



### G76 Fractures of the Neck Structures in Suicidal Hangings: A Retrospective Study on Contributing Variables

Anny Sauvageau, MD\*, Office of the Chief Medical Examiner, 7007, 116 Street, Edmonton, AB T6H 5R8, CANADA; and Renaud Clement, MD, 1 Rue Gaston Veil, Nantes, 44093, FRANCE

After attending this presentation, attendees will better understand the variables contributing to the development of neck structures fractures in hanging.

This presentation will impact the forensic science community by contributing to a better understanding of important factors to the development of fractures of the thyroid cartilage and hyoid bone in hangings.

**Introduction:** Fractures of the neck structures figure among the classic autopsy findings in suicidal hangings. Several factors may play a role in the development of fractures of the neck structures in hanging. It has been repetitively demonstrated that the incidence of fractures increases with age. The role of gender is less clear: some authors found a male predominance of fractures, whereas other observed a female predominance or no significant difference between genders. Similarly, studies on the role of several other factors have shown opposite results for the type of hanging (incomplete or complete suspension), the type of ligature, the location of the knot, the highest suspension point and the suspension time. However, most of these studies evaluated these factors independently of the age of the victims. Considering that age is probably the most important factor in the development of neck structures fractures, all other contributing factors should be studied in relation to age. The goal of the study is to evaluate the role of contributing factors to the development of neck structures fractures, taking age categories into account.

**Material and Methods:** Overall, a total of 206 suicidal hangings were analyzed for the presence and localization of fracture of the neck structures. For each case, the following information was also compiled: gender and age, height and weight, type of hanging (complete or incomplete), type of ligature used (rope, wire, clothes, sheet or lace) and localization of the knot (anterior, right, left or posterior).

**Results:** *Incidence of fracture in relation to age and gender:* The incidence of neck structures fractures increased with age ( $\chi^2=21.851$ ;  $p=.000$ ). Victims of less than forty years of age presented an incidence of fracture of 18% whereas this incidence increased significantly to 49% in victims of forty years or more. The average age of victims without fractures of the neck structures was 31.7 compared to 42.6 for victims presenting fractures ( $t=5.66$ ;  $p<.001$ ;  $D=.88$ ). As for gender, the incidence rate of fracture is significantly higher in male victims (31.4%) compared to female ones (11.8%) ( $\chi^2=5.408$ ;  $p=.020$ ).

*Incidence of fracture in relation to the height, weight and BMI:* The incidence of fractures varied significantly with the height ( $t=2.19$ ;  $p=.031$ ;  $D=.33$ ), weight ( $t=4.38$ ;  $p<.001$ ;  $D=.89$ ) and BMI ( $t=3.84$ ;  $p<.001$ ;  $D=.60$ ) (Table 3). The average height of hanging victims with fractures of the neck structures was of 1.74 m compared to 1.71 m for victims without fractures. As for the average weight and BMI of victims with fractures, it was of 78.2 kg and 25.6 respectively, compared to 68.6 kg and 23.2 in victims without fractures.

*Incidence of fracture in relation to the type of hanging and the type of ligature:* The incidence of fractures did not vary significantly with the type of hanging ( $\chi^2=.05$ ;  $p=.828$ ;  $\Phi=.015$ ) and the type of ligature ( $\chi^2=3.12$ ;  $p=.077$ ;  $\Phi=.077$ ). However, when taking the age of the victims into account, a different picture was revealed: in individuals aged forty years or more, victims with complete suspension of the body presented with a significantly higher incidence of petechiae (63.2%) compared to victims with incomplete suspension (31.0%) ( $\chi^2=6.79$ ;  $p=.009$ ;  $\Phi=.318$ ). This difference was not present in individuals of less than forty years of age ( $\chi^2=.52$ ;  $p=.471$ ;  $\Phi=.061$ ). As for the type of ligature, no significant difference was found in individuals of less than forty years of age ( $\chi^2=.11$ ;  $p=.737$ ;  $\Phi=.028$ ) as well as in older victims ( $\chi^2=.01$ ;  $p=.936$ ;  $\Phi=.010$ ).

*Incidence of fracture in relation to the localisation of the knot:* The incidence of fractures did not vary significantly with the localisation of the knot ( $\chi^2=4.11$ ;  $p=.250$ ;  $\Phi=.141$ ). The side lateralization of fracture in relation to the position of the knot will also be presented.

**Conclusion:** Apart from age, several other factors seem to play an important role in the development of fractures of the neck structures: height, weight and BMI. The type of hanging is also an important factor in victims of more than forty years of age.

**Hanging, Thyroid Cartilage, Fracture**