Traumatic injuries associated with suicide attempts: A retrospective study from single national level 1 trauma center

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ABSTRACT

Background: Suicide is a complex phenomenon involving several risk factors. We aimed to describe the frequency, pattern, and outcomes of patients with traumatic injuries following suicide attempts admitted to a level 1 trauma center.

Methods: We conducted a retrospective analysis of data obtained from Qatar National Trauma Registry and mortuary database. The study included all patients with traumatic injuries following suicide attempts, admitted to the Hamad Trauma Center (HTC) from April 2008 to March 2018.

Results: During this 10–year period, 206 patients were admitted to the HTC for injuries associated with suicide attempts. The majority were males (76%), young age (mean age 31 years), and expatriates specifically from South Asia (55%). The most common injury was due to self-inflicted cutting and piercing (51%) followed by jumping from height (30%). Females chose jumping from high place more often as a method of suicide attempt (59% vs. 20%), while males chose self-stabbing or cutting their throat (59% vs. 25%) (P = 0.001). Most of the patients had head injuries (30%) that was severe in terms of abbreviated injury scale score (3.6 ± 0.9). More than half (54%) of the patients required psychiatric consultations. The in-hospital mortality was 8% which was comparable in both genders.

Conclusions: The present study revealed that 1.8% of trauma admissions at HTC were related to suicidal attempts. Better understanding of risk factors is important in devising preventive strategies.

Key Words: Gender, mortuary, suicide, traumatic injury

INTRODUCTION

Suicide is a serious global public health problem which accounts for approximately 800,000 deaths annually, and it is the second leading cause of mortality among adolescents.1,2 Approximately 30% of all deaths from injuries worldwide were intentional, and homicide and suicide were among the leading causes of deaths in the age group of 15–49 years.3 Suicide are commonly underreported in the Eastern Mediterranean Region (EMR), and the method of suicide in this region differs from other parts of the world.3 A study on various
methods of suicide in the EMR revealed that the most common method of suicide was hanging, followed by self-immolation, and poisoning. These three methods accounted for 77% of all methods of suicide in the EMR; however, poisoning and self-immolation were gender dependent and hanging was country dependent. Only few studies from Arab countries on suicide are available in the published medical literature mainly because cultural and religious factors influence reporting. Data from a psychiatry hospital in Qatar revealed that 165 patients were admitted to the hospital for self-inflicted injuries in a 12-month period; of these, 28% were near-fatal deliberate self-harm. Hanging was the most common method followed by jumping from a height.

Attempted suicide remains as an unmet challenge of the trauma system because of the lack of documentation, countless potential mechanisms of injury, and difficulties in capturing suicidal behavior. The main risk factors for suicide attempts are young age; socioeconomic status; unemployment; mental disorders such as bipolar disorders, depression, and schizophrenia; drug use and alcohol; history of prior attempts, family history of suicide, assault, and head injuries. In addition, not living at home is another risk factor for repeat attempts. The World Health Organization (WHO) reported that the number of suicide attempts exceed the completed suicide by up to 20 times. Suicide attempts often cause severe injuries when compared to unintentional injuries and associated with increased hospital length of stay (HLOS), hospital cost as well as in-hospital mortality. The present study aimed to determine the frequency of various methods of suicide, injury characteristics, and outcomes by gender of patients admitted to a level 1 trauma center in Qatar following suicide attempts.

**METHODS**

A retrospective study was conducted among all patients with traumatic injuries following suicide attempts who were admitted to the Hamad Trauma Center (HTC) between April 1, 2008, and March 30, 2018. The HTC is a national trauma center at the Hamad General Hospital (HGH) under the Hamad Medical Corporation (HMC), Doha, Qatar. The data were obtained retrospectively from the Qatar National Trauma Registry (QNTR) of the HTC which is a database available in both the National Trauma Data Bank and the Trauma Quality Improvement Program of the American College of Surgeons-Committee on Trauma.

Initially, all trauma patients admitted to the HTC in the study duration were identified from the QNTR. Of which, the patients admitted for suicide and self-inflicted injuries were identified using the International Classification of Diseases, Ninth Revision, Clinical Modification Codes (codes E950–959). Patients with nonsuicidal self-inflicted injuries admitted to the hospital and suicide cases brought in dead (BID) to the hospital were excluded from the final analysis. The BID data were obtained from the HMC mortuary database. Self-inflicted drowning and poisonings were not seen and treated at the HTC, were treated at regular emergency department (ED), and therefore were excluded from this analysis.

Data collection included patients’ demographic information (age, gender, and nationality); mechanism of injury (stab or cut injuries, injuries associated with jumping from height or hanging, other multiple mechanisms such as stabbing and jumping from heights or stabbing/cutting and jumping in front of moving vehicle), injury characteristics (abbreviated injury scale [AIS] for head, chest, spine and abdomen; injury severity score [ISS]); and outcomes (length of stay [LOS] in hospital and mortality).

Initially, all patients were evaluated and treated according to the ATLS protocols, and then, the patients underwent surgical and trauma intensive care unit (ICU) care as per the requirement. The survivors were referred to psychiatric services for the assessment of suicidal ideation, for prescribing medications if needed, and to provide postdischarge care in the psychiatry unit. This study was approved by the Institutional Review Board (IRB) of HMC (IRB#16311/16and MRC-01-18-323). This manuscript adheres to the Strengthening the Reporting of Observational studies in Epidemiology guidelines.

**Statistical analysis**

Statistical data analysis was done using SPSS software (Statistical Package for the Social Sciences, version 17.0, SPSS Inc., Chicago, IL, USA). Data were summarized in the form of proportions and frequency tables for categorical variables. Continuous variables were summarized using means, median, and standard deviation. P values were computed for categorical variables using Chi-square test and Fisher’s exact test depending on the size of the data set. Independent student t-test was used for continuous variables. A two-tailed P < 0.05 was considered statistically significant difference.

**RESULTS**

A total of 16,900 trauma admissions were recorded in the QNTR during the study period. Of these, 206 admissions were patients with traumatic injuries resulting from suicide attempts. The mortuary database between March 1, 2008, and December 31, 2015, provided data on 310 BID cases providing a partial picture of suicide cases, resulting in immediate death. However, these cases were excluded in the final analysis and only trauma admissions...
following suicide attempts ($n = 206$) were included in this analysis. Figure 1 shows flowchart for the study design.

Table 1 shows the characteristics of patients by gender included in the study. The mean age of the patients was 31 years, ranging from 10 to 64 years. The most vulnerable age group was 20–40 years ($n = 148, 72\%$); nearly $8\% (n = 16)$ were under the age of 20 years [Figure 2]. The majority of cases were males ($n = 157, 76\%$) and South Asian (55%) migrants. Only 12 (5.8%) were Qatari nationals.

The most common mechanism of injury was self-inflicted stabs or cut wounds in more than half of the victims followed by injuries related to jumping from height in one out of three cases. No firearm injuries were reported [Table 1]. Apart from these external injuries, the most common site of injury was the extremities (31%) followed by the head, neck, or face (30%) and abdomen (25%). The mean AIS was high for head injury victims (3.6) followed by chest (2.7), abdomen (2.4), and spine (2.3). The median ISS was 5 (1–75).

More than half (54%) of the patients underwent psychiatric consultation and nearly 11% had psychiatric admissions. The median HLOS was 5 (0–143) days and ICU admission was not required in three out of four patients. One out of ten cases stayed in the hospital for less than 24 h. The overall mortality was nearly 8% [Table 1].

Table 1 shows the comparative analysis of the demographic characteristics, mechanism of injury, severity of injury, and outcomes by gender. South Asian males were more likely to be the victims when compared to their female counterparts (64% vs. 29%), whereas East Asian females were more likely to get injured than their male counterparts (35% vs. 8%, $P = 0.001$).

A significant difference in the mechanism of injuries by gender was found; females were more likely to attempt suicide by jumping (59% vs. 20%) whereas male preponderance was reported in cut throat or self-stabbing (59% vs. 25%, $P = 0.001$). Consequently, females were more vulnerable to spinal injuries (33% vs. 12%, $P = 0.001$); however, injury severities to head, chest, spine, or abdomen were comparable. ISS by gender was comparable. In addition, HLOS and mortality showed no significant differences by gender.

**DISCUSSION**

Studies to identify the characteristics, risk factors, and mechanisms of traumatic injuries associated with suicidal attempts from the Middle Eastern region are rare. The present study is a unique study from Qatar, an oil-rich, fast-growing economy with multicultural population of approximately 2.7 million. The study population was nationally representative as HTC is the only level 1
Table 1: Characteristics of patients with traumatic injuries associated with suicide attempts ($n = 206$)

| Characteristics                              | Overall ($n = 206$) | Male ($n = 157$) | Female ($n = 49$) | $P$  |
|----------------------------------------------|---------------------|------------------|-------------------|------|
| Mean Age                                     | 31.3 ± 9.8          | 32.2 ± 10.1      | 28.5 ± 8.4        | 0.07 |
| Nationality                                  |                     |                  |                   |      |
| South Asian                                  | 114 (55.3)          | 100 (63.7)       | 14 (28.6)         | 0.001|
| East Asian                                   | 29 (14.1)           | 12 (7.6)         | 17 (34.7)         |      |
| Arabs                                        | 42 (20.4)           | 31 (19.7)        | 11 (22.4)         |      |
| Other                                        | 21 (10.1)           | 11 (7.0)         | 5 (10.2)          |      |
| Mechanisms of injury                         |                     |                  |                   |      |
| Stab/cut injuries                            | 105 (51.0)          | 93 (59.2)        | 12 (24.5)         | 0.001|
| Jumping from height                          | 61 (29.6)           | 32 (20.4)        | 29 (59.2)         |      |
| Hanging                                      | 17 (8.3)            | 13 (8.3)         | 4 (8.2)           |      |
| Others*                                      | 23 (11.1)           | 19 (12.1)        | 4 (8.2)           |      |
| Body sites of injury                         |                     |                  |                   |      |
| Head/face or neck                            | 61 (29.6)           | 49 (31.2)        | 12 (24.5)         | 0.37 |
| Extremities                                  | 64 (31.1)           | 44 (28.0)        | 20 (40.8)         | 0.09 |
| Abdomen                                      | 51 (24.8)           | 40 (25.5)        | 11 (22.4)         | 0.07 |
| Spine                                        | 34 (16.5)           | 18 (11.5)        | 16 (32.7)         | 0.001|
| Chest                                        | 29 (14.1)           | 25 (15.9)        | 4 (8.2)           | 0.24 **|
| Median AIS                                    |                     |                  |                   |      |
| Head                                         | 3.6 ± 0.9           | 3.6 ± 0.9        | 3.5 ± 1.3         | 0.48 |
| Chest                                        | 2.7 ± 0.9           | 2.6 ± 0.9        | 2.8 ± 0.5         | 0.29 |
| Spine                                        | 2.3 ± 0.6           | 2.2 ± 0.4        | 2.3 ± 0.8         | 0.39 |
| Abdomen                                      | 2.4 ± 0.9           | 2.4 ± 0.9        | 2.4 ± 0.8         | 0.66 |
| Median Injury Severity Score                  | 5 (1-75)            | 5 (1-75)         | 5 (1-50)          | 0.57 |
| Psychiatric consultation                      | 111 (53.9)          | 88 (56.0)        | 23 (46.9)         | 0.34 |
| Psychiatric admission                         | 22 (10.7)           | 19 (12.1)        | 3 (6.1)           | 0.35 **|
| Median Hospital Length of Stay                | 5 (0-143)           | 5 (0-143)        | 5 (0-61)          | 0.35 |
| Mortality                                     | 16 (7.8)            | 11 (7.1)         | 5 (10.2)          | 0.47 |

*Others include burning, jumping out of moving vehicle, jumping in front of moving vehicle and multiple mechanisms such as poisoning and hanging, stabbing and hanging, stabbing and jumping from height, stabbing/cutting and jumping in front of moving vehicle and undocumented mechanisms. ** Fisher Exact test

A recent report from the United Kingdom (UK) revealed that the proportion of suicide-related trauma admissions among total trauma admissions was 1.7%, which is similar to our result. The study from the United States (US) also reported the male predominance (83%) among suicide-related admissions in level 1 trauma center. The median age in the UK report was 36 years, and one-third of cases belong to 20–29 years of age group. The higher incidence in the young age group was evident in our study also; the mean age was 31 years and more than three-quarters belong to the 20–39 years of age group. In

Figure 2: Suicide cases in Qatar by age groups (April 2008–March 2018)
contrast to these reports, female suicide attempts were predominant (79%) in an ED based study in Turkey.\textsuperscript{[15]} The majority of cases (70%) represented very young age group (16–24 years).\textsuperscript{[15]}

High proportions of Indians and Nepalese migrant worker population among the attempted suicide cases in our study reflect the population structure of Qatar. According to the available data source on population by nationality, Indians (22%), Nepalese (13%), and Bangladeshis (13%) represent three largest communities in Qatar (the large majority are expatriate workers) whereas Qataris represent 15% of the total population in Qatar.\textsuperscript{[16]} These data were based on various demographic data sets published by the Planning and Statistics Authority in Qatar and from various from foreign embassies in Qatar.\textsuperscript{[16]} Expatriates became an important factor in the economic dynamism by satisfying employment sectors in Qatar. Expatriate workers are temporary workers who came from foreign countries and working under contracts for limited duration, often exceeding 1 year, and the contracts may be renewed multiple times, thus prolonging their stay in the country.\textsuperscript{[17]}

Migrant workers, especially from low-income and middle-income countries, face several issues including low-wage occupations and are more likely to be involved high-risk jobs and industries.\textsuperscript{[18]} These occupational risk factors were shown to have a major role in increased risk of poor mental health outcomes in migrant workers.\textsuperscript{[19]} In addition to the population structure of Qatar, the expatriate worker status and associated occupational risk factors along with the socioeconomic profile of the South Asians in the country might have contributed to the increased proportion of suicide attempts and trauma admissions.

A study from the Eastern province of Saudi Arabia revealed a similar pattern of suicidal behavior among the expatriate population; Indians (45%) were the majority among suicidal cases followed by Saudi nationals (20%).\textsuperscript{[19]} Dervic \textit{et al}. investigated suicide rates in the national and expatriate population in Dubai city of the United Arab Emirates and found that suicide rate among expatriates was 6.3 per 100,000 population which was seven times higher when compared to the nationals (0.9 per 100,000 population).\textsuperscript{[20]} Male suicide rate was more than three times higher when compared to females.\textsuperscript{[20]} Nearly 94% of the cases were from Asia; specifically, 79% were Indians, and 15% were from other Asian countries.\textsuperscript{[20]} The majority were above 30 years of age, single, and employed and with an education of secondary school level and below.\textsuperscript{[20]} Spallek \textit{et al}. demonstrated that migrants from countries having higher suicide risk bring along the risk to country of settlement at least for the initial period of migration.\textsuperscript{[21]}

A variation in the mechanism of injuries following suicide attempts was also reported in several studies. Jumps from a height and self-stabbing were most commonly used methods for suicide attempt in the UK.\textsuperscript{[14]} However, the study from the US reported that stab-wounds were more common among the victims followed by motor-vehicle-related injuries.\textsuperscript{[10]} On the other hand, hanging and suffocation were the most common causes of death in the study from Saudi Arabia.\textsuperscript{[19]} In our study, cutting throat or self-stabbing were most frequent; specifically among males. This method of suicide was 22% in the UK study but was very rare in the Saudi study.\textsuperscript{[14,19]} Notably, our study was among the trauma admissions where 92% were survived in the hospital while the Saudi study was based on autopsy reports. In our study, jumping from height was the method of suicide attempt in 34% of the admissions. Severe trauma was associated with this mechanism which is evident from the data that more than half of the in-hospital deaths were reported among this group of patients. This method of suicide attempt was reported among 58% of the suicide attempt admissions in the UK.\textsuperscript{[14]} Värnik \textit{et al}. studied trends and patterns in suicide in 15 European countries and found that jumping from high place accounted for 3%–15% of the suicide attempts since it was an easy method, does not require elaborate planning, and can result in severe injuries.\textsuperscript{[22]} Intentional jumping occurs more frequently from a height over 4 m, and more than half of the jumpers were likely to die before reaching the hospital or ED.\textsuperscript{[23]} Head and chest injuries were often responsible for the deaths in the majority of jumpers, whereas pelvis, limb, and vertebral injuries were seen more commonly in survivors.\textsuperscript{[24]}

Methods of suicide attempts were shown to have an interesting gender-specific relationship, which is evident in our study also. Males frequently resorted to cutting their throats or stabbing themselves as common methods for suicide, whereas females more commonly chose to jump from high place. Based on the data from 16 countries participating in the European Alliance Against Depression, Värnik \textit{et al}. revealed that hanging was the most preferred method among both males and females.\textsuperscript{[25]} Hanging (54%) was followed by firearms (10%) and poisoning by drugs (9%) in males, while hanging (36%) was followed by poisoning by drugs (25%) and jumping from a high place (15%) in females.\textsuperscript{[25]}

Tsirigotis \textit{et al}. reported that females more frequently chose poisoning by drugs and exsanguination while males often preferred hanging and asphyxiation.\textsuperscript{[26]} This study was based on medical records and survey among the subjects aged between 14 and 33 years and admitted to the hospital for attempted suicide.\textsuperscript{[26]} A study from Turkey reported that the majority of patients who attempted suicide by taking medication or toxic substances were single, were high-income females, with an elementary-level education, and were unemployed.\textsuperscript{[27]} A further analysis of personal information from these patients revealed that...
family-related issues (30%) were the major factor that led to the suicide attempts followed by loneliness and/or harassment (23%) and mental illness (16%).[27]

Interestingly, there was no single case of firearm-related events in our study, probably because of the extremely limited access to firearms in the community due to stringent gun ownership laws. In Qatar, the right to private gun ownership is not guaranteed by law. In addition, gunshot injuries are more lethal and the victims are more likely to die before reaching a hospital.

Limitations
Because of the retrospective design of the study, some important, and potentially contributory, variables such as socioeconomic level, education, history of trauma, substance abuse, previous suicide attempts, reason for suicide attempts, number of attempts, and place of attempt could not be collected. This information could contribute to the evidence-base needed when devising preventive strategies for self-inflicted injuries. The study was unable to access the complete morgue or coroner database and therefore BID data available only for the duration from March 2008 and December 31, 2015. This analysis includes only those cases that arrived at the hospital alive, and therefore, the potential impact of suicide on the healthcare system was not fully described. However, this study is the first of its kind in Qatar, and further qualitative and quantitative studies are required to address the reason/s for suicide attempts as these data are not routinely collected by both databases utilized in the present study. Further studies are needed on this public health problem to provide the evidence for creating and implementing locally appropriate prevention strategies.

CONCLUSIONS
Trauma admissions, following suicide attempts, represent a significant mental and public health challenge for the national health system of Qatar. The higher proportion of expatriate victims reflects the unique population structure of Qatar. Gender differences in the preferred method of suicide attempts and injury characteristics exist in our patient population. A better understanding of contributory factors is needed to better address this issue. A targeted root cause analysis, in relation to psychosocial and psychiatric aspects of suicide, is needed to inform locally appropriate prevention efforts.

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Conflicts of interest
There are no conflicts of interest.

Research quality and ethics statement
This study obtained ethical approval from Research Ethics Committee, at Medical Research Center, HMC, Doha, Qatar (IRB#16311/16andMRC-01-18-323). The authors followed applicable EQUATOR Network (http://www.equator-network.org/) guidelines during the conduct of this research project.

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