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Factors affecting survival following self-inflicted head and neck gunshot wounds: a single-centre retrospective review

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Abstract. Self-inflicted head and neck gunshot wounds are a common modality of suicide in the USA. This study reviewed all self-inflicted head and neck gunshot wound patients with complete records ($n = 157$) treated at a tertiary centre between 2002 and 2012 inclusive. The associations between mortality and patient/clinical variables were evaluated with the χ^2 test or Fisher's exact test for statistical difference testing. Outcomes recorded were death ($n = 92$, 59%), discharge to long-term care/rehabilitation ($n = 58$, 37%), and discharge home ($n = 7$, 4%). The majority of patients were male (86.6%) and single/separated/divorced (55.5%). The mortality rate by site, in descending order, was temporal 82%, frontal scalp 69%, submental/intraoral 30%, and neck 25%. Involvement of the central nervous system ($n = 127$) resulted in a 70% mortality, but a lower mortality was observed among patients with an avulsion injury ($P = 0.025$). A tracheostomy within 24 h of admission was statistically associated with improved survival ($P < 0.001$), but confounding factors were found. Multivariate analysis revealed increasing age, temporal entry site, and the severity of central nervous system involvement to be positively associated with an increased mortality.

Key words: suicide; gunshot; head and neck.

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Suicide was the tenth leading cause of death in the USA in 2013, and firearms were used in more than 50% of suicide deaths ($n = 21{,}175$).[1] Self-inflicted head and neck gunshot wounds (SIHNGSWs) result in a relatively high mortality rate.[2] Intentional self-inflicted gunshot wounds are a particularly distressing injury, and patients surviving the initial injury can be left with severe physical, mental, and psychological injuries. No matter how a gunshot wound is sustained, the same principles of initial management apply, as outlined in the Advanced Trauma Life Support (ATLS) protocol.[3] Gunshot wounds may be classified as non-penetrating (where the projectile only abrades skin or causes a thermal injury), penetrating (where the projectile enters the facial complex but does not exit), perforating (entry and exit points present), or avulsive (projectile enters and exits with substantial tissue loss).[4,5] There is a relative lack of information surrounding factors predictive of survival from SIHNGSWs due to the high lethality before hospitalization. The purpose of this study was to identify factors that affect survival within this group of patients.

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Materials and methods

Patients admitted to a tertiary care trauma centre with a SIHNGSW between January 2002 and December 2012 inclusive were studied retrospectively. The study was approved by the institutional review board. All patients with a documented SIHNGSW who presented alive were included. Head and neck gunshot wounds that were not self-inflicted and those for which records were incomplete were excluded.

Data were collected through a chart review, review of the radiological findings, and if present, the autopsy report. A single physician performed the chart review and recorded each subject's age, sex, marital status, admission Glasgow Coma Scale (GCS) score, and gunshot wound characteristics, including the site of entry, size of the entry wound (<1 cm or >1 cm), structures traversed, the site and size of the exit wound (<1 cm or >1 cm), if applicable, and if it was an avulsive wound or not. Gunshot wounds were classified into four categories as defined in the Introduction. If the bullet was documented or noted to have entered the cranial cavity, or the initial GCS score was <9, the case was documented as 'CNS involved'. Admission laboratory data collected included complete blood count, coagulation profile, and toxicology screen results. All transfusions within 24 h of admission were recorded. Surgical treatments, including the timeline when performed, were collected. Outcomes at the time of hospital discharge included discharge to home, discharge to a rehabilitation centre, or death.

To aid data analysis, patients were classified into subgroups based on the bullet entry site (temporal, frontal, intraoral, submental, or neck), injury characteristics (entry size, presence and size of an exit wound, avulsion injury), and comorbidities (depression, previous self-harm), and subgroups were compared with respect to clinical outcomes.

The statistical analysis was performed using the χ^2 test or Fisher's exact test. The level of statistical significance was set at $P < 0.05$; all tests were two-sided. The analysis was performed using SAS 9.2 software (SAS Institute Inc., Cary, NC, USA).

Results

One hundred and sixty-one patients were seen with a SIHNGSW during the selected study period. Four patients were excluded due to incomplete data, leaving a total of 157 subjects. The majority were male (86.6%) and single/separated/divorced (55.5%); mean age was 44.9 years (range 18–88 years).

Increasing age was associated with poorer survival ($P = 0.033$), as shown in Fig. 1. Sex did not influence survival ($P = 0.54$). When marital status was recorded, 44.5% of subjects were married; married patients were found to have a higher mortality rate compared to single patients ($P = 0.006$). An admission GCS score of <9 and involvement of the central nervous system (CNS) ($n = 127$) resulted in a 70% mortality ($P < 0.001$).

Thirty-nine patients (61.9%) with a submental/intraoral entry site had involvement of the CNS, of whom 19 (48.7%) died. Isolated physical compromise of the frontal lobe of the brain without other lobes of the brain being compromised was seen in 45.7% ($n = 16$) of patients with intraoral entry sites and 32.1% ($n = 9$) of patients with submental entry sites. Temporal and frontal scalp gunshot wound injury sites had the highest mortality rates, as shown in Table 1. Entry wound size ($P = 0.8$) and the presence of an exit wound ($P = 0.62$) were not statistically significant in terms of survival; however, an avulsion injury was associated with improved survival ($P = 0.025$). Of those with avulsive wounds, 79% (26/33) had either a submental ($n = 16$) or intraoral ($n = 10$) entry site.

Table 1. Outcome of self-inflicted head and neck gunshot wounds by entry site.

	Death	Rehabilitation	Home
Temporal	63	14	0
Frontal	9	4	0
Intraoral	15	16	4
Submental	4	22	2
Neck	1	2	1

Within the entire patient sample, 25 patients (all with either an intraoral or a submental SIHNGSW) had a tracheostomy within 24 h of admission, which was associated with improved survival ($P < 0.001$). On isolating those with an intraoral or submental SIHNGSW, a tracheostomy in this subset of patients was found not to be correlated with improved survival ($P = 0.353$). Sixty-three patients were taken to the operating room; these patients had a statistically significant survival advantage over those who did not go to the operating room ($P < 0.001$) (Fig. 2). Admission labs were drawn in 138 patients. Toxicology was positive in 66 patients and a positive toxicology result was associated with improved survival ($P = 0.001$).

On univariate analysis, a haemoglobin <9 g/dl ($P = 0.001$) and an international normalized ratio (INR) >1.1 ($P < 0.001$) were correlated with increased mortality; however, transfusing within 24 h was not statistically associated with improved survival ($P = 0.089$). On multivariate analysis, haemoglobin level, INR, and transfusion within 24 h of admission were not statistically associated with mortality (Table 2).

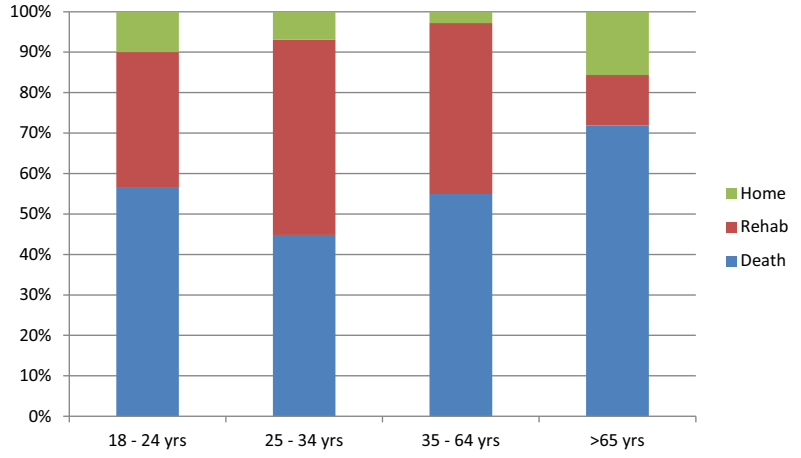

Fig. 1. Outcome of self-inflicted head and neck gunshot wounds by age group; *x*-axis shows the age categories, *y*-axis shows the percentages of subjects.

Discussion

Victims of self-inflicted gunshot wounds perceive this method to have a high lethality, and hence their attempt is not merely a