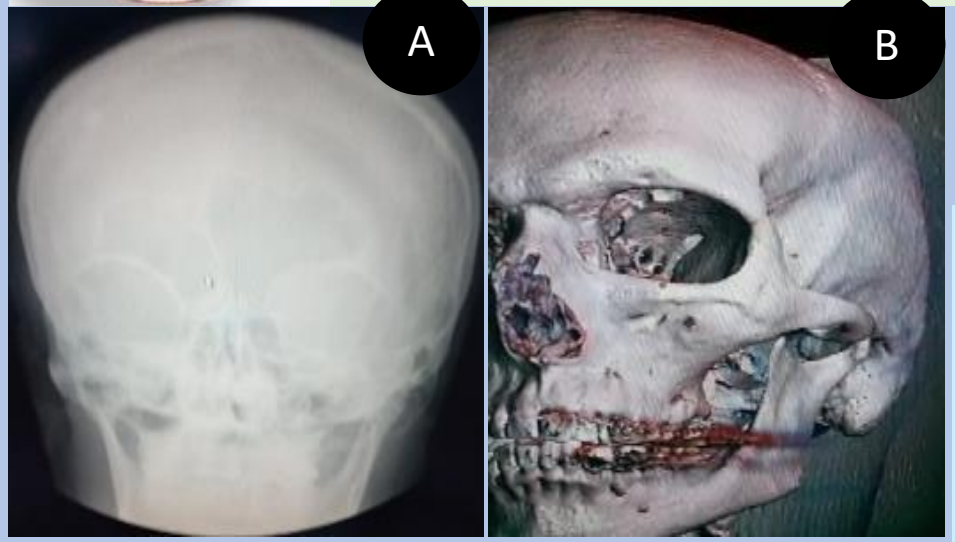
«XX Anniversary All-Russian National Congress of Radiologists and Therapists "Radiology – 2026»

Radiological assessment of skull fractures in multitrauma diagnostic challenges and solutions.



Admitted to the hospital after a fall. Diagnosis: closed TBI. (A) Based on the X-ray images of the skull, a fracture line diagnosis report was obtained in the left occipital region, typical of traumatic changes (false positive). (B) 3D reformatted CT images of the skull were obtained, and no pathological lesion site typical of traumatic injury was recorded.

Background. Skull fractures are a major component of traumatic brain injury and are commonly caused by road traffic accidents, falls from height, and blunt trauma. Their clinical importance is determined by the risk of intracranial, vascular, and neurological complications.

Objective. To assess the role of radiological methods in the differential diagnosis of skull fractures and compare the diagnostic value of X-ray examination with computed tomography.

Materials and Methods. The study analyzed clinical and radiological data on skull fractures, including linear, depressed, diastatic, and basilar forms. Attention was given to fracture localization, related cranial nerve and vascular injuries, cerebrospinal fluid leakage, and the comparative utility of radiographic projections and axial CT.

Results and Discussion. In total, 167 patients out of 969 were diagnosed with traumatic brain injury. X-ray examination was performed in 98 cases (58.7%), CT in 162 (97.0%), and MRI in 20 (12.0%). Combined trauma was observed in 63 patients (88.7%), whereas isolated trauma was identified in 8 (11.3%). Conventional skull radiography remains an initial imaging modality, particularly in mild traumatic brain injury and in settings with limited diagnostic resources. Its main value lies in detecting gross bone discontinuity, depressed fragments, foreign bodies, and some chronic post-traumatic or inflammatory changes. However, its diagnostic performance is restricted by the complex anatomy of the skull, superimposition of bony structures, and difficulty distinguishing fracture lines from normal sutures or vascular grooves. Consequently, radiography has low sensitivity for subtle fractures and cannot reliably assess intracranial hemorrhage, brain contusion, or soft-tissue injury.
In general CT demonstrated clear superiority in detecting head injuries after road traffic accidents, with sensitivity of 89.0% and specificity of 98.4% in polytrauma. It was particularly effective in the differential diagnosis of skull fractures because thin-section cross-sectional imaging allows accurate evaluation of fracture type, localization, displacement, and extension to the skull base. This is especially important in basilar skull fractures, which may be clinically occult but are often associated with cranial nerve dysfunction, vascular injury, and cerebrospinal fluid leakage. CT also enables simultaneous detection of epidural, subdural, and intracerebral hemorrhages, pneumocephalus, and other secondary signs of intracranial trauma. Reformation of CT images in axial and cranial projections further improved timely and accurate diagnosis of skull fractures and skull bone lesions. Diagnosis was more challenging in multitrauma, where shock, impaired consciousness, facial injuries, and concomitant cervical spine trauma could obscure neurological signs and delay recognition of skull base injury. MRI showed the highest specificity for combined traumatic brain injury (100.0%), while CT also remained highly informative, with specificity of 96.7% and sensitivity of 91.8% in brain injury. Overall, CT should be regarded as the gold standard in the acute phase, whereas X-ray retains only an auxiliary role in selected or resource-limited settings.

Conclusion. Differential diagnosis of skull fractures requires integration of clinical evaluation with modern radiological imaging. Although X-ray may contribute to preliminary assessment, CT provides the diagnostic precision necessary for early recognition of fractures, associated intracranial complications, and optimal treatment planning.

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