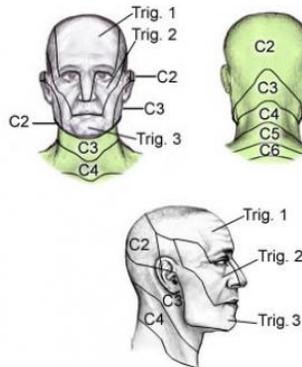


Dermatomes Anatomy

Overview

The surface of the skin is divided into specific areas called dermatomes, which are derived from the cells of a somite. These cells differentiate into the following 3 regions: (1) myotome, which forms some of the skeletal muscle; (2) dermatome, which forms the connective tissues, including the dermis; and (3) sclerotome, which gives rise to the vertebrae. A dermatome is an area of skin in which sensory nerves derive from a single spinal nerve root (see the following image).



Dermatomes of the head, face, and neck.

There are 31 segments of the spinal cord, each with a pair (right and left) of ventral (anterior) and dorsal (posterior) nerve roots that innervate motor and sensory function, respectively. The anterior and posterior nerve roots combine on each side to form the spinal nerves as they exit the vertebral canal through the intervertebral foramina or neuroforamina.

The 31 spine segments on each side give rise to 31 spinal nerves, which are composed of 8 cervical, 12 thoracic, 5 lumbar, 5 sacral, and 1 coccygeal spinal nerve.

Dermatomes exist for each of these spinal nerves, except the first cervical spinal nerve. Sensory information from a specific dermatome is transmitted by the sensory nerve fibers to the spinal nerve of a specific segment of the spinal cord.

The C1-C7 nerve roots emerge above their respective vertebrae; the C8 nerve root emerges between the C7 and T1 vertebrae. The remaining nerve roots emerge below their respective vertebrae.

Along the thorax and abdomen, the dermatomes are evenly spaced segments stacked up on top of each other, and each is supplied by a different spinal nerve. The dermatomes along the arms and legs differ from the pattern of the trunk dermatomes, because they run longitudinally along the limbs. The general pattern is similar in all people, but significant variations exist in dermatome maps from person to person.^[1]

Clinical significance

Dermatomes are useful to help localize neurologic levels, particularly in radiculopathy. Effacement or encroachment of a spinal nerve may or may not exhibit symptoms in the dermatomic area covered by the compressed nerve roots in addition to weakness, or deep tendon reflex loss.

Viruses that infect spinal nerves, such as herpes zoster infections (shingles), can reveal their origin by showing up as a painful dermatomic area. Herpes zoster, a virus that can be dormant in the dorsal root ganglion, migrates along the spinal nerve to affect only the area of skin served by that nerve.

American Spinal Injury Association classification

Dermatomes are clinically important and necessary for assessing and diagnosing the level of spinal cord injury in the American Spinal Injury Association (ASIA) Impairment scale.^[2]

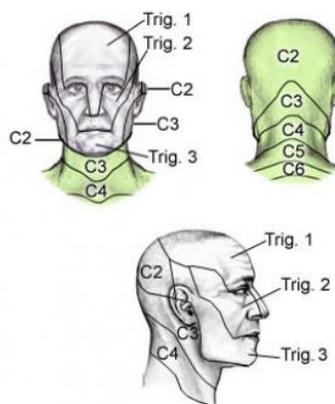
Gross Anatomy

Basic anatomy, dorsal (sensory) roots

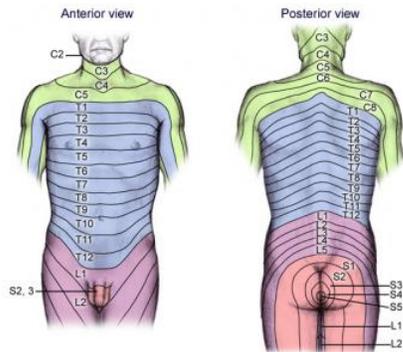
The cell bodies of sensory neurons of spinal nerves are located in the dorsal root ganglia.^[3, 4, 5] Each dorsal root contains the input from all the structures within the distribution of its corresponding body segment (ie, somite). Dermatomal maps portray sensory distributions for each level. These maps differ somewhat according to the methods used in their construction.

Charts based on injection of local anesthetics into single dorsal root ganglia show bands of hypalgesia to be continuous longitudinally from the periphery to the spine. Maps derived from other methods, such as observation of [herpes zoster](#) lesion distributions or surgical root section, show discontinuous patterns. In addition, innervation from one dermatomal segment to another overlaps considerably, more so for touch than for pain. As the dermatomes travel from the back to the chest and abdomen, they tend to dip inferiorly.^[6]

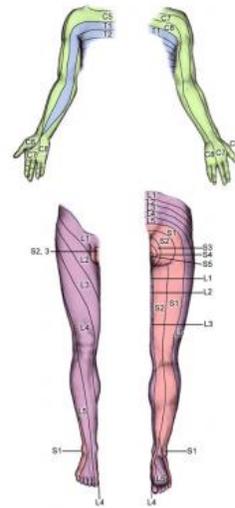
See the following dermatome maps.



Dermatomes of the head, face, and neck.



Dermatomes of the trunk and back.



Dermatomes of the extremities.

Clinically important dermatomes

Upper extremity

- C6 - Thumb
- C7 - Middle finger
- C8 - Little finger
- T1 - Inner forearm
- T2 - Upper inner arm

Lower extremity

- L3 - Knee
- L4 - Medial malleolus
- L5 - Dorsum of foot
- L5 - Toes 1-3
- S1 - Toes 4 and 5; lateral malleolus

Other

- C2 and C3 - Posterior head and neck
- T4 - Nipple
- T10 - Umbilicus

Natural Variants

The dermatome is a basic concept, yet much variability exists between dermatome maps in standard anatomy and medical guideline textbooks. A review of 14 different dermatome maps by Lee et al showed striking variations within each individual map.^[7] Nearly all maps reviewed were based on 2 primary sources, Foerster^[8] and/or Keegan and Garrett.^[9]

Most areas of the skin are innervated by 2 or more spinal nerve roots, which may be the reason for variability between individuals. Other possibilities of such variability could be due to intrathecal intersegmental anastomoses of dorsal spinal rootlets, allowing sensory neurons at one dorsal root ganglion to enter the spinal cord at a different level.^[7]

Other Considerations

Blood supply

The spinal cord and its associated spinal nerves are supplied by a single anterior spinal artery and 2 posterior spinal arteries. The anterior spinal artery supplies the anterior two thirds of the cord. The posterior spinal arteries supply the dorsal columns. All three spinal arteries arise from the vertebral arteries in the skull and descend through the base of the skull. Segmental branches of the thoracic and abdominal aorta have radicular branches that anastomose with the spinal arteries to provide additional blood supply to the spinal arteries. One of the largest radicular branches, the great radicular artery or artery of Adamkiewicz, supplies the anterior spinal artery, which enters the spinal cord between T5 and L1, with the most common entry point between T9 and T12.

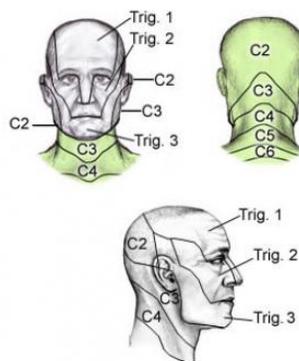
Development

Dermatomes are derived from the outer portion of an embryo from which the skin and subcutaneous tissues are developed and become the areas of skin supplied by the branches of a single dorsal root ganglion. In the developing embryo, dermatomes arise from somitic mesoderm, which develops from the middle layer of embryonic tissue lateral to the developing neural tube. Dermatomes are arranged with basic segmental pattern in the vertebrate trunk, although some overlap exists with similar areas above and below.

Dermatologic mapping

Dermatomes of the head, face, and neck

Below, Image 1 depicts and Table 1 describes the head, face, and neck dermatomes.



Dermatomes of the head, face, and neck.

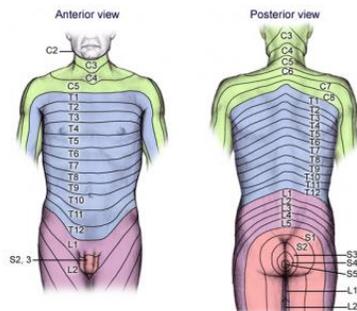
Table 1. Dermatomes of the Head and Neck

| Spinal Component | Skin Distribution |
|--|---|
| Divisions of the trigeminal nerve (cranial nerve [CN] V1, V2, and V3) | Most of the skin of the face, including anterior aspect of lower jaw (CN V3); the area of skin in front of both ears; superior part of the lateral aspect of the auricle (CN V3) |
| Cervical plexus (ventral rami of C2-C4) | Skin over the angle of the mandible, anterior to and behind the ear, the anterior neck and back of the head and neck; inferior part of the lateral aspect of the auricle and skin on medial aspect of the auricle; the lateral and anterior aspects of the neck |
| Greater occipital nerve (dorsal ramus of C2), third occipital nerve (dorsal ramus of C3), and the posterior divisions of C4-C6 | The posterior aspect of the head (C2) and neck (C3) with C4-C6 innervating the back of the neck |

Dermatomes of the trunk

The dermatomes of the trunk are relatively evenly spaced out; however, considerable overlap of innervations between adjacent dermatomes often occurs. Thus, a loss of afferent nerve function by one spinal nerve would not generally cause complete loss of sensation, but a decrease in sensation may be experienced.

Below, Image 2 depicts and Table 2 describes the trunk dermatomes.



Dermatomes of the trunk and back.

Table 2. Dermatomes of the Trunk

| Spinal Component | Skin Distribution |
|--|---|
| T3 dermatome | Runs along the third and fourth interspace |
| T4 dermatome | Nipple line |
| T6 dermatome | At the level of the xiphoid process |
| T10 dermatome | Level of the umbilicus |
| T12 dermatome | Just above the hip girdle |
| Remaining thoracic spinal nerve dermatomes | Relatively evenly distributed between the above-mentioned thoracic dermatomes |
| L1 dermatome | The hip girdle and the groin/inguinal area |

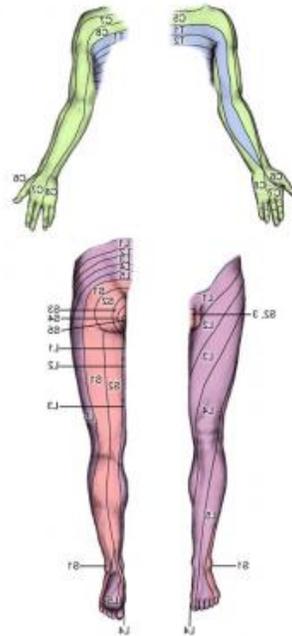
Dermatomes of the extremities

The organization of dermatomes in the limbs is more complex than that of the dermatomal distribution in the trunk as a result of the limb buds and corresponding dermatomes being "pulled out" during early embryologic development.

The medial, intermediate, and lateral supraclavicular nerves from the cervical plexus supply the dermatomal distribution to the root of the neck, upper pectoral, deltoid, and the outer trapezius areas. The posterior divisions of the upper 3 thoracic nerves supply

the region over the trapezius area to the spine of the scapula. The brachial plexus gives rise to most of the rest of the cutaneous innervation of the upper extremity.

Contrary to the considerable overlap of the dermatomes of the trunk, the overlap between the peripheral nerves of the limbs (upper and lower extremities) is far less extensive (see the following image). Thus, in the limbs, complete interruption of a single peripheral nerve typically produces changes in sensation that are, indeed, appreciated by a patient.



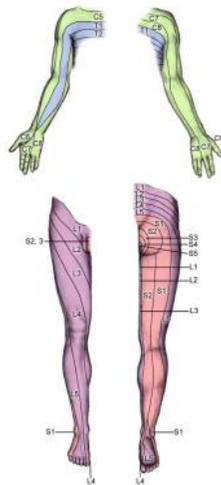
Dermatomes of the extremities.

Table 3 describes the upper extremity dermatomes.

Table 3. Dermatomes of the Upper Extremity

| Spinal Component | Skin Distribution |
|----------------------------------|---|
| Third and fourth cervical nerves | Limited area of skin over the root of the neck, upper aspect of the pectoral region, and shoulder |
| C5 dermatome | Lateral aspect of the upper extremities at and above the elbow |
| C6 dermatome | The forearm and the radial side of the hand |
| C7 dermatome | The middle finger |
| C8 dermatome | The skin over the small finger and the medial aspect of each hand |
| T1 dermatome | The medial side of the forearm |
| T2 dermatome | The medial and upper aspect of the arm and the axillary region |

Dermatomal distribution in the lower extremity has a spiral arrangement stemming from the rotation of the limb as an adaptation to the erect position during development (see the following image).



Dermatomes of the extremities.

NOTE: Pain due to pleurisy, peritonitis, or gallbladder disease can often be referred to the skin over the point of the shoulder, halfway down the lateral side of the deltoid muscle. This is because this area of skin is supplied by the supraclavicular nerves (C3 and C4), and the pain generated from pleurisy, peritonitis, and/or gallbladder disease is carried from the diaphragmatic pleura and peritoneum via afferent fibers of the phrenic nerve (C3-C5).^[10]

Below, Table 4 describes the lower extremity dermatomes.

Table 4. Dermatomes of the Lower Extremity and Genitalia

| Spinal Component | Skin Distribution |
|------------------|--|
| L1 dermatome | The skin over the back lateral to the L1 vertebra; wraps around the lower trunk/upper part of lower extremity to the hip girdle and the groin area |
| L2 dermatome | Anterior aspect of each thigh; the skin over the medial aspect of the mid thigh |
| L3 dermatome | Anterior aspect of each thigh; anterolateral thigh and continues down to the medial aspect of the knee and the medial aspect of the posterior lower leg, proximal to the medial malleolus |
| L4 dermatome | Posterolateral thigh and the anterior tibial area; it crosses the knee joint over the patella and also covers the skin over the medial malleolus and the medial aspect of the foot and the great toe |
| L5 dermatome | Posterolateral thigh (just inferior to L4 dermatome) and wraps around to lateral aspect of the anterior lower leg and dorsum of the foot; it crosses the knee joint on the lateral aspect of the knee; also covers the plantar aspect of the foot and the second through fourth toes |
| S1 dermatome | The heel, the lateral aspect of the foot, the lateral aspect of the posterior thigh, and most of the posterior lower leg |
| S2 dermatome | Most of the back of the thigh and a small area along the medial aspect of the posterior lower leg; the penis and scrotum |
| S3 dermatome | The medial aspect of the buttocks; perianal area; penis and scrotum |
| S4 dermatome | Skin over the perineal region (along with S5); perianal area and genitals |
| S5 dermatome | Skin over the perineal region (along with S4); the skin immediately at and adjacent to the anus |