Summary

Hanging is a form of ligature strangulation in which the force applied to the neck derives from the gravitational drag of the weight of the body. The furrow on the neck is mainly a postmortem phenomenon. To establish the intravital hanging, any inner neck structure injury indicating ligature mark intravitality is to be identified. The aim of this prospective autopsy study was to determine frequency of inner neck structure injuries in hanging with regard to the point of the ligature knot and the other victims‘ characteristics (body suspension, gender, age, weight). We tried to identify the mechanism of injury for the neck structures and determine, according to the obtained results, a possible specific or most characteristic inner neck injury in regard to the ligature knot location. This study also aimed to determine the frequency of Simon’s bleedings in the lumbar region of the spinal column in cases of hanging. The authors prospectively studied 178 consecutive cases of hanging deaths.

Fracture of throat skeleton was detected in 128 cases of hanging (72%). The hyoid bone fractures were indentified in 56 cases of hanging (31,5%). Horn thyroid cartilage fractures were found in 101 cases of hanging (56,8%). The occurrance of fractures of throat skeleton was independent of gender, age, weight and completeness of victim’s body suspension. There was significant correlation between occurance of neck injuries and the location of the ligature knot ($p=0,0249$), however the results suggest that the hyoid bone horn and horn thyroid cartilage injuries are not reliable in reconstruction of the ligature knot location. A possible mechanism of these fractures is direct pressure that the horns of these structures exert on to the spine as well as indirect, caused by the stretching of lateral thyroid ligament and thyroid membrane. Amussat’s sign was found in 29 out of 178 cases of hanging (16,1%). A statistically significant association between occurrence of ruptures in the intimal layer of carotid arteries and the victims’ age was discovered ($p<0,05$). The occurrence of Amussat’s rupture was independent of gender, weight, completeness of victim’s body suspension and position of the ligature knot on the neck. The most probable mechanism causing occurrence of ruptures in the intimal layer of carotid arteries is a combination of direct compression by ligature and indirect stretching mechanism due to the gravitational drag of the weight of the body.

Clavicular haemorrhages of the sternocleidomastoid muscles were detected in 110 out of 178 cases of hanging (62%). A statistically significant association between occurrence of haemorrhages and completeness of victim’s body suspension was discovered ($p=0,046$) as well as a significant association between occurrence of haemorrhages and the position of the ligature knot on the neck ($p=0,008$). The occurrence of clavicular haemorrhages of the sternocleidomastoid muscles was independent of age, gender, and weight. The most probable mechanism causing occurrence of haemorrhage is indirect stretching mechanism due to the gravitational drag of the weight of the body.

Simon’s haemorrhages were found in 65 out of 178 cases of hanging (37%) and also in 17 cases in a group of 350 controls with various causes of death. Simon’s haemorrhages can be considered as an objective vital finding which is not absolutely specific for hanging. This study suggests that Simon’s bleedings in cases of hanging are more frequent in rather young individuals ($p<0,001$), in cases with free body suspension ($p<0,001$) and in individuals with minimal degenerative changes in the lumbosacral part of the spinal column ($p<0,001$). Simon’s bleedings, in cases of hanging, most likely occur due to agonal convulsions and forced movements in lumbosacral part of spinal column. Additional factor for the appearance of Simon’s bleedings in hanging is traction of body and especially this part of spinal column due to gravity.

Keywords: hanging; neck injury; autopsy; Simon’s bleedings; asphyxia; vital sign