MEDICAL EDUCATION RESOURCE

# Surface Marking and Radiological Anatomy

### Introduction

Surface marking helps identify underlying anatomical structures through external landmarks, assisting in examination, clinical diagnosis and surgical procedures. Radiological anatomy correlates these landmarks with imaging, improving interpretation of X-rays, CT, and MRI.

### Surface Landmarks

These are palpable or easily visible points on the face, head, and neck, used to project deeper structures.

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## Landmarks on the Face

(Information taken from the section beginning at L38–L41 of the retrieved document)

• **Frontozygomatic suture** – felt as a depression at the upper lateral orbital margin.
• **Infraorbital margin** – sharp border below the orbit, useful for nerve block positioning.
• **Zygomatic arch** – easily felt; marks the position of the temporalis muscle and its fascia.
• **Mandibular notch** – felt as a curved depression between the condylar and coronoid processes; used to locate masseteric nerve entry.
• **Jugal point** – anterior end of the upper border of zygomatic arch; an orientation point for fractures.

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## Landmarks of the Lateral Side of the Head

(Information supported by L41–L42 and additional parts of file result 1)

• **Marginal tubercle of the zygoma** – projects along the frontal process of the zygomatic bone, used in surgical approaches.

• **Pterion** – junction of frontal, parietal, temporal and sphenoid bones; thinnest part of skull, overlies middle meningeal artery.
• **Frankfurt plane** – line from infraorbital margin to external acoustic meatus; standard anthropometric reference.
• **Mandibular notch and neck of mandible** – visible and palpable during intraoral nerve blocks and maxillofacial examination.

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### Landmarks on the Side of the Neck

(Supported by L43–L44 and elaborated using the content in file result 1 under “Landmarks on Anterior Aspect of Neck”)

• **Mandible** – lower border forms base of the face; angle of mandible helps assess facial nerve injury or swelling.
• **Hyoid bone** – felt just above the thyroid cartilage; used to assess swallowing and floor of mouth pathology.
• **Thyroid cartilage** – prominent "Adam’s apple”; key guide to laryngeal structures.
• **Cricoid cartilage** – felt as a complete ring below thyroid cartilage; landmark for emergency airway access (cricothyrotomy).
• **Tracheal rings** – palpable in the midline; deviation suggests mediastinal shift.
• **Sternocleidomastoid muscle** – defines anterior and posterior triangles of the neck; guides identification of major vessels and nerves.

## LANDMARKS ON THE ANTERIOR ASPECT OF THE NECK

• **Mandible**
The lower border of the mandible forms the base of the face. The angle of the mandible lies opposite the second cervical vertebra. The mental protuberance forms the chin.

• **Hyoid Bone**
Located in the midline just above the thyroid cartilage. It moves upwards during swallowing.

• **Thyroid Cartilage**

Forms the prominent *laryngeal prominence (Adam's apple)*. More prominent in males.

• **Cricothyroid Membrane**

A soft interval between the thyroid and cricoid cartilages. Important for emergency cricothyrotomy.

• **Cricoid Cartilage**

A complete ring of cartilage located below the thyroid cartilage. Serves as a key landmark for subglottic space and upper trachea.

• **Trachea**

Tracheal rings can be palpated in the midline. Deviation to either side indicates mediastinal shift.

• **Suprasternal Notch**

A depression between the medial ends of the clavicles. Used to identify tracheal deviation and measure jugular venous pressure.

## OTHER IMPORTANT LANDMARKS

• **Frontozygomatic Suture**

Felt as a slight depression at the upper part of the lateral orbital margin.

• **Marginal Tubercle of Zygoma**

A small projection on the posterior border of the frontal process of the zygomatic bone.

• **Frankfurt Plane**

A reference plane used in skull orientation—extends from the infraorbital margin to the upper margin of the external acoustic meatus.

• **Jugal Point**

Represents the anterior end of the upper border of the zygomatic arch.

• **Mandibular Notch**

A curved depression between the condylar and coronoid processes of the mandible.

## SURFACE MARKING OF VARIOUS STRUCTURES

The following structures are projected onto the skin surface using reliable anatomical planes and palpable points.

## ARTERIES

### Common Carotid Artery

• Draw a vertical line from the **sternoclavicular joint** to the **upper border of the thyroid cartilage**.
• The artery lies deep to the sternocleidomastoid along this line.

### External Carotid Artery

• Begins at the upper border of the thyroid cartilage.
• Passes upward anterior to the ear.
• Ends behind the neck of the mandible by dividing into maxillary and superficial temporal arteries.

### Facial Artery

• Starts at the **angle of the mandible**, just anterior to the masseter.
• Winds upward and medially across the face to the **corner of the mouth**, then to the **side of the nose**, and finally to the **medial canthus**.

### Superficial Temporal Artery

• Mark a point just above the **tragus of the ear**.
• The artery then ascends vertically in front of the ear within the temporal region.

### Occipital Artery

• Begins opposite the facial artery origin.
• Runs posteriorly toward the **mastoid region**, then ascends to the **occiput**.

### Vertebral Artery (Cervical Part)

• Lies deep in the neck and not directly palpable.
• Projected from the **transverse process of C6** upward through the cervical transverse foramina to the foramen magnum.

## VEINS / SINUSES (Surface Marking)

### Internal Jugular Vein

• Begin at the **mastoid process**.
• Draw a straight line to the **sternoclavicular joint**.
• The vein lies deep to the sternocleidomastoid along this entire course.

### External Jugular Vein

• Starts just **behind the angle of the mandible**.
• Runs obliquely across the sternocleidomastoid.
• Ends above the **middle of the clavicle**.

### Anterior Jugular Vein

• Begins near the **midline below the chin**.
• Runs downward close to the midline and dips deep above the sternum.

### Superior Sagittal Sinus (Surface Projection on Scalp)

• Mark a midline curve from the **glabella** to the **external occipital protuberance**.
• Lies deep to the sagittal suture.

### Transverse Sinus

• Draw a horizontal line from the **inion** toward the **mastoid process** on each side.

### Sigmoid Sinus

• Curves downward from the end of the transverse sinus to the **jugular foramen** behind the mastoid.

## NERVES (Surface Marking)

### Facial Nerve (Extracranial Course)

• Emerges at the **stylomastoid foramen** (just below and medial to the mastoid tip).
• Runs forward into the parotid gland, dividing into temporofacial and cervicofacial branches.

**Accessory Nerve (Spinal Part)**

• Appears at the **middle of the posterior border of sternocleidomastoid**.
• Crosses the posterior triangle obliquely to the **trapezius**.

**Hypoglossal Nerve**

• Mark a point midway between the **mastoid process** and **angle of mandible**.
• It curves forward across the carotid arteries and goes deep to the mylohyoid toward the tongue.

**Lingual Nerve**

• Courses below the **submandibular duct**, approaching the lateral tongue.
• Marked indirectly: below the mandible, near molar region inside oral cavity.

**Infraorbital Nerve**

• Emerges at the **infraorbital foramen**, one fingerbreadth below the infraorbital margin.

## GLANDS (Surface Marking)

**Parotid Gland**

• Occupies the area:
– Between **zygomatic arch** and **angle of mandible**
– Anterior to the **mastoid process**
• Draw an inverted triangle covering this region.

**Submandibular Gland**

• Lies beneath the **mandibular body**.
• Mark the area in the submandibular fossa between the angle and chin.

**Thyroid Gland**

• Two lobes lie beside the trachea from the **5th cervical vertebra to 1st thoracic vertebra**.
• The isthmus crosses the **2nd–4th tracheal rings**.

### Parathyroid Glands

• Small nodules located on the **posterior surface** of the thyroid lobes, near the middle and lower thirds.

## PARANASAL SINUSES (Surface Marking)

### Frontal Sinus

• Located above the **medial third of the supraorbital margin**.
• Usually marked as a rectangle above the eyebrows.

### Maxillary Sinus

• Occupies the region of the **cheek**.
• Surface marking corresponds to an area bounded by the infraorbital margin above and the upper teeth below.

### Ethmoidal Sinuses

• Lie deep between the medial orbit walls.
• Surface marking corresponds to the **medial canthus** region.

### Sphenoidal Sinus

• Situated deep in the skull.
• Surface marking approximates to the area **deep behind the nasal root**.

## RADIOLOGICAL ANATOMY (Overview)

Radiological anatomy defines how major bones, sinuses and foramina appear on standard X-ray views, helping correlate surface landmarks with imaging.

## LATERAL VIEW OF SKULL (PLAIN SKIAGRAM)

Key structures visible:

- Frontal, parietal, occipital, temporal bones
- Sphenoid (greater and lesser wings)
- Sella turcica
- Frontal and maxillary sinuses
- Mastoid air cells
- Coronal and lambdoid sutures
- External acoustic meatus
- Mandible: ramus, angle, condyle, coronoid
- Zygomatic arch
- Cranial fossae outline
- Tip of the odontoid process

## SPECIAL PA VIEW FOR PARANASAL SINUSES (Occipitofrontal / Waters / Caldwell Views)

### Waters View (Occipitomental View)

- Best shows **maxillary sinuses**.
- Also visualizes orbital rims, nasal cavity, zygoma.

### Caldwell View (Occipitofrontal View)

- Visualizes **frontal sinus and ethmoidal cells**.
- Petrous ridges appear in the lower orbit.

### Submentovertical (SMV) View

- Shows **sphenoidal sinus**, zygomatic arches, and skull base.

## CAROTID ANGIOGRAM (Key Features)

### Internal Carotid Artery (ICA)

- Shows cervical, petrous, cavernous and cerebral parts.
- Carotid siphon appears as an S-shaped curve.

• Anterior and middle cerebral arteries branch in characteristic patterns.

**External Carotid Artery (ECA)**

• Shows branching into maxillary, superficial temporal, facial and lingual arteries.

**Clinical Importance**

• Identifies aneurysms, stenosis, arteriovenous malformations.
• Assesses collateral circulation in stroke.