

## Abdominal Stab Wounds in Israel, 1997–2004: Significant Increase in Overall Incidence and Prevalence of Severe Injury

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### Abstract

**Background:** Non-operative management following abdominal stab wounds is possible in selected patients who are both hemodynamically stable and do not have signs of peritonitis. However, the rate of failure of non-operative management is higher in Israel than in western countries.

**Objectives:** To assess the patterns of injury following abdominal stabbing.

**Methods:** Data from the Israeli Trauma Registry were used to identify all patients with abdominal stab injury admitted to eight different trauma centers between 1997 and 2004.

**Results:** The number of patients admitted per year more than doubled between 1997 and 2004, from 257 to 599. The percentage of patients with severe injury (Index Severity Score  $\geq 16$ ) increased from 9.4% to 19.0%. The incidence of multiple stab injuries almost doubled, from 37% to 62%.

**Conclusions:** Review of the data in the Israeli Trauma Registry indicates an increase in both absolute rate and relative incidence of serious stab injuries. This indicates that patterns of injury following stab wounds are not necessarily similar, not even within the same geographical area over time.

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In the last two decades the approach to patients with penetrating abdominal stab injury has changed from operative treatment in all patients to selective conservative management. Following physical examination, local wound exploration, diagnostic peritoneal lavage and/or imaging, the trauma surgeon may decide to offer a patient with abdominal stab wound injury observation rather than operation. Lack of clinical deterioration during the first 4 hours of observation is indicative of minor injury that is unlikely to require surgery at all [1]. This selective approach to abdominal stab injuries has proven to be safe. It carries with it the added benefit of avoiding unnecessary morbidity, which is not uncommon following negative or non-therapeutic laparotomies [2].

Overall, the failure rate of non-operative treatment following stab injury in Israel is 10.8% (Gertner Institute, non-published

data). This figure is higher than that reported by studies in other western countries, which range from 0% to 6% [3-5]. This relative increase in failure rate seen in Israel prompted us to evaluate our patient population.

### Patients and Methods

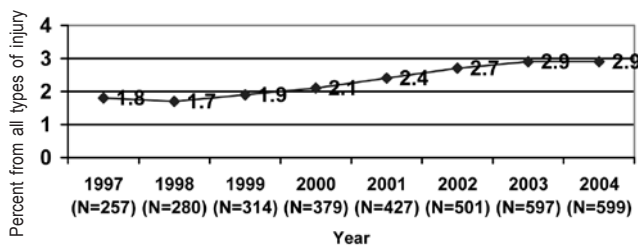
Retrospective data on patients who sustained abdominal stab wounds during an 8 year period (1997–2004) were retrieved from the Israeli Trauma Registry. During that period the Israeli Trauma Registry prospectively collected data from eight Israeli trauma centers. This registry includes data concerning all trauma patients who are either admitted for hospitalization or die in the emergency department. The registry does not include data on patients who were either discharged from the emergency department or patients who died previous to their admission to the emergency department. Data retrieved from the registry included demographics, gender, age, mechanism of injury, Injury Severity Score, and surgical interventions when necessary. For purposes of this study, solitary or multiple stab wounds that involved the abdominal compartment were defined as abdominal stab injury. Solitary or multiple stab wounds that did not involve the abdomen at all were defined as stab injuries elsewhere.

In accordance with commonly practiced guidelines in Israel, we assumed that all patients who were operated within the first hours of admission were either hemodynamically unstable or thought to have significant intraabdominal injury that required surgery. For purposes of analysis, patients who were not operated on within 4 hours of admission were considered to have been chosen for observation rather than mandatory exploration. Any patient operated on beyond 4 hours from admission was therefore considered as failure of non-operative treatment.

### Results

During the relevant time period, 143,210 trauma patients were reported by the eight trauma centers participating in this study. Of these, 3354 (2.3%) sustained stab injuries in different anatomical sites. Evaluation of cases reported per year demonstrates that the yearly incidence of stab wounds more than doubled between 1997 and 2004, from 257 stab injuries per year to 599. Percentage-wise, this corresponds to an increase of 61% (from

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**Figure 1.** Annual percent of stab wounds from total patients in the Israeli Trauma Registry

**Table 1.** Annual incidence of hemodynamically stable patients with abdominal stab injuries\* as compared to patients with injuries elsewhere

Year	1997	1998	1999	2000	2001	2002	2003	2004	Total
Patients with abdominal stab injury	108 (43%)	124 (45%)	157 (51%)	167 (45%)	180 (43%)	227 (46%)	294 (50%)	268 (45%)	1525 (46%)
Patients with stab injuries elsewhere	142 (57%)	150 (55%)	153 (49%)	205 (55%)	243 (57%)	268 (54%)	293 (50%)	327 (55%)	1781 (54%)
Total no of patients	250	274	310	372	423	495	587	595	3306

\* Includes patients with multiple stab injuries involving the abdominal compartment

**Table 2.** Annual distribution of single and multiple stab wounds in abdominal stab-injured patients

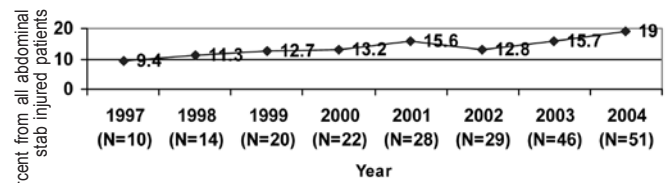
Year	1997	1998	1999	2000	2001	2002	2003	2004	Total
Patients with isolated stab wound	68 (63%)	58 (47%)	90 (57%)	87 (52%)	91 (51%)	112 (49%)	130 (44%)	103 (38%)	739
Patients with multiple stab wounds	40 (37%)	66 (53%)	67 (43%)	80 (48%)	89 (49%)	115 (51%)	164 (56%)	165 (62%)	786
Total abdominal stabs	108	124	157	167	180	227	294	268	1525

1.8% to 2.9%) in the relative contribution of stab injuries to the overall trauma cases reported to the registry [Figure 1].

Of the 3354 patients with stab injuries, only 48 (1.4%) were reported to be hemodynamically unstable on presentation (systolic blood pressure < 100 mmHg and pulse greater than 120 per minute) and these patients will not be discussed further. Of the other 3306 patients, 1525 (46.1%) sustained injury to the abdominal compartment, while 1781 (53.9%) were injured elsewhere. Analysis per year reveals that the relative incidence, percentage-wise, remained fairly constant throughout the years [Table 1].

Figure 2 presents the proportion of hemodynamically stable patients with abdominal stab injury who were found to have severe injury (ISS<sup>1</sup> ≥ 16). Throughout the years the proportion of patients with severe injury more than doubled. A possible explanation for this finding may be the results of a sub-analysis of these patients indicating that the percentage of multiple stab injuries increased through the years as well [Table 2]. Within 8 years, the ratio of single stab injuries to multiple stab injuries practically turned around, from approximately 1:2 ratio to 2:1

ISS = Injury Severity Score



**Figure 2.** Percentage of hemodynamically stable patients with abdominal stab injuries whose ISS indicated severe injury (ISS ≥ 16)

ratio in favor of multiple stab injuries. The liver (68 cases) was found to be the most common abdominal organ injured by stabbing, followed by the jejunum (54 cases) and colon (41 cases).

### Discussion

Non-operative management for asymptomatic abdominal stab wounds has become the standard practice in the last two decades [6,7]. Prior to this, exploratory laparotomies were performed for every penetrating abdominal stab wound. Such explorations, although seldom fatal, resulted in a non-therapeutic laparotomy rate of 29–39% and were associated with a postoperative morbidity rate as high as 43% [3,8]. Compared to the non-operative approach, patients undergoing unnecessary laparotomy will suffer from considerable postoperative pain and discomfort, incisional scar, prolonged hospital stay and convalescence with increased costs, as well as the risk of late adhesive intestinal obstruction.

In order to avoid missing serious but initially asymptomatic injuries, several diagnostic algorithms have been suggested. These algorithms take into consideration physical examination, local wound exploration, diagnostic peritoneal lavage and/or imaging.

The clinical presentation, findings on examination, and location of the penetrating wounds are important determinants of early treatment planning. For example, clinical presentations of hemorrhagic shock or generalized peritonitis are considered clear indications for early laparotomy with a positive predictive value of over 80% for injuries requiring surgical repair [9]. In one series, in which omental evisceration was considered an indication for laparotomy, 75% of the patients were found to have serious abdominal injury on laparotomy. However, omental evisceration in a stable patient lacking evidence of peritonitis is not considered by all trauma surgeons to be an absolute indication for laparotomy [10]. This controversial issue certainly should be clarified by prospective future investigation.

Many trauma centers perform local wound exploration to determine whether or not peritoneal penetration has occurred. However, this method is dependent on the body habitus of the patient. Peritoneal penetration will readily be discovered in a thin patient, while in an obese patient or a patient with thick

abdominal musculature this method may prove difficult and futile. Moreover, even when peritoneal penetration has been visualized, no clear correlation to the severity of the abdominal injury can be established, nor is this an adequate indication for laparotomy [11].

Diagnostic peritoneal lavage is often used to identify bleeding in the abdominal cavity. However, there is no threshold that is both highly sensitive and highly specific in indicating the need for laparotomy which will result in a therapeutic exploration. In one series in which a diagnostic peritoneal lavage count of greater than 10,000 red blood cells/mm<sup>3</sup> was used as a criterion for laparotomy, no injuries were missed [12] and only 5 (19%) of the 26 explorations resulted in therapeutic laparotomies.

Plain abdominal radiographs are rarely effective in the evaluation of abdominal stab wounds. Many patients requiring surgical repair have normal X-rays. While it is true that extraluminal air when demonstrated on plain films is a poor prognostic finding and indicates a high likelihood of significant organ injury, on the whole, abnormal roentgenograms add a negligible contribution to the evaluation of trauma patients [13].

Abdominal ultrasonography evaluation for free intraabdominal fluids is fast, reliable, non-invasive and inexpensive. However, the demonstration of blood in the abdominal cavity does not necessarily coincide with the presence of significant organ injury. Bleeding from the liver, spleen or even omental injury may stop spontaneously. Moreover, the blood demonstrated may have originated from the wound within the abdominal wall, which represents a false positive finding by ultrasonography [14].

Computed tomography scan was found to be an effective tool in evaluating stab wounds to the abdomen. It identifies solid organ injury with great specificity and sensitivity. Additionally, CT visualizes the retroperitoneum and can detect peritoneal penetration. However, CT scan has low reliability in detecting both bowel and diaphragmatic injuries [15].

Diagnostic laparoscopy is considered by some to be a safe and accurate method to evaluate stab wound injury located to the anterior and lateral walls of the abdomen, while avoiding non-therapeutic laparotomy [16]. In these circumstances this procedure has proven to be highly reliable in confirming penetration of the abdomen and in diagnosing left diaphragmatic tears. However, most trauma surgeons do not recommend performing laparoscopy routinely in anterolateral abdominal stab wounds due to high costs and added effectiveness following the other methods of evaluation [4]. Moreover, its effectiveness highly depends on the surgeon's laparoscopic skills.

In this study we demonstrate that in the 8 year period 1997–2004, there was an increase in number and severity of injury following stab wounds. This intriguing increase involved both stab wounds to the abdomen and those that targeted other body areas. In our opinion, the fact that the majority of victims appeared with multiple stab wounds is related to the increase seen in severity of injury. A patient with multiple stabs is not a victim of a coincidental conflict but a victim of premeditated intent to inflict the most serious injury possible.

The limitation of this retrospective study is that we are

unable to identify the risk factors for failure of non-operative treatment. This may be due to lack of uniformity in protocol among the different centers participating in the Trauma Registry. It is imperative that we know whether the continuous increase in the incidence of multiple stab wounds and the continuous increase in the severity of injury lead to an increase in the failure of non-operative treatment, which mandates a change in policy. The intriguing finding of the changing face of stab injury in Israel warrants a prospective study of these patients.

## References

1. Alzamel H, Cohn SM. When is it safe to discharge asymptomatic patients with abdominal stab wounds? *J Trauma* 2005;58:523–5.
2. Ertekin C, Yanar H, Taviloglu K, Guloglu R, Alimoglu O. Unnecessary laparotomy by using physical examination and different diagnostic modalities for penetrating abdominal stab wounds. *Emerg Med J* 2005;22:790–4.
3. Leppäniemi AK, Haapiainen RK. Selective nonoperative management of abdominal stab wounds: prospective, randomized study. *World J Surg* 1996;20:1101–6.
4. Leppaniemi A, Haapiainen R. Diagnostic laparoscopy in abdominal stab wound: a prospective, randomized study. *J Trauma* 2003;55:634–45.
5. Tsikitis V, Biffi WL, Majercik S, Harrington DT, Cioffi WG. Selective clinical management of anterior abdominal stab wounds. *Am J Surg* 2004;188:807–12.
6. Shaftan GW. Indications for operation in abdominal trauma. *Am J Surg* 1960;99:657–64.
7. Demetriades D, Hadjizacharia P, Constantinou C, et al. Selective nonoperative management of penetrating abdominal solid organ injuries. *Ann Surg* 2006;244:620–8.
8. Renz BM, Feliciano DV. The length of hospital stay after an unnecessary laparotomy for trauma: a prospective study. *J Trauma* 1996;40:187–90.
9. Burnweit CA, Thal ER. Significance of omental evisceration in abdominal stab wounds. *Am J Surg* 1986;152:670–3.
10. McFarlane ME. Non-operative management of stab wounds to the abdomen with omental evisceration. *J R Coll Surg Edinb* 1996; 41:239–40.
11. Markovchick VJ, Moore EE, Moore J, Rosen P. Local wound exploration of anterior abdominal stab wounds. *J Emerg Med* 1985; 2:287–91.
12. Gonzalez RP, Turk B, Falimirski ME, Holevar MR. Abdominal stab wounds: diagnostic peritoneal lavage criteria for emergency room discharge. *J Trauma* 2001;51:939–43.
13. Kester DE, Andrassy RJ, Aust JB. The value and cost effectiveness of abdominal roentgenograms in the evaluation of stab wounds to the abdomen. *Surg Gynecol Obstet* 1986;162:337–9.
14. Leppaniemi AK, Voutilainen PE, Haapiainen RK. Indications for early mandatory laparotomy in abdominal stab wounds. *Br J Surg* 1999;86:76–80.
15. Rehm CG, Sherman R, Hinz TW. The role of CT scan in evaluation for laparotomy in patients with stab wounds of the abdomen. *J Trauma* 1989;29:446–50.
16. Ahmed N, Whelan J, Brownlee J, Chari V, Chung R. The contribution of laparoscopy in evaluation of penetrating abdominal wounds. *J Am Coll Surg* 2005;201:213–16.

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