sacrum	Bladder, rectum	None	Saddle area, genitals, anus, impotence, massive posterior

*In any part of which pain may be felt.
Abbreviations: PKB = prone knee bending; SLR = straight leg raising.

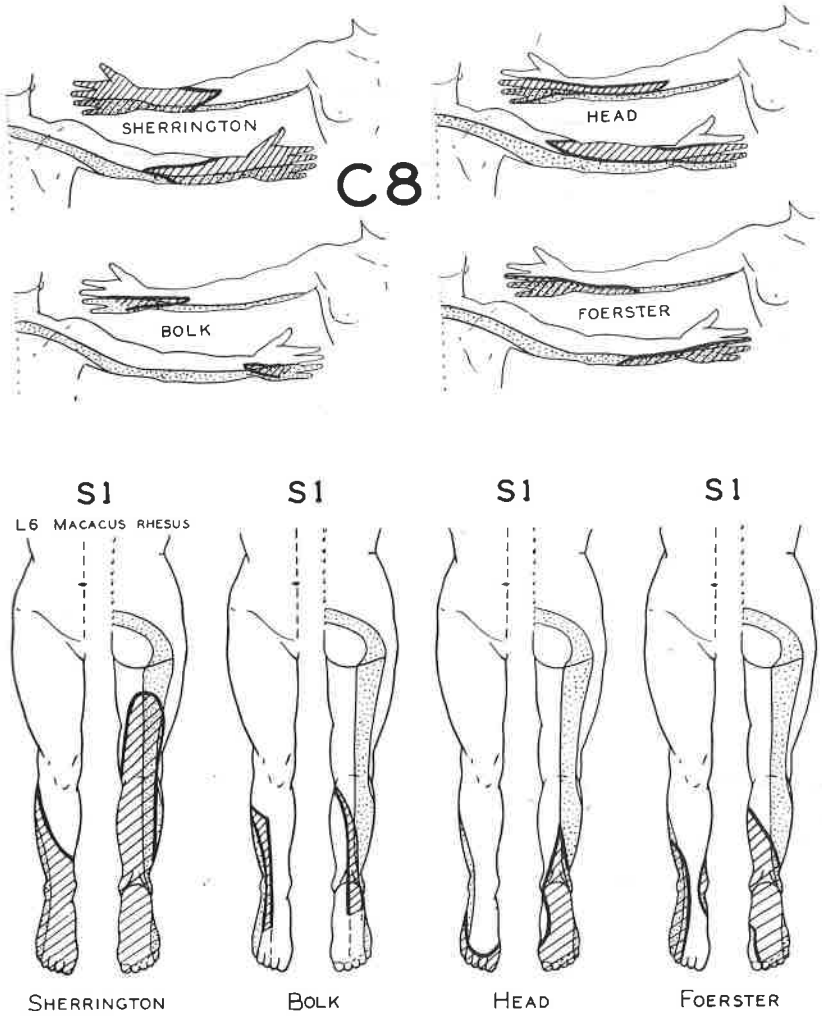

FIGURE 1–6. The variability of dermatomes at C8 and S1 as found by researchers. Similar variability is demonstrated in most cervical, lumbar, and sacral vertebrae. (From Keegan, J. J., and F. D. Garrett: Anat. Rec. 102:430, 433, 1948.)

tion, chemical irritants (e.g., alcohol, lead, or arsenic), or metabolic abnormalities. For example, diabetes may cause a metabolic peripheral neuropathy of one or more nerves.

In peripheral nerves, the epineurium consists of a loose areolar connective tissue matrix surrounding the nerve fiber and allows changes in growth length of the bundled nerve fibers (funiculi) without allowing the bundles to be strained. The perineurium protects the nerve bundles by acting as a diffusion barrier to irritants and provides tensile strength and elasticity to the nerve.

Myotomes

As defined earlier, *myotomes* are groups of muscles supplied by a single nerve root. A lesion of a single nerve root is usually associated with paresis (incomplete paralysis) of the muscle (myotome) supplied by that nerve root. On the other hand, a lesion of a peripheral nerve leads to complete paralysis of the muscles supplied by that nerve, especially if the injury results in *axonotmesis* or *neurotmesis*. The difference in the amount of resulting paralysis results from the fact that more than one myotome contributes to the formation of a muscle embryologically.

Sclerotomes

A *sclerotome* is an area of bone or fascia supplied by a single nerve root (Fig. 1–7). As with dermatomes, sclerotomes can show a great deal of variability among individuals.

Referred Pain

It is the nature of this makeup of dermatomes, myotomes, and sclerotomes that can lead to referred pain, which is felt in a part of the body that is usually a considerable distance from the tissues that have caused the pain and is explained as an error in perception on the part of the brain. Many theories of the mechanism of referred pain have been developed, but none has been proved conclusively. Gen-

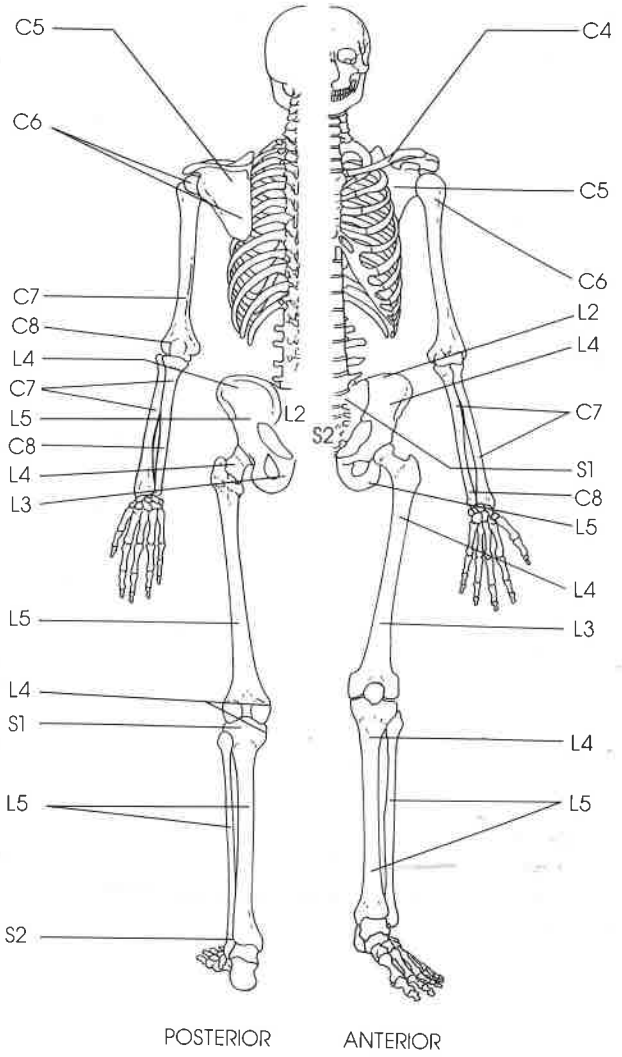

FIGURE 1–7 Sclerotomes of the body. Lines from nerve roots show area supplied by sclerotomes.

erally, referred pain may involve one or more of the following mechanisms:

1. Misinterpretation by the brain as to the source of the painful impulses.
2. Inability of the brain to interpret a summation of noxious stimuli from various sources.
3. Disturbance of the internuncial pool by afferent nerve impulses.

Referral of pain is a common occurrence in problems associated with the musculoskeletal system. Pain is often felt at points remote from the site of the lesion. The reference of pain is an indicator of the segment that is at fault. For example, pain in the L5 dermatome could arise from irritation around the L5 nerve root, from an L5 disc, from facet involvement of L4–L5, from any muscle supplied by the L5 nerve root, or from any visceral structures having L5 innervation.

Movements

Because the assessment is an examination of the moving parts of the body, testing of the active, passive, and resisted isometric movements can yield information concerning the tissues that could be at fault.

Active Movements

Active movements can be "actively" performed by voluntary muscles and have their own special value (i.e., they combine tests of a patient's willingness to perform the movement, joint range, control, and muscle power). Both contractile and inert tissues are involved or moved during active movements. When active movements occur, one or more rigid structures (bones) move, and such movement results in all structures that attach to that bone also moving. The examiner should note which movements, if any, cause pain and the amount and quality of pain that results. For example, small, unguarded movements causing intense pain indicate an irritable joint.

Contractile tissues may have tension placed on them by stretching or contracting.[1] These structures include the muscles, their tendons, and their attachments into the bone. *Inert tissues* have tension put on them by stretching or pinching.[1] They include all structures that would not be considered contractile, such as joint capsules, ligaments, bursae, blood vessels, nerves and their sheaths, cartilage, dura mater, and so on.

If there is an organic lesion, some movements will be found to be abnormal or painful and others will not. Negative findings must balance positive ones, and the examination must be extensive enough to allow characteristic patterns to emerge. Determination of the problem is not made on the strength of the first positive finding; it is made only when it is clear that there are no other contradictory signs. Movements should be repeated several times quickly to rule out any problem such as vascular insufficiency. The active component is a functional test of the anatomic and dynamic aspects of the body and joints. When testing active movements, the examiner should note:

1. When and where during the movement the onset of pain occurs.
2. Whether the movement increases the intensity and quality of the pain.
3. The reaction of the patient to pain.
4. The amount of observable restriction.
5. The pattern of movement.
6. The movement of associated joints.
7. The willingness of the patient to move the part.
8. The quality of the movement.
9. Any limitation and its nature.