



A135 Skeletal Trauma Resulting From Falls Involving Stairs: An Analysis of Fracture Patterns and Morphologies Using Postmortem Computed Tomography (PMCT)

*Samantha K. Rowbotham, MA**, Monash University, Dept of Forensic Medicine, 65 Kavanagh Street, Southbank, Victoria 3006, AUSTRALIA; *Soren Blau, PhD*, 65 Kavanagh Street, Southbank, Melbourne, Victoria 3146, AUSTRALIA; and *Jacqueline Hislop-Jambrich, PhD*, Toshiba Medical, 12-24 Talavera Road, North Ryde 2113, AUSTRALIA

After attending this presentation, attendees will better understand the skeletal fracture patterns and fracture morphologies that result from fatal falls involving stairs.

This presentation will impact the forensic science community by providing forensic anthropologists with an improved evaluation of skeletal fractures resulting from falls involving stairs. This presentation will also demonstrate the value of PMCT analyses in the context of detailed National Coronial Information System (NCIS) documentation for providing comprehensive, contextual, and accurate analyses and interpretations of skeletal trauma.

Falls are the second-leading global cause of unintentional injury and death.¹ Understanding the skeletal Blunt Force Trauma (BFT) resulting from falls, both in terms of the resulting fracture patterns and morphologies, is of value to forensic anthropologists when interpreting circumstances of death in medicolegal cases involving skeletal BFT; however, the skeletal BFT resulting from falls involving stairs in particular is poorly understood. Currently, a small number of forensic pathology and clinical medicine studies have investigated trauma patterns following falls involving stairs and have illustrated that all areas of the skeleton are susceptible to skeletal fracturing, given the “tumbling” nature of this mechanism.² As these disciplines are predominantly focused on the soft tissues as well as the skeletal structure, unfortunately the level of skeletal trauma detail is typically not sufficient for forensic anthropologists to use when forming interpretations regarding the circumstances of death from only the skeletal material. To address this deficit, this study has investigated the skeletal fracture patterns and morphologies (size and shape) resulting from falls involving stairs using PMCT data in the context of detailed NCIS data.

A search of the NCIS database for fatal falls involving stairs in Victoria, Australia, between 2005 and 2014, identified 89 cases. For each case, the variables known to influence an individual's fall, and to subsequently influence how his/her skeleton fractured, were recorded. These variables were comprised of sex, age, body mass index, number of stairs, landing/stair surface, manner of fall, and the presence of psychoactive drugs and preconditions (medical and/or physical). Skeletal trauma for each case was analyzed using the associated full-body PMCT scan (undertaken as part of the routine autopsy process at the Victorian Institute of Forensic Medicine using a 128-row helical CT – SOMATOM® Definition Flash). The data were analyzed using the *syngo.via* imaging software. Skeletal trauma recording for each individual was comprised of the skeletal element and anatomical location traumatized, fracture/s classification, descriptions of the fracture/s (including measurements and angles where appropriate), and a schematic of the fractures. The skeletal fracture patterns and morphologies were investigated in the context of the NCIS variables.

The 89 cases of fatal falls involving stairs was comprised of individuals between the ages of 42 and 103 years (mean 78±11 years) with a relatively equal sex distribution of 47% females and 53% males. Almost all falls were mechanical, the location of the stairs were a combination of indoor and outdoor environments, and the number of stairs involved varied from 1 to 15 steps. Preliminary results indicate all regions of the skeleton, except for the



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hands and feet, were susceptible to fracturing following falls involving stairs, and that the fracture pattern resulting from the fall is largely determined by the associated variables. Skeletal trauma was present in 62% of individuals (55 cases) and within those cases, 75% exhibited trauma to one skeletal region while the remaining 25% exhibited poly trauma. Fracturing was primarily associated with the skull (45%) with the majority of these fractures sited to the vault, and typically comprised single linear fractures, depressed fractures, and/or hinge fractures. The cervical vertebrae (25%), ribs (20%), and femora (13%) were also frequently fractured. Almost all cases of rib fractures were associated with trauma to other skeletal regions.

This research will provide improved qualitative evaluations of skeletal fractures resulting from falls involving stairs and, subsequently, augment forensic anthropologists' interpretations of circumstances of fatal falls in medicolegal contexts.

Reference(s):

1. <http://www.who.int/mediacentre/factsheets/fs344/en/> (accessed September 10, 2014).
2. Rowbotham S.K., Blau S. Skeletal fractures resulting from fatal falls: a review of the literature. *Forensic Sci Int*. DOI: 10.1016/j.forsciint.2016.04.037.

Stair Falls, Computed Tomography, Skeletal Trauma