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G100 Discrimination of Falls and Blows in Blunt Head Trauma: Assessment of Predictability Through Combined Criteria

Anny Sauvageau, MD*, S. Racette, BSc, and C. Kremer, MSc, *Laboratoire de sciences judiciaires et de médecine légale, 1701 Parthenais Street, 12th Floor, Montreal, Quebec H2K 3S7, CANADA*

The goal of this presentation is to propose a criteria tool for the distinction of falls from blows in blunt head trauma.

This presentation will impact the forensic community by providing new insight into the evaluation of blunt head injuries.

The discrimination of falls from homicidal blows in blunt head injuries is a common but difficult problem in forensic pathology. One of the most often used criteria to evaluate this issue is the hat brim line rule. According to this rule, an injury located above the hat brim line (HBL) is more likely the result of a blow, while a fall would generally produce a wound at the level of HBL. The objective of this study was to evaluate the validity of this criterion, as long as of two other possible criteria: side lateralization of skull fractures and number of lacerations. Furthermore, a combined criteria tool will be developed.

Over a 6-year period (2000-2005), all autopsy cases from the Montreal *Laboratoire de sciences judiciaires et de médecine légale* were analyzed. Cases selected consisted of falls downstairs, falls from one's own height, and head trauma by a blunt weapon. Upon review of photographs and autopsy reports, all cranial fractures and lacerations were positioned on figures representing the head and the skull in different anatomical views. For the present study, HBL was defined as the area located between two lines parallel to a line inspired by the Frankfort horizontal plane (horizontal plane passing through right and left porion points and the left orbitale), the superior margin passing through the glabella (G line) and the inferior margin passing through the center of the external auditory meatus (EAM line). For each case, the following elements were compiled: location of fractures in relation to HBL, side lateralization of skull fractures and number of lacerations.

A total of 114 cases were selected: 21 cases of downstairs falls, 29 cases of falls from one's own height, and 64 cases of head trauma by a blunt weapon. The location of a cranial fracture inside HBL was of little interest in the distinction of falls from blows. On the other hand, fractures located above HBL were associated to blows in 75.9% and to falls in only 24.1%. Hence, a fracture positioned above HBL was in favour of a blow ($\alpha=0.02$, contingency coefficient=0.25). Side lateralization of fractures was also of interest in the distinction of falls from blows: right skull fractures were more likely to result from falls whereas left skull fractures were more often associated with blows ($\alpha=0.007$, contingency coefficient=0.36). Even more interesting was the number of lacerations: cases presenting 3 or less lacerations were mostly falls cases (60.5%), whereas all cases (100%) with more than 3 lacerations were cases of blows ($\alpha=0.000$, contingency coefficient=0.48).

By combining those criteria, a better predicting rate was achieved. Indeed, the presence of at least two criteria in favor of a fall was successfully predicting cases in 65.9%, whereas the presence of at least two criteria in favor of a blow revealed a perfect score of 100% of successful prediction. Furthermore, by combining the three criteria altogether, the predictability of the criteria tool was even better: the presence of a combination of three criteria in favour of blows still demonstrated a success rate of 100%, while the success rate for falls reached 83.3% ($\alpha=0.001$, contingency coefficient=0.62).

Considering the previous results, the presence of a fracture above HBL, of a left side lateralization of skull fractures and the presence of more than three lacerations are criteria in favor of a blow. On the contrary, a typical fall case is more likely to present with a fracture inside HBL, a right side lateralization of skull fractures and 3 lacerations or less. A criteria tool based on combination of those criteria can achieve a predictability rate of 100% for cases of blows and 83.3% in falls cases.

Blunt Head Trauma, Hat Brim Line, Skull Fracture