

CASE REPORT

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Suicide by the Use of a Chain Saw

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ABSTRACT: The paper describes a case of suicide by the use of a chain saw. Visceral and tissue damage caused by vibrations are documented in occupational medicine, but fatal damage is not often seen at autopsy. This paper gives an account of the damage to viscera and tissues that has been noted when strong vibrations of low frequency have been directed to the body for a very short time with fatal result after a few minutes survival time.

KEYWORDS: pathology and biology, chain saws, suicide, vibrations

A 54-year-old man was found dead in his kitchen one afternoon. The following investigation revealed that he had tried to cut his chest with a knife, and had then told his mother-in-law, who was in the house, that he knew a more effective way, apparently to commit suicide. He had then gone into a shed in the garden where he had sawed his chest with an electric chain saw. His mother-in-law ran to a neighbor for help, and then saw the victim return into the house, bleeding. At the request of the mother-in-law the neighbor called the police and an ambulance. When they arrived at the house some 20 to 25 minutes later the man was dead. The electric chain saw and its immediate vicinity were covered with blood, hair, and bone fragments. The victim for some time had suffered from an alcohol problem for which he had been hospitalized once. Three weeks before his death he had received a gastric lavage after taking an overdose of tranquilizers. A week before his death he had told his wife that he would kill himself with the chain saw.

The saw has a 1200-W, 220-V, 56-Hz engine, and a weight of 4.4 kg (Fig. 1). The length is 60 cm including the projecting rim of the chain. The chain's number of revolutions is 9.5 per second. It is not difficult for an adult person to hold the saw with the tip of the steel rim against his chest. It is estimated that the man worked the saw on himself for a few seconds, definitely less than a minute.

Autopsy Findings

The man was 169 cm tall and weighed 89 kg. The hypostatic lividity was clearly visible and rather dark, suggesting that the bleeding had not been very severe. At the bend of the left elbow were three shallow 1- to 3-cm long slashes. These were obviously hesitation cuts inflicted

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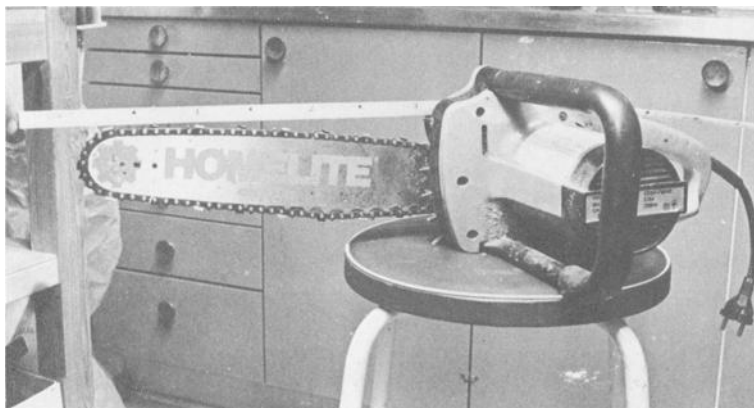


FIG. 1—*The chain saw.*

with the knife. In the midline of the chest was a 32-cm longitudinal wound that showed marks of bleeding but was not gaping except for the upper part where a 10-cm-long and 3.5-cm-wide opening in the skin and subcutaneous fat revealed the sternal bone in which the bone marrow was visible in a 6-cm-long and 0.5-cm-wide furrow, obviously caused by the chain saw (Fig. 2). The sternum was not perforated and the connective tissue at the back of the sternum was intact.

The right lung had collapsed and measured 14 by 11 by 5 cm. The pulmonary tissue of the right lung was light grayish pink. The left lung had not collapsed. Its parenchyma was slightly rubbery and its color was a little darker than that of the right lung. On the surface of the lungs there were emphysematous bullae of varying sizes. There were no signs of other pulmonary diseases. The chain had not torn the pulmonary tissue. There was no bleeding into the pleural spaces, and the pulmonary artery, trachea, and bronchi were intact. There were no changes in the cerebral tissue and the cerebrospinal fluid was clear. The larynx was of normal appearance.

The pericardial sac was not injured, and there was no blood in the pericardial space. The heart was moderately enlarged, weighing 450 g, with slightly atheromatous coronary arteries and with no visible changes in the cardiac muscle. There was no air in the cardiac ventricles. The gastrointestinal tract showed no pathological changes. The liver weighed 2260 g and showed severe fatty change. The renal tissue was pale, suggesting antemortem hypotension. The medulla of the adrenal glands was slightly hyperemic. There was no bleeding into the thoracic or abdominal cavities.

Examination of the microscopic sections revealed slight hyperemia of the tissue of the right lung and small foci of hemorrhage in the tissue of the left lung and in the kidneys. The sample of blood and urine did not contain alcohol. No toxic matter was found in the viscera. A small amount of dimethyl diazepam was found in the liver sample.

Based upon the autopsy findings, the vibrations of the chain saw caused emphysematous bullae to burst which resulted in pneumothorax, the apparent cause of death.

Discussion

The human body reacts in various ways to vibrations, depending on their amplitudes, frequencies, durations, and the parts of the body that are subjected to the vibrations. If the frequency is below 2 to 3 Hz the body reacts as an entity. If the frequency is less than 18 Hz each "blow" will be felt separately. Each tissue has its own physical properties with regard to vibrations, and the tissues react to the vibrations in various ways. The different parts of the organism have their own ranges of resonance; the lumbar region and the vertebral column react



FIG. 2—Anterior view of the deceased, showing a 32-cm-long slash in the midline of the chest. In the upper part of the slash, there is a 10-cm-long wound caused by the chain saw. Note hesitation cuts at the bend of the left elbow.

strongly to vibrations of 5 Hz, and the thoracic and abdominal organs to vibrations of 3 Hz [1]. The head is sensitive to vibrations of 20 to 30 Hz [2]. The abdominal wall reacts maximally to a frequency of 5 to 8 Hz and the anterior thoracic wall reacts to a frequency of 7 to 11 Hz [3,4].

At low vibration frequencies, that is, below 100 Hz, the human body can be described as one mechanical system. At higher frequencies up to some 100 kHz the vibration energy proceeds like waves and at still higher frequencies (100 kHz through MHz frequencies) the compression waves dominate. These waves proceed through the medium in a manner that is similar to radiation.

Direct visible lesions caused by vibrations are seldom seen in humans, except changes in the hands of persons who for a long time have worked with pneumatic drills. Mice [5] and rats [6] have been killed through exposure to vibrations. The experiments showed that the lethal effect depends on frequency and is connected to resonance frequencies in the viscera with subsequent tearing of the tissues. Mice can be fatally injured after a few minutes exposure to 15 to 20 g with frequencies of 15 to 25 Hz. Rats died after a 5- to 30-min exposure to vibrations at some 10 g. The lungs and hearts of the rats were frequently injured, but cerebral damage, which mainly consisted of superficial hemorrhage, was not often seen. In humans severe chest pain has been noted when the force of vibration has exceeded 3 g, and intestinal bleeding has been noted after exposure to 6 g at 20 to 25 Hz for 15 min.

Summary

Deaths in which vibration plays a crucial role are not often seen at autopsy. In occupational medicine damage to the bones of the hands occurring after longtime use of tools with low frequency engines and damage to small blood vessels occurring after longtime use of engines of higher frequencies have been well documented.

This case demonstrates the types of damage to viscera and tissues that have been noted when violent vibrations of low frequency have been directed to the body for a very short time with fatal result after a few minutes survival time.

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