

# Imaging of the Perivertebral Space



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## KEYWORDS

- Perivertebral space • Prevertebral space • Paraspinal space • Deep cervical fascia
- Suprahyoid neck • Infrahyoid neck

## KEY POINTS

- The perivertebral space is a complex compartment spanning the suprahyoid and infrahyoid neck and enveloped by the deep layer of the deep cervical fascia.
- By accurately localizing a disease process in this space and understanding the various tissue types contained within the prevertebral and paraspinal components, radiologists can provide meaningful differential diagnoses.
- Correct localization guides clinical decision making and treatment.

## INTRODUCTION

The perivertebral space (PVS) lies deep within the neck surrounding the vertebral column, extending from the skull base to the mediastinum. The PVS is enveloped by the deep layer of the deep cervical fascia (DLDCF) and contains different tissue types, including muscles, bones, nerves, and vascular structures. Physical examination is of limited use in evaluating this space deeply located within the cervical soft tissues; therefore, imaging is important when interrogating for abnormalities.

This article defines the PVS anatomy, guides lesion localization, discusses different disease processes arising within this space, and reviews the best imaging approaches.

## NORMAL ANATOMY

The PVS comprises the cervical soft tissues surrounding the vertebral column, traversing the suprahyoid and infrahyoid neck and extending from the skull base to the T4 level. The DLDCF encases the PVS and is interrupted only by traversing brachial plexus (BP) nerve roots.<sup>1</sup> The DLDCF divides the PVS into an anterior

prevertebral space and posterior paraspinal space.<sup>1</sup> The anatomic landscape is formed by multiple other spaces in the suprahyoid and infrahyoid neck: the retropharyngeal space (RPS) anteriorly, carotid space laterally, and the posterior cervical space posterolaterally. Understanding the relationship of the PVS to adjacent spaces is key in disease localization.

## FASCIAL LAYERS

The spaces of the suprahyoid and infrahyoid neck are defined by the layers of the deep cervical fascia (**Fig. 1**). The deep cervical fascia can be split into superficial, middle, and deep segments. Within the suprahyoid neck, the superficial layer of the deep cervical fascia (SLDCF) delineates the masticator space, parotid space, as well as a portion of the carotid sheath. Within the infrahyoid neck, the SLDCF encases the strap muscles, sternocleidomastoid muscles, and trapezius muscles.<sup>2</sup>

In the suprahyoid neck, the middle layer of the deep cervical fascia (MLDCF) defines the deep margin of the pharyngeal mucosa and gives contributions to the carotid sheath. The infrahyoid

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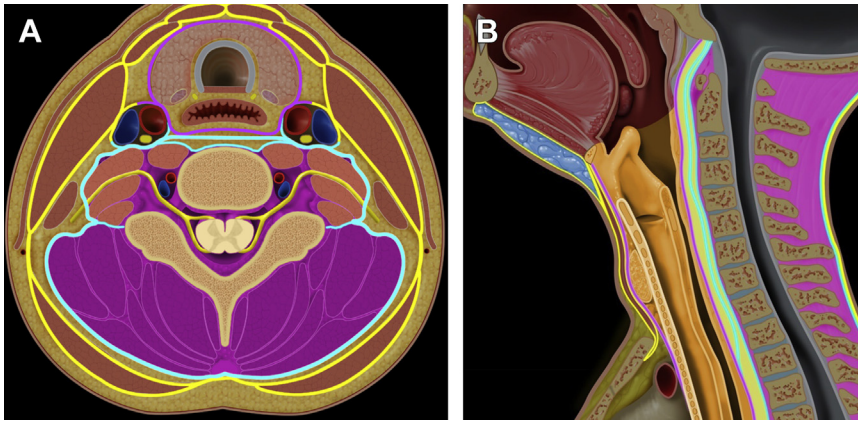
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**Fig. 1.** (A) Axial graphic through the perivertebral space at the level of the infrahyoid neck. The perivertebral space is deep to the turquoise line representing the DLDCF. As the cervical fascia attaches to the transverse processes, it splits the perivertebral space into prevertebral and paraspinous components. The vertebral body, vertebral artery and vein, BP nerve roots, as well as multiple muscle of the neck are contained within this space. The relationship to the carotid space (anterior and lateral), the retropharyngeal space (anterior), as well as the posterior cervical space (superficial and posterior) are also defined. (B) Sagittal graphic through the midline of the cervical soft tissues delineates the craniocaudal extent of the perivertebral space. The attachment from the skull base to the posterior mediastinum is shown. The paraspinous space posteriorly is highlighted in purple and outlined by a turquoise line representing the DLDCF. The prevertebral space extends in a more transverse dimension, immediately abutting the anterior aspect of the cervical vertebral bodies. ([B] Courtesy of Amirsys, Salt Lake City, UT, USA, with permission.)

components of the MLDCF enclose the visceral space.<sup>2</sup>

The DLDCF surrounds the PVS and contributes to the carotid sheath in both the suprahyoid and infrahyoid neck. It has lateral openings for the BP nerve roots. The anterior portion of the DLDCF lies in front of the prevertebral muscles, extending to the transverse processes laterally. This anterior part serves as a barrier to infection, such as discitis-osteomyelitis, extending anteriorly from the spine into the retropharyngeal space. In contrast, it blocks pharyngeal lesions from penetrating posteriorly. The posterior part arches over the paraspinous muscles, attaching to the ligamentum nuchae.<sup>2</sup> In addition, there is inferior extension of the pharyngobasilar fascia from the superior pharyngeal constrictor muscle over the prevertebral space.<sup>3</sup>

A unique portion of the DLDCF is the alar fascia. This slip of fascia separates the danger space from the more anterior RPS, forms their lateral walls, and provides a portion of the carotid sheath. The RPS lies immediately anterior to the prevertebral space, extending variably from the clivus to the T1 to T6 levels. At its inferior extent, it fuses with the visceral space to obliterate the true RPS.<sup>4</sup> The danger space is posteriorly located and extends further inferiorly into the posterior mediastinum to the level of the diaphragm. The alar fascia is imperceptible on imaging; therefore, the danger space and the RPS cannot be distinguished in a healthy patient.<sup>2,5</sup>

## PREVERTEBRAL SPACE

Muscles comprise most of the prevertebral space. Two major muscles of neck flexion are the longus capitis and longus colli (longus capitis/colli complex). The longus capitis defines the anterior prevertebral space, originating from the anterior tubercles of the C3 to C6 transverse processes and inserting on the basilar portion of the occipital bone (Fig. 2). The longer paired longus colli muscles originate on the anterior tubercle of the atlas and insert on the anterior tubercles of the upper cervical vertebral bodies to the T3 level (Fig. 3).<sup>2</sup> In addition, there are anterior and lateral rectus muscles that lie deep to the superior aspect of the longus capitis.

Along with the longus capitis/colli complex, the anterior, middle, and posterior scalene muscles also reside in the prevertebral space. The scalene muscles have an important role in inspiration, neck flexion, and laterally bending. The anterior scalene muscle lies deep to the sternocleidomastoid muscle, originating from the anterior tubercles of the C3 to C6 transverse processes and inserting on the scalene tubercle of the first rib.<sup>6,7</sup> Important anatomic features include its location between the subclavian vein and artery and anterior position relative to the BP nerve roots. The middle scalene muscle originates from the posterior tubercles of the C2 to C7 transverse processes and inserts on the upper surface of the first rib, posterior to the subclavian artery. The posterior

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