Prevertebral Region

10

Core Messages

- The prevertebral plane is the deep limit of our dissection. It is usually exposed in demolitive surgery of the pharynx or in the drainage of retropharyngeal lymph node stations.

10.1 Anatomic Layout

The prevertebral plane is exposed on exeresis of the median-region viscera. Said plane is bounded laterally by the transverse processes of the cervical vertebrae, superiorly by the occipital bone, and inferiorly by the first thoracic vertebra.

The region consists of a slender musculoaponeurotic layer covering the cervical column. The most important structures are the cervical sympathetic chain and the vertebral artery, which cross the region from top to bottom (Fig. 10.1).

Significant Anatomical Structures: deep cervical fascia, cervical sympathetic chain, stellate ganglion, Claude Bernard–Horner's syndrome, vertebral artery, prevertebral plane

Landmarks: stellate ganglion, carotid tubercle, transverse process of the atlas

10.2 Cervical Sympathetic Chain

The dissection exercise begins by considering the prevertebral muscular plane and the deep cervical fascia that covers it. The pharynx, the oesophagus, and the vascular nerve bundle of the neck can be easily separated from this plane. The complex of these structures is lifted with one hand while the other dissects the thin layer of loose cellular tissue that connects it to the deep plane.

The deep muscle plane is invested by the deep cervical fascia that continues laterally over the scalene muscles. This fascia divides into two to hold the cervical sympathetic chain, located just medially to the anterior tubercles of the transverse vertebral processes.

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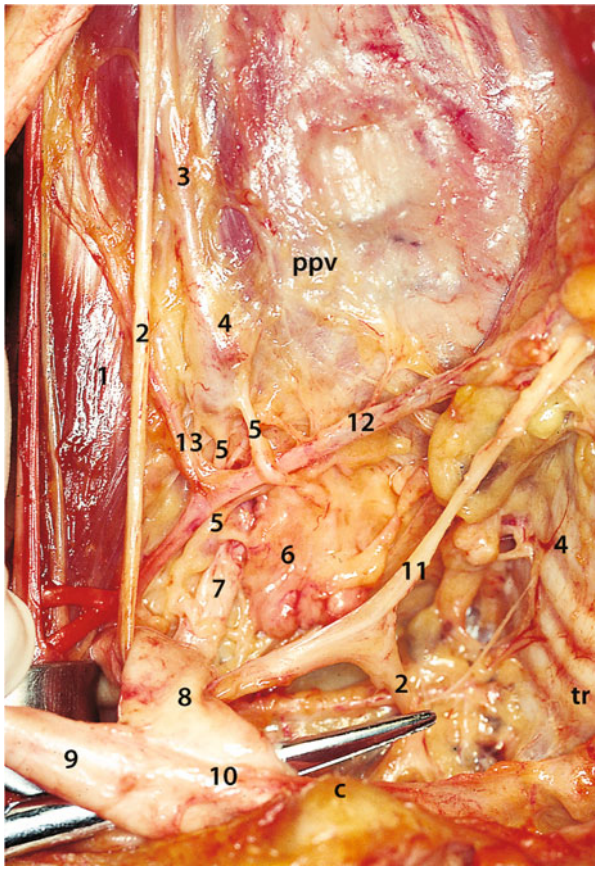

Fig. 10.1 Prevertebral plane. *ppv* Prevertebral plane, *tr* trachea, *1* anterior scalene muscle, *2* vagus nerve, *3* cervical sympathetic chain (superior portion), *4* middle cervical ganglion, *5* cervical sympathetic chain (inferior portion), *6* inferior cervical ganglion and first thoracic ganglion (stellate ganglion), *7* vertebral artery, *8* subclavian artery, *9* common carotid artery, *10* innominate artery, *11* recurrent nerve, *12* inferior thyroid artery, *13* ascending cervical artery

This nerve cord adheres to the deep muscular plane, thereby distinguishing it from the vagus that, albeit adjacent, is an integral part of the cervical vasculonervous bundle, invested by a vascular sheath shared with the carotid artery and internal jugular vein.

Remarks: The cervical sympathetic chain extends from just beneath the external orifice of the carotid canal to the level of the first rib, where it continues with the thoracic tract. It presents three ganglia: the superior ganglion is 3–4 cm long, fusiform, and located just beneath the base of the skull; the middle, inconstant ganglion lies where the inferior thyroid artery crosses the sympathetic trunk; the inferior ganglion is the most voluminous, being fused with the first thoracic ganglion to form the stellate ganglion, and lies just posteriorly to the origin of the vertebral artery. Afferent distribution to the cervical sympathetic ganglia arises from the thoracic sympathetic ganglia, which receive white (myelinated) rami communicantes from the spinal cord through spinal nerves (preganglionic fibres). Efferent impulses, through grey (unmyelinated) rami communicantes, are conveyed by the spinal nerves to the periphery and distributed to the various organs (postganglionic fibres), innervating their involuntary muscles and regulating secretory activity. The cervical sympathetic chain has a powerful vasomotor action, in the sense that its stimulation produces vasoconstriction and its interruption produces vasodilatation [1].

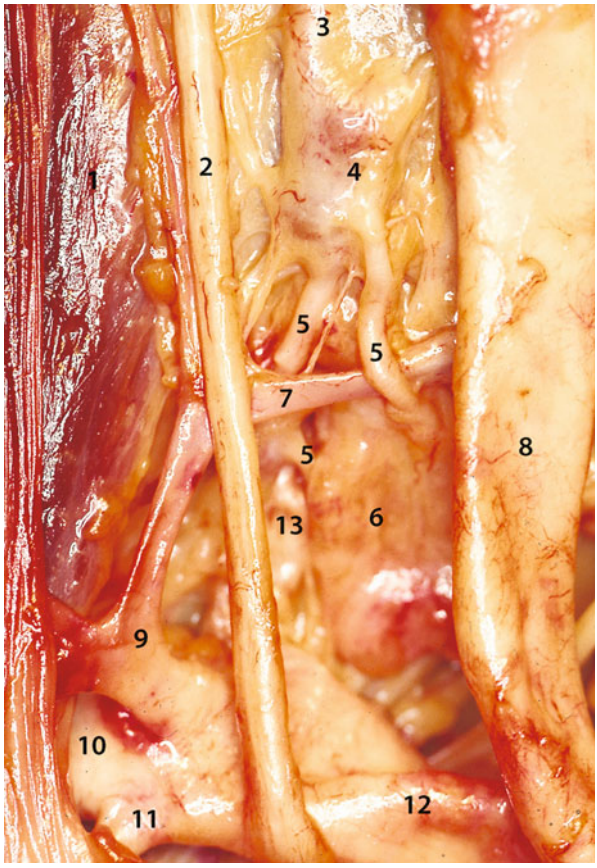

Fig. 10.2 Cervical sympathetic chain. *1* Anterior scalene muscle, *2* vagus nerve, *3* cervical sympathetic chain (superior portion), *4* middle cervical ganglion, *5* cervical sympathetic chain (inferior portion), *6* inferior cervical ganglion and first thoracic ganglion (stellate ganglion), *7* inferior thyroid artery, *8* common carotid artery, *9* thyrocervical trunk, *10* subclavian artery, *11* internal thoracic artery, *12* innominate artery, *13* vertebral artery

Complications: Injury to the iatrogenic cervical sympathetic chain is a very rare occurrence, less than 1 % [2]. Instead, the neoplastic infiltration of the deep plane following metastatic adenopathies or tumours of the apex of the lung is more frequent. We must also consider the section of the cervical sympathetic chain during radical neck dissection when the adenopathy involves the structure. In all these cases, a clinical syndrome is found (Claude Bernard–Horner's syndrome), characterised by ptosis of the eyelid, miosis, and enophthalmos and rarely associated with an increase in saliva viscosity, alterations of the cerebral flow, and pressor instability [3]. The enophthalmos is caused by paralysis of the eye bulb detrusor and ptosis of the eyelid by paralysis of the tarsal muscle. Miosis is caused by paralysis of the dilator pupillae. The innervating fibres run a long course: they exit from the spinal cord with the first thoracic nerve (brachial plexus) and, through a communicating branch, reach the stellate ganglion, from which they ascend to the eye along the cervical sympathetic trunk. This course explains how pupillary alterations can also result from lesions to the brachial plexus, involving the first thoracic nerve at its origin (apex of the lung, upper mediastinum).

In the dissection, the three sympathetic ganglia and some communicating branches are identified and isolated; in particular there is the constant presence of a communicating branch between the middle ganglion and the stellate ganglion, which forms an eyelet around the inferior thyroid artery (Fig. 10.2).

10.3 Vertebral Artery

The vertebral artery has already been identified at its origin, which is immediately proximal to the origin of the thyrocervical trunk. The inferior thyroid artery is immediately above it. The vertebral vein, instead, passes anteriorly to the subclavian artery and empties into the brachiocephalic vein. Our dissection follows the ascent of both vessels, medially to the anterior scalene muscle, to the level of the seventh cervical vertebra, where they bend medially and embed by penetrating the transverse foramina of the overlying cervical vertebrae.

The vertebral artery section, extending from the origin to the entrance to the transverse foramen of the sixth cervical vertebra, is the surgical portion and most easily accessible part of the artery. The carotid tubercle is an excellent landmark (Fig. 10.3).

Exercise 9: vertebral artery (Fig. 10.4)

The vertebral artery re-emerges and lateralises between the transverse process of the epistropheus and the transverse process of the atlas, describing a curve with lateral convexity. We shall try to identify it between these two structures.

Turning the head contralaterally, we shall first identify the transverse process of the atlas and then that of the epistropheus. We look for the artery below, dissecting the interior intertransverse muscles, along a line that joins the apex of the two transverse processes. Farther down than the artery, with an oblique downward path, we

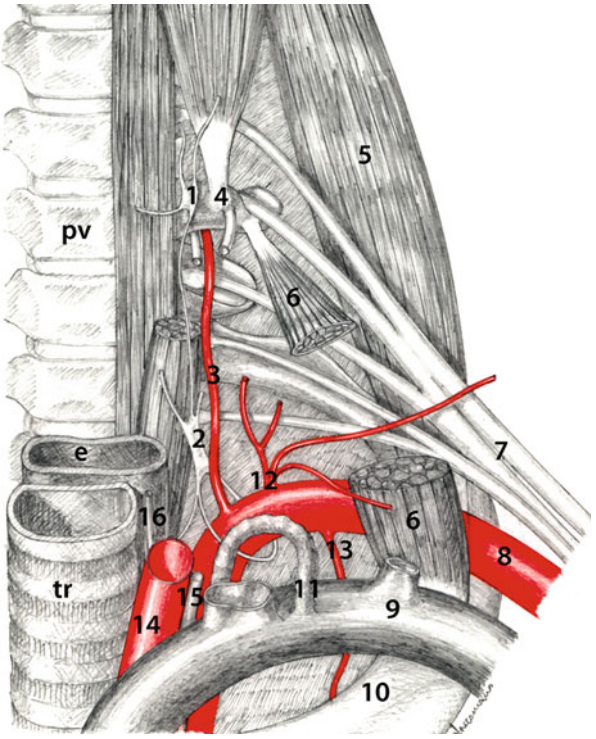

Fig. 10.3 Vertebral artery and carotid tubercle. *pv* Vertebral plane, *e* oesophagus, *tr* trachea, *1* middle cervical ganglion, *2* inferior cervical ganglion and first thoracic ganglion (stellate ganglion), *3* vertebral artery, *4* carotid tubercle, *5* medial scalene muscle, *6* anterior scalene muscle, *7* brachial plexus, *8* subclavian artery, *9* subclavian vein, *10* first rib, *11* thoracic duct, *12* thyrocervical trunk, *13* internal thoracic artery, *14* common carotid artery, *15* vagus nerve, *16* recurrent nerve

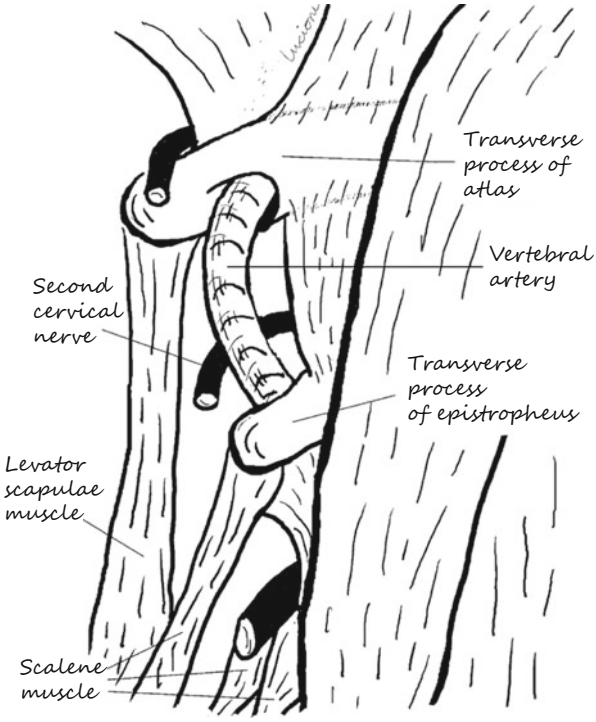

Fig. 10.4 Exercise 9: vertebral artery

can identify the anterior branch of the second cervical nerve, which will form the cervical plexus lower down.

This procedure may also be carried out between the transverse processes of the underlying vertebrae, but it is easier to reach the artery between the atlas and the epistropheus.

10.4 Prevertebral Plane

At the end of dissection, the composition of the prevertebral plane should be examined. Inferiorly to the deep cervical fascia, it comprises four muscle groups:

1. The rectus capitis anterior muscles, extending from the basal surface of the occipital bone to the transverse processes of the atlas
2. The longus capitis muscles, extending from the basal surface of the occipital bone to the anterior tubercles of the third through sixth cervical vertebrae
3. The longus colli muscles, which are composite and extend from the transverse processes of the atlas to those of the fourth through sixth cervical vertebrae and second and third thoracic vertebrae
4. The intertransverse muscles, extending from one transverse vertebral process to the next (Fig. 10.5)

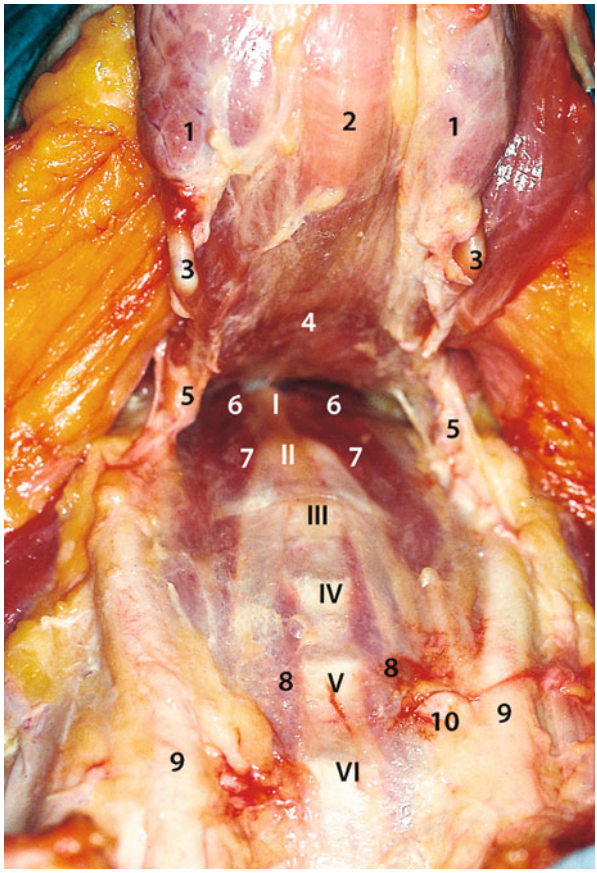

Fig. 10.5 Prevertebral muscles. *1* Posterior margin of thyroid lobes, *2* posterior hypopharynx wall, *3* superior cornu of thyroid cartilage, *4* posterior oropharyngeal wall, *5* greater cornu of hyoid bone, *6* rectus capitis anterior muscles, *7* longus capitis muscles, *8* longus colli muscles, *9* common carotid artery, *10* right carotid tubercle, *I–VI* cervical vertebrae

10.5 Epilogue

On the operating field there remain the prevertebral muscular plane, the internal carotid artery and the internal jugular vein, the cervical oesophagus and the open hypopharynx.

It is time to turn out the lights on our dissection exercise. All that is left for us to do is reconstitute the cadaver and wash the surgical instruments. Then sit down and think things over in front of a steaming hot cup of coffee.

Take-Home Messages

- The cervical sympathetic chain does not come from the skull but originates in the thorax and ends at the top just below the base of the skull.
- The deep cervical fascia that covers the prevertebral muscles may be used in demolitive surgery of the neck as an aid for the reconstruction of the hypopharynx.

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