

Retrospective investigation of patients undergoing splenectomy: Our 8-year clinical experience in a single center

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ABSTRACT

OBJECTIVE: Elective splenectomy is often performed due to hematological diseases. In this study, we aimed to investigate the splenectomy procedures performed in our clinic under emergency and elective conditions by analyzing the surgical techniques applied, surgical indications, and the clinical and demographic data of the patients, while seeking to discuss this subject, which holds a significant place in general surgical practice, in light of current literature.

METHODS: Patients who underwent splenectomy surgery in the general surgery clinic of a tertiary care hospital between September 2016 and September 2024 were included in the study. Clinical and demographic data of the patients were collected retrospectively through the hospital information management system records.

RESULTS: The mean age of 89 patients included in the study was 41.0±18.8 years (18-76 years). The male/female ratio was 1.3/1. The most common indication for splenectomy was trauma (38.2%). This was followed by mass (29.2%), splenomegaly (14.6%), and immune thrombocytopenic purpura (ITP) (14.6%). Of the patients, 62.9% underwent open surgery, while 37.1% were operated on using the laparoscopic technique. Of the patients, 57.3% underwent elective surgery, while emergency surgery was planned for 42.7%.

CONCLUSION: While splenectomy is a life-saving intervention in emergency conditions, it has become the most important treatment in some hematological diseases. Firstly, accurate surgical indication and the selection of an appropriate surgical technique tailored to the patient are of critical importance. There are still controversial issues in the current literature regarding the indications for splenectomy and the surgical technique to be applied.

Keywords: Hemolytic anemia; laparoscopy; spleen; splenectomy.

Cite this article as: Erten E, Ucaner B, Cimen S. Retrospective investigation of patients undergoing splenectomy: Our 8-year clinical experience in a single center. *North Clin Istanbul* 2025;12(2):231–238.

In addition to playing an active role in the hematological system, the spleen is also an important organ due to its role in the immune system. The spleen plays an active role in both cellular and humoral immunity [1]. Splenectomy can be performed under emergency and elective conditions. Splenectomy was first performed for therapeutic purposes by Wells in 1887, and

it has been a successfully applied method ever since [2]. Elective splenectomy is often performed due to hematological diseases. Splenectomy may be preferred in the treatment of hematological diseases such as hemolytic anemia, idiopathic thrombocytopenic purpura, sickle cell anemia, hereditary spherocytosis, and thalassemia. In addition, a splenectomy can be performed in spleen

Received: December 03, 2024

Revised: December 25, 2024

Accepted: January 11, 2025

Online: April 25, 2025

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abscess and hydatid cyst [3, 4]. In recent years, in light of technological innovations and increased surgical experience, minimally invasive methods have come to the forefront. Laparoscopic splenectomy, robot-assisted splenectomy, and NOTES (natural orifice transluminal endoscopic surgery) can be included among these methods [5, 6]. Laparoscopic splenectomy, first performed by Delaitre in 1991, has become the gold standard treatment in elective cases and for suitable patients due to its advantages, including shorter hospital stay, lower infection rates, reduced postoperative pain, and other benefits specific to laparoscopy [7, 8]. Today, with a better understanding of spleen physiology and function, it has been recognized that splenectomy is curative in some hematological diseases, while it has a palliative effect on the treatment of certain other conditions [9].

In this study, we aimed to investigate the splenectomy procedures performed in our clinic under emergency and elective conditions by analyzing the surgical techniques applied, surgical indications, and the clinical and demographic data of the patients, while seeking to discuss this subject, which holds a significant place in general surgical practice, in light of current literature.

MATERIALS AND METHODS

The study included patients who underwent splenectomy surgery in the general surgery clinic of a tertiary hospital between September 2016 and September 2024. A total of 147 patients underwent splenectomy during the years of the study, and after applying exclusion criteria, the study was conducted using the data of 89 patients included in the analysis.

This study was approved by the Gulhane Training and Research Hospital Non-interventional Clinical Research Ethics Committee with decision no. 2024/63 dated November 14, 2024. This study was conducted in accordance with the World Medical Association Declaration of Helsinki-Ethical Principles for Medical Research Involving Human Subjects.

Clinical and demographic data of the patients were collected retrospectively through the hospital information management system records. The clinical data of the patients were investigated based on the preferred surgical method (open/laparoscopic), surgical indications (trauma, hematological diseases, benign spleen

Highlight key points

- The most common indication for splenectomy was trauma (38.2%). This was followed by mass (29.2%), splenomegaly (14.6%), and immune thrombocytopenic purpura (ITP) (14.6%).
- Of the patients, 62.9% underwent open surgery, while 37.1% were operated on using the laparoscopic technique.
- Of the patients, 57.3% underwent elective surgery, while emergency surgery was planned for 42.7%.

conditions), biochemical parameters (complete blood count and other routine biochemical parameters), hospital stay duration, intensive care unit (ICU) stay duration, Charlson Comorbidity Index (CCI), Clavien-Dindo Classification, spleen size (cm), and operation time (minutes). In addition, demographic data of the patients such as age, gender and smoking status were also included in the study.

Patients under 18 years of age, those operated on for metastatic diseases, patients whose surgery was initially laparoscopic but converted to open surgery, and patients who underwent abdominal surgery other than splenectomy and had splenectomy performed due to iatrogenic injury during the procedure were excluded from the study.

Statistical Analysis

All analyses were performed by using the IBM SPSS Statistics® Statistical Software Program version 22.0 (IBM Corporation, 1 New Orchard Road, Armonk, New York, United States). Descriptive statistics were expressed as numbers, percentages, mean, standard deviation, and median. The suitability of the variables for normal distribution was analyzed. Age, body mass index (BMI), hemoglobin, hematocrit, urea, creatinine, and spleen size were found to be normally distributed, while CCI, WBC, platelet count, operation time, hospital stay, and ICU stay durations were not normally distributed. Patient characteristics were compared based on the surgical technique, type of surgery (elective, emergency), and ICU admission. Normally distributed variables were analyzed using the Student's T test, while non-normally distributed variables were analyzed using the Mann-Whitney U test. Chi-square test and Fisher's Exact test were used to compare the nominal data. In statistical analyses, comparisons with p-values below 0.05 were considered statistically significant.

RESULTS

The mean age of 89 patients included in the study was 41.0 ± 18.8 years (18–76 years). The male/female ratio was 1.3/1. The most common indication for splenectomy was trauma (38.2%). This was followed by mass (29.2%), splenomegaly (14.6%), and immune thrombocytopenic purpura (ITP) (14.6%). Of the patients, 62.9% underwent open surgery, while 37.1% were operated on using the laparoscopic technique. Of the patients, 57.3% underwent elective surgery, while emergency surgery was planned for 42.7%. The median operation time was 140 minutes, with a range from 50 to 410 minutes. Approximately three-fifths of the cases were admitted to the ICU after the operation. Postoperatively, according to the Clavien-Dindo classification, 60.7% of patients experienced grade I complications, 23.6% had grade II complications, and 9% had grade V complications. 10.1% of the cases died in the postoperative period (Table 1).

Demographic characteristics, laboratory results, and prognostic features related to splenectomy were compared between the emergency and elective surgery cases. The proportion of cases with an ASA score of III–V was higher in the emergency surgery group compared to the elective surgery group ($p < 0.001$). Among the laboratory results of the emergency surgery group, WBC ($p = 0.003$), urea ($p = 0.002$), and creatinine levels ($p = 0.038$) were higher. The proportion of trauma-related surgeries was higher in the emergency surgery group compared to the elective cases ($p < 0.001$). No difference was observed in operation time; however, open technique was more frequently used in the emergency surgery group ($p < 0.001$). The rate of Clavien-Dindo class I complications was higher in the elective surgery group, while the rates of class II–V complications were lower ($p < 0.001$). Finally, in the emergency surgery group, ICU stay ($p < 0.001$) and hospital stay ($p = 0.005$) were longer, and the mortality rate was higher (21.1% vs. 2%, $p = 0.004$) (Table 2).

The characteristics of the cases were compared according to the surgical technique. The proportion of cases with an ASA score of III–V was higher in the open surgery group compared to the laparoscopic technique group ($p < 0.001$). In the open surgery group, urea ($p = 0.001$) and creatinine ($p = 0.031$) levels, as well as the frequency of trauma as an indication for splenectomy ($p < 0.001$), were higher. ICU stay ($p < 0.001$) and hospital stay ($p < 0.001$) were longer in the open surgery group. No patients were lost in the laparoscopic surgery group (0% vs. 16.1%, $p = 0.024$) (Table 3).

TABLE 1. Descriptive characteristics of patients

Demographic-descriptive characteristics	Number (Percentage)
Age*	41.0±18.8
Gender (%)	
Female	43.8
Male	56.2
BMI (kg/m ²)*	24.4±3.0
Smoking (%)	14.6
ASA score (%)	
I	14.6
II	56.2
III	15.7
IV	10.1
V	3.4
CCI**	1 (0–7)
Lab	
WBC (10 ³ /μl)**	7.3 (0.4–33.3)
Hemoglobin (g/dl)*	11.8±2.5
Hematocrit (%)*	35.6±7.8
Platelet (10 ⁶ /μl)**	179 (8–386)
Urea (mg/dl)*	31.5±14.1
Creatinine (mg/dl)*	0.94±0.46
Features associated with splenectomy	
Indication for surgery (%)	
Trauma	38.2
Mass	29.2
Splenomegaly	14.6
ITP	1.6
Others	3.4
Surgery time (min)**	140 (50–410)
Surgical technique (%)	
Open	62.9
Laparoscopic	37.1
Surgery type (%)	
Emergency	42.7
Elective	57.3
Spleen size (cm)*	14.9±5.4
Prognostic features	
Clavien-Dindo Classification (%)	
I	60.7
II	23.6
III	3.4
IV	3.4
V	9.0
ICU admission	54 (60.7)
ICU stay (days)**	1 (1–33)
Hospital stay duration (days)**	7 (1–70)
Mortality	9 (10.1)

BMI: Body Mass Index; ASA: American Society of Anesthesiologists Score; CCI: Charlson Comorbidity Index; WBC: White blood cell count; ITP: Immune Thrombocytopenic Purpura; ICU: Intensive care unit. *: Mean±SD; **: Median (min–max).

TABLE 2. Analysis of patient characteristics according to surgery type (emergency, elective)

	Emergency (n=38) Number (Percentage)	Elective (n=51) Number (Percentage)	p
Demographic-descriptive characteristics			
Age*	41.9±17.9	40.4±19.6	0.715 [†]
Gender (%)			0.476 ^{††}
Female	39.5	47.1	
Male	60.5	52.9	
BMI (kg/m ²)*	24.6±2.2	24.3±3.6	0.663 [†]
Smoking (%)	15.8	13.7	0.785 ^{††}
ASA Score (%)			<0.001 ^{††}
I-II	44.7	90.2	
III-V	55.3	9.8	
CCI**	1 (0–7)	1 (0–7)	0.642 ⁺
Lab			
WBC (10 ³ /μl)**	9.7 (0.4–22.5)	6.5 (1.7–33.3)	0.003 ⁺
Hemoglobin (g/dl)*	11.2±3.2	12.3±1.8	0.052 [†]
Hematocrit (%)*	33.6±10.1	37.1±5.2	0.055 [†]
Platelet (10 ⁶ /μl)**	180 (8–386)	165 (24–378)	0.630 ⁺
Urea (mg/dl)*	36.9±17.2	27.5±9.6	0.002 [†]
Creatinine (mg/dl)*	1.07±0.67	0.84±0.13	0.038 [†]
Features associated with splenectomy			
Indication for surgery (%)			<0.001 ^{††}
Trauma	89.5	0	
Mass	2.6	49.0	
Splenomegaly	0	25.5	
ITP	2.6	23.5	
Others	5.3	2.0	
Surgery time (min)**	133 (50–410)	140 (60–250)	0.531 ⁺
Surgical technique (%)			<0.001 ^{††}
Open	97.4	37.3	
Laparoscopic	2.6	62.7	
Spleen size (cm)*	11.5 (8–22)	15 (9–35)	<0.001 ⁺
Prognostic features			
Clavien-Dindo Classification (%)			<0.001 ^{††}
I	21.1	90.2	
II-V	78.9	9.8	
ICU admission	27 (71.1)	27 (52.9)	0.084 ^{††}
ICU stay (days)**	4 (1–33)	1 (1–10)	<0.001 ⁺
Hospital stay duration (days)**	8 (1–70)	5 (2–36)	0.005 ⁺
Mortality	8 (21.1)	1 (2.0)	0.004 ⁺⁺

BMI: Body Mass Index; ASA: American Society of Anesthesiologists Score; CCI: Charlson Comorbidity Index; WBC: White blood cell count; ITP: Immune Thrombocytopenic Purpura; ICU: Intensive care unit. *: Mean±SD; **: Median (min–max); †: Student t test; ††: Chi-square test; +: Mann Whitney U test; ++: Fisher Exact test.

TABLE 3. Analysis of patient characteristics according to surgical technique (open, laparoscopic)

	Open (n=56) Number (Percentage)	Laparoscopic (n=33) Number (Percentage)	p
Demographic-descriptive characteristics			
Age*	43.5±18.8	36.7±18.3	0.101 [†]
Gender (%)			0.117 ^{††}
Female	37.5	54.5	
Male	62.5	45.5	
BMI (kg/m ²)*	24.6±2.8	24.1±3.4	0.480 [†]
Smoking (%)	16.1	12.1	0.760 ⁺
ASA Score (%)			<0.001 ^{††}
I-II	53.6	52.4	
III-V	46.4	0	
CCI**	1 (0–7)	1 (0–5)	0.321 ⁺⁺
Lab			
WBC (10 ³ /μl)**	8.1 (0.4–33.3)	6.7 (1.8–17.4)	0.138 ⁺⁺
Hemoglobin (g/dl)*	11.5±2.8	12.3±1.8	0.129 [†]
Hematocrit (%)*	34.9±9.0	36.9±5.3	0.196 [†]
Platelet (10 ⁶ /μl)**	170 (8–386)	229 (24–378)	0.310 ⁺⁺
Urea (mg/dl)*	34.7±16.0	26.2±7.6	0.001 [†]
Creatinine (mg/dl)*	1.00±0.56	0.83±0.14	0.031 [†]
Features associated with splenectomy			
Indication for surgery (%)			<0.001 ^{††}
Trauma	60.7	0	
Mass	25.0	36.4	
Splenomegaly	8.9	24.2	
ITP	1.8	36.4	
Others	3.6	3.0	
Surgery time (min)**	135 (50–410)	140 (60–235)	0.868 ⁺⁺
Surgical technique (%)			<0.001 ^{††}
Open	66.1	3.0	
Laparoscopic	33.9	97.0	
Spleen size (cm)*	13 (8–35)	14.5 (9–22)	0.526 ⁺⁺
Prognostic features			
Clavien-Dindo Classification (%)			<0.001 ^{††}
I	39.3	97.0	
II-V	60.7	3.0	
ICU admission	36 (64.3)	18 (54.5)	0.364 ^{††}
ICU stay (days)**	3 (1–33)	1 (1–2)	<0.001 ^{††}
Hospital stay duration (days)**	8 (1–70)	5 (2–18)	<0.001 ^{††}
Mortality	9 (16.1)	0	0.024 ⁺

BMI: Body Mass Index; ASA: American Society of Anesthesiologists Score; CCI: Charlson Comorbidity Index; WBC: White blood cell count; ITP: Immune Thrombocytopenic Purpura; ICU: Intensive care unit. *: Mean±SD; **: Median (min–max); †: Student t test; ††: Chi-square test; +: Mann Whitney U test; ++: Fisher Exact test.

Patients who were admitted to the ICU after splenectomy were compared with those who were not. Among the patients admitted to the ICU, the proportion of those with an ASA score of III-V ($p=0.044$), as well as WBC ($p=0.024$) and urea levels ($p=0.003$), were higher. The frequency of Clavien-Dindo class III-V complications was more common among the patients admitted to the ICU (Table 4).

DISCUSSION

The spleen is an important organ for the body, playing a significant role in both the hematologic and immune systems. For this reason, the necessity of preserving the spleen as much as possible has been reported in recent studies [10]. Splenectomy is a significant surgery in general surgical practice. Traditionally performed using an open method, splenectomy can also be carried out through minimally invasive techniques such as laparoscopic and robotic surgery. As a result of advancing medical capabilities and increased surgical experience, minimally invasive methods have replaced traditional open splenectomy in appropriate cases [11].

Based on the data from our study, age and gender did not show statistically significant differences among patients who underwent splenectomy. Similarly, when examining the results of a study conducted by Camejo et al. [12] in Germany on 106 patients, it was reported that demographic parameters such as age and gender did not yield significant results in splenectomy cases, showing consistency with the results of our study.

Approximately one-third of the patients who underwent splenectomy were operated on using the laparoscopic technique. We believe that the high proportion of patients who underwent surgery under emergency conditions, accounting for nearly half of the total patient population, played a significant role in obtaining this result. Especially in emergency splenectomies performed due to trauma, open surgery was generally the preferred technique due to the presence of hemodynamic instability in the patients. However, in appropriate cases, laparoscopic splenectomy, a much more minimally invasive method compared to open surgery, was preferred. Studies on this topic have reported several advantages of laparoscopic splenectomy compared to open splenectomy [13, 14]. Laparoscopic splenectomy has become the gold standard technique today due to the low mortality and morbidity in the postoperative period, shorter hospital stay, lower postoperative pain, and other advantages offered by laparoscopy.

When evaluating the indications for splenectomy, we observe that trauma is the most common cause among emergency indications, while splenic masses (such as splenic abscess, splenic cysts, and other benign splenic diseases) are the most frequent among elective indications. A study conducted in Türkiye with 204 patients revealed that, similar to our findings, trauma was the most common indication for splenectomy in emergency cases, while hematologic disorders were the leading indication for elective splenectomies [15]. In another study by Bonnet et al. [16], it was reported that among the hematologic disorders, which constitute the majority of elective splenectomies, hemolytic anemia and immune thrombocytopenic purpura were the most commonly observed indications for splenectomy.

In our study, when evaluating the complications that developed during postoperative follow-up according to the Clavien-Dindo Classification, the complication rates in emergency and open splenectomies were found to be significantly higher compared to elective cases and laparoscopic splenectomies. In a meta-analysis conducted by Feng et al. [17] in China, the postoperative complication rate in laparoscopic splenectomies was found to be lower compared to open splenectomies. In another study conducted in Canada, it was noted that infections and thrombotic complications played a significant role in the complications that developed after splenectomy. Additionally, the same study reported that postoperative portal vein thrombosis was more frequently observed in patients who underwent laparoscopic surgery [18]. When the subject is analyzed overall, laparoscopic splenectomy, as a minimally invasive technique, offers several advantages over open splenectomy. However, due to the distinct characteristics of laparoscopic surgery, there may also be certain drawbacks compared to open surgery. The increased incidence of portal vein thrombosis in laparoscopic surgery is also considered one of these drawbacks.

In our study, the mortality rate following splenectomy was reported to be approximately 10%. Various studies on the subject report mortality rates ranging from 2.4% to 6% [19–21]. We believe that the result is influenced because approximately half of the patients included in our study underwent surgery under emergency conditions, with about 90% of the emergency splenectomy indications being trauma-related admissions.

There were some limitations in our study. A limitation of the study is its retrospective design. Another limitation could be the fact that the surgeries were not managed by a single surgeon and anesthetist.

TABLE 4. Comparison of patient characteristics who were and were not admitted to the intensive care unit

	ICU (+) (n=54) Number (Percentage)	ICU (-) (n=35) Number (Percentage)	p
Demographic-descriptive characteristics			
Age*	41.7±19.0	40.0±18.8	0.678 [†]
Gender (%)			0.772 ^{††}
Female	42.6	45.7	
Male	57.4	54.3	
BMI (kg/m ²)*	24.7±3.3	24.0±2.7	0.335 [†]
Smoking (%)	13.0	17.1	0.585 ^{††}
ASA Score (%)			0.044^{††}
I-II	63.0	82.9	
III-V	37.0	17.1	
CCI**	1 (0–7)	1 (0–6)	0.729 ⁺
Lab			
WBC (10 ³ /μl)**	8.6 (0.4–33.3)	6.4 (1.7–20.1)	0.024⁺
Hemoglobin (g/dl)*	11.9±2.2	11.7±2.9	0.707 [†]
Hematocrit (%)*	36.0±6.9	35.0±9.2	0.541 [†]
Platelet (10 ⁶ /μl)**	188 (8–386)	140 (38–378)	0.399 ⁺
Urea (mg/dl)*	34.7±16.2	26.7±8.3	0.003[†]
Creatinine (mg/dl)*	1.00±0.57	0.85±0.19	0.133 [†]
Features associated with splenectomy			
Indication for surgery (%)			0.278 ^{††}
Trauma	44.4	28.6	
Mass	24.1	37.1	
Splenomegaly	13.0	17.1	
ITP	13.0	17.1	
Others	5.6	0	
Surgery time (min)**	143 (50–410)	130 (60–235)	0.078 ⁺
Surgical technique (%)			0.364 ^{††}
Open	66.7	57.1	
Laparoscopic	33.3	42.9	
Surgery type (%)			0.084 ^{††}
Emergency	50.0	31.4	
Elective	50.0	68.6	
Spleen size (cm)*	13 (8–35)	14 (9–32)	0.555 ⁺
Prognostic features			
Clavien-Dindo Classification (%)			0.003^{††}
I	48.1	80.0	
II-V	51.9	20.0	
Hospital stay duration (days)**	7 (1–70)	6 (1–19)	0.538 ⁺
Mortality	8 (14.8)	1 (2.9)	0.083 ⁺⁺

BMI: Body Mass Index; ASA: American Society of Anesthesiologists Score; CCI: Charlson Comorbidity Index; WBC: White blood cell count; ITP: Immune Thrombocytopenic Purpura; ICU: Intensive care unit. *: Mean±SD; **: Median (min–max); †: Student t test; ††: Chi-square test; +: Mann Whitney U test; ++: Fisher Exact test.

Conclusion

The spleen is an important organ for both the immune system and the hematological system. On the other hand, splenectomy is a significant surgery in general surgical practice. In conclusion, while splenectomy is a life-saving intervention in emergency conditions, it has become the most important treatment method in some hematological diseases. Firstly, accurate surgical indication and the selection of an appropriate surgical technique tailored to the patient are of critical importance. There are still controversial issues in the current literature regarding the indications for splenectomy and the surgical technique to be applied. As the number of homogeneous, larger population studies and prospective studies related to the topic increases, the questions in clinicians' minds will find answers.

Ethics Committee Approval: The Gulhane Training and Research Hospital Non-interventional Clinical Research Ethics Committee granted approval for this study (date: 14.11.2024, number: 2024/63).

Authorship Contributions: Concept – EE, BU; Design – BU, SC; Supervision – SC, EE; Fundings – BU, EE; Materials – BU, SC; Data collection and/or processing – SC, BU; Analysis and/or interpretation – EE, BU; Literature review – BU, SC; Writing – BU, EE; Critical review – BU, EE, SC.

Conflict of Interest: No conflict of interest was declared by the authors.

Use of AI for Writing Assistance: The authors declared that artificial intelligence and artificial intelligence-related software were not used in the study.

Financial Disclosure: The authors declared that this study has received no financial support.

Peer-review: Externally peer-reviewed.

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