G13 Role of Preoperative 3D-CT Reconstruction in Depressed Skull Fractures Treated With Craniectomy: A Case Report of Forensic Interest

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The goal of this presentation is to describe a new approach to cranial trauma treated with craniectomy: 3D-CT reconstruction based on preopertaive scanning.

This presentation will impact the forensic science community by demonstrating how new radiological techniques and reconstruction can be utilized to assist the forensic pathologist in assessing cranial trauma after surgical intervention.

Patients affected by cranial trauma with depressed skull fractures and intracranial pressure increase generally undergo neurosurgical intervention. Since craniotomy and craniectomy remove skull fragments and generate new fracture lines, they complicate forensic examination and sometimes prevent a clear identification of skull fracture etiology.

To overcome this kind of problems a 3D reconstruction based on preoperative CT scanning, giving a picture of the "*status quo*" ante neurosurgery, can help the forensic examiner in identifying skull fracture origin and their means of production.

The authors report the case of a 41 year-old-man assaulted by his pusher: he presented at the emergency room with severe cranial trauma with a depressed skull fracture at the vertex, bilateral subdural hemorrhage, and multiple intraparenchymal contusions. The rapid impairment of GCS (Glasgow Coma Score) from 14 to 8 forced the surgeons to perform a craniotomy; despite such intervention neurological conditions kept on worsening (GCS of 4) and after a few hours a craniectomy was performed. The patient died after 40 days of hospitalization in an Intensive Care Unit (ICU) for multi-organ failure (MOF).

The forensic autopsy revealed the absence of various bone fragments at the vertex (consequences of the craniectomy), bilateral fractures at the anterior and medial fossa, bilateral cortical contusions at the frontal and parietal lobe, and a smaller cortical contusion at the right temporal lobe. Histological examination showed focal necrotic and hemorrhagic lesions surrounded by gliosis and several hemosiderin-laden macrophages, dating the trauma at about 30-50 days before autopsy.

Because of the absence of various bone fragments at the vertex the necroscopic examination didn't allow a precise analysis of the skull fractures. Thus a 3D-CT reconstruction of the preoperative scanning was performed with SSD (surface shaded display) and MIP (maximum intensity projections) technique.

A comparative study between necroscopic and radiological data differentiated the surgical from the traumatic lesions, which were produced by a cylindrical blunt object with a reduced area of impact.

A fit-matching analysis between virtual blunt objects and the skull fractures found out that the pusher had beaten the victim using a baton with a diameter of 3 cm and a length of about 1.50 meters.

These findings helped the police officers in searching for the crime weapon, which was found hidden in a bush not far from the site of the assault.

Computed tomography techniques with tridimensional reconstruction have been developed over the last 10 years and have found various applications in the forensic field. The most recent development is multislice computed tomography combined with photogrammetry-based surface optical scanning and image rendering techniques. The combination of these different techniques can be used to produce three-dimensional images of injury patterns for comparison with suspect weapons.

This technology is generally used in postmortem examination to complete or replace forensic autopsy (Virtopsy®).

However, when patients suffering a trauma undergo surgical intervention, which modifies wound morphology and complicates forensic examination, a 3D-CT reconstruction based on preoperative scanning gives a picture of the "*status quo*" before surgical procedures and thus helps the forensic examiner in identifying wounds etiology and their means of production.

Depressed Skull Fractures, 3D-CT, Craniectomy

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