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Physical activity following fatal injury from sharp pointed weapons

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Abstract Cases of suicide from sharp pointed weapons ($n = 12$) witnessed by one or more persons are reported with regard to the potential for physical activity. One case each involved the ulnar artery, the great saphenous vein and the periphery of the lung and liver and the physical activity following these injuries lasted for several hours. In one case, the left carotid and vertebral arteries were transected and the physical activity lasted for approximately 10 s. An extraordinary case involved a protracted incapacitation due to heart tamponade from a small myocardial injury caused by a cannula. In the remaining seven cases, a stab wound to the heart was present. With regard to the physical activity, a long-term group (2–10 min, $n = 4$) can be differentiated from a short-term group (approximately 10 s, $n = 2$) and one case of immediate incapacitation. The size of the myocardial perforation was 7–10 mm in length in the long-term group compared to 1.4–2 cm in the short-term group. So small perforations of the heart or incisions of the carotid artery offer a potential for considerable physical activity. Large perforations of the heart or a transection of the carotid and vertebral arteries can result in short-term activity.

Key words Sharp force · Knife · Suicide · Physical activity · Incapacitation

Introduction

Estimating the potential for physical activity following a fatal injury can gain major importance in the reconstruction of the events (Karger 1997). In court, questions concerning the time until collapse and the type of physical activity possible for the victim are frequently raised in homicide cases. One method of investigating the potential for physical activity is the correlation of post-mortem

findings with reliable witness accounts of the incident. However, witnesses of homicide can be biased because they participated in the events or are associated with one of the parties involved. Therefore, suicides from sharp force which have been witnessed by another person were chosen for this investigation instead of homicides. Suicides and homicide victims usually show similar injuries with regard to the critical organs wounded and the witness accounts are more reliable in suicides.

Material and methods

An evaluation was carried out on 65 consecutive suicides from sharp pointed weapons from autopsies carried out at the Institute of Legal Medicine, University of Münster. In 12 of these cases, the suicidal action and the subsequent behaviour were witnessed and these cases were examined using the autopsy records and the prosecution department records including the police report and the witness testimony. In one case two police officers were present and in two cases several persons witnessed the incident. The wife or a close relative was present in the remaining cases. Several suicides occurred in highly emotional marital situations. Homicide could be ruled out beyond any reasonable doubt in every case.

Case reports

Brief descriptions of the individual cases supplement the summary given in Table 1.

Case 1

A nurse cut her right wrist. Her son forced her to apply dressings and left her while she apparently was in a stable condition but found her dead when he returned.

Case 2

A man incized the great saphenous vein 2 cm in length. In order to support the bleeding, he applied the muscle pump and took a hot bath similar to historical Roman suicides. Death occurred after approximately 7 h while his wife was present most of the time.

Table 1 Summary of the 12 suicide cases involving sharp pointed weapons

No.	Sex/age	Type of injury	Organs injured	Cause of death	Witness	Physical activity	Survival time
1	f/48y	cut right wrist	transection ulnar artery	exsanguination	son	applied dressings, walked (approx. 4 h)	> 6 h
2	m/42y	cut left ankle	incision great saphenous vein	exsanguination	wife	took a bath (> 5 h)	approx. 7 h
3	m/23y	stab right chest	lung, liver, pericardium	exsanguination (haemothorax)	wife	removed knife, walked (> 2 h)	2 days
4	m/46y	cut left neck	transection of carotid and vertebral arteries	exsanguination	wife	walked 10 m (approx. 10 s)	short
5	m/37y	puncture left chest	puncture wound left ventricle	heart tamponade (600 ml blood)	wife	walked, concealed injury (approx. 2 h)	approx. 3 h
6	m/37y	stab left chest	incision right ventricle 1 cm in length	heart tamponade (400 ml blood)	> 10 persons (pub)	removed knife, sat down (approx. 10 min)	> 1 h
7	m/22y	stab left chest	incision left ventricle 8 mm in length	heart tamponade (300 ml blood)	2 police officers	collapse after 3 min	approx. 20 min
8	m/32y	stab left chest	incision left ventricle 1 cm in length	exsanguination	wife and friends	talked, walked 10 m (approx. 3 min)	2 days
9	m/27y	stab left chest	incision left ventricle 7 mm in length	exsanguination (haemothorax)	wife	sat down, talked (approx. 2 min)	approx. 20 min
10	m/36y	stab right chest	incision right ventricle 1.4 cm in length	heart tamponade (250 ml blood)	wife	removed knife (approx. 10 s)	approx. 20 min
11	m/40y	stab left chest	incision right ventricle 2 cm in length	heart tamponade/exsanguination	sister	walked, talked (approx. 10 s)	approx. 15 min
12	m/26y	stab left chest	incision left ventricle 1.5 cm in length	heart tamponade (450 ml blood)	father	immediate collapse	approx. 30 min

Case 3

The man stabbed himself in the right chest during a dispute with his wife. The injuries to the lung and liver were located at the periphery of the organs and the physical activity was not affected. Surgery was not performed and the man died 2 h later. Haemothorax at the right side (2200 ml blood) and haematoperitoneum (700 ml blood).

Case 4

While sitting at a table in the living room the man completely transected the carotid and vertebral arteries, which resulted in a complete stop of the blood flow to the brain on one side. He then stood up and walked 10 m to the corridor where he collapsed.

Case 5

A former drug addict punctured the anterior wall of the left ventricle with a long cannula. The resulting small perforation caused a heart tamponade (600 ml blood) and the man collapsed 2 h later. During this period he was able to conceal the injury from his wife who was present all the time.

Case 6

The man stabbed himself in the left chest while in a public house and immediately removed the flick knife. A friend then seized the knife, which afforded considerable force. The man subsequently sat down on a chair and waited for transport to a hospital.

Case 7

Several police cars pursued a car and managed to stop it on a motorway. The driver stabbed himself in the left chest while sitting in the car and collapsed after 3 min when the police officers broke the window glass.

Case 8

The man stabbed himself in the left chest in his restaurant while his wife and guests were present. He immediately removed the knife, threw it away and followed his wife to the door where he at first fell to the ground but soon rose again. He talked for several minutes in a sitting position.

Case 9

The man stabbed himself in the left chest in a standing position, sat down on a sofa and talked with his wife. Haemothorax at the left side (2800 ml blood).

Case 10

The man immediately removed the knife after he had stabbed himself in the right chest and collapsed approximately 10 s later.

Case 11

After the man had removed the knife from his left chest his sister slapped him in the face because she thought he only wanted to frighten her by sticking the knife between his chest and arm. The man then said: "If this is not enough..." and put the knife to his neck but collapsed. The cause of death was most likely a combination of exsanguination (haemothorax, 1600 ml blood) and heart tamponade (150 ml blood).

Case 12

The man immediately collapsed from a standing position with the knife still in the chest.

Except for cases 2 (razor blade) and 5 (cannula), all weapons used were kitchen or flick knives. The injured organs listed in Table 1 are not complete in all cases because, for example, most injuries to the heart also involved the ventral lung. All injuries to the heart only perforated the anterior wall. In four cases, additional cut injuries were present which did not damage major vessels or penetrate a body cavity. The survival time was not strictly correlated to the latent period until incapacitation (Table 1). Alcohol was found in six cases varying from 0.48 g/l (case 2) to 2.71 g/l (case 11). Toxicological investigations were performed in four cases but the results were negative. The previous social and medical history included suicide attempts (cases 1, 2, 9, 10, 12) or psychiatric therapy (cases 1, 5, 8, 9, 11, 12) in 8 out of the 12 cases. Suicide notes were not found.

Discussion

Suicide in the presence of another person is rare and indicates a psychiatric disorder (Friedrich-Schöler and Friedrich 1980) or a highly emotional situation and a spur-of-the-moment decision (Mueller 1933; Weimann 1933). Therefore, suicide notes were not present and the suicides came as a surprise to the witnesses. However, the male sex of most suicides, the presence of alcohol in half of the cases and especially the high frequency of previous psychiatric disorders does not markedly differ from the 53 sharp force suicides without witnesses autopsied at our Institute or from a series of 51 cases investigated by Start et al. (1992).

The fatal outcome in cases 1 and 2 was more surprising than the extensive latent period until incapacitation. Bleeding from distal extremity arteries (case 1) is frequently limited by contraction and subsequent invagination of the vessel wall (Staubesand 1957; Treske 1963). Lengthwise and incomplete crosswise severance of the vessel can obstruct this spontaneous arterial hemostasis (Sigrist and Dirnhofer 1983) but in case 1, a complete crosswise transection was present. Exsanguination from a peripheral vein (case 2) is a very rare event which can be favoured by coagulopathy or increased intravascular pressure (Rabl and Sigrist 1992). These factors were excluded in case 2 where the suicide took considerable measures to bleed to death. In case 3, surgical intervention would most likely have prevented the death. In case 4, the estimated period of 10 s until collapse corresponds to the oxygen reserve stored in the brain. But if the blood flow is not completely prevented on one side, the physical activity can last for minutes. This is illustrated by an additional case which was not witnessed, where the suicide transected the left common carotid artery and incised the jugular vein 5 mm in length. A bloodstain pattern led from the living room down a flight of stairs to the cellar where abundant bloodstains were concentrated around a drain on the floor. In an attempt to clean the floor, the man had even used a sheet to wipe off some of the blood. In case 5, the very small size of the myocardial perforation enabled the man to conceal the injury in the beginning, which is similar to a case described by Shiono and Takaesu (1986).

The remaining seven cases (cases 6–12) involve larger perforations of the heart. The physical activity witnessed lasted for 2–10 min in four cases (cases 6–9), the physical activity was restricted to approximately 10 s in two cases (case 10, 11) and it was absent in one case (case 12). The incision in the myocardium was longer in the short-term or no activity group (1.4–2 cm, cases 10–12) than in the long-term group (7 mm–1 cm, cases 6–9) and short-term activity appears to be associated with heart tamponade (Table 1). In a large series of 72 stab wounds to the heart, Geringer (1919) found that incisions of 1.5 cm or longer and those perforating two myocardial walls cause rapid incapacitation. Consequently, considerable physical activity is more likely if the myocardial perforation is small and exsanguination rather than heart tamponade is the cause of death but heart tamponade can also develop slowly (cases 6, 7). The reason for this variable effect of intrapericardial blood is probably that the pressure inside the pericardium depends not only on the amount of blood but also on the speed of bleeding and on the elasticity of and drainage from the pericardium.

Thoresen and Rognum (1986) found physical activity documented in only 21% of fatalities from sharp force. This is very low and could be due to a different method of assessing physical activity. In a series of 39 stab wound fatalities, Staak and König (1977) found at least a small degree of physical activity in every case. Spitz et al. (1961) investigated 49 homicidal stab wound fatalities of which 25% collapsed at the site of injury. Since not all injuries involved the heart, this result is surprising when compared to this series. The reason is probably that suicides anticipate a severe injury and can therefore use the potential for physical activity more often than homicide victims, who are frequently taken by surprise. Compared to fatal gunshot wounds, fatal injury from sharp force offers more potential for physical activity (Spitz et al. 1961; Staak and König 1977; Levy and Rao 1988). Also, the survival time in victims from sharp force is longer (Spitz et al. 1961; Levy and Rao 1988) and the mortality rate is lower (Beall et al. 1972; Demetriades and van der Veen 1983; Marshall et al. 1984) compared to gunshot victims. The reason is the nature of the injury, i.e. slit-like wound configurations in sharp force versus gaping defects in gunshots (Spitz et al. 1961). Tissue elasticity can narrow or even close the slit-like injury, which is uncommon in gunshot wounds. Therefore, the speed of blood loss is commonly lower in stab wounds and the potential for physical activity, even if the heart is injured, should not be underestimated.

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