

Splenic surgery: a ten years experience of a tertiary center in Turkey



Ann. Ital. Chir., 2022 93, 1: 59-64
pii: S0003469X22037307

Orgun Gunes*, Yusuf Murat Bag**, Emre Turgut***, Ajda Gunes****, Fatih Sumer***, Cuneys Kayaalp***

*Department of Gastrointestinal Surgery, Atatürk Training and Research Hospital, Izmir, Turkey

**Department of Gastrointestinal Surgery, Van Training and Research Hospital, Van, Turkey

***Department of Gastrointestinal Surgery, Inonu University Faculty of Medicine, Malatya Turkey

****Department of Hematology, Ege University Faculty of Medicine, Izmir, Turkey

Splenic surgery: a ten years experience of a tertiary center in Turkey

AIM: Splenectomy has been performed for various indications. In this study, we aimed to present the experience of a tertiary center on splenic surgery and analyze what has changed in the last 10 years.

MATERIAL AND METHODS: Three hundred and sixteen patients who underwent splenic surgery were enrolled in the study. Demographic data, comorbidities, American Society of Anesthesiologists score, indications, operation type, postoperative complications, and mortality were analyzed retrospectively.

RESULTS: The most common indication was traumatic splenic injury. Immune thrombocytopenic purpura (ITP) and gastric cancer were the second and third. Splenectomy was performed on 300 (94.9%) patients. Splenorrhaphy, partial splenectomy, and splenopexy were the other procedures performed. Postoperative complications occurred in almost one-third of the patients (n=118, 37.3%). Most of them were grade 5 according to the Clavien-Dindo classification.

CONCLUSIONS: Splenectomy has become a less preferred treatment option with the development of non-operative management in splenic trauma, medical treatments for hematological diseases, and a better understanding of the immune, hematological and metabolic functions of the spleen. In the future, minimally invasive and spleen-sparing surgeries will be performed more frequently for patients who need splenectomy even for those with trauma.

KEY WORDS: Cyst, Hematology, Laparoscopy, Sepsis, Splenectomy, Trauma

Introduction

The spleen which is a part of the reticuloendothelial system has both hematological and immunological functions. It plays an important role in the immediate immunological response against antigens carried by the blood. It is important for both humoral and cellular immunity¹. Splenectomy has been performed for various indications since it was first described by Quittenbaum in 1826². The most common indications are trauma, hematological disorders, and malignancies.

Laparoscopic splenectomy was first reported by Delaitre and Maignien in 1991³ and since then has been replacing the traditional open procedure. Although laparoscopy has offered some benefits on surgical outcomes, the indications for splenectomy have narrowed over time as the immune functions of the spleen are better understood. Surgeons have become more inclined to preserve the spleen.

In this study, we aimed to present the experience of a tertiary center on splenic surgery and analyze what has changed in the last 10 years.

Materials and Methods

The study was approved by the institutional review board (approval No. 2021/1753). Three hundred and sixteen patients who underwent splenic surgery between January

Pervenuto in Redazione Ottobre 2021. Accettato per la pubblicazione Novembre 2021

Correspondence to: Orgun Gunes, MD, Atatürk Training and Research Hospital, 35000 Izmir, Turkey (e-mail: orgungunes@hotmail.com)

2009 and January 2019 were enrolled in the study. We included all patients whose data were available and there were no exclusion criteria. Demographic data, comorbidities, ASA (American Society of Anesthesiologists) score, indications, operation type, postoperative complications, and mortality were analyzed retrospectively. Postoperative complications were classified according to the Clavien-Dindo classification ⁴.

STATISTICAL ANALYSIS

The normality of the distribution of numerical variables was tested by the Shapiro-Wilk test. Numerical variables were presented as median (minimum-maximum) and categorical variables were presented as frequencies and percentages. The IBM SPSS Statistics for Windows, version 25.0 (IBM Corp., Armonk, N.Y., USA) was used for analysis.

Results

Patients' demographic data are given in Table I. The median age of the study group was 51 years (4-104 years) and 54.4% of the patients (n=172) were male. Almost one in four patients had at least one comorbidity. Most of the patients (n=217, 68.7%) were classified as ASA 2.

Indications for surgery and mortality rates are presented in Table II. The most common indication was traumatic splenic injury. Immune thrombocytopenic purpura (ITP) and gastric cancer were the second and third. Splenectomy was performed on 300 (94.9%) patients. Conventional splenectomy was the most preferred procedure. Splenorrhaphy, partial splenectomy, and splenopexy were the other procedures performed. Most of the patients underwent surgery under elective conditions (n=221, 69.9%), only one-third of the patients were operated on under emergent conditions (Table III). Postoperative complications occurred in almost one-third of the patients (n=118, 37.3%). Most of them

TABLE I - Patients' demographic data

	Study group (n=316)
Age	51 (4-104)
Gender (male)	172 (54.4)
ASA physical status classification	
1	27 (8.5)
2	217 (68.7)
3	69 (21.8)
4	3 (1)
Comorbidity (yes)	77 (24.4)

ASA: American Society of Anesthesiologists.

TABLE II - Indications for surgery and mortality

Indication	n (%)	30-day mortality(%)
Trauma	91(28.8)	18(19.8)
ITP	56(17.8)	1(1.8)
Gastric cancer (D2 dissection)	33(10.5)	3(9.1)
Distal pancreatic mass	30(9.5)	2(6.7)
Secondary malignancies	23(7.4)	7(30.4)
Splenic cyst	13(4.1)	0(0)
Iatrogenic	13(4.1)	3(23.1)
Portal hypertension	11(3.5)	1(9.1)
Hematological malignancies	9(2.9)	3(33.3)
Splenic abscess	9(2.9)	2(22.2)
Liver transplantation	5(1.7)	2(%40)
Splenomegaly	5(1.7)	0(0)
Hemangioma	4(1.2)	1(25)
Hydatid cyst	4(1.2)	0(0)
Hereditary spherocytosis	2(0.6)	0(0)
Myelofibrosis	2(0.6)	1(50)
Autoimmune hemolytic anemia	2(0.6)	0(0)
Felty's syndrome	1(0.3)	0(0)
Spontaneous rupture	1(0.3)	0(0)
Splenic vein thrombosis	1(0.3)	0(0)
Wandering spleen	1(0.3)	0(0)

ITP: Immune thrombocytopenic purpura.

TABLE III - Types of surgery performed

Surgery	n(%)	Open(%)	Laparo
Splenectomy	300(94.9)	212(70.7)	83(27.3)
Splenorrhaphy	10(3.2)	10(100)	0
Partialsplenectomy	5(1.6)	1(20)	4(80)
Splenopexy (WS*)	1(0.3)	0(0)	1(100)

*Wandering spleen

were grade 5 according to the Clavien-Dindo classification (Table IV).

Discussion

Trauma is still the most common indication for splenectomy despite the treatment of splenic traumatic injury has shifted to non-operative management to protect the spleen and its functions ^{5,6}. Nowadays, if hemodynamic is stable, even high-grade splenic injuries can be successfully treated conservatively. A multi-center cohort study, although it was not statistically significant, found mortality to be higher after splenic trauma in the splenectomy group (24.8%) compared to the non-operative treatment group (22.2%) ⁷. In this study, in accordance with the literature, 28.7% (n=91) of the patients underwent splenectomy due to trauma and this was the most common indication. And also, mortality was found to be 19.8% after splenectomy for trauma, which was compatible with the literature too.

TABLE IV - Postoperative complications

C-D	Complication	N.	Treatment
1	Wound infection	16	Conservative
	Subphrenic fluid collection	5	Conservative
	Fever	9	Conservative
2	Urinary tract infection	8	Antibiotics
	Pneumonia	7	Antibiotics
	Subphrenic hematoma	3	Blood transfusion
	Portal vein thrombosis	3	Anticoagulant therapy
3a	Pancreatic fistula	5	Percutaneous drainage
	Subphrenic abscess	3	Percutaneous drainage
	Intraabdominal hematoma	1	Percutaneous drainage
	Port-site bleeding	1	Suture-ligation
3b	Intraabdominal hemorrhage	4	Relaparotomy/relaparoscopy
	Subphrenic abscess	2	Relaparotomy/relaparoscopy
	Colon injury	1	Relaparotomy
	Gastric injury	1	Relaparotomy
	Diaphragmatic injury	1	Relaparoscopy
4a	ARF (due to postoperative bleeding)	2	Relaparotomy
4b	ARF and PF	2	Renal and pulmonary support therapy
5	Death due to multiple trauma	18	Death
	Sepsis following anastomotic leak	8	Death
	Bleeding	8	Death
	Massive pulmonary embolism	4	Death
	Febrile neutropenia and sepsis	3	Death
	Arterial mesenteric ischemia	1	Death
	Pancreatic fistula and perforation of stomach(probabl due to termal injury), ARF and PF	1	Death
	Pancreatic fistula(secondary perforation of colon, multiple reoperations)	1	Death

C-D: Clavien-Dindo classification, ARF: Acute renal failure, PF: Pulmonary failure

The second most common splenectomy indication is hematological diseases. In 1910, Sutherland and Burghard described splenectomy in the treatment of hereditary spherocytosis (HS) first. After, in 1916, Kaznelson performed splenectomy in the treatment of ITP^{8,9}. Although splenectomy has lagged behind with the availability of new medical treatment options for hematological diseases, it still keeps the importance in the diagnosis and treatment especially for drug-resistant diseases and splenomegaly complications. Among the hematological diseases, splenectomy is performed most frequently due to ITP. Girgin et al.¹⁰ and Necat et al.¹¹ found the rate of ITP 56% and 82.7%, respectively in patients who underwent splenectomy for hematological diseases. In this study, this rate was 72.7%. One of 56 patients who underwent splenectomy for ITP developed mortality due to postoperative bleeding. It was stated in a systematic review by Kojouriet et al.¹² that 66% of patients who underwent splenectomy had complete remission, 88% of them had a complete or partial response, and 15% of them had a relapse. Many studies have investigated prognostic factors for complete response, but no generally accepted prognostic factor was found¹². The accessory spleen was detected in four patients (7.1%) during surgery. Resection of accessory spleen was performed for one patient due to relapsed

ITP. It is recommended to investigate routine accessory spleen preoperatively for benign hematological diseases¹³. According to our experience, laparoscopic exploration is sufficient for diagnosis and treatment¹⁴. Erythrocyte diseases such as HS and hemolytic anemias are other hematological diseases that may require splenectomy. A good clinical response in the long term, with low mortality and morbidity, is provided with splenectomy in these patients¹⁵. In this study, four patients were operated on for HS and hemolytic anemia. Cholecystectomy was not performed and no mortality was observed. The prognosis of myelofibrosis is poor and splenectomy does not improve survival. However, it can be performed for symptomatic patients with splenomegaly¹⁶. Mortality occurred in one of the two patients who underwent splenectomy for myelofibrosis. One patient with Felty's syndrome underwent splenectomy due to recurrent infections caused by neutropenia. In the past splenomegaly was considered as a contraindication for minimally invasive spleen surgery. Nowadays, with developing technology and gained experience, laparoscopic splenectomies can be performed for splenomegaly however it was found to be associated with prolonged operation time, increased blood loss, and prolonged hospital stay¹⁷. Vessel sealing devices can eliminate these disadvantages according to our experience¹⁸. In addition,

preoperative splenic artery embolization can increase the success rate of laparoscopy by reducing the spleen size ¹⁹. In this study, we successfully performed minimal invasive splenectomy on 5 patients with splenomegaly.

The third most common indication for splenectomy in this study was splenectomies performed for radical resection of gastric cancer. Thirty-three patients underwent splenectomy due to gastric cancer, mortality developed in 3 of these patients. Previously splenectomy was a part of gastric cancer surgery, but today splenectomy is no longer routine except for tumoral invasion. Therefore, splenectomies performed for gastric cancer have decreased.

Distal pancreatectomy and splenectomy were performed in 30 patients due to pancreatic mass. Postoperative pancreatic fistula occurred in seven patients and two of these died. One another indication for splenectomy is pancreatic masses. Distal pancreatectomy can be performed either combined with splenectomy or preserving the spleen. In a meta-analysis, it was found that postoperative pancreatic fistula rates were 9.9% with spleen preserving technique and 21% with combined splenectomy ²⁰. In this study, the postoperative pancreatic fistula rate after splenectomies for pancreatic mass was 23.3% and this was in accordance with the literature.

Splenectomy was performed in 23 patients due to metastasis or direct invasion of the seconder malignancies. Mortality occurred in seven (30.4%) of these patients in the early postoperative period. Thirteen patients underwent splenectomy due to the occurrence of iatrogenic splenic injury while performing another surgical procedure. Six of these procedures were gastric cancer surgery, three were colon cancer surgery, two were gastric bypass surgery, one for mesenteric ischemia surgery, and one for ovarian surgery. Three of these patients died in the postoperative period.

Primary splenic cysts are classified as parasitic and non-parasitic and non-parasitic cysts are very rare. Secondary splenic cysts can develop due to trauma, necrosis, and infection. Patients with symptomatic cysts, cysts larger than 5 cm, or parasitic cysts should be treated others should be followed up ²¹. In this study, we performed 17 splenectomies for splenic cysts and four of these were for parasitic cysts. One patient was operated on urgently due to a hydatid cyst rupture. Four patients underwent splenectomy after the percutaneous cyst drainage (two for continuous drainage and two for resistant symptoms). No mortality occurred in these patients.

Liver transplantation is the most effective treatment of cirrhosis but sometimes splenectomy and pericardial devascularization may be needed. Esophagogastric varices and hypersplenism are the main clinical signs in portal hypertension. Splenectomy with pericardial devascularization is an option for the treatment of esophagogastric varices. Besides a splenectomy can be performed in addition to liver transplantation for patients with end-stage liver diseases. In this study, 11 patients underwent splenectomy to control the clinical consequences of por-

tal hypertension. Splenectomy with liver transplantation was performed in five patients.

The most common cause of a splenic abscess is hematogenous spread from a distant infectious focus and neighborhood spread is another form of splenic abscess development ²². Diabetes, immunosuppressive condition, and trauma are the risk factors for splenic abscess. Splenectomy is one of the main treatment options for splenic abscess. In the literature, mortality after splenectomy for splenic abscess ranges between 12.4% and 27.6% ²². In this study, we performed 9 splenectomies for splenic abscess and two died (mortality rate was 22.2 %).

Eighty-nine of 316 surgeries were performed laparoscopically. Conversion was needed for five patients (indications for the surgery were hematological diseases for all of them) and all were due to uncontrolled bleeding. Splenectomy was performed for 300 patients, splenography was performed for 10 patients, partial splenectomy was performed for 5 patients and splenopexy was performed for one patient due to wandering spleen.

Splenorrhaphy and partial splenectomy are alternatives to splenectomy with the advantage of preserving the immune functions of the spleen. For focal lesions and hypersplenism, partial splenectomy may be considered as an ideal treatment. Regrowth of the remnant splenic tissue is an adverse effect of partial splenectomy ²³. In addition, remnant tissue can be torsioned. In this study, we performed 10 splenorrhaphies and 5 partial splenectomies with no complication.

Morris and Bullock claimed that splenectomy would increase susceptibility to infection ²⁴, King and Schumacker documented this ²⁵. Previous studies showed that the life-threatening sepsis rate after splenectomy ranges from 0.1% to 3.2% and mortality due to sepsis increased up to 50% ^{26,27}. Vaccination, prophylactic antibiotic use decreased the overwhelming post-splenectomy infection (OPSI) rate. This study showed an OPSI rate of 0.9% and the mortality due to OPSI was 100%.

In our study, grade 1 and grade 2 complications occurred in 51 patients, grade 3a and grade 3b complications occurred in 19 patients, and grade 4 complications occurred in 4 patients. Eight patients (2.5%) had postoperative thromboembolic complications. Five patients died due to massive pulmonary emboli and mesenteric ischemia. Three patients developed portal vein thrombosis and were treated with heparin and warfarin.

Thromboembolic complications after splenectomy are higher for patients who underwent splenectomy for hematological diseases and increases up to 10% ²⁸. In this study, this rate was 2.5% for all indications. In a previous study, the relative risk of 90-day mortality after splenectomy was found to be 33.6%, regardless of the indication. The risk decreases after 90 days but remains higher than the general population for a year ²⁹. In our study, we analyzed the 30-day mortality, and we found a mortality rate of 13.9% for all indications.

The study has some limitations. First, the study had a retrospective design. Second, surgical techniques and indications have changed due to the wide time interval. Finally, we could not analyze the long-term complications such as atherosclerosis, hyperlipidemia as we could not achieve all the patients.

In conclusion, splenectomy has become a less preferred treatment option with the development of non-operative management in splenic trauma, medical treatments for hematological diseases, and a better understanding of the immune, hematological and metabolic functions of the spleen. In the future, minimally invasive and spleen-sparing surgeries will be performed more frequently for patients who need splenectomy even for those with trauma.

Riassunto

La splenectomia è stata eseguita per varie indicazioni. In questo studio, abbiamo voluto presentare l'esperienza di un centro terziario sulla chirurgia splenica e analizzare cosa è cambiato negli ultimi 10 anni.

Sono stati arruolati nello studio trecentosedici pazienti sottoposti a chirurgia splenica. I dati demografici, le comorbidità, il punteggio dell'American Society of Anesthesiologists, le indicazioni, il tipo di operazione, le complicanze postoperatorie e la mortalità sono stati analizzati retrospettivamente.

L'indicazione più comune alla chirurgia della milza è rappresentata da una lesione traumatica. La porpora trombocitopenica immune (ITP) e il cancro gastrico rappresentano la seconda e la terza indicazione. La splenectomia è stata eseguita su 300 (94,9%) pazienti. La splenorrafia, la splenectomia parziale e la splenopessia sono state le altre procedure eseguite. Complicanze postoperatorie si sono verificate in quasi un terzo dei pazienti (n=118, 37,3%). La maggior parte di loro era di grado 5 secondo la classificazione Clavien-Dindo.

In conclusione la splenectomia si è dimostrata una scelta in diminuzione per il trattamento delle lesioni traumatiche della milza, con lo sviluppo dell'atteggiamento conservativo, con i trattamenti medici per le malattie ematologiche e una migliore comprensione delle funzioni immunitarie, ematologiche e metaboliche della milza. In futuro, gli interventi chirurgici mini invasivi e la chirurgia conservativa della milza saranno eseguiti più frequentemente per i pazienti un tempo trattati con splenectomia, anche nel caso dei traumi.

References

1. Traub A, Giebink GS, Smith C, et al.: *Splenic reticuloendothelial function after splenectomy, spleen repair and spleen autotransplantation*. N Engl J Med, 1987; 317:1559-564.
2. Morgenstern L: *A History of Splenectomy; or: Surgical Diseases of*

the Spleen. In: Hiatt JR, Phillips EH, Morgenstern (Eds). Springer, Berlin, 1997; 3-14.

3. Delaitre B, Maignien B: *Splenectomy by the laparoscopic approach. Report of a case*. Presse Med, 1991; 20: 2263.

4. Clavien PA, Barkun J, De Oliveira ML, et al.: *The Clavien-Dindo classification of surgical complications: five-year experience*. Ann surg, 2009; 250: 187-96.

5. Stassen NA, Bhullar I, Cheng JD, et al.: *Selective non-operative management of Blunt splenic injury: An Eastern association for the surgery of trauma practice Management guideline*. J Trauma Acute Care Surg, 2012; 73: 294-300.

6. Tugnoli G, Casali M, Villani S, Biscardi A, Baldoni F: *The treatment of splenic injuries from splenectomy to non-operative management: Our experience on 429 cases*. Ann Ital Chir, 2003; 74.

7. Heuer M, Taeger G, Kaiser GM: *No further incidence of sepsis after splenectomy for severe trauma: A multi-institutional experience of the trauma registry of the DGU with 1,630 patients*. Eur J Med Res, 2010; 15: 258-65.

8. Balague C, Targarona E.M, Cerdan G, et al.: *Longterm outcome after laparoscopic splenectomy related to hematological diagnosis*. Surg Endosc, 2004; 18:1283-87.

9. Coad JE, Matutes E, Catovsky D: *Splenectomy in lymphoproliferative disorders: A report of 70 cases and review of the literature*. Leuk Lymphoma; 1993; 10: 245-64.

10. Girgin S, Gedik E, Baç B, et al.: *Benign hematolojik hastalıklarda splenektomi sonuçlarımız*. JAEM, 2008; 4: 42-5.

11. Almalı N, Yılmaz O: *204 Splenektomi Olgusunun Analizi, Splenektomi Endikasyonları Değişiyor mu?* Van Tıp Derg, 2019; 26: 520-5.

12. Kojouri K, Vesely SK, Terrell DR, et al.: *Splenectomy for adult patients with idiopathic thrombocytopenic purpura: A systematic review to assess long-term platelet count responses, prediction of response, and surgical complications*. Blood, 2004; 104: 2623-34.

13. Lewis SM, Swirski D: *The spleen and its disorders*. Oxford textbook of Medicine, Oxford University Press, 1996.

14. Örgün Güneş: *Splenektomi Sonrası Akseuar Dalağa Bağlı Nüks Gelişen İmmün Trombositopenili Hastada Laparoskopik Akseuar Dalak Eksizyonu; or: Genel Cerrahide Nadir Görülen Acil ve Elektif Vakalar*. Ender Alınır (Eds). Akademisyen Kitapevi, Ankara, 2020. p. 543-46.

15. Lechner K, Jäger U: *How I treat auto immune hemolytic anemias in adults*. Blood, 2010; 116:1831-38.

16. Clarke PJ, Morris PJ: *Surgery of the spleen*. Oxford textbook of Surgery, Oxford University Press, 1994.

17. Pugliese R, Sansonna F, Scandroglio I, et al.: *Laparoscopic splenectomy: A retrospective review of 75 cases*. IntSurg, 2006; 91: 82-6.

18. Aydin C, Kayaalp C, Olmez A, et al.: *Laparoscopic splenectomy with a vessel sealing device*. Minim invasive Ther Allied Technol, 2008; 17: 308-12.

19. Iwase K, Higaki J, Yoon HE, et al.: *Splenic artery embolization using contour emboli before laparoscopic or laparoscopically assisted splenectomy*. Surg Laparosc Endosc Percutan Tech, 2002; 12: 331-36.

20. Nakata K, Shikata S, Ohtsuka T, et al.: *Minimally invasive preservation versus splenectomy during distal pancreatectomy: A systematic review and meta-analysis*. J Hepatobiliary Pancreat Sci, 2018; 25: 476–88.
21. Hansen MB, Moller AC: *Splenic cysts*. Surg Laparosc Endosc Percutan Tech, 2004; 14: 316-22.
22. Lee MC, Lee CM: *Splenic abscess: an uncommon entity with potentially life-threatening evolution*. Can J Infect Dis Med Microbiol, 2018; 2018: 8610657.
23. de Buys Roessingh AS, de Lagausie P, Rohrlach P, et al.: *Follow up of partial splenectomy in children with hereditary spherocytosis*. J Pediatr Surg, 2004; 37: 1459-463.
24. Morris DH, Bullock FD: *The importance of the spleen in resistance to infection*. Ann Surg, 1919; 70: 513-21.
25. King H, Schumacker HB: *Splenic studies. I. Susceptibility to infection after splenectomy performed in infancy*. Ann Surg, 1952; 136: 239-42.
26. Bisharat N, Omari H, Lavi I, et al.: *Risk of Infection and Death Among Post-splenectomy Patients*. Journal of Infection, 2001; 43: 182-86.
27. Sarangi J, Coleby M, Trivella M, et al.: *Prevention of post splenectomy sepsis: A population based approach*. J Public Health Med, 1997; 19: 208-12.
28. Mohren M, Markmann I, Dworschak U, et al.: *Thromboembolic complications after splenectomy for haematologic diseases*. Am J Hematol. 2004; 2004: 143-47.
29. Yong M, Thomsen RW, Schoonen WM, et al.: *Mortality risk in splenectomised patients: A Danish population-based cohort study*. Eur J InternMed, 2010; 21:12-6.

READ-ONLY COPY
PRINTING PROHIBITED