Original Article

ANALYSIS OF PATIENTS UNDERGOING SPLENECTOMY FOR SPLEEN MASSES

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ABSTRACT

Aims: Spleen masses, which are discovered on imaging studies, usually create difficulty in diagnosis and treatment. Except for lymphomas involving the spleen, primary and secondary neoplasms are rare and discovered by chance. This study analyses a series of splenectomies in a surgical clinic to evaluate the management of incidentally diagnosed splenic masses.

Study design: This retrospective study included patients operated for spleen masses between 2010 and 2021. Patients with a history of lymphoproliferative disease and splenectomy performed as part of a larger resection were excluded.

Methodology: The patients were divided into three groups, i.e. cystic, benign and malignant, based on the results of pathological examinations. The groups were compared in terms of age, gender, tumor size, and previous history of malignancy.

Results: Splenectomy was performed in 512 patients in 11 years, 62 of whom had solid and cystic lesions detected on imaging. Thirty-five patients (56,5%) were female and the median age was 40 years (range: 18-80 years). Forty-four patients (71%) had distinct symptoms. Radiological evaluations of all the patients were made. Diagnostic biopsy could not be performed in any of the patients. The final pathological examination showed cysts in 38 patients (61,3%), benign lesions in nine patients (14,5%) and malignant lesions in 15 patients (24,2%). Out of 15 patients with malignant lesions, one patient had Hodgkin's lymphoma, four patients had diffuse large B cell lymphoma and ten patients had metastatic tumors. There was a significant difference in age between the groups and the malignant group was older **(p = 0.017).** The size of the lesions also significantly differed and the malignant lesions had a significantly smaller diameter **(p = 0.014).** A significantly higher rate of the malignant group had a previous history of cancer (p**<0,001)**.

Conclusion: Spleen neoplasms are masses that are difficult to diagnose. Most of them are asymptomatic and are found after splenectomies by coincidence. Splenectomy can be utilized as both a diagnostic and curative method. It should be kept in mind that the lesions detected in the spleen in patients with a history of malignancy can be metastatic.

Key Words: Benign, Cystic, Malignant, Splenectomy

Abbreviations:

PET/CT: positron emission tomography with computed tomography

SANTs: Sclerosing angiomatoid nodular transformation

PML: primary malignant lymphoma

1. INTRODUCTION

Splenectomy is one of the most frequent surgeries performed by general surgeons mainly for the treatment of traumas and hematological diseases [1]. The spleen is extremely vulnerable to injuries secondary to traumas since it does not have a protective anatomic cage due to its location in the abdomen [2]. The most frequent indications for splenectomy are grade 4-5 spleen injury, symptoms of massive splenomegaly, cysts and tumors of the spleen and diagnosis and treatment of hematological diseases [2,3].

Due to frequent uses of cross-sectional imaging for patients with abdominal symptoms and frequent uses of imaging techniques for cancer surveillance, spleen masses are more frequently encountered. Primary splenic lesions typically arise from either lymphoid or endothelial components as cystic or solid lesions [3]. Hemangioma, hamartoma, lymphangioma, extra-medullary hematopoiesis, inflammatory pseudotumor, littoral cell angioma, and sclerosing angiomatoid nodular transformations (SANTs) are the primary benign splenic neoplasms. Splenic angiosarcoma is the most common primary non-hematopoietic malignant tumor of the spleen [4]. Lymphoma, myeloma, and metastases are the other malignant entities involving the spleen. Primary and secondary spleen malignancies are considered rare. However, their exact incidences are not known and their clinical importance is unclear. Detection of a new splenic lesion in a patient with a history of cancer is a difficult diagnostic and treatment dilemma [4,5].

Splenic metastases occur in 2–9% of cancer patients and are seen as isolated splenic lesions in 5.2% of patients. Metastatic lesions may result from cancers of the breasts, lungs, ovaries and large bowels and melanoma [6,7].

Splenic cysts are classified as primary or secondary according to the presence of lined epithelium . Primary cysts are mostly parasitic due to Echinococcus granulosus, and non-parasitic lesions are extremely rare. Secondary cysts are related to trauma and splenic infarction [8].

This study analyses a series of splenectomies in a surgical clinic to evaluate the management of incidentally diagnosed splenic masses.

2. PATIENTS AND METHODS

2.1 Patient selection

After ethical approval was obtained from the ethical committee of Adana City Training and Research Hospital on 27 January 2021 (approval number: 75/1288), the patients undergoing splenectomy in the general surgery clinic of the hospital between January 2010 and January 2021 were included in the study. The patients having a history of lymphoproliferative disease, hypersplenism, spleen abscess and traumatic spleen lesions and aged under 18 years were not included in the study. The patients with intraabdominal or extraabdominal disease due to a malignancy were not included, either. Data about age, gender, symptoms at presentation, imaging techniques used, history of cancer and diameter of the mass were gathered from electronic patient records and results of the pathological examinations. Insufficient or missing data about the variables examined in the hospital records was another reason for exclusion of the patients. The patients were divided into cystic, benign and malignant groups based on the results of the pathological examinations.

2.2 Statistical Analysis

The cystic, benign and malignant groups were compared in terms of age, gender, tumor size and the number of lesions. Descriptive statistics were utilized to calculate frequencies and percentages of all the relevant variables. One-way ANOVA was used to compare continuous

variables and Chi-square test was used to compare categorical variables. All the statistical analyses were made by using the Statistical Package for Social Sciences (SPSS) 25.0 (SPSS, Inc., Chicago, IL, USA). The statistical significance was set at $p<0.05$.

3. RESULTS

The study sample included a total of 62 patients, of whom 27 were male and 35 were female. The median age of the patients was 40 years (range: 18-80 years). Forty-four patients had distinct symptoms (71%). All the patients had abdominal ultrasonography, 44 patients (71%) had computed tomography, nine patients (14,5%) had magnetic resonance imaging and six patients (9,7%) had positron emission tomography with computed tomography (PET/CT). None of the patients had core needle biopsy.

Sixty-two patients underwent total splenectomy. The last pathological examination showed cysts in 38 patients (61,3%), benign lesions in nine patients (14,5%) and malignant lesions in 15 patients (24,2%). Eleven patients (17,7%) had parasitic cysts, seventeen patients (17,5%) had epithelial cysts and ten patients (16,5%) had nonepithelial cysts. Regarding benign lesions, three patients (4,8%) had hemangioma, two patients (3,2%) had hamartoma, two patients (3,2%) had sclerosing angiomatoid nodular transformation, one patient (1,6%) had Littoral cell angioma and one patient (1,6%) had splenic inflammatory myofibroblastic tumor. Regarding malignant lesions, one patient had Hodgkin's lymphoma, four patients had diffuse large B cell lymphoma and ten patients had metastatic tumors. Fourteen patients had a history of prior cancer and ten of these patients had malignant spleen lesions (Table 1).

Gender did not significantly differ between the groups. Age was significantly different between the groups and the malignant group was significantly older **(p = 0.017).**

Table 1. Demographic and Clinical Features of Patients (*n* = 62)	
Age (yr.) med (min-max)	40.5 (18-80)
Gender	

Male	27 (43,5%)
Female	35 (56,5%)
Distinct Symptoms	
Yes	44 (71%)
No	18 (29%)
Prior cancer	
Yes	14 (22,6%)
No	48 (77,4%)
Metastatic cancer (*n* = 10)	
Ovary	4 (6,5%)
Colon/rectum	2 (3,2%)
Sarcomas	2 (3,2%)
Breast	1 (1,6%)
Endometrial	1 (1,6%)
Primary splenic cancer (*n* = 5)	
Lymphoma	5 (8%)
Benign tumors (*n* = 9)	
Hemangioma	3 (4,8%)
Hamartoma	2 (3,2%)
Splenic inflammatory myofibroblastic tumor	1 (1,6%)
Littoral cell angioma	1 (1,6%)
SANTs	2 (3,2%)
Splenic Cyst (*n* = 38)	
Splenic hydatic cyst	11 (17,7%)
Splenic epithelial cyst	17 (27,2%)
Splenic non-epithelial cyst	10 (16,5%)

Table 2. Factors Associated with Malignancy

	Cystic	**Benign**	**Malignant**	**p value**

Age (mean± SD)	36,8±18,0	43,8±15	52,4±17	**0,017**
Gender (%)				
Female	21(44,7%)	7(77,8%)	7(46,7%)	0,321
Male	17 (55,3%)	2(22,2%)	8(53,3%)	
Lesion Size on Imaging (cm)	9,07±3,5	12,4±6,4	7,1±4,06	**0,014**
Prior malignancy (%)				
Yes	3(7,9%)	0	10 (66,7%)	**<0,001**
No	35(92,1%)	9(100%)	5 (33,3%)	

There was a significant difference between the benign and malignant lesions in terms of their preoperative size **(p = 0.014).** The groups had a very significant difference with respect to the history of prior malignancy and 66% of the malignant group had a history of prior malignancy (p **<0,001) (Table 2).**

4. DISCUSSION

Splenic cysts and tumors are not common. Therefore, they cause difficulties for surgeons responsible for their evaluation and treatment. A detailed history can help to differentiate them from other conditions and should involve the possibility of an infectious etiology. Asymptomatic simple cysts smaller than 5cm can appear. Larger, symptomatic and complicated cysts require treatment with splenectomy most frequently. Solid tumors are classified into lymphoid and nonlymphoid tumors. It is widely known that a reliable diagnosis of spleen masses is difficult or impossible without removing them and performing a pathological examination. Percutaneous biopsy is not recommended [8,9].

Metastases to the spleen occur in 2-9% of cancer patients and are seen as isolated splenic lesions in 5.2% of the patients [10]. Postmortem examinations reveal metastases to the

spleen in 2.3%-12.9% of cancer patients. These metastases are relatively rare clinical conditions and are usually detected in the presence of a widespread metastatic disease [11,12]. Although the spleen is frequently involved in patients with non-Hodgkin's lymphoma and in one third of the patients with Hodgkin's disease, primary malignant lymphoma (PML) of the spleen is rare. The definition of PML is debatable. However, it has been recommended that cases of lymphoma only limited to the spleen or splenic hilus should be considered to have this entity. Although PML is rare, it is the most frequent primary malignancy of the spleen [13,14]. In the present series, ten patients had metastatic cancer and five patients had lymphoma and all of them underwent splenectomy. Ovarian cancer was the most frequently metastasizing tumor. None of the cases of metastatic cancer was known to have a history of malignancy.

Hemangioma is the most frequent benign neoplasm of the spleen and most of the splenic hemangiomas are coincidentally found on imaging tests. Splenic hamartoma is a rare benign lesion that consists of malformed splenic red pulp elements without organized lymphoid follicles and whose exact cause is unclear. In general, hamartomas are coincidentally or rarely detected as a large mass or splenomegaly. Littoral cell angioma is a rare vascular tumor covering splenic red pulp sinuses and originating from littoral cells. It involves the spleen with its multiple nodular masses of red pulp elements. Most of the patients with littoral cell angioma present with signs of splenomegaly and hypersplenism on laboratory tests. Sclerosing angiomatoid nodular transformation (SANT) is an extremely rare lesion of the spleen first defined by Martel et al. in 2004. Its exact incidence remains unclear. Patients with SANT are asymptomatic and it is detected on imaging tests by chance. Symptomatic patients commonly present with an incidental splenic mass, abdominal discomfort or pain [15,16]. In the present series, nine patients had SANT and were treated with splenectomy. The patients did not need additional treatment after surgery.

Splenic cyst hydatid disease is usually caused by larval forms of Echinococcus granulosus. Splenic involvement, which appears in less than 2% of all the patients with hydatid disease, is rare. The clinical picture of splenic cyst hydatid disease is nonspecific: it presents with abdominal pain, palpable splenomegaly and fever. Splenic involvement is usually caused by systemic invasion or intraperitoneal invasion from a ruptured liver cyst [17]. Congenital cysts

of the spleen (that is, epithelial cysts and epidermoid cysts) are covered by epithelial cells. They are considered to appear as squamous metaplastic mesothelial cysts or squamous metaplastic cysts inside already available mesothelial cysts, resulting from embryonic inclusions of the surface mesothelium in the developing spleen. They are usually found in patients having no symptoms and detected on imaging tests by coincidence [18]. Although the classical treatment approach to parasitic cysts is total splenectomy, percutaneous drainage of splenic cyst hydatid through an injection together with consecutive reaspiration of a scolicidal agent (puncture-aspiration-injection-reaspiration technique) has been recommended as an alternative nonsurgical treatment for selected patients. If cysts are not parasitic, surgery is preferred for the cases of lesions with diameters larger than 5 cm to prevent possible complications and recurrences [8]. In the present series, 11 patients had parasitic cysts. They were treated with total splenectomy due to the diameters of the cysts.

Yuksel et al. classified spleen masses they incidentally detected into cystic, benign and malignant groups. They reported that although the groups did not differ in gender and age, a higher rate of the metastatic lesions consisted of multiple masses and the diameters of the metastatic tumors had smaller diameters [5]. Similarly, in the present study, the tumor diameter in the malignant group was smaller. However, the patients with malignant tumors were older and the patients found to have metastases had a prior diagnosis of primary malignancy.

This study has some limitations. It had a retrospective design and a limited number of patients. The dataset did not include the patients who could not be followed or the patients with splenic masses not undergoing splenectomy for various reasons such as declining surgery.

5. CONCLUSION

Spleen neoplasms are rare masses causing diagnostic difficulties. Most of them are asymptomatic and incidentally diagnosed after splenectomy. It can be utilized for both diagnosis and treatment. Surgeons should bear in mind that lesions detected in the spleen of a patient with a history of malignancy can be metastases from another focus.

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COMPETING INTERESTS

Authors have declared that no competing interests exist**.**

Authors' Contribution

Osman ERDOGAN (OE) critical revision, drafting and writing article, Alper PARLAKGUMUS (AP), conception and interpretation of data, Ugras DABAN (UD), design and literature research, Zeynel Abidin TAS (ZAT), interpretation, for critically important intellectual content, Oktay IRKORUCU (OI), approved of the final version to be submitted

CONSENT

Informed consent was obtained from the patients.

ETHICAL APPROVAL

This study was performed after ethical approval was obtained from the ethical committee of Adana City Training and Research Hospital.

REFERENCES

1. Sözüer EM, Ok E, Banli O, Ince O, Kekeç Z. Travmatik dalak yaralanmalari [Traumatic splenic injuries]. Ulus Travma Derg. 2001;7(1):17-21. Turkish.
2. Özkök G, Argon A, Canpolat S, Taşlı F, Karahan B, Zengel B et al. Splenektomi Materyallerinin Klinikopatolojik Özellikleri: On altı Yıllık Deneyim. Okmeydanı Tıp Dergisi 2015;31(3):129-133. doi:10.5222/otd.2015.1004
3. Gaetke-Udager K, Wasnik AP, Kaza RK, Al-Hawary MM, Maturen KE, Udager AM, Azar SF, Francis IR. Multimodality imaging of splenic lesions and the role of non-vascular, image-guided intervention. Abdom Imaging. 2014 ;39(3):570-87. doi: 10.1007/s00261-014-0080-6.
4. Falk S, Krishnan J, Meis JM. Primary angiosarcoma of the spleen. A clinicopathologic study of 40 cases. Am J Surg Pathol. 1993;17(10):959-70. doi: 10.1097/00000478-199310000-00001.
5. Pugalenthi A, Bradley C, Gonen M, Do KG, Strong V, Jarnagin W et al. Splenectomy to treat splenic lesions: an analysis of 148 cases at a cancer center. J Surg Oncol. 2013;108(8):521-5. doi: 10.1002/jso.23433.
6. Tserkezoglou A, Kontou S, Hatjieleftheriou G, Nikolaidou ME, Plataniotis G, Apostolikas N et al. Solitary parenchymal splenic recurrence of ovarian adenocarcinoma: a case report and review of the literature. Anticancer Res. 2005;25(2B):1471-6.
7. Fredericks C, Kubasiak J, Kumar V, Luu M. Splenectomy for Primary and Secondary Splenic Neoplasm. Am Surg. 2016;82(8):e204-5
8. Morgenstern L. Nonparasitic splenic cysts: pathogenesis, classification, and treatment. J Am Coll Surg. 2002;194(3):306-14. doi: 10.1016/s1072-7515(01)01178-4.
9. Alkofer B, Lepennec V, Chiche L. Kystes et tumeurs spléniques: diagnostic et prise en charge [Splenic cysts and tumors: diagnosis and management]. J Chir (Paris). 2005;142(1):6-13. French. doi: 10.1016/s0021-7697(05)80830-0.
10. Lam KY, Tang V. Metastatic tumors to the spleen: a 25-year clinicopathologic study. Arch Pathol Lab Med. 2000;124(4):526-30. doi: 10.5858/2000-124-0526-MTTTS.
11. Schön CA, Görg C, Ramaswamy A, Barth PJ. Splenic metastases in a large unselected autopsy series. Pathol Res Pract. 2006;202(5):351-6. doi: 10.1016/j.prp.2005.12.008.

12. Yuksel U. M, Turanli S, Berberoglu A. U, Gulben, K. Management of Incidentally Diagnosed Splenic Masses. *Indian Journal of Surgery*, 2018;*80*(4), 318-321. doi: 10.1007/s12262-016-1582-y
13. Brox A, Shustik C. Non-Hodgkin's lymphoma of the spleen. Leuk Lymphoma. 1993 ;11(3-4):165-71. doi: 10.3109/10428199309086992.
14. Metser U, Miller E, Kessler A, Lerman H, Lievshitz G, Oren R et al. Solid splenic masses: evaluation with 18F-FDG PET/CT. J Nucl Med. 2005;46(1):52-9.
15. Kaza RK, Azar S, Al-Hawary MM, Francis IR. Primary and secondary neoplasms of the spleen. Cancer Imaging. 2010;13;10(1):173-82. doi: 10.1102/1470-7330.2010.0026.
16. Wang TB, Hu BG, Liu DW, Gao ZH, Shi HP, Dong WG. Sclerosing angiomatoid nodular transformation of the spleen: A case report and literature review. Oncol Lett. 2016;12(2):928-932. doi: 10.3892/ol.2016.4720.
17. Malik AA, ul Bari S, Younis M, Wani KA, Rather AA. Primary splenic hydatidosis. Indian J Gastroenterol. 2011;30(4):175-7. doi: 10.1007/s12664-011-0104-x.
18. Thipphavong S, Duigenan S, Schindera ST, Gee MS, Philips S. Nonneoplastic, benign, and malignant splenic diseases: cross-sectional imaging findings and rare disease entities. AJR Am J Roentgenol. 2014;203(2):315-22. doi: 10.2214/AJR.13.11777.