MEDICAL EDUCATION RESOURCE

Back of the Neck

Back of the Neck

Introduction

The back of the neck forms the **posterior part of the cervical region**, extending from the **external occipital protuberance and superior nuchal line** above to the **spine of the seventh cervical vertebra** below. It includes a complex of **muscles, fasciae, and neurovascular structures** that stabilize and move the head and neck.

Dissection

During dissection:

- Make a **midline incision** from the external occipital protuberance to the spine of C7.
- Reflect the skin laterally to expose **superficial fascia** containing **cutaneous nerves** and **small veins**.
- The deeper layer reveals **trapezius**, **splenius**, **semispinalis**, and **suboccipital muscles** .
  The **greater occipital nerve** and **occipital artery** are key landmarks during dissection.

Nerve Supply of Skin

- **Posterior primary rami** of cervical spinal nerves supply the skin of the back of the neck.
  - **C2 (Greater occipital nerve):** supplies skin over occiput up to vertex.

- **C3 (Third occipital nerve):** supplies skin of upper posterior neck.
- **C4 and below:** supply lower cervical and upper thoracic regions.

- These nerves pierce **trapezius** near the midline and travel upwards.

Muscles of the Back

The muscles are arranged in **three layers**:

1. **Superficial Layer**
   - **Trapezius:** Elevates, retracts, and rotates scapula.
   - **Latissimus dorsi:** Extends, adducts, and medially rotates the humerus.
2. **Intermediate Layer**
   - **Levator scapulae:** Elevates scapula.
   - **Rhomboideus major and minor:** Retract scapula.
3. **Deep (Intrinsic) Layer**
   - **Splenius capitis and cervicis:** Extend and rotate head and neck.
   - **Semispinalis capitis, multifidus, rotatores:** Extend and stabilize vertebral column.
   - **Erector spinae group (spinalis, longissimus, iliocostalis):** Maintain posture and extend the spine.

Suboccipital Region

A small, deep compartment below the occipital bone and posterior to atlas and axis.

Boundaries of Suboccipital Triangle:

- **Medial:** Rectus capitis posterior major
- **Lateral:** Obliquus capitis superior
- **Inferior:** Obliquus capitis inferior
- **Roof:** Semispinalis capitis
- **Floor:** Posterior atlanto-occipital membrane and posterior arch of atlas

Contents:

- **Third part of vertebral artery**
- **Suboccipital nerve (dorsal ramus of C1)**
- **Suboccipital venous plexus**

Dissection of Suboccipital Region

- Reflect semispinalis capitis to expose the **suboccipital muscles**.
- Identify the **vertebral artery** as it curves medially above the posterior arch of atlas.
- Locate the **suboccipital nerve** entering the triangle and the **greater occipital nerve** emerging below the obliquus capitis inferior.

Suboccipital Muscles

Muscles

The suboccipital muscles form a small muscular group deep to semispinalis capitis, situated around the **atlas and axis**.

1. **Rectus capitis posterior major**
    - **Origin:** Spinous process of the axis (C2)
    - **Insertion:** Lateral part of inferior nuchal line of occipital bone
    - **Nerve supply:** Suboccipital nerve (dorsal ramus of C1)
    - **Action:** Extension and rotation of head to the same side
2. **Rectus capitis posterior minor**
    - **Origin:** Posterior tubercle of atlas (C1)
    - **Insertion:** Medial part of inferior nuchal line
    - **Nerve supply:** Suboccipital nerve
    - **Action:** Extension of head
3. **Obliquus capitis superior**
    - **Origin:** Transverse process of atlas (C1)
    - **Insertion:** Between superior and inferior nuchal lines on occipital bone
    - **Nerve supply:** Suboccipital nerve

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- **Action:** Extension and lateral bending of head

4. **Obliquus capitis inferior**
    - **Origin:** Spinous process of axis (C2)
    - **Insertion:** Transverse process of atlas (C1)
    - **Nerve supply:** Suboccipital nerve
    - **Action:** Rotation of atlas and head to same side

Exposure of Suboccipital Triangle

Boundaries

- **Medial:** Rectus capitis posterior major
- **Lateral:** Obliquus capitis superior
- **Inferior:** Obliquus capitis inferior
- **Roof:** Semispinalis capitis
- **Floor:** Posterior arch of atlas and posterior atlanto-occipital membrane

Contents

- **Third part of vertebral artery**
- **Suboccipital nerve (dorsal ramus of C1)**

- **Suboccipital venous plexus**

Dissection Steps

1. Reflect semispinalis capitis to reveal **suboccipital muscles**.
2. Identify the **vertebral artery** curving medially above the posterior arch of atlas.
3. Trace the **suboccipital nerve** entering the triangle.
4. Observe the **greater occipital nerve** emerging below obliquus capitis inferior.

Clinical Anatomy

- **Vertebral artery entrapment:**
  - Excessive rotation or hyperextension of the head may **compress the vertebral artery** within the suboccipital triangle ? dizziness, syncope, or visual disturbances.
- **Whiplash injury:**
  - Sudden hyperextension of the neck (as in rear-end collisions) can **tear suboccipital and deep cervical muscles** or strain ligaments of the atlanto-occipital and atlantoaxial joints.
- **Torticollis (Wry neck):**
  - Due to **spasm or shortening of sternocleidomastoid** or deep neck muscles including suboccipital group.
  - Produces characteristic **tilt and rotation of head**.

- **Occipital neuralgia:**
    - Irritation of **greater occipital nerve (C2)** causes pain radiating over the occipital scalp; may result from entrapment as it pierces the **semispinalis capitis**.
- **Suboccipital nerve block:**
    - Used for **pain relief** in occipital neuralgia; anesthetic injected near **greater occipital nerve** at the superior nuchal line.

Mnemonics

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1. Boundaries of Suboccipital Triangle

Mnemonic:
? **“ROS Loves India”**

- **R** – Rectus capitis posterior major (medial boundary)
- **O** – Obliquus capitis superior (lateral boundary)
- **S** – Obliquus capitis inferior (inferior boundary)

Roof: Semispinalis capitis
Floor: Posterior arch of atlas and posterior atlanto-occipital membrane

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2. Contents of Suboccipital Triangle

Mnemonic:
? **“Very Strong Vein”**

- **V** – Vertebral artery (third part)
- **S** – Suboccipital nerve (dorsal ramus of C1)
- **V** – Suboccipital venous plexus

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3. Muscles forming floor of posterior triangle vs. suboccipital triangle

Mnemonic for Suboccipital Floor:
? **“MAP”**

- **M** – Membrane (posterior atlanto-occipital)
- **A** – Arch (posterior arch of atlas)
- **P** – Parts related (vertebral artery groove)

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4. Muscles supplied by Suboccipital Nerve

Mnemonic:
? **“ROOO”** (four O’s)

- **R** – Rectus capitis posterior major
- **O** – Rectus capitis posterior minor
- **O** – Obliquus capitis superior
- **O** – Obliquus capitis inferior

> **Facts to Remember**

- The **back of the neck** contains deep muscles responsible for **extension, rotation, and stabilization** of the head and cervical vertebrae.
- The **suboccipital region** is located **below the occipital bone** and **between the atlas and axis** vertebrae.
- The **suboccipital triangle** is an **important landmark** in neurosurgery for exposure of the **vertebral artery** and **posterior arch of atlas**.
- **All suboccipital muscles** are supplied by the **dorsal ramus of C1 (suboccipital nerve)** — unique because it is **purely motor**.
- The **greater occipital nerve (C2 dorsal ramus)** is **sensory** to the posterior scalp and does **not** pass through the triangle.
- The **vertebral artery** forms a **loop** within the triangle before entering the **foramen magnum**. This loop allows free head movement but can be **compressed in extreme rotation**.
- The **posterior atlanto-occipital membrane** forms the **floor** of the triangle and has a **defect** where the vertebral artery passes.
- **Occipital neuralgia** can result from irritation of the **greater occipital nerve** after it pierces **semispinalis capitis**.
- **Whiplash injury** commonly involves strain or tear of suboccipital muscles and posterior neck ligaments due to **sudden hyperextension**.
- **Suboccipital nerve block** is used clinically for pain relief in occipital headache or neuralgia.

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Clinicoanatomical Problems — Back of the Neck and Suboccipital Region

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1. Whiplash Injury

- Occurs due to **sudden hyperextension of the neck**, often in rear-end automobile collisions.
- Causes **tearing of suboccipital muscles**, **ligaments**, or **joint capsules** at the craniovertebral junction.
- May result in **neck stiffness, pain, and reduced range of motion**.
- Severe cases can affect **spinal cord or brainstem** due to instability between **atlas and axis**.

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2. Vertebral Artery Compression

- The **third part of the vertebral artery** winds around the posterior arch of the atlas.
- Excessive **rotation or extension of the head** can compress this artery.
- Results in **dizziness, vertigo, blurred vision**, or **fainting** (vertebrobasilar insufficiency).
- Clinically important during manipulative therapy or cervical spondylosis.

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3. Torticollis (Wry Neck)

- Characterized by **tilting of the head to one side and rotation to the opposite side**.
- May be due to **spasm or fibrosis** of **sternocleidomastoid** or **suboccipital muscles**.

- Can be **congenital** (due to birth trauma) or **acquired** (infections, inflammation, trauma).

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4. Occipital Neuralgia

- Caused by irritation of the **greater occipital nerve (C2 dorsal ramus)**.
- Pain radiates from **upper neck to the posterior scalp**.
- Often results from **entrapment of the nerve** as it pierces the **semispinalis capitis**.
- May be relieved by **local anesthetic block** or **physiotherapy**.

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5. Atlanto-axial Instability

- Seen in **trauma, rheumatoid arthritis, Down's syndrome**, or **tuberculosis**.
- Laxity of **transverse ligament of the atlas** causes **anterior displacement of the atlas** over the axis.
- May compress the **spinal cord** leading to **quadriparesis** or even **death**.

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6. Surgical Access to the Vertebral Artery

- The **suboccipital triangle** provides a safe surgical approach to the **third part of the vertebral artery**.
- Knowledge of its **boundaries and contents** is vital during vascular or neurosurgical procedures in this region.

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7. Suboccipital Nerve Block

- Given for **relief of occipital headaches**.
- Injection is made near the **greater occipital nerve** at the **superior nuchal line**, lateral to the external occipital protuberance.

Frequently Asked Questions — Back of the Neck and Suboccipital Region

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1. Name the muscles forming the boundaries of the suboccipital triangle.

- **Medial boundary:** Rectus capitis posterior major
- **Lateral boundary:** Obliquus capitis superior
- **Inferior boundary:** Obliquus capitis inferior

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2. What forms the floor and roof of the suboccipital triangle?

- **Floor:** Posterior atlanto-occipital membrane and posterior arch of atlas.
- **Roof:** Semispinalis capitis muscle and deep fascia.

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3. Name the contents of the suboccipital triangle.

- Third part of **vertebral artery**
- **Suboccipital nerve (dorsal ramus of C1)**
- **Suboccipital venous plexus**

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4. What is the nerve supply of suboccipital muscles?

- **Suboccipital nerve (dorsal ramus of C1)** supplies all the four suboccipital muscles:
    - Rectus capitis posterior major
    - Rectus capitis posterior minor
    - Obliquus capitis superior
    - Obliquus capitis inferior

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5. What is the clinical significance of the suboccipital triangle?

- It provides **surgical access** to the **third part of the vertebral artery**.
- Important in **angiography** and **vascular surgeries** near the craniovertebral junction.

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6. What is occipital neuralgia and how does it occur?

- **Pain in the posterior scalp** due to irritation of the **greater occipital nerve (C2 dorsal ramus)**.
- The nerve gets **compressed while piercing the semispinalis capitis**, causing sharp or throbbing pain.

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7. What are the effects of vertebral artery compression?

- Excessive **rotation or extension** of the neck can compress the artery, leading to:
    - **Vertigo**

- **Visual disturbances**
- **Loss of balance** or **syncope**

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8. What is the difference between the suboccipital and greater occipital nerves?

- **Suboccipital nerve (C1):** Purely motor; supplies suboccipital muscles; lies inside the triangle.
- **Greater occipital nerve (C2):** Purely sensory; supplies posterior scalp; lies outside the triangle.

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9. What is torticollis?

- Abnormal **tilt and rotation of the head** caused by spasm or fibrosis of **sternocleidomastoid or suboccipital muscles**.
- May be **congenital** (birth injury) or **acquired** (infections or trauma).

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10. Why is the vertebral artery loop important?

- The **loop in the third part** of vertebral artery allows **head movement without stretching the vessel**.
- Prevents ischemia during normal motion but may compress in extreme rotation.

These questions are frequently asked in both **theory viva** and **practical examinations** to assess understanding of the **suboccipital region anatomy and its clinical relevance**

Multiple Choice Questions — Back of the Neck and Suboccipital Region

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1. The suboccipital triangle is located between which two vertebrae?

A. C1 and C2

B. C2 and C3

C. C3 and C4

D. C4 and C5

? **Answer:** A. C1 and C2

Explanation: The triangle lies between the **atlas (C1)** and **axis (C2)**, deep to semispinalis capitis.

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2. The nerve supply of suboccipital muscles is derived from —

A. Dorsal ramus of C1

B. Dorsal ramus of C2

C. Ventral ramus of C1

D. Ventral ramus of C2

? **Answer:** A. Dorsal ramus of C1

Explanation: The **suboccipital nerve (C1)** is purely motor and supplies all four suboccipital muscles.

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3. The greater occipital nerve is —

A. Dorsal ramus of C1

B. Ventral ramus of C1

C. Dorsal ramus of C2

D. Ventral ramus of C2

? **Answer:** C. Dorsal ramus of C2

Explanation: It is the **dorsal ramus of the second cervical nerve** and supplies the posterior scalp.

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4. The floor of the suboccipital triangle is formed by —

A. Semispinalis capitis

B. Posterior arch of atlas and posterior atlanto-occipital membrane

C. Rectus capitis posterior major

D. Obliquus capitis inferior

? **Answer:** B. Posterior arch of atlas and posterior atlanto-occipital membrane

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5. The roof of the suboccipital triangle is formed by —

A. Semispinalis capitis

B. Trapezius

C. Splenius capitis

D. Sternocleidomastoid

? **Answer:** A. Semispinalis capitis

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6. The contents of the suboccipital triangle include all except —

A. Third part of vertebral artery

B. Suboccipital nerve

C. Suboccipital venous plexus

D. Greater occipital nerve

? **Answer:** D. Greater occipital nerve

Explanation: Greater occipital nerve lies **below** the triangle, not within it.

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7. The vertebral artery enters the cranial cavity through —

A. Foramen lacerum

B. Foramen magnum

C. Jugular foramen

D. Foramen ovale

? **Answer:** B. Foramen magnum

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8. The vertebral artery is a branch of —

A. Common carotid artery

B. Internal carotid artery

C. Subclavian artery

D. External carotid artery

? **Answer:** C. Subclavian artery

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9. Which muscle rotates the atlas and head to the same side?

A. Rectus capitis posterior minor

B. Obliquus capitis superior

C. Obliquus capitis inferior

D. Splenius capitis

? **Answer:** C. Obliquus capitis inferior

Explanation: It acts on the **atlantoaxial joint** to rotate the head to the **same side**.

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10. Which of the following is purely motor?

A. Greater occipital nerve

B. Lesser occipital nerve

C. Suboccipital nerve

D. Transverse cervical nerve

? **Answer:** C. Suboccipital nerve

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11. Pain radiating from the neck to the back of the scalp is due to involvement of —

A. Suboccipital nerve

B. Greater occipital nerve

C. Lesser occipital nerve

D. Accessory nerve

? **Answer:** B. Greater occipital nerve

Explanation: It supplies sensory fibers to the **posterior scalp** and is responsible for **occipital neuralgia**.

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12. The vertebral artery is liable to compression during —

A. Flexion of the neck

B. Rotation or extension of the neck

C. Inspiration

D. Swallowing

? **Answer:** B. Rotation or extension of the neck

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13. The muscle forming the medial boundary of suboccipital triangle is —

A. Obliquus capitis inferior

B. Rectus capitis posterior major

C. Rectus capitis posterior minor

D. Obliquus capitis superior

? **Answer:** B. Rectus capitis

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14. The nerve emerging below obliquus capitis inferior is —

A. Suboccipital nerve

B. Accessory nerve

C. Greater occipital nerve

D. Lesser occipital nerve

? **Answer:** C. Greater occipital nerve

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15. The suboccipital triangle is an important landmark because —

A. It contains the accessory nerve

B. It contains the third part of the vertebral artery

C. It contains the brachial plexus

D. It contains the hypoglossal nerve

? **Answer:** B. It contains the third part of the vertebral artery

Viva Voce — Back of the Neck and Suboccipital Region

Q1. What forms the posterior boundary of the neck?

The **external occipital protuberance** and **superior nuchal line** above, and the **spine of C7 vertebra** below, form the posterior boundary.

Q2. What are the main layers of muscles in the back of the neck?

- **Superficial layer:** Trapezius
- **Intermediate layer:** Splenius capitis and splenius cervicis
- **Deep layer:** Semispinalis capitis and suboccipital muscles

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Q3. Name the suboccipital muscles.

Rectus capitis posterior major, rectus capitis posterior minor, obliquus capitis superior, and obliquus capitis inferior.

Q4. Which nerve supplies all suboccipital muscles?

The **suboccipital nerve** (dorsal ramus of C1).

Q5. What are the boundaries of the suboccipital triangle?

- **Medial:** Rectus capitis posterior major
- **Lateral:** Obliquus capitis superior
- **Inferior:** Obliquus capitis inferior

Q6. What forms the floor and roof of the suboccipital triangle?

- **Floor:** Posterior arch of atlas and posterior atlanto-occipital membrane
- **Roof:** Semispinalis capitis muscle

Q7. What are the contents of the suboccipital triangle?

- Third part of the **vertebral artery**
- **Suboccipital nerve (C1 dorsal ramus)**
- **Suboccipital venous plexus**

Q8. Which nerve is purely motor in this region?

The **suboccipital nerve** (C1 dorsal ramus).

Q9. Which nerve is purely sensory in the same region?
The **greater occipital nerve** (C2 dorsal ramus).

Q10. What is the difference between the suboccipital and greater occipital nerves?

- **Suboccipital nerve:** Motor; lies **within** the triangle; supplies **muscles**.
- **Greater occipital nerve:** Sensory; lies **below** the triangle; supplies **posterior scalp**.

Q11. Which muscle rotates the head to the same side?
Obliquus capitis inferior.

Q12. What is the action of rectus capitis posterior major?
Extension and **rotation** of the head to the same side.

Q13. What is the action of obliquus capitis superior?
Extension and **lateral flexion** of the head.

Q14. What artery passes through the suboccipital triangle?
The **third part of the vertebral artery**.

Q15. The vertebral artery is a branch of which vessel?
The **subclavian artery**.

Q16. Through which foramen does the vertebral artery enter the cranial cavity?
Through the **foramen magnum**.

Q17. Why does the vertebral artery form a loop before entering the skull?
To allow **free rotation of the head** without stretching or compressing the artery.

Q18. What is the clinical importance of the suboccipital triangle?

- It is the **surgical landmark** for exposing the **third part of vertebral artery**.

- Site for **vertebral angiography** and **nerve blocks**.

Q19. What is occipital neuralgia?
Pain over the **posterior scalp** due to irritation of the **greater occipital nerve** (C2 dorsal ramus), often from entrapment in **semispinalis capitis**.

Q20. What is the cause of dizziness during neck rotation?
Compression of the **vertebral artery** within the **suboccipital triangle**.

Q21. What is whiplash injury?
A **hyperextension injury of the neck**, commonly from rear-end car collisions, leading to **strain or tear of suboccipital muscles and ligaments**.

Q22. Which muscle overlies the suboccipital triangle?
Semispinalis capitis forms its **roof**.

Q23. What structure lies deep to the posterior atlanto-occipital membrane?
The **dura mater** and **spinal cord**.

Q24. Which nerve emerges below the obliquus capitis inferior muscle?
The **greater occipital nerve**.

Q25. What movements occur at the atlanto-occipital and atlantoaxial joints?

- **Atlanto-occipital joint:** Flexion and extension (“yes” movement).
- **Atlantoaxial joint:** Rotation (“no” movement).