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Anterior abdominal stab injury: a comparison of self-inflicted and intentional third-party stabbings

Aman Banerjee, M.D.[a], **Hannah Y. Zhou, B.S.**[b], **Katherine B. Kelly, M.D.**[a], **Bianca D. Downs, M.S.**[c], **John J. Como, M.D., M.P.H.**[a], and **Jeffrey A. Claridge, M.D., M.S.**[a,*]

[a]Department of Surgery, MetroHealth Medical Center Campus, Case Western Reserve University School of Medicine, Cleveland, OH 44109, USA

[b]Case Western Reserve University School of Medicine, Cleveland, OH, USA

[c]Department of Mathematics, Cleveland State University, Cleveland, OH, USA

Abstract

BACKGROUND—There is minimal literature comparing self-inflicted (SI) with non–self-inflicted (NSI) anterior abdominal stab wounds (AASW).

METHODS—Adult patients treated at a level 1 trauma center from 2006 through 2011 with an AASW were reviewed.

RESULTS—There were 215 patients with an AASW; 20% were SI. NSI patients had more nonabdominal injuries (47% vs 16%, $P < .01$) and disposition directly to the operating room (45% vs 26%, $P = .02$). Intra-abdominal injury rates were similar. One hundred twenty-eight patients had isolated AASWs; 28% were SI. SI patients had higher admission rates (86% vs 63%, $P = .01$). One hundred three patients had isolated stable/asymptomatic AASWs; 31% were SI. SI patients had more admissions (84% vs 52%, $P < .01$), had higher intensive care unit admission rates (23% vs 5%, $P = .01$), longer LOS (3.2 vs 1.4, $P < .01$), and higher hospital charges ($18,000 vs $11,000, $P < .01$). The rates of intra-abdominal injury were again similar.

CONCLUSIONS—Controlling for extra-abdominal injuries, SI AASW patients have similar rates of intra-abdominal injury but use more resource.

Keywords

Self-inflicted injury; Anterior abdominal stab wounds; Outcomes; Penetrating trauma

It is estimated that there were an average of 420,000 visits to US emergency departments per year for attempted suicide or intentional self-harm from the years 1993 through 2008 or 1.5 visits per 1,000 US population.[1] Suicide remains a significant cause of death in the United States. In 2008, it was the 3rd leading cause of death among those 15 to 24 years of age, the 2nd for ages 25 to 34, and the 4th for those aged 35 to 54 years.[2] Suicide by stabbing is rare,

*Corresponding author. Tel.: 216-778-7651; fax: 216-778-1129. jclaridge@metrohealth.org.

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representing 1.6% to 3% of all suicides.[3,4] Previous reports derived from psychiatric and forensic sources pro- vide limited clinical information on patients with self- inflicted stab wounds to aid the trauma provider.[5–7]

Data on clinical characteristics and outcomes of self-inflicted abdominal stab wounds suggest that self-inflicted abdominal stab wounds can result in significant yet often nonlethal abdominal and retroperitoneal injuries.[8] Many of these studies rely on hospital admission data and may there-fore understate the true burden of these injuries. In addition, we were unable to find any studies that directly compared the demographics, pattern of injury, diagnostic workup, and outcomes of patients with self-inflicted abdominal stab injuries compared with non–self-inflicted injuries. In the absence of hard signs of intra-abdominal injury, trauma and emergency medicine providers may have a lower index of suspicion for self-inflicted abdominal stab wound patients, which may lead to a delay in diagnosis or missed injury.

Therefore, we sought to review the characteristics, clinical features, and outcomes of patients who presented to the emergency department (ED) with self-inflicted anterior abdominal stab wounds and to compare them with patients having non–self-inflicted anterior abdominal stab wounds. We hypothesized that patients with self-inflicted wounds would be less severely injured overall and have lower rates of intra-abdominal injury than patients with non–self-inflicted anterior abdominal stab wounds.

Methods

After institutional review board approval, a retrospective review of all adult trauma patients who presented to the ED at a regional level 1 designated trauma center with an anterior abdominal stab wound over a 6-year period between January 1, 2006, and December 31, 2011, was conducted. Patients were identified using the following *International Classification of Diseases, Ninth Revision E* codes: E920.3 (accidents caused by knives, swords, and daggers), E920.9 (accidents caused by an unspecified cutting and piercing instrument or object), E956 (suicide and self-inflicted injury by a cutting and piercing instrument), E966 (assault by a cutting and piercing instrument), E979.4 (terrorism involving firearms), and E986 (injury by cutting and piercing instruments, undetermined whether accidentally or purposely inflicted).

Data were collected from patients' electronic medical records (Epic Systems Corporation, Madison, WI) and the trauma registry (TraumaBase; Clinical Data Management Inc, Genesee, CO). Data collected included age, sex, location and number of stab wounds, other injuries, heart rate, blood pressure, the presence of hemodynamic instability/symptomatic wounds, Injury Severity Score (ISS), diagnostic testing in the ED, results of diagnostic testing, disposition from the ED, operative procedures, operative findings, ED length of stay (LOS), intensive care unit LOS, total hospital LOS, complications (eg, rates of bacteremia, surgical site infection, urinary tract infection, catheter-associated infections, deep venous thrombosis, pulmonary embolism, and wound dehiscence), mortality, and hospital charges.

Patients were grouped into self-inflicted and non–self-inflicted groups based on documentation in the history and physical examination. The anterior abdomen was defined as the area located within the boundaries of the costal margins, anterior axillary lines, and inguinal ligaments. Unstable/symptomatic patients were defined as patients having a heart rate > 120 beats/min; a systolic blood pressure <90 mm Hg; or symptoms requiring immediate operative management such as evisceration, traumatic hernia, peritonitis, or significant bleeding. Stable/asymptomatic patients were defined as patients who did not exhibit the aforementioned signs and symptoms.

Data were analyzed using SPSS for Windows version 20 (SPSS Inc, Chicago, IL). Numeric data were compared using the Student *t* test or a nonparametric test as appropriate. Categoric data were compared using either the chi-square or Fisher exact test. A *P* value ≤.05 was considered statistically significant.

Results

Analysis of all anterior abdominal stab wounds

During the study period, there were 570,070 ED visits. Three thousand five hundred fifty-nine patients were identified using our screening criteria; of these, 215 patients were identified as having an anterior abdominal stab wound. Patient characteristics and demographics are shown in Table 1. The mean age was 35 years; men comprised 86% of the treated patients. The mean ISS was 2.7; 26% of patients had multiple abdominal stab wounds, 41% had extra-abdominal injuries, and 26% exhibited unstable/symptomatic injuries. Of these patients, 172 (80%) had non–self-inflicted stab wounds, and 43 (20%) had self-inflicted wounds. Patient characteristics and demographics were well matched between the groups. Patients in the self- inflicted group were older (mean 39 vs 34 years, $P = .03$). There was no statistical difference in sex between self-inflicted and non–self-inflicted groups. Injury severity, as assessed by the ISS, was similar between self-inflicted and non–self-inflicted patients. Patients with self-inflicted stab wounds had similar rates of multiple abdominal stab wounds compared with those having non–self-inflicted stab wounds. Self-inflicted patients were less likely to have secondary injuries in addition to the penetrating wound to their anterior abdomen compared with non–self-inflicted patients (16% vs 47%, $P < .01$). Non–self-inflicted patients were twice as likely to be unstable/symptomatic.

Hospital course and outcomes are summarized in Table 2. The ED diagnostic workup was evaluated. Non–self-inflicted patients had higher utilization rates of focused assessment of sonography for trauma (FAST) compared with self-inflicted patients (40% vs 21%, $P = .03$). Utilization rates of computed tomography (CT) scans (30% vs 38%,$P = .4$) and local wound exploration (51% vs 41%, $P = .2$) were similar for the self-inflicted and non–self-inflicted groups, respectively. The mean ED length of stay was longer for self-inflicted patients compared with non–self-inflicted stab wound patients (314 vs 180 minutes, $P = .13$); however, this did not reach statistical significance. Non–self-inflicted patients had higher rates of disposition to the operating room directly from the ED compared with self-inflicted patients (45% vs 26%, $P = .02$). However, there was no difference in the overall rate of operative management or the incidence of intra-abdominal injury between groups.

Self-inflicted patients had similar rates of inpatient admission compared with non–self-inflicted patients. Self-inflicted stab wound patients received operative management at similar rates as non–self-inflicted patients. Self-inflicted stab patients also had similar rates of injuries identified at the time of surgery as non–self-inflicted patients.

The LOS in the intensive care unit and in the hospital between self-inflicted and non–self-inflicted stab patients was similar. Self-inflicted patients generated similar amounts of total hospital charges compared with non–self-inflicted patients. The overall complication rates were similar between self-inflicted and non–self-inflicted patients. Mortality was similar between self-inflicted and non–self-inflicted patients.

Analysis of patients with isolated abdominal stab wounds

Of the 215 anterior abdominal stab wound patients, 128 patients had an isolated stab wound to the anterior abdomen. Of these, 92 (72%) were non–self-inflicted, and 36 (28%) were self-inflicted. The mean age, sex, ISS, incidence of multiple abdominal stab wounds, incidence of unstable/symptomatic wounds, ED diagnostic workup, and ED LOS were similar between the self-inflicted and non–self-inflicted groups. Self-inflicted patients had higher rates of admission to the hospital (86% vs 63%, $P = .01$). The rates of overall operative management and intraoperative injuries were similar between the self-inflicted and non–self-inflicted groups. The intensive care unit and total hospital LOS was also similar. No difference in mortality was observed between the groups. The total hospital charges were similar between the self-inflicted and non–self-inflicted groups. There were also no significant differences in readmission (3% vs 2%, $P = 1$) or complication rates (11% vs 8%, $P = .5$) between the self-inflicted and non–self-inflicted groups.

Analysis of stable/asymptomatic patients with isolated anterior abdominal stab wounds

There were 103 patients who had an isolated anterior abdominal stab wound who were stable/asymptomatic. Of these, 71 (69%) patients were non–self-inflicted, and 32 (31%) were self-inflicted. Once again, age, sex proportion, ISS, the incidence of multiple stab wounds, ED diagnostic workup, ED LOS, the rate of operative management, and the incidence of intraoperative injuries were similar between the 2 groups. Self-inflicted patients were more likely to be admitted than non–self-inflicted patients (84% vs 52%, $P < .01$). No patient died in either of the 2 groups. The mean total hospital LOS was longer for the self-inflicted group compared with the non–self-inflicted group. The mean total hospital charges were higher for self-inflicted patients compared with non–self-inflicted patients ($18,000 vs $11,000, $P < .01$).

Comments

To our knowledge, this study is the first to compare the epidemiology and outcomes of patients with self-inflicted and non–self-inflicted anterior abdominal stab wounds in a large series. Within this population, we examined 3 clinically distinct groups: patients with extra-abdominal injuries in addition to their abdominal stab wound, patients with isolated abdominal stab wounds, and stable/asymptomatic isolated abdominal stab wounds. The incidence of self-inflicted stab wounds to the anterior abdomen was 20%. Self-inflicted

patients tended to be older and predominantly male, which is consistent with other studies on self-inflicted penetrating injuries.[8–10] Self-inflicted patients had low ISS scores with a mean of 2, which is lower than the ISS scores of 4.0[9] and 5.8[8] previously reported in the literature. This may be the result of the inclusion of patients who were evaluated in the ED and discharged to a psychiatric facility rather than including only admitted patients in the analysis.

Self-inflicted abdominal stab wound patients exhibited the same rate of multiple abdominal stab wounds but had lower rates of extra-abdominal injuries. This finding of multiple abdominal stab wounds in self-inflicted injuries was also shown in another case series in which the mean number of stab wounds per patient was 1.5.[8] Self-inflicted patients had lower rates of hemodynamic instability or symptomatic abdominal wounds and had lower rates of direct disposition to the operating room from the ED. The diagnostic workup was similar between groups with the exception that non–self-inflicted stab patients had higher FAST use in the ED than self-inflicted abdominal stab patients. The increased use of FAST in non–self-inflicted patients may be because of its bedside availability and ease of use to visualize intraperitoneal or pericardial fluid in a population with a high incidence of hemodynamic instability. No difference in the use of local wound exploration or CT scanning was observed. The overall rates of operative management and intra-abdominal injuries were similar between groups.

Subgroup analysis of stable/asymptomatic patients with isolated anterior abdominal stab wounds showed increased resource utilization by self-inflicted stab wound patients as indicated by that group’s higher rate of admission, longer total hospital LOS, and higher total hospital charges. These differences may be related to increased costs of caring for self-inflicted patients such as the requirement of a sitter for continuous monitoring as well as health system inefficiencies that delay disposition to a psychiatric inpatient facility. A recent population analysis found that patients surviving self-inflicted injury tended to have higher risk-adjusted mortality and longer intensive care unit and total hospital LOS than patients with unintentional injuries.[11] This review of National Trauma Data Bank data did not examine specific injury patterns such as rates of severe brain injury; as a result, the outcomes reported could be the result of having a higher percentage of self-inflicted penetrating head injuries. The higher rate of admission and longer hospital LOS in this population may result from the inability to discharge self-inflicted patients home out of concern that these patients pose a risk to themselves. It may also result from a delay in arranging disposition to an inpatient psychiatric facility. However, because the specific reason for admission was not captured by the database, we are unable to definitively state whether the reason for admission and hospitalization was because of the stab wound or for psychiatric evaluation.

This study is limited by its retrospective design, and the single institution design may limit generalization of the results. Self-inflicted anterior abdominal stab wounds accounted for a small percentage of trauma activations resulting in a small sample size. This may have introduced type 2 error and limited subgroup analysis of individual complications. This study did not examine differences in substance abuse, diagnosis or treatment for mental health illness, or recidivism rates between self-inflicted and non–self-inflicted patients. As a

result, it is unclear whether differences in admission rates resulted from patients being uncooperative or having an unreliable examination because of intoxication. Information was collected only on patients who were evaluated at the trauma center; therefore, patients with injuries resulting in death at the scene were not included in the analysis, which may understate injury severity.

This study shows that patients with self-inflicted anterior abdominal stab wounds have similar rates of intra-abdominal injury as those with non–self-inflicted injuries despite a lower incidence of hemodynamic instability or symptomatic abdominal wounds on presentation. There is no evidence to support a lower index of suspicion for intra-abdominal injury when evaluating this patient population. However, controlling for extra-abdominal injury, self-inflicted patients use more hospital resources than non–self-inflicted patients. Further investigation is needed to determine the causes of the increased hospital LOS and total hospital charges in this population. Additionally, the wide variation in the rates of local wound exploration, FAST, and CT scanning at our center to evaluate patients with anterior abdominal stab wounds was surprising. This underlies the need for the implementation of an injury algorithm to guide the workup and treatment of anterior abdominal stab wounds at our institution.

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Discussion

Akpofure Peter Ekeh, M.D. (Dayton, OH): The authors studied patients who have anterior abdominal wall stab wounds to see if they were self-inflicted or not. You also have noted

that among those who have just the isolated anterior abdominal stab wounds, they have a higher rate of disposition to the operating room. What are the specific protocols at your institution that you use to evaluate stab wounds in general? Do you use observation, wound exploration, or laparoscopy? It appears that some of the patients who had self-inflicted stab wound injuries were discharged from the ED. What is your explanation for this given that most of these will if not all will require psychiatric evaluation? How do you discharge those kinds of patients from the ED? Lastly, in your opinion, how should we use the information from this study? Should there be any difference in the management; should it matter to us if they stabbed themselves or somebody else stabbed them?

Aman Banerjee, M.D.: There is no formal written algorithm for working up these patients. Adding to the confusion a little bit more, during the 6-year study period, the hospital went from a call schedule that included general surgery attendings taking trauma calls at the institution to a situation in which you would have only trauma providers taking call, so that may have had some variability. There is no current protocol at our institution for working these patients up. The diagnostic work-up is determined by the attending trauma surgeon and can therefore vary significantly. Depending on what time of day you come in, we do have an inpatient psychiatric facility. So, if the patients came in and were medically cleared by the trauma provider and had no need for observation, they would be able to be discharged to this inpatient psychiatric facility and not have been counted as an admission. As to how should this change your practice, I think this is kind of just further evidence for the use of a protocol for injury types to reduce bias on the part of the trauma provider. If you have an agreed-upon protocol for a penetrating abdominal injury that you go through the algorithm if they are hemodynamically stable or asymptomatic, then that just kind of further reduces your chance of introducing any bias and missing an injury because these patients do present less acutely.

Douglas Naylor, M.D. (Cleveland, OH): From working in one of the competing institutions in the city there, your article really presents a lot of questions. Did you collect any data in terms of substance use or the recidivism rate among those who had self-inflicted stab wounds? Finally, with your discussion of the psychiatric inpatient unit, how many have you teased out those patients who were admitted to the intensive care unit? That is, was this just for observation, or was this for comfort of the admitting surgeon?

Dr Banerjee: As far as substance use, we did not investigate substance use. Our institution is looking at recidivism data to try to see whether trauma recidivists have worse outcomes. Within that dataset, we have not really teased out; it is kind of global information whether it was a blunt mechanism or penetrating mechanism, and so we do have that information that we can try to relate to this study. As far as the admission rates to the intensive care unit, we were not really able to tease out the reason. At our institution, the intensive care units are, like everyone else's, a pretty scarce resource at a trauma hospital, and so you have to have criteria. You cannot just observe a patient who is hemodynamically stable for serial examinations in the intensive care unit, so they would have had to have shown some sort of hemodynamic instability requiring act of resuscitation or observation.

Table 1

Population demographic information

n	215
Age	34.7 ± 12.5
% male	86
ISS	2.7 ± 0.4
Multiple stab wounds (%)	26
Extra-abdominal injury (%)	41
Hemodynamically unstable/symptomatic injury (%)	26

Mean (± standard error of mean).

Table 2

Hospital course and outcomes of anterior abdominal stab wound patients

	Non–self-inflicted stab patients	Self-inflicted stab patients	*P* value
All abdominal stab wounds			
N	172	43	NA
Multiple stab wounds (%)	25	28	.7
Extra-abdominal injury (%)	47	16	<.01
Unstable/symptomatic injury (%)	29	14	.05
Hospital course			
ED LOS (min)	180	314	.13
Inpatient admission (%)	73	81	.33
Went to operating room (%)	49	37	.2
Intraoperative injury identified (%)	37	26	.2
Multiple intra-abdominal injuries identified (%)	33	15	.3
Outcomes			
ICU LOS (d)	0.5	1.2	.2
Total LOS (d)	2.5	3.6	.14
Total hospital charges ($)	19,000	21,000	.5
Complications (%)	11	9	1
Mortality (%)	2	0	.6
Anterior abdominal stab wounds only			
N	92	36	NA
Multiple stab wounds (%)	22	25	.8
Unstable/symptomatic injury (%)	23	11	.2
Hospital course			
ED LOS (min)	184	304	.4
Inpatient admission	63	86	.01
Went to operating room	45	39	.7
Intraoperative injury identified (%)	37	28	.4
Multiple intra-abdominal injuries identified (%)	39	17	.3
Outcomes			
ICU LOS (d)	.6	.8	.5
Total LOS (d)	2.4	3.4	.2
Total hospital charges ($)	17,000	19,000	.6
Complications (%)	8	11	.5
Mortality (%)	1	0	1
Asymptomatic/stable anterior abdominal stab wounds only			
n	71	32	NA
Hospital course			
ED LOS (min)	212	337	.5
Inpatient admission (%)	52	84	<.01
Went to operating room (%)	28	31	.8

	Non–self-inflicted stab patients	Self-inflicted stab patients	*P* value
Intraoperative injury identified (%)	20	22	.8
Multiple intra-abdominal injuries identified (%)	22	13	1
Outcomes			
ICU LOS (d)	.2	.8	<.01
Total LOS (d)	1.4	3.2	<.01
Total hospital charges ($)	11,000	18,000	<.01
Complications (%)	4	13	.2
Mortality (%)	0	0	NA