The role of virtopsy in the interpretation of great height fall lesions

Poster No.: C-1769  
Congress: ECR 2015  
Type: Scientific Exhibit  
Authors: F. Pancrazi, C. Giaconi, S. Fornaro, D. Forni, D. Caramella; Pisa/IT  
Keywords: Forensic / Necropsy studies, CT, Medico-legal issues, Forensics  
DOI: 10.1594/ecr2015/C-1769

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org
Aims and objectives

To establish the role of virtopsy in the evaluation and recognition of trauma dynamics and causes of death whenever great heights fall lesions are present.

In great heights falls we observe usually skull, pelvic bone and burst vertebral fractures. Intoxication and suicidal intent might be present.

In Feet-first impact we find association of typical fractures with feet and ankle fractures. In Head-first, we might observe isolated lesion of the skull which presents a typical pattern Fig. 1 on page 2.

Otherwise in Lateral-impacts there might be the association with pelvic lesions, rib cage fractures and pulmonary contusions.

Images for this section:
**Fig. 1:** Image showing comminuted burst fractures starting at the lateral prominent part of the skull (point of impact) which represent typical fall from great height's pattern
Methods and materials

We evaluate three cases in which corpse’s finding circumstances and external lesions were suspicious for great heights falls but there wasn’t the possibility of a sure recognition of death cause and trauma dynamics.

In these patients deceased in not well clarified circumstances we performed a whole body (apex-feet) spiral CT acquisition with a thin-section 16-raw CT scanner, in order to perform high resolution 3D and multiplanar reconstruction. We used a total beam collimation of 16x1mm, reconstruction thickness 1mm, reconstruction interval 1mm, kVp 120, mA 250, pitch 1,531, and standard reconstruction algorithm.

CT findings have been analyzed to distinguish previous or acute bone lesions; to evaluate internal organs, recognize and localize foreign objects and to discover vital signs present at the moment of trauma.

Results

In our first case the corpse was found on his back near a five-storey building. The external forensic examination showed lacerated contused wounds of the skull Fig. 2 on page 5, deep left shoulder wound, similar to gunshot’s wounds Fig. 3 on page 6, preternatural rib cage’s mobility (generally indicative of bilateral rib fractures) and no external signs of pelvic injury.

Virtopsy, performed before the autopsy, excluded the presence of foreign bodies: likely a bone fragment of the left scapula caused the deep left shoulder wound. It was also possible to demonstrate and quantify the presence of subcutaneous emphysema, as vital sign at the moment of trauma Fig. 4 on page 7.

At the level of the skull was observed a typical pattern for precipitation from great heights Fig. 5 on page 8.

The association with bilateral scapula and multiple ribs, Fig. 6 on page 9, right iliac wing ileo and ischio-pubic branches fractures Fig. 7 on page 10 allowed to establish a Lateral-impact dynamics.

The second case was a lady of 82 years-old found in the stairwell floor of her house in prone position with arms extended above the head.
The external forensic examination showed preternatural rib cage's mobility, indicative of bilateral rib’s fractures, pelvic instability indicative of pelvic fractures; shortened and externally rotated right leg indicative for non-displaced fracture of the proximal femur; preternatural mobility and deformity of the lower third of the right leg, suspicious for comminuted fractures at this level).

Virtopsy confirmed and helped to define the fractures' pattern present in all these sight of complex access at autopsy.

In particular were observed, in lower limbs, fractures at the level of right calcaneus, talus and in the distal part of tibia and fibula Fig. 8 on page 11 right femural, acetabular, ischio-pubic branches Fig. 9 on page 12 and bilateral tibial fractures Fig. 10 on page 13.

At the level of the thoracic cage: multiple rib’s fractures Fig. 11 on page 14 and sternum fracture, which has probably caused laceration of the pericardium shown by autopsy.

In this case Virtopsy confirmed the presence of precipitation from great height lesion's pattern excluding other types of harmfulness, and allowed us to hypothesize a Feet-first impact type associated with Lateral-impact trauma.

The person likely died after the traumatic hemorrhagic shock due to trauma.

In the third case in which external examination and forensic context were unclear, virtopsy helped to determine whether precipitation or investment occurred, showing a typical height falls lesion's pattern.

The corpse, discovered near a three-storey building, showed bilateral scapular Fig. 12 on page 15 / Fig. 13 on page 16 and rib's fractures Fig. 14 on page 16, right iliac wing, bilateral ischio-pubic and ilio-pubic branches fractures, Fig. 15 on page 17.

**Images for this section:**
Fig. 2: Image showing the point of impact at the level of the cutaneous tissue
Fig. 3: Image showing deep left shoulder wound, similar to gunshot's wounds
**Fig. 4:** Coronal MultiPlanar Reconstruction (MPR) showing right subcutaneous emphysema
**Fig. 5:** Head injury due to a fall from a great height. Oblique right lateral 3D VR CT image showing comminuted burst fractures starting at the lateral prominent part of the skull (point of impact)
**Fig. 6:** Oblique right lateral 3D VR CT image showing bilateral scapular and multiple rib's fractures
**Fig. 7:** Oblique right lateral 3D VR CT image showing bilateral ileo-pubic and ischio-pubic branches fractures with the association of right iliac wing fracture
Fig. 8: Oblique left lateral 3D VR CT image showing fractures at the level of right calcaneus and talus and in the distal part of tibia and fibula
Fig. 9: Oblique left lateral 3D VR CT image showing ileo-pubic and ischio-pubic branches fractures, associated with femoral and acetabular fractures
Fig. 10: Axial CT image showing right and left tibial fractures
Fig. 11: Oblique right lateral 3D VR CT image 3D reconstruction showing multiple rib’s fractures
**Fig. 12:** Axial CT images showing right scapula fracture

**Fig. 13:** Axial CT images showing left scapula fracture
Fig. 14: Oblique posterior 3D VR CT image reconstruction showing multiple rib’s fractures
Fig. 15: Oblique left lateral 3D VR CT image showing right iliac wing, bilateral ischio-pubic and ilio-pubic branches fractures
Conclusion

Virtopsy is useful for the identification and determination of height fall lesion's patterns and to reconstruct trauma dynamics.

Virtopsy, performed previously to the autopsy, allows to highlight the effects of traumatic injury on corpses, even in more complex access autopsy locations. Multiplanar CT reconstructions help in the evaluation of fractures and then to reconstruct the likely impact modality of the body on the ground in case of precipitation.

Virtopsy is a reliable non-invasive method that can be considered useful to guide a focused autopsy, and is able to provide documentation assessable at successive times, even after the body has been cremated or buried. It should not be considered a substitute, but a complementary forensic investigation; to strengthen and improve the quality of the judicial autopsy.

Personal information

References


2. G. Teresinski, R. Madro, Ankle joint injuries as a reconstruction parameter in car-to-pedestrian accidents Forensic Science International 118 -2001) 65±73


4. M. Shkrum, D. Ramsay, Forensic Pathology of Trauma 2007 Humana Press Inc 999 Riverview Drive, Suite 208 Totowa, New Jersey 07512

5. R. Dirnhofer; C. Jackowski, P. Vock, et al. VIRTOPSY: Minimally Invasive, Imaging-guided Virtual Autopsy; Radiographics 2006