



Case review

Neck injury patterns resulting from the use of petrol and electric chainsaws in suicides. Report on two cases



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ARTICLE INFO

Article history:

Received 16 December 2013

Received in revised form

5 February 2014

Accepted 15 April 2014

Available online 29 April 2014

Keywords:

Suicide

Neck injuries

Petrol chainsaw

Electric chainsaw

ABSTRACT

Suicides due to neck injuries caused by chainsaws are uncommon events. The cutting elements of petrol and electric chainsaws produce different features in lethal neck injuries. The accurate evaluation of the death scene, of the power and mechanical characteristics of the chainsaw and of wound morphology are all essential in distinguishing a case of suicide.

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1. Neck injuries in chainsaw suicides

Suicides committed using a chainsaw are uncommon and highly damaging events.^{1–6}

The victims, frequently suffering from mental disorders, apply the cutting attachment to the back or side of the neck, to the lower part of the head or to the throat, while more unusual suicides involve the lethal self-mutilation of arms, thorax or abdomen.^{1–8}

The application of the guide bar to the neck or lower part of the head produces deep, lethal wounds involving the tegumental areas, muscle, bone, nerves and spinal cord, which cause a rapid demise due to exsanguination and collapse due to the interruption of spinal sympathetic fibres.^{1,9,10}

Analysis of the death scene and related circumstances may sometimes be inconclusive, with forensic investigators having initial difficulty in differentiating between suicide and homicide events.⁹

In the event of a chainsaw-related death it is essential that the following steps are taken in order to determine whether a suicide or homicide has been committed: an accurate reconstruction of the event, the scrupulous investigation of the death scene, the

reconstruction of the victim's psychiatric history or the prior experience of handling chainsaws or similar tools, and the execution of appropriate autopsy examinations.

Furthermore, a comparison of the macroscopic morphology of the neck and head wounds with the power and mechanical characteristics of the chainsaw found near the corpse should confirm whether that tool was in fact used and to differentiate between the use of a petrol or electric chainsaw.

Schiwy-Bochat et al. and Reuhl et al. described the typical morphology of neck injuries caused by the use of chainsaw as consisting of one main lesion involving the skin and the underlying anatomical planes caused by rough and deep cutting into and removal of the tissues, which may produce contused and irregular skin flaps at the initial point of contact and penetration of the surface tissues by the chain teeth.^{3,9}

The main cut is generally straight but may present some tags in the side walls which are extensively contused.^{3,9,11}

Wound morphology is determined by the shape of the saw teeth whose perpendicular cutting surfaces are designed to cut and remove wood (see Fig. 1).¹

As a result, the wounded tissue is cut, bruised, chewed and coarsely removed while the margins of the wound may often be contaminated with foreign oily substances, sawdust or wood chips, bark, grease, bacteria or fungal microspores normally lodging on the chain and teeth.^{9,11}

The teeth's chewing effect produces an accumulation of coarser, heavier fragments of tissue below the cutting attachment while

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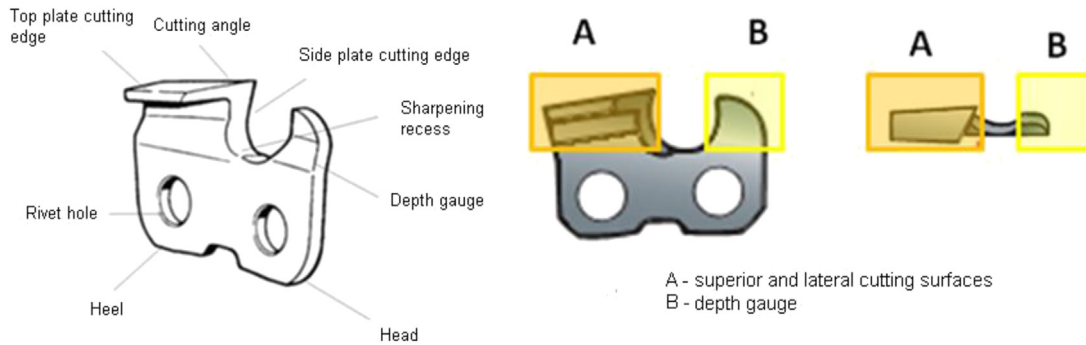


Fig. 1. Saw chain element.

smaller, lighter fragments of tissue and blood are normally launched ahead from the tip of the bar.¹²

Schiwy-Bochat et al. reported that the saw teeth normally slip off the skin on initial contact with surface tissues but, after increasing manual pressure, the saw penetrates the deeper tissues causing lethal wounds to the deep vessels and nerves of the neck as far as the cervical spine bones.³

When the chain hits bone, in the absence of sufficient manual pressure applied by the operator, the dangerous phenomenon known as “kickback” may occur, with the guide bar bouncing back and causing small, secondary, smooth-edged, parallel wounds above the deep primary wound, which may also be enlarged.^{9,10,15,16}

The wounds caused by kickback may be morphologically different from tentative wounds caused by multiple applications of the bar and may be distant from the main wound and generally less deep.

The main wound caused by a chainsaw might, in some cases, appear to have been caused by a homicidal attack with a chopping device or an axe because its edges may in some areas present a raised flap. However, the edges of a wound caused by a chainsaw are generally more irregular, bruised and ragged when compared with those caused by a steel blade.⁹

Autoptic macroscopic and histological confirmation of the vitality of the margins of the main wound are mandatory, in order to exclude the presence of post-mortem cross-cutting wounds on the corpse, inflicted after the subject had been killed by means of a chainsaw or other tools or weapons.

Moreover the evaluation of the blood level of carbon monoxide and aromatic compounds from unburned lubrication oil absorbed through the alveolo-capillary membrane, may confirm that the subject breathed exhaust fumes from the chainsaw immediately before death.¹⁸

Tournel et al. reported that the mechanical vibrations produced by a chainsaw may also cause lesions when the tool is used on the human body.¹⁰

The severity of these wounds is a consequence of the amplitude, frequency and duration of the vibrations and the density of the part of the body in question.

The greater the density, the greater the transmission of mechanical waves and their fragmentation effects, especially in bone.

Tournel et al. reported that lesions of the cervical area due to vibrations may appear at frequencies near 50–60 Hz, while in the case of frequencies approaching 100 kHz the vibration energy is transmitted in the form of destructive waves so that the damage to the cervical vertebrae or the basal bones of the skull presents as multiple fractures or crumbling.^{2,10}

In the case of vibrations above 100 kHz the destructive compressive waves will increase and give rise to a macerated appearance in the deepest internal areas of the lateral walls of the wound and will involve bone, cartilage (periarticular, thyroid, hyoid, tracheal rings), ligaments, tendons, and soft tissues such as muscles, blood vessels and nerves.¹⁰

The angle of incidence between the longitudinal axis of the neck and the longitudinal axis of the guide bar is generally less than 90°, since the handgrip of the chainsaw is held down and the bar is held up, while the angle of incidence between the longitudinal axis of the neck and the transverse axis of the bar can be more or less than 90°, because the bar is generally held against the neck with a rotation of its transverse axis, depending on how the chainsaw is held by the subject.

The duration of the manual pressure applied to the throttle trigger switch is generally no longer than a few seconds due to reaction to the perceived pain and the loss of consciousness induced by neurovascular lesions, so that a complete suicidal decapitation in reality never occurs because the chain does not keep running when the trigger is released and because the chainsaw generally falls from the hands of the victim.

Overall the depth and the seriousness of the injuries caused by a chainsaw are influenced by a combination of the variables such as the intensity and duration of the force applied to the guide bar held against the neck, the size, weight and power of the chainsaw used, chain velocity, chain acceleration and deceleration time, vibrations delivered, the sharpness of the cutting elements, and the pitch and depth gauge settings.

The width of a wound also varies according to the lateral oscillation of the saw because the subject does not have full manual control over the tool and because of the vibrations generated by the engine.¹¹

Those who stand while applying the chainsaw to the neck, may take a few steps before losing consciousness and falling to the floor while the saw comes to a standstill and is retrieved at a certain distance from the corpse with the engine either still running or off.

The presence of footprints in blood on the floor, with the chainsaw lying some metres away from the corpse, might suggest homicide rather than suicide (the victim having apparently been pursued by an attacker wielding the chainsaw).^{9,11}

Various authors have described and differentiated the typical morphological features of wounds to the neck or basal areas of the skull produced by petrol and electric chainsaws observed during post-mortem examination.^{9,10}

Reuhl et al. reported the features of conspicuous neck wounds caused by petrol chainsaws as consisting of deep, gaping injuries, measuring several centimetres in width and several centimetres in length, with the edges mostly torn and ragged.⁹

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