


CASE REPORT

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Accidental and occupational ligature strangulation in northern Tunisia: four-case study

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Abstract

Background: Death by strangulation is a violent and frequent method of homicides. Strangulation is rarely accidental due to ligature which is caused by a wide variety of objects such as cords, ropes or clothing articles (scarves). It concerns mostly accidents at work, rarely road traffic accidents and domestic ones. We report four cases of occupational and accidental strangulation causing death.

Case presentation: In our cases, the ligature link was a scarf or a towel. The link was caught on the belt of a tractor in two cases: on a drill pipe and on a combine harvester. Death occurred on site in three cases. The external examination has marked an asphyxia syndrome associated with a large strangulation mark. Furthermore, the autopsy findings have revealed large ecchymotic infiltrations of the neck muscles, a rupture of the trachea, and the oesophagus with a disjunction of cervical vertebra with a contusion of the spinal cord.

Conclusions: The ruptures of the trachea, oesophagus and cervical vertebra are not classic strangulation lesions but are explained by the brutality and violence of the traction exerted on the neck. We highlight the importance of preventive measures in this accidental type of deaths.

Keywords: Accidental, Autopsy, Ligature strangulation, Occupational

Background

Our work looked into the aspects of accidental and occupational strangulation in Tunisia. It is a four-case report of accidental strangulation autopsied in the Forensic Department of Tunis during the period between 2007 and 2015, which is the only department that performs forensic autopsies (around 2000 per year) of corpses from almost all the northern part of Tunisia (10 out of 24 districts of Tunisia, about 42% of the total population (4.6 million) (National Institute of Statistics, 2017). We reported four cases of accidental strangulation causing the death of four farmers. The lesions found in the external examination and in the autopsy were discussed according to the existing literature. The aim of the study is to discuss through these cases the particular aspects of this rare forensic shape of strangulation, as

well as the prevention of these accidents. The issue of the discussion was to conclude the preventive measures.

Case presentation

Case 1

A 21-year-old healthy man working as a farmer was a victim of an accident while he was working in a field. He was accidentally entangled by a towel that he put around his neck which it was taken in the axle of its tractor. It was wrapped twice around his neck, the anterior left shoulder and the anterior of the thorax. The death occurred immediately.

External examination

Parchment bruising in the basicervical and thoracic indicated a friction of the towel against the skin and a cervical groove, located below, with a wide limit. It is blurry at the posterior and left lateral of the neck (Fig. 1).

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Fig. 1 Shows a parchment bruising in the basicervical and thoracic regions due to a friction of the towel against the skin in case 1

Autopsy findings

Cervical and thoracic subcutaneous emphysema, haemorrhagic infiltration of the neck muscles without rupture in the neck skin and a rupture of the oesophagus and trachea at the third tracheal ring (Fig. 2) were present. The carotid arteries, jugular veins, hyoid bone, thyroid cartilage and cervical spine were intact. We noted asphyxia signs as diffuse visceral congestion, petechial in conjunctivae and a pulmonary and cerebral oedema.

Histopathological examination

Samples of soft tissues (brain, lungs, heart, liver, kidneys, spleen and pancreas) were taken, and a microscopic examination was performed on the samples after being fixed in formalin and stained in the standard coloration “haematoxylin-eosin”. Pulmonary and cerebral oedema were present too but with no other specific lesions.

Toxicological examination

Body fluids (cardiac and peripheral blood, urine) and gastric content were sampled for toxicological investigations. Toxicological analyses were performed and were negative.

The death was attributed to the ligature strangulation due to the pressure of the neck by the bath towel being entangled in the tractor.

Case 2

A 30-year-old woman farm worker died 1 h after her arrival to the emergency department of a regional hospital. She was taken by her colleagues after an accidental strangulation by her scarf which it was caught in the drive of a plow attached to a tractor.

External examination

Apart from a tracheotomy, a basicervical groove, complete and posterior and horizontal to the neck, was present (Fig. 3).

Autopsy findings

Haemorrhagic infiltration of the neck muscles without rupture of the skin was present with a partial rupture of the trachea (Fig. 4). The carotid arteries, jugular veins, hyoid bone, thyroid and cricoid cartilage and the cervical spine showed no lesions. In addition, asphyxia signs were found as a diffuse visceral congestion and a pulmonary and cerebral oedema.

Histopathological examination

Samples of soft tissues (brain, lungs, heart, liver, kidneys, spleen and pancreas) were taken, and a microscopic examination was performed on the samples after being fixed in formalin and stained in the standard coloration “haematoxylin-eosin”. Pulmonary and cerebral oedema were present with no other specific lesions.

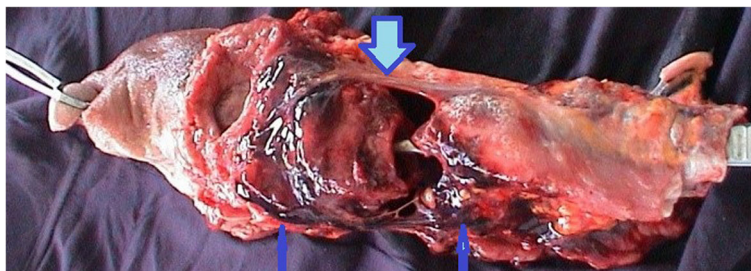


Fig. 2 The thin arrows show a haemorrhagic infiltration of the neck muscles, and the thick arrow shows a rupture of the oesophagus and trachea at the third tracheal ring in case 1



Fig. 3 Shows a basicervical groove complete and horizontal in case 2

Toxicological examination

Body fluids (cardiac and peripheral blood, urine) and gastric content were sampled for toxicological investigations. Toxicological analyses were performed and were negative.

The death was attributed to the ligature strangulation due to the pressure of the neck by the scarf being entangled in the tractor.

Case 3

A 32-year-old farmer was a victim of an accident at his work. He was accidentally strangled by a towel which he put around his neck. The towel was taken by a drill pipe of a well. He died on the spot.

External examination

Cervical groove much marked in the posterior neck was present with no other injuries.

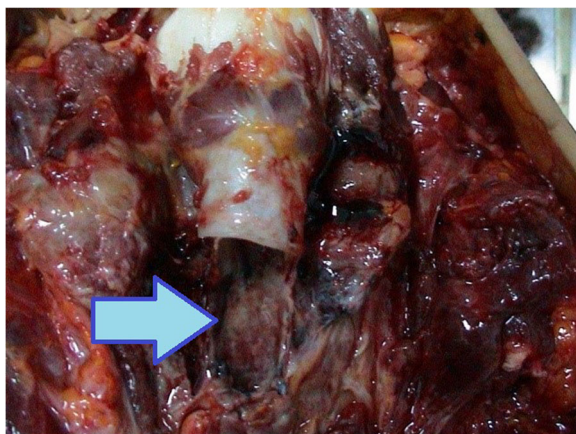


Fig. 4 Shows a partial rupture of the trachea in case 2

Autopsy findings

Bleeding in the muscles of the neck and a tracheal rupture were present at the autopsy. Although petechial haemorrhages were found in the bilateral palpebral conjunctivae, epicardium and scalp, there were no gross abnormalities, other than congestion, were found in other organs.

Histopathological examination

Samples of soft tissues (brain, lungs, heart, liver, kidneys, spleen and pancreas) were taken, and a microscopic examination was performed on the samples after being fixed in formalin and stained in the standard coloration "haematoxylin-eosin". Pulmonary and cerebral oedema were present with no other specific lesions.

Toxicological examination

Body fluids (cardiac and peripheral blood, urine) and gastric content were sampled for toxicological investigations. The Toxicological analyses were performed and were negative.

The death was attributed to the ligature strangulation due to the pressure of the neck by the towel being entangled in the machine.

Case 4

A 41-year-old farmer was a victim of an accident at his workplace. He was accidentally strangled when his scarf was entangled in a combine harvester while he was in a go-to harvest field. He died on the spot. The sudden and brutal pressure on the neck made severe lesions.

External examination

A soft link (scarf) was presently wrapped around the neck doing two laps without any node. After the removal of the link, we noted the presence of a cervical bottom groove, posterior and left lateral (Fig. 5). This groove was ecchymotic parchment with fuzzy boundaries.

Autopsy findings

Cervical and thoracic subcutaneous emphysema and a disjunction fracture C5–C6 (Fig. 6) with a contusion of the spinal cord (Fig. 7) were present without a rupture of the cervical skin. The carotid arteries, jugular veins, hyoid bone, thyroid and cricoid cartilage and cervical spine showed no lesions. Asphyxia signs as facial and ungual cyanosis, congestion of the viscera and petechial haemorrhages of the conjunctivae were also present.

Histopathological examination

Samples of soft tissues (brain, lungs, heart, liver, kidneys, spleen and pancreas) were taken, and a microscopic examination was performed on the samples after being fixed in formalin and stained in the standard coloration



Fig. 5 Shows a cervical bottom groove, posterior and left lateral in case 4

“haematoxylin-eosin”. Pulmonary and cerebral oedema were present with no other specific lesions.

Toxicological examination

Body fluids (cardiac and peripheral blood, urine) and gastric content were sampled for toxicological investigations. The Toxicological analyses were performed and were negative.

The death was attributed to the ligature strangulation due to the pressure of the neck by the scarf being entangled in the machine.

Discussion

Strangulation is a common way for homicides (Aggarwal and Agarwal 1998; Shetty and Shetty 2006; Deidiker 1999; Gupta et al. 2004; Kohli et al. 1996; Verma et al. 2005; Verma and Lal 2006). Although accidental strangulation is rare, it is occasionally reported knowing that the circumstantial evidence alone can indicate the nature

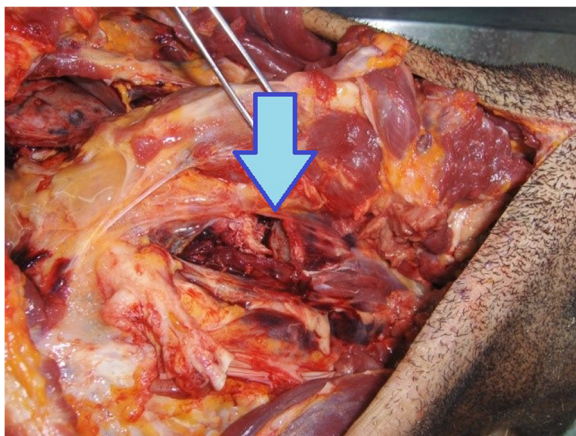


Fig. 6 Shows a disjunction fracture C5–C6 in case 4

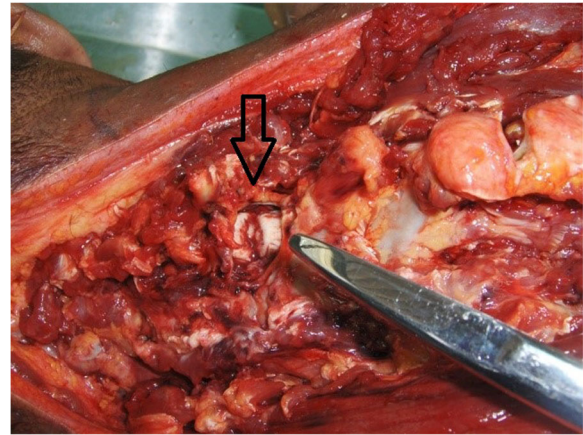


Fig. 7 Shows a contusion of the spinal cord in case 4

of the occurrence. Accidental strangulation is uncommon but more frequent in children (accidental hanging) or elderly persons (Aggarwal and Agarwal 1998; Kohli et al. 1996). However, cases of accidental hypoxia after auto-erotic deaths and after thefts were also reported in the literature (Saukko and Knight 2016).

The cause of death in our cases was asphyxia. It was secondary to brain vessel occlusion in two cases, to tracheal disruption in one case and to a cervical contusion in another case. Petechiae and congestion are caused by an acute rise in venous pressure. Congestion is often associated with tissue swelling. The oedema is the result of a fast transudation, within few minutes, through the capillary and venule walls. It concerns essentially the brain and the lungs.

In cases 2 and 4, cervical and thoracic subcutaneous emphysema were also reported in the autopsy findings. This particular and antemortem sign was already described in the literature and explained by any cause of sudden increase in intra-alveolar pressure (e.g. blunt trauma, tracheal intubation or an interruption of respiratory mucosa) (Saukko and Knight 2016).

The mechanism of death depends on two factors: the amount of resistance made by the victim and the amount of force of the moving machine. In some cases of accidental strangulation, death was due to the compression of the neck leading to tracheal and esophageal disruption. It was reported in the literature that about half of the cases of ligature strangulations may show the fracture of the neck structures (Souza et al. 2013).

In our study, an unusual case of fracture and dislocation of the cervical vertebra inducing accidental ligature strangulation was reported (case 4). Fracture and dislocation of the cervical vertebra are seen in hangings associated with a long drop or with a heavy body, but it is not reported in ligature strangulation. We assumed that the great force exerted by the combine harvester caused

Table 1 Important findings in the case reports

Case	Age	Sex	Occupation	Strangulation link	External examination	Autopsy findings
1	21	M	Farmer	Towel	Posterior and left lateral cervical groove	Subcutaneous emphysema Haemorrhagic infiltration of the neck muscles Rupture of the oesophagus and trachea
2	30	F	Farmer	Scarf	Posterior and horizontal cervical groove	Haemorrhagic infiltration of the neck muscles Partial rupture of the trachea
3	32	M	Farmer	Towel	Posterior cervical groove	Haemorrhagic infiltration of the muscles of the neck Tracheal rupture
4	41	M	Farmer	Scarf	Posterior and left lateral cervical groove Fuzzy boundaries	Disjunction fracture C5–C6 Contusion of the spinal cord next

probably a violent hyperextension of the neck causing the disjunction of the cervical vertebra and the contusion of the spinal cord. In hangings associated with a long drop or with a heavy body, lesions are much more severe with total separation of the vertebra and a rupture of the spinal cord (Saukko and Knight 2016).

In adults, accidental ligature strangulation usually involves an article of clothing (Aggarwal and Agarwal 1998; Shetty and Shetty 2006; Deidiker 1999; Kohli et al. 1996; Verma et al. 2005) becoming entangled in some moving machine causing a major constriction of the neck. In our cases, machines responsible for this kind of strangulation were tractors, a combine harvester and a well drive pipe. In literature, we have seen also motor vehicles, industrial machinery, household objects and ironing machines (Aggarwal and Agarwal 1998; Shetty and Shetty 2006; Gupta et al. 2004; Kohli et al. 1996; Verma et al. 2005; Verma and Lal 2006). As stated, the common mechanism in this type of strangulation is the progressive constriction of the neck made by an article of the victim's clothing.

A striking fact that has been noticed, in the literature, is the frequency of the phenomenon of accidental strangulation in India (Aggarwal and Agarwal 1998; Shetty and Shetty 2006; Gupta et al. 2004; Kohli et al. 1996; Verma et al. 2005; Verma and Lal 2006; Verma 2007; Chattopadhyay and Pal 2008; Singh et al. 2003). This frequency is probably related to particularities of clothing ("chunni" around the neck) and the means of transport used in this country (tricycles with unprotected wheels).

Various cases of accidental strangulation have been reported in children and infants (Aggarwal and Agarwal 1998; Saukko and Knight 2016). These children became entangled mostly in cords while playing.

Autopsy findings are important to distinguish between the forensic forms of death (Table 1). In homicides, we find other intricate traumatic lesions and specially defensive lesions. In suicides, we find generally a psychiatric disorder and self-injuries. The accidental assumption is retained after the investigation has eliminated homicide or suicide, especially if the witnesses were present and the circumstances of death were clear.

This particular mode of accidental death shows the importance of careful and proper handling of the mechanical device, even the most innocuous ones, for the prevention of these work accidents. It also sheds the light on the importance of the prevention of domestic accidents including infants by watching them carefully and protecting windows. A strict implementation of dress code and abandoning loose apparel is needed in such workplaces. In India, using protection while driving and avoiding chunnies while taking transports may be a means to prevent these accidents (Verma 2007; Saukko and Knight 2016).

Conclusions

Accidental strangulation remains rare. It returns especially within the framework of an industrial accident (clothes stuck in machines). Particular findings such as tracheal and esophageal disruption and cervical vertebra disjunction are uncommon but were also found in our cases.

The prevention of this type of accident often goes through simple and effective measures such as respect for the work uniform and the awareness of the workers.

Authors' contributions

Every author contributed by reassembling and taking the pictures of each case and by discussing these cases by reviewing the literature. YN, MG and AM participated in the last revisions. All authors read and approved the final manuscript.

Authors' information

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Ethics approval and consent to participate

Ethical approval was obtained from the ethics committee.

Consent for publication

Yes

Competing interests

The authors declare that they have no competing interests.

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