

Clinical Signs And Radiographic Guides For Diagnosis Of Maxillofacial Trauma

Dr.Raghav S Moorthy¹, Dr.Indrapriyadharshini J²

¹(Department of Oral and Maxillofacial Surgery,MGPGIDS, Chennai,India)

²(Department of Oral Medicine and Radiology,MGPGIDS, Chennai, India)

Abstract:

In different national demographics, maxillofacial injuries are associated with other body injuries that aren't consistent with one another. These discrepant numbers are a result of several factors, including topography, traffic control laws, social attitudes, and environmental conditions. India's growing population is leading to a rise in the incidence of trauma, with traffic accidents being the most common cause. Compared to wealthy countries, India has a 20-fold higher population death rate, with around eight deaths for every 100 automobiles. Emergency personnel and experts need to know the standard results and protocols for treating maxillofacial trauma in their respective areas. To assist in diagnosing or evaluating maxillofacial injuries and identify the specific type of damage involved, this article offers an in-depth review of indications, features, and identifying guides. In addition to helping diagnose the condition, these recommendations support doctors in triaging patients and acting quickly to minimise preventable complications and unfavourable results.

Key Word: Maxillofacial trauma, Clinical Signs, Radiographic Guides, Triage , Diagnostic Signs.

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I. Introduction

Maxillofacial injuries have been linked to other injuries to the body by a wide range of 10 to 88% in multiple research studies executed in different national demographics (1). The nature of the terrain, traffic management regulations, societal perceptions, and environmental factors all contribute to these disparate figures across different ethnicities (2). Because of the noticeable prominence of the face (3), maxillofacial injuries can contribute to psychological trauma (4), which worsens the afflicted personnel's quality of life. The prevalence of trauma is rising dramatically in India due to the country's expanding population, with Road Traffic Accidents being the most frequent contributing factor. There is a 20-fold increase in population mortality compared to developed nations. In advanced nations, one person dies for every 1000 motor vehicles; in India, however, around eight people are killed for every 100 vehicles (5). Given the high number of cases of maxillofacial injuries in a country like India, it's critical that emergency staff members and specialists also become knowledgeable about the most typical findings and guidelines that are pathognomonic, contributing, and suggestive of maxillofacial trauma in particular regions. This paper attempts to provide a detailed overview of various signs, characteristics features, and identifying guides that help diagnose or shortlist the presence or absence of maxillofacial injuries and if so help narrow down to the type of injury involved.

The various diagnostic guides have been separated into two categories those identified clinically and those identified radiographically.

II. Clinical Signs:

Battle's Sign: (Fig 1) (6)

- a) Synonyms: Battle Sign
- b) Area of Interest: Posterior Auricular Region, Mastoid Region
- c) Identifying Features: Bruising over the Mastoid Process behind the ear.
- d) Indicating type of Fracture: Fracture of Middle/ posterior cranial fossa
- e) Remarks: Suggestive of significant internal injury to the brain.

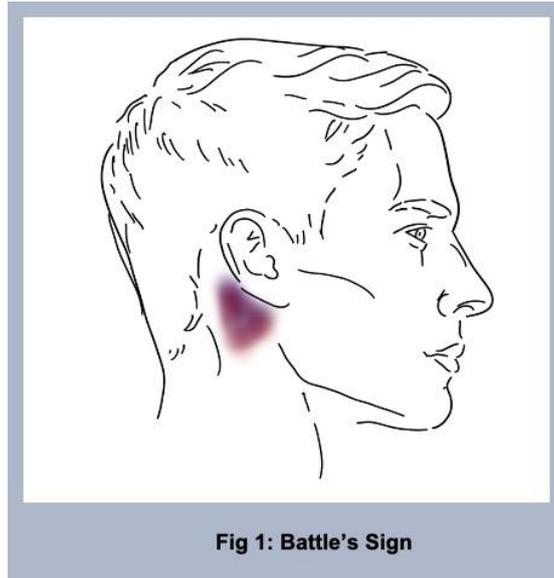


Fig 1: Battle's Sign

2. **Guerin's Sign: (Fig 2) (7)**

- a) Synonyms: NIL
- b) Area of Interest: Hard palate Region
- c) Identifying Features: Ecchymosis and Bruising over the Anterior / Greater Palatine Arteries in the hard palate.
- d) Indicating type of Fracture: LeForte I Fracture
- e) Remarks: The direction of Force for injury is in the downward direction low on the maxillary dentoalveolar rim.

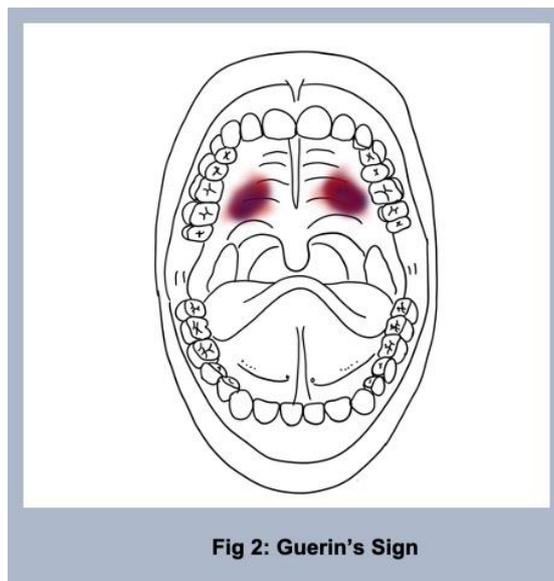
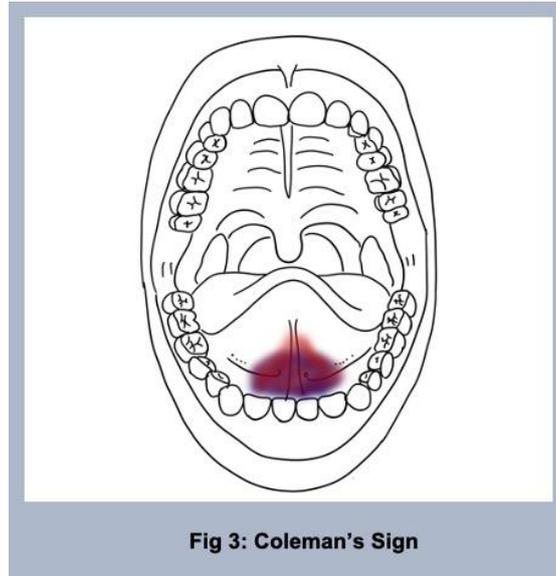


Fig 2: Guerin's Sign

3. **Coleman's Sign: (Fig 3) (8)**

- a) Synonyms: Corman's Sign
- b) Area of Interest: Ventral Surface of Tongue and Floor of Mouth (Sublingual)
- c) Identifying Features: Effusion of blood into the tissue planes of floor of the mouth, elevating its mucous membrane and producing a characteristic bluish, tense swelling under the tongue.
- d) Indicating type of Fracture: Parasymphysis and Body of Mandible Fracture
- e) Remarks: Characteristic Intraoral Sign exclusive to fractures of Mandible.



4. **Tramline Sign: (9)**
 - a) Synonyms: Tyretrack Sign
 - b) Area of Interest: Cerebro Spinal Fluid (CSF) drainage from the nose.
 - c) Identifying features: Following epistaxis, the blood clot dries and the flow of CSF continues; it forms a classical (tram line) pattern as seen in the case of CSF Rhinorrhea.
 - d) Indicating Type of Fracture: Lefort II, Lefort III
 - e) Remarks: Presents with Classical Headache of either the high pressure or low-pressure type.

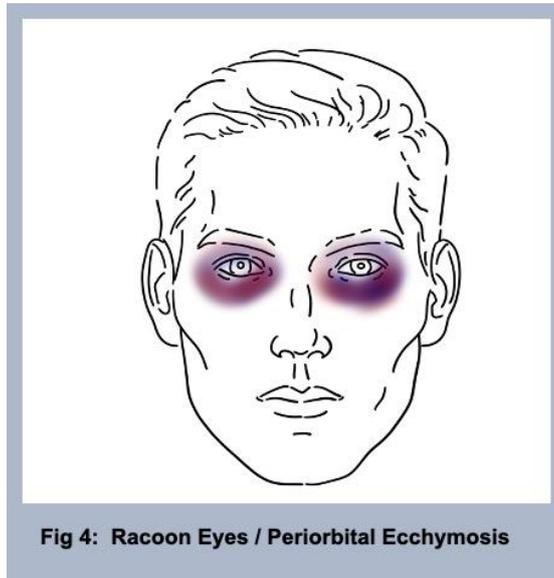
5. **Target Sign: (9)**
 - a) Synonyms: Halo Sign, Double Ring Sign
 - b) Area of Interest: CSF Fluid Drainage from the nose.
 - c) Identifying Features: When the CSF is mixed with blood or nasal discharge, the CSF moves away on the filter paper, and the blood moves closer, so two rings are visible.
 - d) Indicating Type of Fracture: Lefort II, Lefort III
 - e) Remarks: 'Reservoir sign' in which the CSF goes out when taking a head up position in the lying position. The handkerchief test is used to identify CSF Leakage.

6. **Crackpot Sign: (10)**
 - a) Synonyms: NIL
 - b) Area of Interest: Maxilla and Midface
 - c) Identifying Features: When the upper teeth are percussiated, a characteristic sound akin to that made when "cracked-pot" is struck with a spoon is created.
 - d) Indicating Type of Fractures: Lefort I fractures
 - e) Remarks: The nature of comparison to cracked pot resonates with the fracture present over a hollow pneumatic bone of maxilla.

7. **Step Deformity Sign: (11)**
 - a) Synonyms: NIL
 - b) Area of Interest: Maxillofacial Skeleton
 - c) Identifying Features: Gap in the continuity of the otherwise smooth tooth or cortical border of bone.
 - d) Indicating Type of Fractures: Maxillofacial fractures
 - e) Remarks: Such a gap may also produce a "step-type" defect, where the two fragments have become displaced relative to one another in orientation and position.

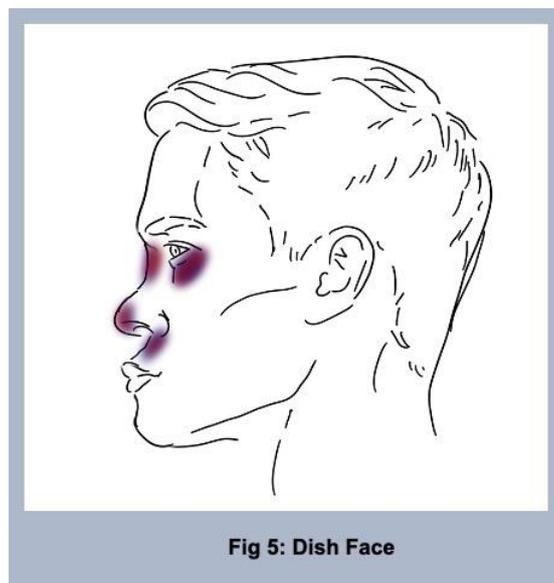
8. **Raccoon Sign: (Fig 4) (12)**
 - a) Synonyms: Raccoon Eyes, Panda Sign, Periorbital Ecchymosis.
 - b) Area of Interest : Region Around the Eyes
 - c) Identifying Features: Unilateral or bilateral progressive periorbital ecchymosis associated with edema.
 - d) Indicating Type of Fracture: Anterior Skull Base Fracture, Lefort II, Lefort III

- e) Remarks: This finding is not observed immediately following the injury and is typically delayed by 1 to 3 days. If it presents bilaterally, this finding is highly predictive of an anterior skull base fracture. Seen in Moon Faces and Panda Faces.



9. **Dish Face Sign: (Fig 5) (13)**

- a) Synonyms: NIL
b) Area of Interest: Maxillofacial Skeleton
c) Identifying Features: lengthening of facial height- elongation and flattening of the face
d) Indicating Type of Fractures: Midface fractures , Lefort III Fractures
e) Remarks: An anterior open bite results from the midfacial bones being crushed or sheared off the cranial base, causing backwards displacement along the inclined skull base. This permits the maxillae's posterior teeth to erupt into premature contact with the posterior mandibular teeth.



10. **Tell-Tale Sign: (14)**

- a) Synonyms: Tell-tale Hematoma
b) Area of Interest: Coronoid process
c) Identifying Features: "Tell-tale hematoma" refers to a hematoma in a particular location or associated with specific symptoms that are highly indicative of its presence.
d) Indicating Type of Fractures: Coronoid Process of Mandible Fracture

- e) Remarks: If there is a hematoma associated with a coronoid process fracture of the mandible, the tell-tale signs could include: Swelling in the area of the coronoid process, palpable or visible lump or bulge in the region, Bruising or discolouration of the skin overlying the hematoma, Tenderness and pain in the affected area.

III. Radiographic Guides:

1. **Magnification Sign: (15)**

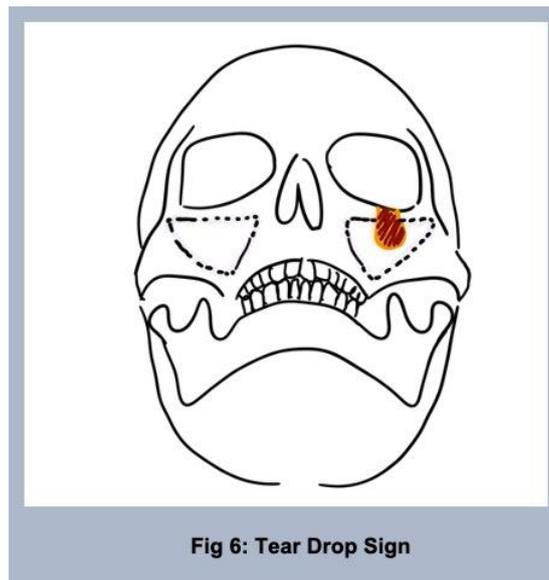
- a) Radiographic View: Orthopantomogram, Computed Tomography (CT), Cone Beam Computed Tomography (CBCT).
b) Area of interest: Mandible Bone
c) Identifying Features: Elongation of Mandible compared to maxilla
d) Type of Fracture: Bilateral Condylar fracture with symphyseal fracture (Triple fracture)
e) Remarks: Lateral displacement of mandibular body causing magnification of the mandible.

2. **Overlap Sign (16)**

- a) Radiographic View: All Intraoral and Extraoral Views
b) Area of Interest: Maxillofacial Skeleton and Dentition
c) Identifying feature: Doubly Radio-opaque region at the site of fracture
d) Type of Fracture: Any type of Fracture involving Maxillofacial Skeleton
e) Remarks: This appearance is characteristic due to the overlapping of fractured segments.

3. **Tear Drop Sign: (Fig 6) (17)**

- a) Radiographic View: Paranasal Sinus (PNS), Posteroanterior (PA)/Anteroposterior (AP) Skull View, CBCT, CT
b) Area of Interest: Orbital Floor and Maxillary Sinus
c) Identifying Features: Herniated intraorbital fat (+/- inferior rectus muscle) protruding through a crack in the inferior orbital wall.
d) Type of Fracture: Orbital Blow Out fracture
e) Remarks: Seen when the displaced fracture segments trap contents of the orbit when recoiled to closure following the injury called the Trapdoor Sign. Dangerous in children called White Eye Blowout Fracture.



4. **Dolan's Lines: (Fig 7 & 8) (18)**

- a) Synonyms: Elephants of Rogers
b) Radiographic View: Occipitomeatal View 10 degrees, Modified Caldwell Projection
c) Area of Interest: Orbit, Zygoma and Maxilla regions
d) Identifying Features:
a. Line 1: Orbital line traces the inner margins of the lateral, inferior, and medial orbital walls, and the nasal arch

- b. Line 2: zygomatic line traces the superior margin of the zygomatic arch and body, extending along the frontal process of the zygoma to the zygomaticofrontal suture
- c. Line 3: maxillary line traces the inferior margin of the zygomatic arch, body, and buttress, and the lateral wall of the maxillary sinus
- e) Indicating Type of Fracture: Midface fractures and Upper third fractures
- f) Remarks: They are usually used as an adjunct to McGrigor-Campbell lines.

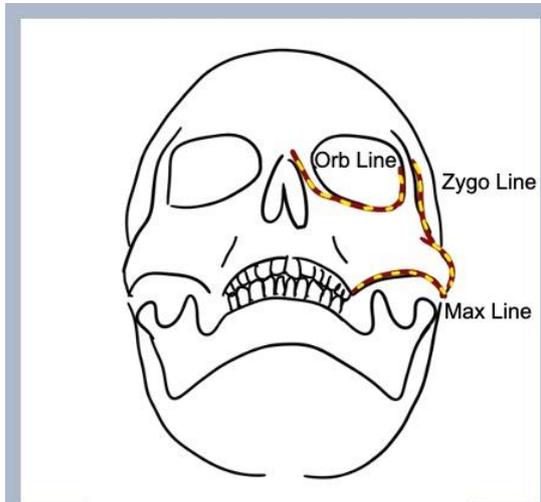


Fig 7: Dolan's Lines – Occipitomeatal View – 10°

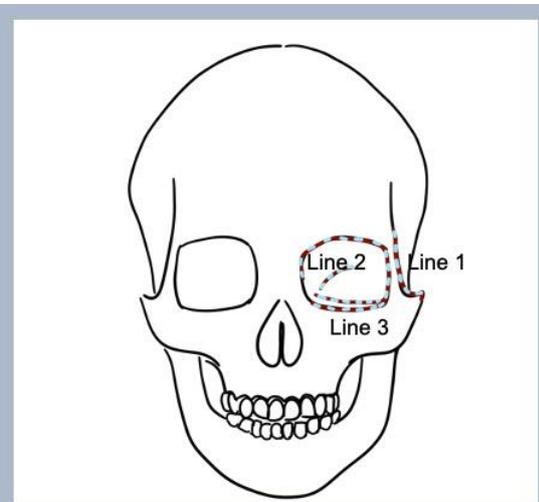


Fig 8: Dolan's Lines – Caldwell Projection

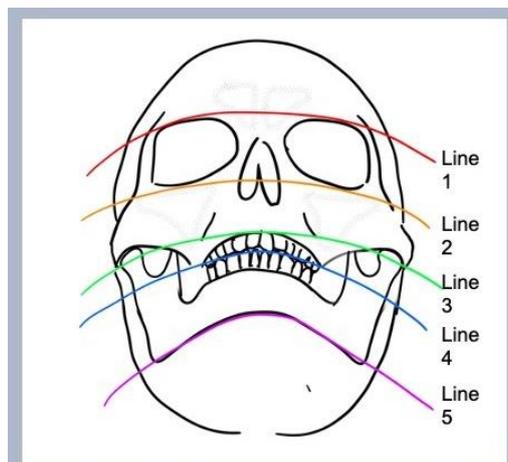
5. McGrigor-Campbell and Trapnell lines: (Fig 9) (19)

- a) Radiographic View: Occipitomeatal View 10 degree
- b) Area of Interest: Maxillofacial Region
- c) Identifying features : first line is traced from one zygomaticofrontal suture to another, across the superior edge of the orbits

Second line traces the zygomatic arch, crosses the zygomatic bone, and traces across the inferior orbital margins to the contralateral zygomatic arch

Third line connects the condyle and coronoid process of the mandible and the maxillary antra on both sides

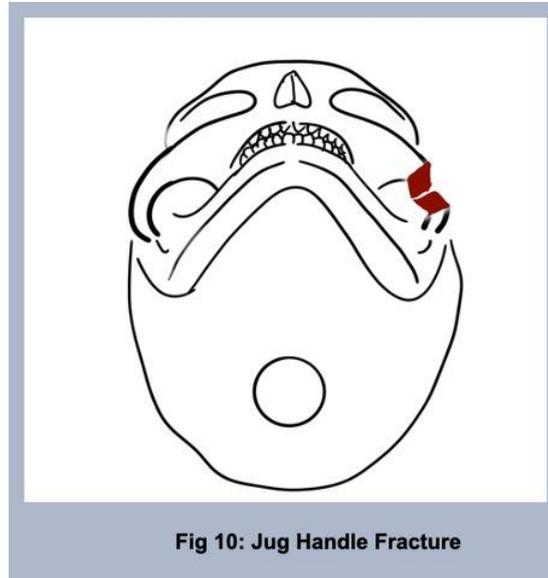
- a. Fourth line crosses the mandibular ramus and the occlusal plane of the teeth
- b. Fifth line is drawn along the lower border of the mandible. (Trapnell Line)
- d) Indicating type of fractures: Maxillofacial Fractures
- e) Remarks: Distrupted first line is called Black Eyebrow Sign , Distrupted 2nd Line is indicative of Tear Drop Sign.



**Fig 9 : Line 1 to Line 4 – Mc Gregor and Campbell Lines
Line 5 – Trapnell's Lines**

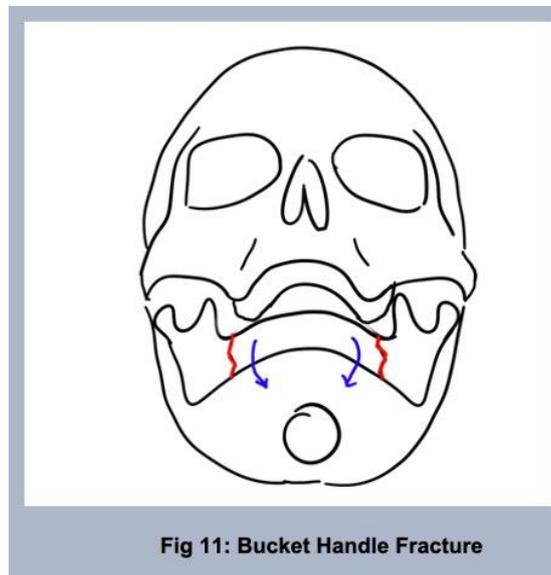
6. **Jug Handle Appearance (Fig 10) (19)**

- a) Radiographic View: Underexposed Submentovertex View
- b) Area of Interest : Zygomatic Arches
- c) Identifying features: The appearance of Zygomatic Arches like to that of a jug handle on either side. Presence of fracture of Arches causes discontinuity of the Jug Handles.
- d) Indicating Type of Fracture: Zygomatic Arch Fractures
- e) Remarks: Also called as Jug Handle Projection.



7. **Bucket Handle Appearance: (Fig 11) (11)**

- a) Radiographic View: OPG, CT , CBCT
- b) Area of Interest : Mandible
- c) Identifying Features: Comparison of Bilaterally fractured edentulous mandible to that of a bucket handle is seen.
- d) Indicating Type of Fracture: Bilateral Edentulous Body of Mandible fractures
- e) Remarks: Stabilization of the airway may require tracheotomy. Occurs most commonly in edentulous mandible.



8. **Pair of Scissors Sign** (16)
 - a) Radiographic View: Lateral Oblique View of Mandible (Ramus)
 - b) Area of Interest : Mandibular Condyle
 - c) Identifying Features: Altered remodeling of fractured mandibular condyle at the time of parturition giving the appearance of Pair of Scissors Sign.
 - d) Indicating Type of Fracture: Condylar neck fractures during forceps delivery
 - e) Remarks: Special type of fracture caused by forceps delivery prenatally. The condylar neck fractures and the fragment dislocates anteriorly.

9. **Loss of Innominate Line:** (20)
 - a) Radiographic View: Waters view, PA/AP View
 - b) Area of Interest : Upper third Of Face
 - c) Identifying Features: Loss of Innominate Line of Sphenoid Bone indicative of Discontinuous Sphenoid Wings.
 - d) Indicating Type of Fracture: Frontal Sinus Fracture, Lefort III fracture, Orbit Fractures, Sphenoid Bone Fractures, Middle Cranial/ Anterior Cranial Fossa Fractures.
 - e) Remarks: The innominate line is the projection of the greater wing of the sphenoid bone seen on frontal radiographs of the skull.

10. **Hemosinus:** (21)
 - a) Radiographic View: Waters view, PA/AP View, CT, CBCT
 - b) Area of Interest : Middle Third , Upper third Of Face
 - c) Identifying Features: Presence of radiopaque sinus or high-attenuation (45 to 80 Hounsfield units) paranasal sinus fluid.
 - d) Indicating Type of Fracture: Frontal Sinus Fracture, Midface fractures.
 - e) Remarks: Hemosinus is caused by a break in the sinus wall caused by a strong blow to the face. This causes the surrounding blood vessels to break, enabling blood to flood out and fill the sinus. Hemosinus most usually affects the frontal and maxillary sinuses, followed by the ethmoidal and sphenoidal sinuses.

IV. Conclusion

The final diagnosis of any maxillofacial fracture must be understood to involve a thorough clinical examination supported by radiographic investigations and a systemic evaluation that takes into account the possibility of brain injury. The above-mentioned detailed signs and guidelines not only help identify the situation at hand, but they also assist the physician in taking the necessary immediate action and triaging the case to prevent avoidable complications and adverse outcomes. Although these clinical indicators cannot provide conclusive evidence for a particular diagnosis, they are frequently associated with certain fractures, which facilitates the diagnosing process overall. The availability of these indicators and guidelines also helps to prevent overlooking locations that may be suggestive of a particular kind of fracture.

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