

The use of μ CT in forensic anthropology: identifying cause of death

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Aims

Computed tomography is a core imaging technology for in many clinical fields, and is increasingly employed in the forensic sciences as part of the forensic autopsy. In recent years, for example, it has been shown that CT is a useful tool for detecting bone fractures, fracture patterning, and auditory ossicle luxation and provides detailed images of the skull which can be used for identification purposes (1, 2, 3). Generally this type of medical and forensic CT has a maximum image resolution of 1-2mm, which means that fine features may be difficult to identify. Micro CT (μ CT) represents a relatively new technological development for this field. It has been demonstrated that high resolution μ CT images have great potential in forensic anthropology, for the documentation and analysis of tool-inflicted bone injuries, matching of weapons to wounds, and bone histology(4, 5, 6). This paper presents an anonymized case report that demonstrates how μ CT may be used to facilitate diagnosis of cause of death.

Case Report

A 40 year old man was found in the street suffering from a scalp wound following a brawl outside a public house. On admission to hospital he was fully conscious, but he required treatment for a ragged, deep bleeding scalp laceration. As the wound was sutured his condition rapidly deteriorated. A clinical CT scan showed an intracerebral haemorrhage within the left frontal lobe of the brain. Successive craniotomies were carried out in an attempt to relieve raised intracranial pressure but after 22 days, the injured man finally died. Four fragments of his skull had been removed during craniotomy; these were from the left side of the cranium, comprising parts of the parietal, frontal, sphenoid and temporal bones, including the pterion. At autopsy, several fine fracture lines were observed on the cranial fragments that had been surgically removed. A plan was made to examine and document these fracture lines using standard digital photography and a dissection microscope, radiography, and μ CT to investigate the extent of the fractures (eg figure 1).

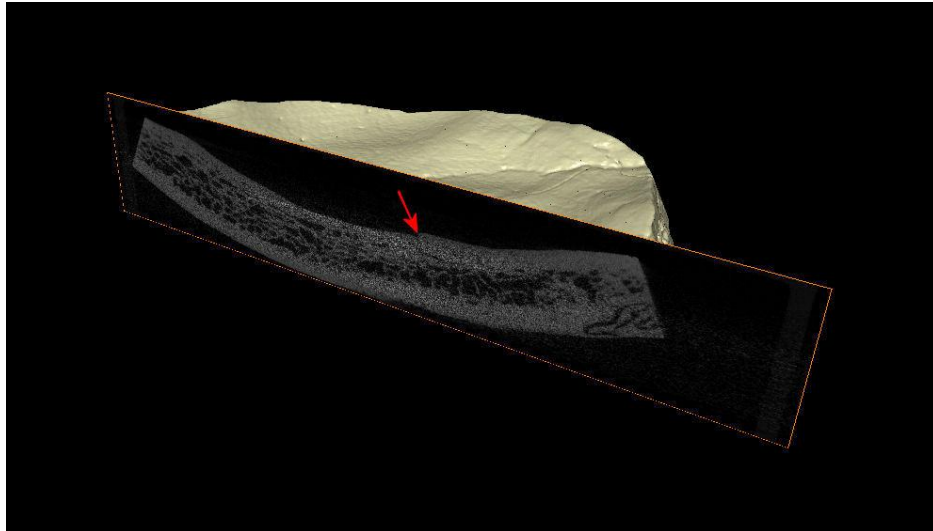


Figure 1. Virtual section; the fracture is arrowed at the endocranial surface and is seen to be extending through the inner table, and terminating in the diploe.

Conclusion

In this case, μ CT was found to be useful as an aid to diagnosis, determining that the injury was due to a blow to the head from a small round object and not due to the subject striking his head against a flat surface as had been described by witnesses. This was essential to the prosecution and conviction. Images from the μ CT scan also proved useful for presentation. Although the fractures were faintly visible as dark lines to the naked eye, μ CT clearly demonstrated the discontinuity of the bone at the fracture. The cross-sectional images in particular constituted useful visual evidence for the case, as the fracture line could be clearly and convincingly demonstrated to a non-expert.

In conclusion, this case illustrates that μ CT technology provides the opportunity to examine bone fragments at very high resolution and entirely non-destructively. The potential of μ CT to forensic science has been identified by several authors and has already made an impact in research investigations, but here it demonstrates new potential as a supplement to forensic autopsy, both as a diagnostic aid and in presentation of pathological findings to non-experts.

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