



Original communication

The hazard of sharp force injuries: Factors influencing outcome



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ABSTRACT

The risk of dying from sharp force injury is difficult to ascertain. To the best of our knowledge, no study has been performed in Norway regarding mortality due to sharp force injury or factors that impact survival. Thus, the objective of the present study was to investigate and assess mortality in subjects with sharp force injury. This retrospective study comprises data on 136 subjects (34 female, 102 male) with suspected severe sharp force injury (self-inflicted or inflicted by others) admitted to Haukeland University Hospital between 2001 and 2010. The majority of subjects were intoxicated, and the injury was most often inflicted by a knife. The incidence of sharp force injury in Western Norway is similar to the incidence in other European countries. Almost half of the subjects with self-inflicted injury died. In cases with injury inflicted by another individual, one in five died. Mortality rates were higher in those with penetrating chest injuries than those with penetrating abdominal injuries and higher in cases with cardiac injury compared to pleural or lung injury. Sharp force injury can be fatal, but the overall mortality rate in this study was 29%. Factors influencing mortality rate were the number of injuries, the topographic regions of the body injured, the anatomical organs/structures inflicted, and emergency measures performed.

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1. Introduction

In court, forensic pathologists are often asked, “How dangerous is a knife injury?” The underlying question is, “What is the risk of dying from sharp force injury?” Therefore, the primary purpose of the present study was to assess mortality in victims of sharp force injuries. We investigated this issue in surviving and deceased victims of sharp force injury admitted to Haukeland University Hospital. We studied subjects with sharp force injury inflicted by others or by the subjects themselves according to The World Health Organisation’s definition of violence¹: “The intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment or deprivation.”

The incidence of sharp force injury in Western Norway is difficult to ascertain, as such patients are treated in different health facilities (e.g., general practitioners, local accident and emergency departments, and hospitals) and there is no coordinated recording of all sharp force injuries. In addition, an unknown proportion of subjects with sharp force injury never seek any treatment. Also, criminal statistics do not provide the full picture, as many victims do not press legal charges, supposedly because of low confidence in the police and justice system.² Between 2001 and 2007, all types of violence were between 2.5 and 3.3% of all crimes reported to the police in Western Norway.³ At the accident and emergency department of Bergen, 10% of assaulted patients are treated for minor sharp force injury.² The real incidence of self-inflicted sharp force injury is also difficult to estimate, as it frequently occurs in secret and the injuries are often superficial, not requiring medical attention.^{4,5} The Child and Adolescent Self-harm in Europe (CASE) study has estimated a lifetime prevalence of all acts of self-harm in Norway to be 16% for women and 5% for men.⁶ According to the homicide statistics of the National Criminal Investigation Service (NCIS), 50% of all homicides in Norway in 2011 were caused by sharp force injury.⁷ According to Statistics Norway, sharp force

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injury caused between 2.1 and 3.6% of all suicides in Norway between 2001 and 2010.⁸

Inclusion criteria and registration procedures vary in different studies of victims of sharp force injury, making a comparison of the success ratios difficult. This study includes subjects with severe injuries or injuries suspected of being severe enough to be admitted to hospital, as well as those who died at the scene. Only one study from Oslo has assessed survival time after sharp force injury in Norway, but all of the cases had fatal outcomes.⁹ To the best of our knowledge, no study has been performed in Norway regarding the mortality rate of sharp force injury and factors that impact survival.

2. Material and methods

Haukeland University Hospital serves as the local hospital of Bergen, the central hospital of Hordaland County, and the regional hospital of Hordaland, Rogaland, and Sogn and Fjordane Counties,¹⁰ covering a population of 996,712 inhabitants in 2009.^{11–13} Data included deceased and surviving subjects with sharp force injury considered severe or potentially severe who were brought to the hospital between 1 January 2001 and 31 December 2010.

We included subjects with self-inflicted injury and those with injury inflicted by others. Subjects with sharp force injuries due to accidents were excluded. The study subjects resided mainly in Bergen, the second largest city of Norway, and its surrounding municipalities.

Data were obtained from the database of the emergency department, the database of the Norwegian Air Ambulance Service, and from the archive of forensic reports in The Gade Laboratory of Pathology. The Trauma Coordinator of Haukeland University Hospital provided additional data for the years 2009 and 2010 from a new database established in 2009 with new registration procedures. Medical records from surviving patients comprised as little as one short page with limited information to several pages. Post-mortem examinations included an assessment of injuries, and in most cases a toxicology report based on analyses of fluid or tissue samples (e.g., blood, urine, psoas major muscle, or vitreous humour).

In deceased subjects, the levels of ethanol and drugs were determined, but in surviving subjects the levels of substances were not often given in the medical records. Therefore, substances were simply recorded as being present or absent in the blood, urine, psoas major muscle, or vitreous fluid. In deceased subjects, postmortem fermentation of ethanol was verified by the presence of metabolic products of ethanol, ethyl glucuronide and ethyl sulphate.

Significance was determined by chi-square tests using SPSS PAWS Statistics, versions 20 and 21. Diagrams were created in Excel (version 2007 and Mac 2011).

The following parameters were recorded: age, perpetrator–victim relationship, scene of event, nationality, weapon/tool used, date of event, number of injuries, anatomical regions injured, organ injury, toxicology results, and treatment. The subjects were grouped according to whether the injuries were self-inflicted or inflicted by others, and by outcome (non-fatal or fatal) and gender.

Subjects were scored according to the Injury Severity Score (ISS) in order to compare our results to those of other studies (Appendix 1). A high ISS is associated with poor performance status/potentially fatal injury. When an ISS was not in the medical records, we calculated it based on the information available.

3. Results

3.1. Characteristics of the study population

The study population included 34 women and 102 men divided into four groups (Table 1). Surviving victims with sharp force

injury inflicted by others were assigned to group 1 (n = 72). Victims of homicide by sharp force injury were group 2 (n = 17). Surviving victims with self-inflicted sharp force injury were group 3 (n = 25). Victims of suicide by sharp force injury were group 4 (n = 22).

Grouping subject ages in intervals of 10 years revealed that the age distribution was different in the groups ($\chi^2 = 63.7$, $df = 18$, $p = 0.001$), with the lowest median age in group 1 and highest in group 4. Subjects who survived an attack (group 1) were younger than subjects who were killed in an attack (group 2), and subjects who survived self-inflicted injury (group 3) were younger than those who committed suicide (group 4). Comparing the first and last 5 years of the study period, we found a 47% increase in sharp force injury due to an increase in males in groups 1 and 4. However, the increase was not significant.

Gender proportions were different in the four subject groups ($\chi^2 = 17.6$, $df = 3$, $p = 0.001$). Among attacked individuals (groups 1 and 2), there were gender differences in perpetrator/victim relationships. A considerable proportion of female victims (39%) had sharp force injury inflicted by a past or present intimate male partner (spouse, co-habitant, or boyfriend), and 56% of these subjects died. In contrast, 9% of male victims were attacked by female intimate partners, and all survived.

The scene was unknown in 40% of the cases in group 1, most related to male victims, reflecting that these subjects claimed to have been attacked by a stranger. In all other groups, a private home was the predominant scene of events (68–82%) ($\chi^2 = 44$, $df = 21$, $p < 0.002$).

In our study population, 81% of the subjects were of Norwegian nationality. The distribution of subjects of non-Norwegian nationality was unevenly distributed between the groups. The proportion of subjects of non-Norwegian nationality was highest in group 1 (28%) ($\chi^2 = 8.6$, $df = 3$, $p = 0.034$).

3.2. Weapon

In 83% of the incidents, a knife was the weapon used to inflict the injury. In 8% of the cases, broken glass was utilised (predominantly in group 1), and in the remaining cases various tools and sharp objects (e.g., scissors, screwdriver, and bayonet). We found no significant differences in regards to the weapon used in relation to subject group, gender, or mortality outcome.

3.3. Time of incident

In groups 1 and 2, a higher occurrence of events occurred on the weekend than in the earlier days of the week. In groups 3 and 4, events were evenly distributed throughout the week. This difference was not significant. In the total study population, most sharp force incidents occurred in the summer.

3.4. Ethanol and drugs

Levels of ethanol and drugs were determined in deceased subjects (groups 2 and 4) and in surviving subjects (groups 1 and 3) if given in the medical records. In surviving subjects, the levels of substances most often were not given in the medical records, just the presence. This made it impossible to compare surviving and deceased subjects in regard to levels of substances.

Ethanol, drugs, or both were detected in 79% of the subjects. The highest proportion of subjects under the influence of ethanol only or both ethanol and drugs was in group 1. The highest proportion of subjects under the influence of drugs only was in group 3 ($\chi^2 = 71.5$, $df = 12$, $p < 0.001$; Fig. 1). Ethanol, drugs, or both were detected in a higher proportion of males than females (83% and 65%,

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