

A Comparison of Self-Inflicted Stab Wounds Versus Assault-Induced Stab Wounds

Sanghyun Ahn,¹ Dong Jin Kim,¹ Kwang Yeol Paik,¹ Jae Hee Chung,¹ Woo-Chan Park,¹ Wook Kim,¹ and In Kyu Lee^{1*}

¹Departments of Surgery, Mary's Hospital, College of Medicine, Catholic University of Korea, Seoul, Korea

*Corresponding author: In Kyu Lee, Departments of Surgery, Mary's Hospital, College of Medicine, Catholic University of Korea, Seoul, Korea. Tel: +82-237791063, Fax: +82-27860802, E-mail: cmcgslee@catholic.ac.kr

Received 2014 November 12; Revised 2014 December 15; Accepted 2014 December 19.

Abstract

Background: Although self-inflicted and assault-induced knife injuries might have different mortality and morbidity rates, no studies have actually evaluated the importance of the cause of knife injuries in terms of patient outcomes and treatment strategies.

Objectives: The aims of this study were to assess the difference between the outcomes of patients presenting with self-inflicted stab wounds (SISW) versus assault-induced stab wounds (AISW).

Patients and Methods: A retrospective review of the relevant electronic medical records was performed for the period between January 2000 and December 2012 for patients who were referred to the department of surgery for stab wounds by the trauma team. The patients were divided into either SISW (n = 10) or AISW groups (n = 11), depending on the cause of the injury.

Results: A total of 19 patients had undergone exploratory laparotomy. Of the nine patients with SISW undergoing this procedure, no injury was found in seven of the patients. In the AISW group, eight of the ten laparotomies were therapeutic. Three patients in the AISW group died during hospital admission. The average number of stab wounds was 1.2 for the SISW group and 3.5 for the AISW group. Organ injuries were more frequent in the AISW group, affecting the lung (2), diaphragm (3), liver (5), small bowel (2), colon (2), and kidney (1).

Conclusions: Although evaluations of the initial vital signs and physical examinations are still important, the history regarding the source of the stab wounds (AISW vs. SISW) may be helpful in determining the appropriate treatment methods and predicting patient outcomes.

Keywords: Stab Wounds, Exploration, Self-Stabbing, Assault, Mortality

1. Background

A knife stab injury is a potentially life-threatening emergency that often requires surgical intervention. In most cases, there is not enough time to thoroughly evaluate a patient's hemodynamic status, and it is important that surgeons are aware of the particularities of this type of injury. Certain medical centers have developed institution-specific algorithms which use a combination of assessments for hemodynamic instability, physical examinations, and computed tomography (1, 2). These algorithms can predict the results of treatment through indicators such as shock, acidosis, transfusion requirements, and the number of organs injured (3). These evaluations are important not only for prompt and safe operations but also for reducing the implementation of unnecessary laparotomies (4).

Overall mortality rates from stabbing range from 2 -

8% (5-7). However, most self-inflicted stab wounds are non-lethal abdominal and retroperitoneal injuries, possibly resulting from a combination of alcohol abuse and personality disorder (8, 9). On the other hand, numerous stab wounds are generally inflicted by a third party with homicidal intent (10). Therefore the source of the stab injury (self-inflicted vs. assault-induced) could affect the clinical outcome. Although self-inflicted and assault-induced knife injuries might have different mortality and morbidity rates, no studies have evaluated the source of the injury as a predictive factor.

2. Objectives

The aims of this study were to assess the mortality and morbidity of self-inflicted stab wounds (SISW) versus assault-induced stab wounds (AISW) and to analyze the factors affecting patient outcomes. It was hypothesized that

assault injuries would be associated with increased mortality and morbidity, and increased incidences of therapeutic laparotomies.

3. Patients and Methods

This study was approved by the internal review board (IRB No: SC14RISI0050) at Yeouido St. Mary's hospital (Seoul, South Korea), which is a tertiary teaching hospital and a trauma center. The requirement of informed consent was waived due to the retrospective nature of the study. A retrospective review of the electronic medical records was performed for the period between January 2000 and December 2012 for patients who were referred to the department of surgery for stab wounds by the trauma team in the emergency room.

Inclusion criteria included patients who were hospitalized for the management of traumatic stab injuries. All of the patients were admitted to the trauma ward for acute management and subsequently referred to a general surgeon on call for further management. Most of these patients had injuries to the abdomen, with three patients being referred for treatment of single neck wounds. Exclusion criteria for adults included a history of repeated self-injurious behavior (self-mutilation) and injuries that were confirmed to be unintentional (accidental) at the time of primary assessment in the emergency room.

3.1. Grouping

The patients were divided into either the self-inflicted stab wound (SISW) or the assault-induced stab wound (AISW) group depending on the source of the injury. The evaluated variables included patient demographics, vital signs upon admission, the presence or absence of alcohol intoxication, location of the stab wounds, number of injured organs, type of surgical procedure required, surgical outcome, hemoglobin levels, blood transfusion requirements, and the length of hospital stay. Computed tomography (CT) scans of the abdomen and pelvis were performed and read by a board-certified radiologist. The results of the CT scans were considered positive only if there were visible solid organ injuries, diaphragm irregularities, omental changes, or findings in which hollow viscous injuries were suspected, including pneumoperitoneum, free fluid, or mesenteric or bowel wall changes.

Hemodynamically unstable patients, patients with prominent signs of peritonitis, and patients with perforated hollow viscera or frank evisceration were deemed to have absolute indications for mandatory laparotomies. The remaining patients were treated by either laparoscopic exploration or selective observation, depending on

the individual practice patterns of the surgeon on call for each respective patient.

3.2. Definitions

Operations were divided into nontherapeutic laparotomy and therapeutic surgery. Nontherapeutic laparotomy is defined as exploratory surgery that reveals minimal organ injuries that do not require placement of sutures, electrocoagulation, or topical hemostatic agents to control active bleeding. A nontherapeutic laparotomy was considered to have a negative finding if no injury was identified.

Laparotomy performed to treat a significant organ injury with subsequent surgical repair was considered to be therapeutic. However, isolated repair of a fascial defect was not considered therapeutic in this study.

3.3. Statistical Analysis

All continuous variables were expressed as means \pm standard deviation, whereas categorical variables were presented as numbers and percentages. Continuous variables were analyzed using the Mann-Whitney U test. Categorical variables were analyzed using Fisher's exact test. A P-value of less than 0.05 was considered statistically significant. All statistical analyses were performed using SPSS for Windows version 18 (SPSS Inc., Chicago, IL, USA).

4. Results

The review identified 21 cases involving stab wounds, with 10 patients in the SISW group and 11 patients in the AISW group. Gender, mean age, and time of accident are reported in [Table 1](#). One patient with SISW had an established psychiatric history of major depressive disorder and irregular administration of medication. Two patients with SISW were diagnosed with depressive disorder during admission. None of the patients had a recorded history of prior suicide attempts or self-mutilation. Most patients without psychiatric disorders had medical conditions or economic difficulties that precipitated the suicide attempt. Drug screens and serum alcohol testing were not routinely performed on this group of patients. All patients with SISW were hemodynamically stable, whereas three patients with AISW had systolic blood pressure $<$ 90 mmHg at the time of presentation. The most common location for SISW was the patient's own residence (80%), whereas the most common locations for AISW included bars (4) and public streets (2).

The patient outcomes are summarized in [Table 2](#). Violation of the peritoneum upon local wound exploration or omental evisceration was confirmed in nine of ten patients

Table 1. Demographics of Patients with Self-Inflicted Stab Wounds and Assault-Induced Stab Wounds^a

	Self-Inflicted Stab Wound (n = 10)	Assault-Induced Stab Wound (n = 11)	P Value ^b
Male : Female	6 : 4	6 : 5	0.670
Mean age, y	50.4 ± 15.8	44.3 ± 16.8	0.377
Psychiatric history	3 (30%)		
Incident time			0.659
8:00 - 20:00	4	3	
20:00 - 8:00	6	8	
Time from incident to ER, min	155.3 ± 332.7	113.6 ± 207.8	0.876
Number of wounds	1.2 ± 0.4	3.5 ± 3.0	0.027
Initial SBP < 90 mmHg	0 (0%)	3 (27.3%)	0.124
Initial HR > 100 times/min	1 (20%)	2 (18.2%)	0.699
Initial hemoglobin, g/dL	14.4 ± 1.9	12.3 ± 2.2	0.041
Preoperative CT (%)	10 (100%)	5 (45.5%)	0.012
Positive CT finding (%)	1 (10%)	4 (80%)	0.004

Abbreviations: CT, computed tomography; ER, emergency room; HR, heart rate.

^aData are presented as mean ± standard deviation (SD) or number and percentage.

^bFisher's exact test/Mann-Whitney U test.

(90%) in the SISW group and ten of 11 (90.9%) in the AISW group, with no statistical differences. These 19 patients had all undergone exploratory laparotomies. Of the nine patients with SISW undergoing exploratory laparotomies (including three laparoscopic explorations), no injury was found in seven. In the AISW group, eight of the ten laparotomies were therapeutic. There were no missed injuries in the follow-up evaluations.

The mean length of hospital stay was four days for the SISW group and eight days for the AISW group, which excluded a patient who was transferred to another hospital and had died shortly after an operation. Three patients in the AISW group had died during hospital admission. In all of these cases, the cause of death was uncontrolled exsanguination and refractory hemorrhagic shock. All of the deaths had occurred within 24 hours of arrival at the hospital. These three patients had been stabbed multiple times in the chest, abdomen, and upper extremities with an average wound number of 6.66.

The anatomic distribution of wounds and the presence of organ injuries are shown in Table 3. The total number of stab wounds was 12 for the SISW group and 38 for the AISW group, with an average of 1.2 and 3.5 wounds per patient for each group, respectively. Organ injuries were more frequent in the AISW group, including the lung (2), diaphragm (3), liver (5), small bowel (2), colon (2), and kidney (1).

5. Discussion

The main finding was that the AISW patients in this study experienced a significantly higher number of wounds, which required more therapeutic operations, longer hospital stays, and a greater risk of death in comparison to the corresponding rates of the SISW patients.

In this study, the overall mortality rate for AISW was 27.3%. All of these patients died in the first 24 hours due to shock or disseminated intravascular coagulation. The mortality rate from stab wounds has been reported to be very low. However, one of the most important factors affecting mortality and morbidity appears to be the source of stabbing (self versus other), as our findings suggest. Here, AISW was associated with a higher number of wounds, organ injuries, and massive tissue damage. The number of organ injuries and the degree of injury depend upon the severity of the trauma, and there is a positive correlation between the number of organs injured and a higher mortality rate (11, 12). In this study, the number of organ injuries was generally higher for the AISW group than for the SISW group (Table 3). The velocity of stabbing or hesitation upon self-infliction may explain this difference.

Nichols et al. reported that a larger number of units of blood or blood products administered at surgery and a larger number of organ injuries are associated with worse outcomes (13). The duration and severity of hemorrhagic shock also affects morbidity and mortality (14). In our study, there was a significant difference in the hemoglobin

Table 2. Comparison of Clinical Features and Outcomes^a

	Self-Inflicted Stab Wound (n = 10)	Assault-Induced Stab Wound (n = 11)	P Value
Blood transfusion	1 (10)	7 (63.6)	0.024
Exploratory laparotomy	9	10	1.000
Therapeutic surgery	1 (10)	8 (72.7)	0.004
Organ injury	1 (10)	10 (90.9)	< 0.001
Length of hospital stay, d ^b	4 ± 1.7	8.1 ± 3.9	0.026
In hospital mortality	0 (0)	3 (27.3)	0.124

^aValues are expressed as No. (%) or mean ± SD.

^bFour patients in AISW were excluded: three patients had died within 24 hours of admission, and one patient was transferred to another institution.

Table 3. Anatomic Distribution of Injuries and Comparison of the Organ(s) Injured

	Self-Inflicted Stab Wounds	Assault-Induced Stab Wounds
Anatomic distribution		
Head	0	1
Neck	1	6
Chest	0	7
Abdomen	9	14
Upper extremities	2	7
Lower extremities	0	3
Total	12	38
Organ injury		
Lung	0	2
Diaphragm	0	3
Liver	0	5
Small bowel	1	2
Mesentery	1	0
Colon	0	2
Major vascular area	0	0
Kidney	0	1
Other	1	3
Total	3	18

levels between the two groups. Low initial hemoglobin levels were highly predictive of laparotomy and mortality (15). Furthermore, the initial hemoglobin level had decreased sharply in patients who had later died from AISW, and there was a need to prepare for massive blood transfusions in these patients. Additionally, systolic blood pressures < 90 mmHg were observed in 27.3% of AISW patients compared

to 0% of SISW at the time of admission to the emergency department.

Self-injurious behaviors are repetitive and chronic stereotyped acts that can result in ending one's own life. In the case of such self-injurious behaviors, suicidal intent is usually low and the rate of eventual completed suicide has been reported to be as low as 1.1% (16). Studies on patients with self-stabbing injuries report that a significant proportion of suicides are the result of impulsive actions, and there is often no mortality in such cases (8, 17). In this study, 50% of the SISW patients were drunk, which is known to cause impulsive suicide attempts in the presence of personal problems (18-20).

Still, the mortality and morbidity rate of self-stabbing varies according to the suicide method. A harakiri wound, a transverse cut of the abdomen and a traditional method of suicide in Japan, is a major cause of death after major vascular injury (9). However, harakiri are relatively exclusive to Japan, and it is difficult to generalize the findings from studies on harakiri suicide attempts to other populations. Additionally, survivors of self-inflicted stabblings who had written suicide notes are at an increased risk of completed suicide in the future (21). Psychosis is also strongly associated with potentially lethal suicide attempts using sharp objects (22). However, in this study, three patients with psychotic illness experienced mortality and morbidity no different from other SISW patients.

Various reports on selective non-operative management of abdominal stab wounds have been published (4, 23, 24). The enthusiasm for non-operative treatment is based on the high rate of nontherapeutic or negative laparotomies, ranging from 23% to 53% for patients with stab wounds (25). In addition, one study has shown that 82% of laparotomies in patients with penetrated abdominal fascia had no visceral evisceration, and no signs of peritoneal irritation were present (26). Thoraco-abdominal injuries remain challenging with respect to effective treat-

ment, and prompt assessments are needed in such cases (27). In our study, the prevalence of penetrating thoraco-abdominal injury was 36.3%, and the mortality rate of this injury was 18.1% in the AISW group. However, there were no thoraco-abdominal injuries in the SISW group.

Ultimately, there is general consensus that patients with abdominal stab wounds presenting with peritonitis and hemorrhagic shock require immediate exploration. In addition, the majority of patients who present frank evisceration after a stab wound require prompt laparotomy (28). In the case of omental evisceration, the patient can be observed selectively if they are hemodynamically stable and otherwise asymptomatic. However, many surgeons are afraid to miss the opportunity for a timely operation and are not able to sequentially examine a patient in all cases. In such cases, laparoscopy may be useful (29, 30). In this study, laparoscopic exploration had been performed on four patients with negative findings in all four of these patients. Delayed laparotomy was performed on one patient. However, a prospective randomized study reported little benefit for delayed laparotomy compared with exploratory laparotomy (31). Therefore, consideration of the potential extent of injuries in patients appears to be more important than simply monitoring the presenting symptoms. For instance, diaphragm injuries in thoraco-abdominal stab wounds are often recognized only after some delay (32). In such cases, laparoscopic exploration would be a useful approach.

5.1. Conclusion

In conclusion, as stab wounds are emergencies requiring immediate action, a treating surgeon should be alerted in such cases to assess the extent of the injury because of the associated mortality and morbidity. Patients who are wounded during an altercation are more likely to have severe organ injuries that require therapeutic operation. Although the evaluation of the initial vital signs and physical examinations are still important, the history regarding the source of the stab wounds (AISW vs. SISW) could be helpful in dictating treatment methods more efficiently and predicting outcomes.

Footnote

Authors' Contribution: Sanghyun Ahn and In Kyu Lee: study concept and design, analysis and interpretation of the data; Dong Jin Kim: acquisition of the data; Sanghyun Ahn: drafting of the manuscript and statistical analysis; Kwang Yeol Paik, Jae Hee Chung, Woo-Chan Park, and Wook Kim: critical revision of the manuscript for important intellectual content.

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