The root of the neck

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OBJECTIVE:
To obtain a fundamental knowledge of the root of the neck with respect to structure and function

READING ASSIGNMENT:
Moore and Agur’s Essential Clinical Anatomy, 3rd edition; pp. 603-612
Agur and Dalley’s Grant’s Atlas of Anatomy, 12th edition; pp. 770-776
Tank’s Grant’s Dissector, 14th edition; pp. 195-199

OUTLINE:
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II. Muscles
III. Blood supply
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   B. Subclavian vein
   C. Common carotid artery
   D. Internal jugular vein
IV. Nerves
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   C. Vagus nerve
   D. Brachial Plexus
V. Other structures in the root of the neck
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   B. Parathyroid gland
   C. Thoracic duct

I. Introduction: Important landmarks/relationships
The root of the neck is the area deep to the origin of the sternocleidomastoid muscle. The root of the neck interconnects the thorax, the neck and axilla. Laterally, the anterior scalene muscle takes its origin from the cervical vertebra (4-6) and inserts on the first rib. Several key structures run anterior to the anterior scalene muscle including the subclavian vein, suprascapular artery, transverse cervical artery, ascending cervical artery and the phrenic nerve. Posterior to the anterior scalene muscle courses the subclavian artery accompanied by the ventral rami of the brachial plexus.
The boundaries of the root of the neck are:
1. anterior: manubrium of the sternum
2. lateral: the first rib
3. posterior: body of the first thoracic vertebra

II. Muscles
Muscles associated with the root of the neck include the anterior scalene muscle and the longus colli muscle. As mentioned above, the anterior scalene muscle takes its origin from the cervical vertebra (4-6) and inserts on the first rib. The longus colli muscle originates from the anterior tubercle of C1 and inserts on the body of the vertebra T3. With the subclavian artery serving as the base, these 2 muscle masses form a triangle that contains the vertebral artery.

III. Blood supply
   A. Subclavian artery
The main arterial supply of the root of the neck comes from the subclavian arteries. On the right side the subclavian arises from the brachiocephalic trunk; on the left side, the subclavian artery arises directly from the aortic arch. The subclavian artery passes deep to the clavicle, superior to the first rib and between the insertions of the anterior and middle scalene muscles. As the subclavian artery exits the root of the neck (i.e. passes the distal edge of the first rib) it continues as the axillary artery. As mentioned earlier in this course, the subclavian artery is divided into 3 subdivisions with the anterior scalene m. covering the second part (i.e. the subclavian artery passes posterior to the anterior scalene muscle).

1. Branches of first division (medial to anterior scalene muscle):
   a. **vertebral a.** – the largest branch, ascends through the transverse foramen of the upper cervical vertebrae
   b. **internal thoracic a.** (also known as the internal mammary artery.)
   c. **thyrocervical trunk** – transverse cervical, suprascapular, inferior thyroid (the ascending cervical artery is variable but usually branches from the inferior thyroid)

2. Branch of the second division (deep to the anterior scalene muscle.):
   a. **costocervical trunk** – deep cervical artery, superior intercostal artery

3. Branch of the third division (lateral to anterior scalene muscle) Not in root of neck:
   a. **dorsal scapular** (may present as the deep descending branch of the transverse cervical artery)

**B. Subclavian vein**
The subclavian vein has a similar course as the subclavian artery; however, there are 3 important differences:
1. the vein is inferior to the artery
2. the vein passes anterior to the anterior scalene muscle
3. the vein is positioned closer to the clavicle than the artery thus the clavicle
   is used as a landmark for intravenous injections

C. Common carotid artery
Similar to the subclavian artery, on the right side the common carotid artery arises from the
brachiocephalic trunk; on the left side the common carotid artery arises directly from the
aortic arch. The common carotid ascends in the root of the neck to pass anteriorly to the
origin of the anterior scalene muscle. Note that the common carotid artery can be compressed
against the transverse process of the of the C6 vertebra- this process is termed the carotid
tubercle.

D. Internal jugular vein
The internal jugular vein drains into a brachiocephalic vein on both sides and descends with
the common carotid a. and the vagus nerve. The internal jugular v. runs medial to the
anterior scalene muscle.

IV. Nerves
A. Sympathetic trunk
The sympathetic trunk runs along the anterior aspect of the longus colli muscle and receives
no white rami communicantes in the neck. Two ganglia (perhaps 3) are associated with the
trunk in the root of the neck:

   1. middle cervical ganglion: The middle cervical ganglion is usually in the
      proximity of the inferior thyroid a. The middle cervical ganglion is connected to the inferior
cervical ganglion by fibers that loop around, both in front of and behind, the subclavian
artery. Thus this connection is known as the ansa subclavia.

   2. inferior cervical ganglion: The inferior cervical ganglion is associated with the
      posterior aspect of the vertebral a. near its origin from the subclavian artery. Frequently the
      inferior cervical ganglion and the first thoracic ganglion are fused forming the stellate
      ganglion (also known as the cervicothoracic ganglion).
      Note: You may see a third ganglion just anterior to the vertebral artery. This
ganglion is known as the vertebral ganglion.

B. Phrenic nerve
The phrenic nerve is formed by ventral rami of C3-C5. The nerve is formed at the superior
lateral aspect of the anterior scalene muscle. The nerve courses anterior to the anterior
scalene muscle and descends into the thorax by passing between the subclavian artery and
vein. The phrenic nerve provides motor innervation to the diaphragm (C3,4,5 –keep the
diaphragm alive) and sensory to the parietal pleura and peritoneum of the diaphragm.

C. Vagus nerve (CN X)
The left and right recurrent (inferior) laryngeal branches of the vagus nerve (CN X) are
positioned in the root of the neck between the esophagus and the trachea. Remember that the
left recurrent laryngeal n courses around the aorta near the ligamentum arteriosum while
the right recurrent laryngeal nerve courses around the right subclavian artery. Cardiac
branches originate in the neck providing presynaptic parasympathetic and visceral afferent innervation to the cardiac plexus.

D. Brachial plexus
We have previously studied the brachial plexus in detail. In this section appreciate that the brachial plexus is formed by the ventral rami of C5-T1. The roots of these spinal nerves extend laterally between the anterior and middle scalene mm. As these roots pass the scalene mm, small branches provide motor innervation to these muscles. Note that the roots, trunks, and divisions of the brachial plexus are located in the neck. The cords and terminal branches are positioned in the axilla and more distally. Note: You should be able to recognize the roots, trunks, divisions and cords on the practical.

V. Other structures in the root of the neck
A. Thyroid gland
The thyroid gland extends around the trachea and esophagus. Superiorly, it is limited by the insertion of the sternothyroid muscle. Inferiorly, it extends to the fifth tracheal ring. The right and left lobes are connected by an isthmus. The thyroid gland functions to regulate metabolism. The thyroid gland receives vascular supply from superior and inferior thyroid arteries. The right and left superior and inferior thyroid arteries form extensive anastomoses within the gland. In about 10% of the population, an unpaired artery can be found. This artery, which courses along the midline of the neck, is named the thyroid ima artery and it may arise form the aorta, right common carotid or the subclavian artery.

B. Parathyroid glands
Four parathyroid glands are associated with the posterior surface of the thyroid gland. The parathyroid glands are small and can be difficult to find. The parathyroid glands secrete parathyroid hormone which regulates calcium metabolism. The superior parathyroid glands are usually located at the level of the inferior border of the cricoid cartilage. The position of the inferior parathyroid glands is highly variable. The inferior thyroid arteries are the primary vascular supply.

C. Thoracic duct
The thoracic duct originates from the cisterna chyli and provides lymphatic drainage for the legs, the pelvis, the abdomen and the left side of the thorax. The thoracic duct enters the neck to the left of the midline. It passes posterior to the carotid sheath but anterior to the branches of the subclavian artery, the anterior scalene m. and the phrenic nerve. The thoracic duct empties its contents into the venous drainage at the junction of the left subclavian vein and the left internal jugular vein.

D. Lymphatic drainage
The thyroid gland drains into the prelaryngeal, pretracheal and paratracheal lymph nodes. Ultimately, the lymphatic drainage of the thyroid gland reaches the deep cervical nodes that lie within the carotid sheath and are closely related to internal jugular vein. The deep cervical nodes may be divided into a superior and an inferior group. The lymphatic drainage of the parathyroid gland is similar to the thyroid gland.
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