

Mechanical asphyxia due to biological agents. Case report and literature review

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Abstract: A 54-year-old man, working as a shepherd, was found dead in a valley, at the bottom of a natural pit, by the family members. The pit had very steep walls, was 3,5 meters deep and had a diameter of about 10 meters. The investigators stated that most probably, some sheep fell into the pit, the shepherd lowered himself there in order to bring them out, but unfortunately the rest of the sheep followed him into the pit, thus collapsing over him and preventing him to get out. At the scene of investigation there were found 75 dead sheep, covering the dead body and surrounding him. A medico-legal autopsy was performed, followed by histological and forensic toxicology analysis. Autopsy revealed advanced putrefaction, a vital sternal fracture and generalized atherosclerosis. The toxicological exam showed an alcohol blood concentration of 2,80 g/l. Therefore, taking into account the onsite scene investigation, the autopsy findings and the ancillary examinations, the death was considered violent, produced by an accidental traumatic asphyxia due to biological agents (sheep), this being a unique case in the activity of the Department of Legal Medicine.

Key Words: thoracoabdominal asphyxia, biological agents, accidental death.

Asphyxia is defined as any condition that leads to tissue oxygen deprivation [1]. Some common causes are hanging, drowning, suffocation, lodging of a foreign body in the air passages, inhalation of smoke and poisonous gases, and trauma to or disease of the lungs or air passages, etc. Compressive asphyxia is a particular type of asphyxia that occurs when a heavy weight presses down on an individual's chest or upper abdomen, making respiration impossible. In most of cases, the forensic literature presents patients that suffered crushing injuries at work or were run over by motor vehicles [2]. At autopsy, there is congestion of the head, neck, and upper trunk with numerous petechiae in these areas, the sclerae, the conjunctivae and the periorbital

skin. Retinal hemorrhages may also be present. Internally, there is often no evidence of trauma in spite of the heavy weight on the chest. From the juridical point of view, traumatic asphyxia is mostly accidental, and very rarely homicidal or suicidal.

Literature review

We tried to present a literature review of the fatal situations in which biological agents acted upon a human body mechanically, and thus inducing traumatic asphyxia, but the examples found were very scarce (see Table 1). However the ones we did find were part of both the forensic and the clinical medicine literature. One of the most famous examples is presented by Dr. DiMaio [3]

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Table 1. Literature examples of asphyxia due to biological agents

Type of asphyxia	Biological agent
Traumatic asphyxia by compressing the chest and abdomen	Sheep/Cows/Horses
Traumatic asphyxia by constricting the chest and abdomen	Python [3]
Obstruction of the lower airways	Round worm [4]
Obstruction of the upper airways	Leech [5, 6]
Airway obstruction	Live fish [7, 8, 9, 10, 11]

and refers to a 5-month-old infant killed by a python. The snake wrapped itself around the baby, tightening its coils whenever the child exhaled. At autopsy, the only marks on the child were teeth marks on the face where the snake had tried to swallow the child whole (his head was too big for the snake’s mouth).

The following examples refer to asphyxia due to different types of parasitic worms which managed to enter the human respiratory tract either from the external environment or endogenous. One author [4] described a case of fatal asphyxia by a 13 cm long round worm that obstructed the lower respiratory tract, which had migrated from the small intestine that was studded with numerous (counted to be 36) round worms. Another report described a rare case of respiratory distress and hemoptysis due to laryngeal leech (*Hirudo medicinalis*) infestation[5]. *Hirudo medicinalis* may be life threatening due to airway obstruction, because the parasite can stick to the mucosal surface of the larynx. Another author describes a case of leech infestation that lead to upper airway obstruction causing suffocation and death[6].

And finally, another author presented a case of a fisherman who swallowed a live fish which resulted in severe upper airway obstruction [7]. To celebrate his first catch of the day the fisherman opened his mouth with his tongue protruding, and kissed the live fish. While doing so, the fish slipped through his fingers and lodged in his hypopharynx. Airway obstruction from the ingestion of a live fish is rare and usually fatal. A similar example is presented by doctor Pinheiro *et al.*, who [8] reported the choking death of a healthy fisherman who put a live sole between his jaws to free up his hands so that he could collect more fish to put into his basket. The fish squirmed into the larynx and upper trachea; attempts by his colleagues to rescue the man using pliers did not succeed, and the man died. At postmortem examination, the fish’s head was pointing down the fisherman’ throat, and the fins and spines were firmly attached to the tracheal mucosa, which explains why the fish was unable to be removed by bystanders. The authors stated that it was impossible to remove the fish by using external manoeuvres or instruments even during autopsy, and only sectioning of the trachea with scissors allowed the release of the fish. Three other deaths from airway obstruction due to swallowing a whole fish are also reported in the medical and forensic literature [9-11].

Other examples we heard of from our colleagues’ practice include cases of cows and horses that fell on the

farmer’s bodies and consequently killing them, but none of them has ever been recorded in a scientific paper.

CASE REPORT

A 54-year-old man, working as a shepherd, was found dead in a valley, at the bottom of a natural pit, by the family members. He worked for the owners of the sheep he was herding, who after realizing he had been missing for several days, they suspected he might had stolen the sheep and fled their village. Consequently they announced the Police, who discovered his dead body under a pile of dead sheep, at the bottom of the natural pit. The pit had very steep walls, was 3,5 meters deep and had a diameter of about 10 meters. The investigators stated that most likely, some sheep fell into the pit, the shepherd lowered himself there in order to bring them out, but unfortunately the rest of the sheep followed him into the pit, thus collapsing over him and preventing him to get out. At the scene of investigation were found 75 dead sheep, covering the dead body and surrounding him. Due to the fact the death was considered to be suspect of being violent, a medico-legal autopsy was ordered by the Police officials.

Autopsy findings:

External examination revealed signs of advanced putrefaction such as “tête de nègre”, hair detachment, posthumously circulation, putrefaction emphysema, darkening of the skin, scrotal edema. There hadn’t been noticed any visible signs of violence.

On close inspection, the internal examination showed a vital fracture of the sternum at the junction of the second and third segment with a dark-violet blood infiltrate at that site. The pleural cavities had no pathological content. Other significant pathological findings except a certain degree of myocardial sclerosis and aortic and coronary atheromatosis hadn’t been found.

The toxicological exam revealed an alcohol blood concentration of 2,80 g/l. Histological examination revealed general changes due to autolysis. Therefore, taking into account the onsite scene investigation, the autopsy findings and the ancillary examinations, the death was considered violent, produced by an accidental traumatic asphyxia due to biological agents (sheep), this being a unique case in the activity of the Department of Legal Medicine.



Figure 1. A natural pit containing dead sheep.



Figure 2. Dead body of a shepherd at the bottom of the pit, following the removal of the dead sheep.



Figure 3. External exam of the dead body.



Figure 4. Vital fracture of the sternum.

DISCUSSION AND CONCLUSION

Compressive asphyxia, also known in the Romanian literature as “thoraco-abdominal compression” is a violent cause of death that usually occurs accidentally, when a heavy object compresses the abdomen and thoracic region, making thus the respiration impossible [12]. Other authors, refer to compressive asphyxia as being a type of mechanical asphyxia, where respiration is prevented by external pressure

on the body, at the same time inhibiting respiratory movements and compromising venous return from the head [13]. The syndrome of compressive asphyxia has been reported regularly in medical publications since its initial description by D'Angers Ollivier following his observations on the cadavers of people trampled upon during crowd disturbances in Paris on Bastille day 1837 [14].

The typical range of the duration of compression is between two and five minutes [15]. The duration and the weight of compression affect the outcome following traumatic asphyxia. Considerable weight can be tolerated for a short period, whereas a comparatively modest weight applied for a longer period may result in death [16]. Classically [17], when taking into account an adult person, the necessary amount of weight needed to produce deadly asphyxia, stretches between 50 kg and 100 kg (in the case of athletic subjects). This type of asphyxia can be explained by two possible thanatogenetic mechanisms [18]: the mechanic-anoxic mechanism (the air cannot be inspired) and the hemodynamic mechanism (the stagnation of the blood – “stagnant anoxia”). The rise in intrathoracic pressure determined by a crushing injury causes the blood from the right side of the heart and great thoracic veins to be ejected cephalad [19].

Among those found at highest risk for traumatic

asphyxia are people ejected from motor vehicles, persons who are run over by motor vehicles or men working under cars that are inadequately supported and fell onto the victims [20]. Other causes include industrial accidents, farm accidents [21] heavy machines, furniture and, rarely, deep sea diving, epileptic seizures and asthma [22].

In medico-legal terms, the traumatic factors are represented by any brutal agents acting on the body, causing as a consequence of this, illness or death. Forensic pathology classifies these traumatic factors into five categories: mechanical, physical, chemical, biological, and psychological [12].

In the paragraphs above we observed that the usual circumstances under which such deaths occur refer to accidental landslides, avalanches, demolished walls, overturned vehicles etc. We observe that the main characteristic of the objects “incriminated” in the previous enumeration is that all of them are lifeless, and can be

included in the mechanical category of traumatic agents. Thus, obviously the asphyxia resulting from compressing the body by these factors is being called “traumatic (mechanical) asphyxia”. In this case report we present a compressive asphyxia due to a living creature (sheep); therefore this type of traumatic agent is biological. This is unusual because, usually biological agents refer to the harmful action of enzymes, insects, animals, microbes, mushrooms, which lead to death through bites, stings, ingestion, etc. In our case however, victim’s death occurred due to the mechanical action of the biological agent, being an association between asphyxia and biological trauma. From these viewpoints, our case is obviously different than the typical compressive asphyxia and moreover its particularity comes from the way a person can die - he wanted to save a sheep probably made some noise, causing the other sheep to come and fell into the pit (due to the well known “herd effect”), and finally killing him.

References

- Richards EC, Wallis ND: Asphyxiation: a review. *Trauma* 2005; 7:37–45.
- Lee MC, Wong SS, Chu JJ, Chang JP, Lin PJ, Shieh MJ, Chang CH. Traumatic asphyxia. Twenty-seventh Annual Meeting of The Society of Thoracic Surgeons. The Annals of Thoracic Surgery. Volume 51, Issue 1, January 1991, Pages 86–88. doi:10.1016/0003-4975(91)90456-Z.
- Di Maio DJ, Di Maio VJM. *Forensic Pathology*. 2nd ed. Boca Raton: CRC Press; 2001.
- Dhruv VK, Gonnade U, Garg SP. Suspected snake bite turning out to be death due to choking round worm infestation – a case report. *JIAFM*, 2005 ; 27 (2). ISSN 0971-0973.
- Ulkumen B, Yilmaz S. A rare cause of respiratory distress and hemoptysis: Laryngeal leech infestation. *Pak J Med Sci* 2012;28(3):543-545.
- Mekonnen D. Leech infestation: the unusual cause of upper airway obstruction. *Ethiop J Health Sci*. Vol. 23, No. 1. March 2013.
- Tam T, Weinberg L, Edington J. Airway obstruction from accidental ingestion of a live fish. *BMJ Case Rep* 2013. doi:10.1136/bcr-2013-010486.
- Pinheiro J, Cordeiro C, Vieira DN. Choking death on a live fish (*Dicologlossa cuneata*). *Am J Forensic Med Pathol* 2003;24:177–178.
- Trevett AJ, Lalloo DG, Kevau IH. A piscatorial epistle. *BMJ* 1992;305:1578–579.
- Pritchard JR. Sudden death by *Lepomis macrochirus* (the killer fish). *Am J Forensic Med Pathol* 1989;10:245–246.
- Deidiker R. Return of the killer fish: accidental choking death on a bluegill (*Lepomis macrochirus*). *Am J Forensic Med Pathol* 2002;23:197–8.
- Perju-Dumbrava D. *Medicina legala (suport de specialitate)*. Chisinau: Combinatul Poligrafic; 2015.
- Sertaridou E, Papaioannou V, Kouliatsis G, Theodorou V, Pneumatikos I. Traumatic asphyxia due to blunt chest trauma: a case report and literature review. Sertaridou et al. *Journal of Medical Case Reports* 2012, 6:257. <http://www.jmedicalcasereports.com/content/6/1/257>.
- D'Angers O. Relation medicale des evenements survenus au Champs de Mars Le 14 Juillet 1837. *Ann d'Hyg* 1837;1 8:485-489.
- Fred HL, Chandler FW. Traumatic asphyxia. *Am J Med* 1960; 29: 508–517.
- Campbell-Hewson G, Egleston CV, Cope AR. Traumatic asphyxia in children. *J Accid Emerg Med* 1997; 14: 47–49.
- Dermengiu D. *Medicina legala – note de curs*. Bucuresti: Editura universitara; 2001.
- Iftenie V, Dermengiu D. *Medicina Legala*. Editia a II-a. Bucuresti: Editura C.H. Beck; 2014.
- Herbert LE, Chandler FW. Traumatic asphyxia. Elsevier. September 1960. Volume 29, Issue 3, DOI: [http://dx.doi.org/10.1016/0002-9343\(60\)90046-2](http://dx.doi.org/10.1016/0002-9343(60)90046-2).
- Skalar DP, Baack B, McFeeley P, Osler T, Marder E, Demarest G. Traumatic asphyxia in New Mexico: A five-year experience. DOI: [http://dx.doi.org/10.1016/0735-6757\(88\)90003-4](http://dx.doi.org/10.1016/0735-6757(88)90003-4).
- Karamustafaoglu YA, Yavasman Y, Tiryaki S, Yoruk Y. Traumatic asphyxia. *Int J Emerg Med* (2010) 3:379–380. DOI 10.1007/s12245-010-0204-x.
- Lowe L, Rapini RP, Johnson TM. Traumatic asphyxia. *J Are Acad Dermatol* 1990; 23: 972–974.