

## Research Article

# Management of gunshot wounds in a scandinavian hospital

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## Abstract

**Background:** The aim of the present study was to investigate the incidence and outcome for gunshot wounds (GSW) patients within a metropolitan city in the western region of Sweden, as well as the predictive value of the triage and decision system used in the Prehospital as well as the hospital setting. **Methods:** All patients with GSW admitted to the Sahlgrenska University Hospital during a three-year period were included in this retrospective analysis. Data were collected from the pre hospital and hospital records. **Results:** There were a total of 44 patients with 88 GSW, ranging from 1 to 8 in each patient. Injuries to neck/head, thorax and abdomen (n=22) were equally present as Injuries in the extremities (n=22). The average ISS score was 14±16 and the overall mortality after 30 days was 14%. In patients with injuries in the extremities no mortality was seen. **Conclusions:** The incidence of GSW in Sweden is still low, as well as GSW related hospital mortality. The present triage and decision system, using both vital signs and injuries in a prehospital trauma algorithm, has a good predictive value for the two-tiered trauma team activation system used.

## Introduction

The global burden of health threats includes, beyond infectious diseases, cardiovascular diseases and malignancies, as well as trauma including increased violence [1]. Gunshot Wounds (GSW) and deaths significantly contribute to this burden of violence [2]. In some countries, the firearm is the most frequently used weapon for homicide and suicide [3,4]. Suicide seems to be more common in rural communities, while homicide is more common in urban communities [5].

Around the world the rate of firearms in homicide varies depending on both national statistics and type of society. Other factors of importance in more developed countries are gang cultures and the use of drugs [6,7]. Global demographic variations in poverty, unemployment rates and urbanization could increase the risk of firearm-related violence [8]. In addition, local and regional proliferation of firearms into civilian populations could also increase the incidence of firearm-related injuries [9]. In this perspective, it is of vital importance that trauma surgeons and emergency physicians are updated with the management of GSW.

In Scandinavia, as in many other parts of Europe, violence constitutes an important focus for the public and political debate on crime. However, a review of serious injuries and deaths from GSW between 1987-1994 indicate that the incidence in Sweden is low, with some regional variations [10]. These variations might in part be related to fighting between different criminal constellations.

In this paper we report our experience of GSW from our ED and Trauma Unit at Sahlgrenska University Hospital.

## Patients and methods

Gothenburg is the second largest city in Sweden, with a population of approximately 600,000. The Accident and Emergency Department at Sahlgrenska University Hospital, with 48,000 annual visits serves as an urban, academic teaching hospital. The Trauma Unit at Sahlgrenska University Hospital deals with about 1,100 Trauma Team Activations (TTA)/year, the vast majority of them being blunt injuries.

All patients (n=44) admitted to the ED at Sahlgrenska University Hospital with GSW from 1 January 2006 to 31 December 2008 were included in this retrospective analysis. Data were collected from the prehospital and hospital records. All patients had a prehospital triage according to METTS-T (Medical Emergency Triage and Treatment System - Trauma), which is used as a two-tiered TTA system at the hospital [11].

Differences between the groups were handled by Student's t-test. The statistics were handled by SPSS 17.0.

## Results

The patient population consisted of 41 men and 3 women. Mean age was 31±11 years with no difference between male and female patients. These 44 patients had sustained 88 GSW, ranging from 1 to 8 in each patient. During the pre-hospital care all patients were assigned into either level 1 or level 2 TTA group, according to the METTS-T

Protocol (Table 1).

The localization of the wounds was in level 2 TTA group in all cases to the extremities, while in level 1 TTA group, head/neck, thorax and abdomen were frequent (Table 2).

All patients with injuries of head/neck, thorax and abdomen were categorized to the level 1 TTA group according to the METTS-T protocol. The total mortality in this material was 14%. There was no mortality in patients who were categorized to a prehospital level 2 TTA group, while in the level 1 TTA group the mortality was 16% (Table 3).

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**Table 1.** Descriptive data for patients

	Level 1 TTA n=37	Level 2 TTA n=7	p-value
Age	31±11	30±15	ns
Number of shots	2.25±1.7	1.0±0	<0.005
ISS	14±16	4±4	0.05

Level 1 TTA  
n=37  
Level 2 TTA  
n=7  
P-value  
Age 31±11 30±15 ns  
Number of shots 2.25±1.7 1.0±0 <0.005  
ISS 14±16 4±4 0.05  
ISS Injury Severity Score  
TTA Trauma Team Activation

**Table 2.** Localization of wounds

	Level 1 TTA n=37	Level 2 TTA n=7	Sum
Head/neck	4	0	4
Thorax	11	0	11
Abdomen	7	0	7
Extremities	15	7	22
<b>Total</b>	<b>37</b>	<b>7</b>	<b>44</b>

Level 1 TTA  
n=37  
Level 2 TTA  
n=7  
Sum  
Head/neck 4 0 4  
Thorax 11 0 11  
Abdomen 7 0 7  
Extremities 15 7 22  
Total 37 7 44

**Table 3.** Outcome at day 30

	Level 1 TTA n=37	Level 2 TTA n=7	Percent
Discharged	27	7	77%
Emergency Hospital	4	0	9%
Dead	6	0	14%

Level 1 TTA  
n=37  
Level 2 TTA  
n=7  
Percent  
Discharged 27 7 77 %  
Emergency hospital 4 0 9 %  
Dead 6 0 14 %

These 6 patients with fatal outcome had sustained GSW to the head (n=1), abdomen (n=1), neck (n=1) or thorax (n=3). All of them had lost one or more 'signs of life' (carotid pulse, breathing efforts, pupillary reflexes) in the prehospital setting (during transport or in the ambulance bay) and had ongoing CPR upon entering the trauma bay.

Four patients were intubated during the ambulance run and the remaining 2 in the ED. One patient became subject to an emergency department thoracotomy revealing 3 separate GSW to the heart, including the left ventricle. The other patients were declared dead in the ED after unsuccessful resuscitation attempts.

## Discussion

In this three-year material from the ED at Sahlgrenska University hospital it was shown that patients sustaining GSW could safely be divided into two main groups; those with no prehospital signs of organ failure in combination with injuries to the extremities have a low risk for fatal

outcome, while those with injuries in other parts of the body and prehospital signs of organ failure are associated with a higher risk of mortality.

These findings are in accordance with results from other studies. Porteous et al reported in 1997 that the highest mortality rates in a UK urban environment occurred in patients sustaining GSW to the head, neck and/or chest, while those with injuries to the abdomen or extremities had either a lower or no mortality [12]. A follow-up study has recently been published, which finds little change in incidence or characteristics of those injured and attending an urban ED over a ten-year period [13].

The pre-hospital primary assessment of patients with GSW should be focused on signs of organ failure such as increased respiratory rate, low oxygen saturation, increased heart rate, low systolic blood pressure or decreased Glasgow Coma Scale, and to the identification of major injuries including (catastrophic) external bleeding. This forms the basis for activation of the trauma team, either as a full or more selective activation. The present study shows that the two-tiered TTA system as predicted by the METTS-T protocol is reliable and safe to use. It is of major importance that the TTA is based on both vital signs and injuries, thus giving the ED and the Trauma Team information on these prognostic factors, before the patient actually arrives at the ED [14].

On arrival at the ED the patient is re-evaluated according to the ATLS® protocols, followed by a structural process to avoid hypothermia as well as fluid overload during the resuscitation phase. After life threatening injuries have been ruled out or taken care of, injuries to the extremities should be further investigated with focus on the presence of vascular, nervous or skeletal injuries. Comparison of the systolic blood pressures between an injured and uninjured extremity using a hand-held Doppler is useful to verify or rule out a vascular injury. Clinical examination and plain x-rays will diagnose most fractures.

Classification of the wound into a high- or low-energy type of injury will dictate the need of a formal surgical debridement in the OR. High-energy GSW with moderate to severe soft tissue destruction also require intravenous antibiotic treatment, whereas the administration of prophylactic antibiotics to civilian patients with low-energy GSW has been debated [15].

## Conclusion

In this small number of cases from the ED at Sahlgrenska University hospital, it was shown that patients with GSW already in the prehospital setting could be divided into two main groups; those with vital signs without deteriorations and extremity wounds, with no risk of mortality, and those with deteriorations in vital parameters and wounds in other areas associated with a higher risk of mortality. It was also shown that a two tiered TTA system, such as METTS-T, is reliable and useful and had a predictive value in patient outcome.

The low incidence of GSW in Scandinavia implies that the experience of each surgeon in dealing with these cases in general is low. However, it is a necessity that trauma surgeons have a thorough understanding of the principles of ballistic injury, and are familiar with the nature of low and high-energy transfer wounds to soft tissue.

Until recently most male surgical residents in Sweden have been subject to a certain amount of training in war surgery during their conscript military service. Sweden has now abandoned the conscript system, and is along with many other countries in Europe continuously downsizing its military forces. In the future, the principles for management of GSW to a larger extent need to be incorporated in the civilian surgical training.

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