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Original Article

Diagnostic performance of multi-slice computed tomography using 2D and 3D images in the assessment of Le Fort fractures

Inas ELFiky [a], Dena Abd El Aziz El Sammak [a,*], Ahmed El Sammak [a], Mohammad Abdelhady [b]

[a] Department of Diagnostic Radiology, Zagazig University, Egypt
[b] Department of ENT Surgery, Zagazig University, Egypt

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ABSTRACT

Objective: The aim of this study was to assess the role of multislice computed tomography (MSCT) using 2D and 3D images in evaluation of different types of Le Fort fractures.

Subjects and methods: 30 cases referred from the Emergency unit in Zagazig University Hospital were included in this study, based on clinical evidence of facial trauma, they underwent multislice computed tomography (MSCT) examination and were shown to be positive for pterygoid fractures.

All patients subjected to non contrast MSCT in axial cuts. Multiplanar reformatted (MPR) images were acquired using the machine software in sagittal and coronal planes. Finally images were transferred to a workstation for reconstruction of 3D images.

Results: Sensitivity of multislice computed tomography (MSCT) in detecting compound Le Fort fractures for radiologists A, B and C was 94.4%, 66.7% and 100% respectively. Sensitivity of MSCT in detecting isolated Le Fort fractures for radiologists A, B and C was 100%. The difference between radiologists A, B and C in detecting Le Fort fractures types was insignificant. Good agreement between radiologists A, B, C and intraoperative findings.

Conclusion: Both 2D-CT and 3D-CT are the best methods in imaging of Le Fort fractures.

1. Introduction

Le Fort fractures of the skull are classic transfacial fractures of the midface, involving the maxillary bone and surrounding structures in either a horizontal, pyramidal or transverse direction [1]. They account for 10–20% of all facial fractures [2]. In 1901, René Le Fort described the term "pillars of resistance," which represent the strongest areas of the facial skeleton, and the fracture patterns he found, occurred between those pillars of resistance [3]. He described three types of Le Fort fractures, common to all is fracture of the pterygoid processes, in addition, each of them has a unique component [4] (Fig. 1). Le Fort I (horizontal fracture or a floating palate), results from a force of injury directed on the maxillary alveolar rim, or upper dental row, in a downward direction. The key component of Le Fort I fracture, in addition to fracture of the pterygoid process, is involvement of the lateral bony margin of the nose. It also involves medial and lateral maxillary sinus walls, the face just above the alveolar ridge of the upper dental row and the inferior nasal septum [5]. Le Fort II (pyramidal fracture) results from a force of injury directed to the lower or mid maxilla. The key component of Le Fort II fracture, in addition to fracture of the pterygoid process, is involvement of inferior orbital rim. It also involves nasal bridge at or below nasofrontal suture, superior medial wall of the maxilla, lacrimal bones, and inferior orbital floor through or near the infraorbital foramen, which contains the infraorbital nerve [5]. Le Fort III (transverse fracture or craniofacial dissociation), may follow impact to the nasal bridge or upper maxilla. The key component of Le Fort III fracture, in addition to fracture of the pterygoid process, is involvement of the zygomatic arch. It also involves nasofrontal and frontomaxillary sutures, medial orbital wall, nasolacrimal groove, ethmoid air cells, orbital floor and infraorbital fissure, lateral orbital wall, zygomaticofrontal junction and zygomatic arch. CSF rhinorrhea is commonly seen with Le Fort III fracture due to ethmoid air cell disruption [5]. Any combination is possible, for example there may be type 2 on one side and type 3 on the other, or there may be type 1 and type 2 on the same side. Le Fort fractures can be associated with other facial fractures, neuromuscular injury and dental avulsions [6]. It is important to stabilize the patient and treat serious insults to

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* Corresponding author.
E-mail address: denaelsammak@gmail.com (Dena Abd El Aziz El Sammak).

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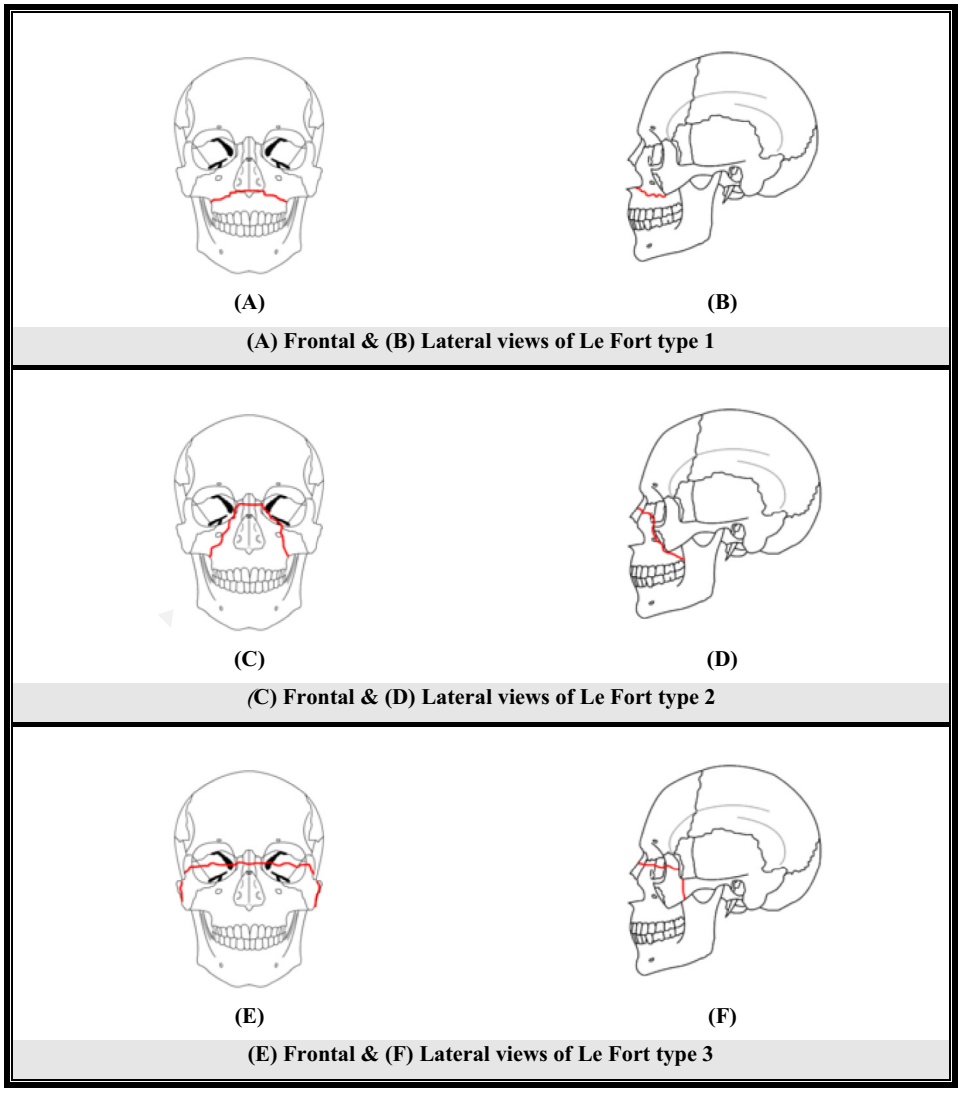

Fig. 1. Types of Le Fort fractures.

the airway, nervous system, cervical spine, chest, and abdomen prior to definitive treatment of the maxillofacial bones [7]. Fixation of unstable fracture segments is the objective of definitive surgical treatment; to restore normal facial skeleton and proper masticatory function [8].

2. Patients and methods

This study was carried out on a prospective basis on 30 patients in the Radiology department, Zagazig University Hospital, referred from the emergency unit of Zagazig University Hospital at the period from February 2015 to July 2016. Inclusion criteria were patients with clinical evidence of maxillofacial injury who underwent multislice CT examination and were shown to be positive for pterygoid process fractures. Every patient was subjected to full history taking & multislice CT examination. Plain radiographs were obtained in 6 patients as initial examination. 10 cases underwent magnetic resonance imaging (MRI) to evaluate suspected injuries in the globe and spinal cord. Multislice CT (MSCT) was done in axial cuts from upper margin of frontal sinus to chin on 128-slice CT scanner (Philips ingenuity 128) using standard CT protocol. Patients with non-fractured pterygoid bone and pregnant females were excluded from the study.

2.1. Preparation of the patient

No specific patient preparation was required. Patient must be quiet and cooperative, otherwise, motion artifacts distort the image. Also dense materials should not be in the scanning field.

2.2. Maxillofacial CT protocol

Patients were scanned in supine position without gantry tilt from upper margin of frontal sinus to chin using the following parameters: 128×1 mm detector row configuration, 1.25 mm slice thickness, 1 mm collimation, 1 mm reconstruction interval, 1.375 pitch, 300 mAs, 120 kVp. Standard bone window 3000/300 (WW/WL). Standard soft tissue window 400/50 (WW/WL).

2.3. Radiation dose

The effective tube current, CT dose index volume (CTDI vol) and dose-length product (DLP) were obtained from the patient protocol of the system. The effective dose was derived from the product of the dose-length product and a conversion coefficient for the anatomical region examined. CTDI vol 14.3 mGy, DLP 866 mGy. cm, Effective dose 1.8 mSv.

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