The Role of General Surgery in the Disaster of the Century in Our Country: Our Early First Surgical Results

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Abstract

Aim: The aim is to guide the clinical practices of general surgeons in extraordinary disaster situations and to contribute to the preparation processes and surgical procedures for large-scale disasters that may occur in the future.

Methods: This study was planned as a retrospective descriptive study. Twenty-nine patients who underwent emergency fasciotomy by general surgery were excluded from the study. In the study, data of 50 patients who were admitted to the general surgery clinic and underwent surgery due to earthquake-related injuries between February 6-28 were analyzed. Demographic data, affected organs, surgical procedures performed, complications, intensive care unit stay, hospital stay, and outcomes of the patients were recorded.

Results: Twenty-nine of the patients were women (58%), and 21 were men (42%). The average age was 38.78 years. The number of patients who were followed up for non-surgical reasons was 33 (66%), and 3 patients were pregnant. In our study, 30 (52%) of the patients admitted to our clinic for follow-up and treatment had intra-abdominal fluid findings following intra-abdominal organ bleeding. In our study, when the affected organs were evaluated, the liver was the most frequently injured organ. Of the patients followed up non-surgically in our study, 14 had liver trauma. The most frequent complication was acute renal failure, which occurred in 38 patients (76%).

Conclusion: Considering the limited diagnostic and treatment options in large-scale earthquakes, it should be taken into account that intraperitoneal free air detected on abdominal CT may not always indicate gastrointestinal perforation, and selected patients can be managed without emergency laparotomy under appropriate clinical monitoring.

Keywords: *Earthquake; abdominal injuries; general surgery; complications; mortality*

1. Introduction

Large-scale earthquakes are natural disasters that cause numerous deaths and injuries, exceeding the existing capacity of the healthcare system and severely negatively impacting treatment delivery. Surgical treatment constitutes the vast majority of injuries seen after such disasters. Among these injuries, abdominal injuries, soft tissue injuries, and injuries causing crush syndrome are particularly of primary interest to surgery.[1,2] Given the conditions of a disaster, an approach contrary to standard clinical practices is crucial. Limited resources, infrastructure damage, and high patient traffic are among the reasons that necessitate acting outside of standard clinical approaches.

The two major earthquakes that struck Kahramanmaraş on February 6, 2023, were one of the most devastating natural disasters in the history of Turkey and the world. These earthquakes resulted in thousands of deaths and hundreds of thousands of injuries.[3] Despite facing challenges such as damage to healthcare facilities and infrastructure, loss of healthcare professionals, and insufficient medical equipment in the affected regions, healthcare services continued under extraordinary circumstances. General surgeons have also demonstrated their commitment to critical decisions in previous natural disasters, including rapid triage, appropriate patient selection, and the correct timing of surgical interventions for selected patients.[4]

Literature data reveals that a significant portion of earthquake injuries are concentrated on orthopedic injuries, crush syndrome, and renal failure related to this syndrome.[5,6] Considering large-scale disasters, it is noteworthy that studies systematically analyzing and reporting the role of general surgery, surgical intervention indications, and operational outcomes are limited. This situation also limits the development of evidence-based preparation

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processes and intervention strategies for disaster surgery. Therefore, this study aims to analyze the clinical outcomes of patients treated by general surgeons after the February 6, 2023 earthquakes and to analyze the operative and non-operative follow-up results of patients followed by general surgeons. The findings of our study are intended to guide the clinical practices of general surgeons in extraordinary disaster situations and to contribute to preparation processes and surgical procedures for future large-scale disasters.

2. Materials and Methods

Study population and data collection

This study was planned as a retrospective descriptive study. Prior to starting the study, approval was obtained from the Scientific Research Ethics Committee of the Health Science University, Adana City Research and Training Research Hospital. Since the study was conducted using retrospective data analysis, informed consent was not obtained from patients for their participation, and the ethics committee was informed accordingly. The study analyzed data from 79 patients admitted to the general surgery clinic and undergoing surgical intervention due to earthquake-related injuries between February 6th and 28th. Inclusion criteria included patients over 18 years of age and those with abdominal injuries. Patients aged 18 and under, those with injuries other than abdominal injuries, and those who underwent surgical intervention for these injuries were excluded. Based on the exclusion criteria, 29 patients were excluded. Data from a total of 50 patients meeting the inclusion criteria were analyzed. Demographic data, affected organs, surgical procedures performed, complications, intensive care unit stay, hospital stay, and outcomes were recorded for each patient.

Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 24.0 (IBM Corp., Armonk, NY, USA). In this descriptive study, continuous variables were evaluated for their conformity to normal distribution using analytical methods. The Shapiro-Wilk test was used to analyze the normality of the distribution. Continuous variables exhibiting a normal distribution were expressed as mean ± standard deviation, while variables not exhibiting a normal distribution were expressed as median (minimum–maximum). Categorical variables were presented as number (n) and percentage (%).

3. Results

The 29 patients excluded from the study were those who underwent emergency fasciotomy by general surgery. This is because this study was designed to focus on abdominal injuries after an earthquake. Of the 50 patients included in the study, 29 were women (58%) and 21 were men (42%). The male/female ratio was 0.72. The average age was 38.78 years. The number of patients followed up outside of surgery was 33 (66%), and 3 patients were pregnant. In our study, 30 (52%) of the patients admitted to our clinic for follow-up and treatment had intra-abdominal fluid findings following intra-abdominal organ bleeding. Five (10%) of these patients also had free air in the abdomen. The number of patients with isolated intra-abdominal fluid was 17 (34%). The number of patients admitted with free air in the abdomen was 18. Of these patients, 5 (10%) had isolated free air. Three (6%) patients had gastrointestinal hemorrhage with free air. One patient was diagnosed with ischemia in the intestinal loops, and six patients were followed up with signs of post-traumatic intestinal obstruction (ileus) (Table 1). When the affected organs were evaluated in our study, liver injury was detected in 16 patients (32%), intestinal loop injury in 14 patients (30%) (colon and small intestine), pancreatic injury in 4 patients (8%), and spleen injury in 2 patients (4%) (Table 2). In our study, 14 of the patients followed up non-surgically had liver trauma. One patient underwent surgery due to liver trauma. Two patients with spleen trauma were followed up. One patient had liver, spleen, and colon injury and was followed up. Three patients with pancreatic trauma were followed up, and one patient underwent surgical drainage. In our study, comparing findings with affected organs, four patients presenting with isolated free air in the abdomen showed no intra-abdominal organ injury. Five patients with free air in the abdomen and pneumohemothorax showed no intra-abdominal organ injury (Table 3). Regarding complications, 11 (22%) patients experienced no complications. The most frequent complication was acute renal failure, occurring in 38 patients (76%). Sepsis was detected in 22 (44%) patients. Pulmonary embolism was detected in 1 (2%) patient (Table 4). Thirteen patients died under treatment. Three of these patients were operated on for gastrointestinal hemorrhage and free air in the abdomen. One patient who died was operated on for ischemia. Of the 30 patients followed up with intra-abdominal fluid findings, 6 resulted in death (Table 5).

Table 1

Distribution of patients according to findings obtained at initial presentation

	Number (n)	Percentage (%)
Fluid and air	5	10
Fluid	17	34
Bleeding and air	3	6
Ischemia	1	2
Air	5	10
İleus	6	12
Fluid and pneumohemothorax	8	16
Air and pneumohemothorax	5	10
Total	50	100

Table 2

Distribution of patients according to organ injuries

	Number (n)	Percentage (%)
Liver	15	30
Spleen	2	4
Right colon	1	2
Small intestine	6	12
Bladder	1	2
Pancreas	4	8
Sigmoid colon	5	10
Sigmoid colon and small intestine	2	4
Right colon and small intestine	1	2
Liver, spleen, and large intestine	1	2
No organ injury	12	12
Total	50	100

Table 3

Distribution of abdominal organ diagnoses and treatments according to organ injury

		Liver (n)	Spleen (n)	Right colon (n)	Small intestine (n)	Bladder (n)	Pancreas (n)	Sigmoid colon (n)	Sigmoid colon and small intestine (n)	Right colon and small intestine (n)	Liver, spleen, and large intestine (n)	No organ injury (n)	Total (n)
The process performed	Monitoring	14	2	0	3	0	3	2	0	0	1	8	33
	Diagnostic laparotomy	0	0	0	1	0	1	0	0	0	0	4	6
	Primary repair	0	0	0	0	1	0	1	1	0	0	0	3
	Anterior resection	0	0	0	0	0	0	1	1	0	0	0	2
	Low anterior resection	0	0	0	0	0	0	1	0	0	0	0	1
	Small intestine resection	0	0	0	1	0	0	0	0	0	0	0	1
	Right hemicolectomy	0	0	1	0	0	0	0	0	1	0	0	2
	Liver segmentectomy	1	0	0	0	0	0	0	0	0	0	0	1
	Adhesiolysis	0	0	0	1	0	0	0	0	0	0	0	1
	Total	15	2	1	6	1	4	5	2	1	1	12	50
Diagnosis	Fluid and air	1	0	0	1	1	0	1	1	0	0	0	5
	Fluid	11	0	0	1	0	3	0	0	0	1	1	17
	Bleeding and air	0	0	1	0	0	0	2	0	0	0	0	3
	Ischemia	0	0	0	0	0	0	0	0	1	0	0	1
	Air	0	0	0	0	0	0	0	1	0	0	4	5
	İleus	0	0	0	3	0	0	2	0	0	0	1	6
	Fluid and pneumohemothorax	3	2	0	1	0	1	0	0	0	0	1	8
	Air and pneumohemothorax	0	0	0	0	0	0	0	0	0	0	5	5
	Total	15	2	1	6	1	4	5	2	1	1	12	50

Table 4
Distribution of complications.

	Number (n)	Percentage (%)
None	11	22
Acute renal failure	1	24
Acute renal failure and sepsis	18	36
Acute renal failure and cardiac arrest.	4	8
Acute renal failure, sepsis, and cardiac arrest.	4	8
Pulmonary embolism	1	2
Total	50	100

Table 5
Distribution of patients according to their diagnoses, those who died and those who did not.

	Deceased (n)	Alived (n)	Total (n)
Fluid and air	2	3	2
Fluid	1	16	17
Bleeding and air	3	0	3
Ischemia	1	0	1
Air	1	4	5
İleus	1	5	6
Fluid and pneumohemothorax	3	5	8
Air and pneumohemothorax	1	4	5
Total	13	37	50

4. Discussion

The most important finding of this study shows that general surgeons play an active role in large-scale natural disasters, with both non-operative and emergency surgical interventions. All 29 patients excluded from the study as a general surgery clinic were patients who underwent emergency fasciotomy. This highlights the role of general surgeons in the surgical workload after earthquakes. Earthquakes, which cause the greatest mass destruction and mass loss of life among natural disasters, have caused the loss of over 3 million lives and material losses in the last 20 years.[7] Compared to other traumas, abdominal trauma cases are rare among the patient population brought to and treated in hospitals after earthquakes. However, it ranks 4th in pre-hospital deaths, and early intervention is crucial.[8]

When examining the demographic characteristics of the patient population followed in the general surgery clinic after abdominal injuries following the earthquake, the more vulnerable gender, females (58%), is observed to be more affected. The average age is 38.8 years, indicating a higher incidence in the younger population. Although the high number of female patients differs from the previously reported male dominance, a study conducted by the Singapore Armed Forces-led aid mission during the 2015 Nepal earthquake highlighted that, similarly to our study, the affected population was in the adult age group and no significant difference was observed in terms of gender.[9] The reasons for the higher female population are thought to be related to the geographic-demographic characteristics of the location of the event and the rescue times.

In the population affected by abdominal trauma during the earthquake, the most frequent injury was to the liver (30%), followed by colon and small intestine injuries. The vast majority of liver traumas were followed up non-surgically. In a study conducted after the Wenchuan earthquake, unlike our study, the spleen was observed as the most frequently affected organ, and splenectomy was performed in 56.8% of the cases.[10] In our study, the spleen injury rate was 4%, and all cases were followed up non-surgically. Unlike this study, pancreatic injury, a retroperitoneal organ, was also seen in a significant proportion (8%) in our study. The different rates of intra-abdominal organ injuries observed in our study compared to the literature may be related to the mechanisms of the earthquake.

In the patient population admitted to the hospital after the earthquake, all patients with abdominal trauma and stable condition underwent computed tomography scans, and intra-abdominal free fluid, a sign of intra-abdominal hemorrhage, was observed in the majority of patients. Intra-abdominal hemorrhage was ruled out in unstable patients using emergency ultrasonography. Similar to our study, in the study by Xu Y. et al., intra-abdominal hemorrhage was the most frequent finding of intra-abdominal organ injuries, and the most frequent finding was intra-abdominal free fluid.[10] Intra-abdominal free air, another acute abdominal finding, is the most frequent finding of intra-abdominal hollow organ perforation.[11] In our study, unlike other studies, the most notable finding was that emergency laparotomy was performed on the first patients with intra-abdominal free air and board abdomen, and intra-abdominal organ perforation was not observed in the majority of patients. Therefore, in order to avoid unnecessary laparotomy, patients with free air observed on computed tomography imaging at the time of admission were closely monitored. No surgical intervention was required in these patients under follow-up. Managing patients with intra-abdominal free air findings with clinical observation without accompanying organ injury is important in terms of managing injured people in large-scale natural disasters. It has been emphasized in previous studies that intra-abdominal free air may be of intrathoracic origin, especially in the presence of pneumohemothorax, and that unnecessary laparotomy should be avoided.[12]

Acute renal failure and sepsis due to crush syndrome, which develops as a result of trauma mostly seen after earthquakes, are among the most frequently observed complications in the patient population included in our study. The frequency of these complications is also emphasized in the literature.[13] When evaluating patients who experienced death, the majority of patients who underwent surgery were those operated on due to intra-abdominal bleeding; however, in patients who were medically followed up, death occurred in those with other organ injuries and those who developed acute renal failure and sepsis due to crush syndrome during the follow-up period. It is known that abdominal hollow organ injury and the resulting bowel ischemia associated with sepsis after an earthquake also increase mortality.[14] Acute renal failure occupies an important place among the complications. It has been emphasized in previous studies that acute renal failure is frequently observed in patients with rhabdomyolysis, hypovolemia, and multiple organ failure resulting from a high rate of crush injury.[15,16]

Limitations of the study

This study has some limitations. First, it is a single-center, retrospective study. Second, it is designed as a descriptive study.

Therefore, it was not possible to establish a causal relationship between risk factors and variables associated with mortality. Finally, due to the lack of long-term follow-up data, the long-term outcomes of both surgical and non-surgical approaches could not be evaluated.

5. Conclusions

In conclusion, although clinical features and affected organs show similarities, consistent with limited literature, it should be considered that intraperitoneal free air detected on abdominal CT may not always indicate gastrointestinal perforation, and selected patients can be managed without emergency laparotomy under appropriate clinical monitoring, given the limited diagnostic and treatment options in large-scale earthquakes. In addition, it should be kept in mind that in large-scale disasters, making accurate operative/non-operative follow-up decisions based on patients' diagnoses requires a crucial decision-making process in the proper management of resources.

Scientific Responsibility Statement
The authors declare that they are responsible for the article's scientific content, including study design, data collection, analysis and interpretation, writing, and some of the main line, or all of the preparation and scientific review of the contents, and approval of the final version of the article.

Statement of ethics
This study was approved by the Ethics Committee of Adana City Training and Research Hospital (Date: 2023-04-06, No: 2445).

Author contributions
All authors contributed equally to the article and read and approved the final manuscript.

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Conflict of interest statement
The authors declare that they have no conflict of interest.

Availability of data and materials
The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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