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SURGICAL RESECTION OF SPLENIC LYMPHOMA: A PATHOLOGICAL REVIEW AND OUTCOME ASSESSMENT

General Surgery

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ABSTRACT

Background: Splenic lymphoma represents a heterogeneous group of hematologic malignancies with primary involvement of the spleen. Surgical resection through splenectomy remains a critical therapeutic intervention for diagnosis, staging, and treatment of splenic lymphomas. **Objective:** This review examines the pathological characteristics, surgical indications, and clinical outcomes of splenic lymphoma patients undergoing surgical resection. **Methods:** A comprehensive literature review was conducted examining studies published between 2010-2024 focusing on surgical management of splenic lymphoma, pathological findings, and patient outcomes. **Results:** Splenectomy provides definitive histological diagnosis in cases where other diagnostic modalities are inconclusive. The most common splenic lymphoma subtypes requiring surgical intervention include splenic marginal zone lymphoma (SMZL), hairy cell leukemia, and diffuse large B-cell lymphoma. Surgical outcomes demonstrate acceptable morbidity rates with significant diagnostic and therapeutic benefits. Five-year overall survival ranges from 60-90% depending on lymphoma subtype and staging. **Conclusions:** Surgical resection remains an essential component in the management of splenic lymphomas, offering both diagnostic certainty and therapeutic benefit with acceptable surgical risk profiles.

KEYWORDS

Splenic Lymphoma, Splenectomy, Pathology, Surgical Outcomes, Hematologic Malignancy

INTRODUCTION

Splenic lymphomas constitute approximately 1-2% of all non-Hodgkin lymphomas and represent a diverse group of hematologic malignancies with primary splenic involvement (Mollejo et al., 2017). The spleen's unique anatomical structure and immunological function create distinct microenvironments that can harbor various lymphoma subtypes, each presenting unique diagnostic and therapeutic challenges (Seymour et al., 2019).

The diagnosis of splenic lymphoma often requires a multidisciplinary approach involving clinical assessment, imaging studies, laboratory investigations, and histopathological examination. While advances in imaging techniques and minimally invasive biopsy procedures have improved diagnostic capabilities, surgical resection through splenectomy remains the gold standard for definitive diagnosis and staging in many cases (Franco et al., 2021).

The heterogeneous nature of splenic lymphomas, ranging from indolent marginal zone lymphomas to aggressive large cell lymphomas, necessitates individualized treatment approaches. Surgical resection serves multiple purposes: providing tissue for accurate histopathological diagnosis, enabling comprehensive staging, and offering therapeutic benefit through debulking in selected cases (Kashyap & Shukla, 2020).

This comprehensive review examines the current evidence regarding surgical resection of splenic lymphomas, focusing on pathological characteristics, surgical indications, technical considerations, and clinical outcomes. Understanding these factors is crucial for optimizing patient selection and improving therapeutic outcomes in this complex patient population.

Epidemiology and Classification

Splenic lymphomas encompass several distinct histological subtypes, each with unique biological behavior and clinical characteristics. The World Health Organization (WHO) classification system recognizes several primary splenic lymphoma entities, with splenic marginal zone lymphoma (SMZL) being the most common, accounting for approximately 20% of all splenic lymphomas (Swerdlow et al., 2018).

Splenic marginal zone lymphoma typically affects older adults with a median age of 65-70 years and shows a slight female predominance. The disease is characterized by indolent behavior but can undergo transformation to more aggressive histologies in 10-15% of cases (Arcaini et al., 2020). Other significant subtypes include hairy cell leukemia, which demonstrates characteristic "hairy" cell morphology and strong CD123 expression, and splenic involvement by diffuse large B-cell lymphoma, which represents a more aggressive entity requiring prompt therapeutic intervention (Troussard et al., 2019).

Pathological Characteristics

The pathological evaluation of splenic lymphoma requires careful examination of splenic architecture, cellular morphology, and immunophenotypic characteristics. Splenic marginal zone lymphoma typically demonstrates expansion of the white pulp marginal zones with replacement of normal follicular architecture (Matutes et al., 2018). The neoplastic cells are small to medium-sized lymphocytes with irregular nuclear contours and abundant pale cytoplasm.

Immunohistochemical analysis reveals characteristic patterns for different lymphoma subtypes. SMZL typically expresses CD20, CD79a, and shows negative staining for CD5, CD10, and cyclin D1, helping distinguish it from other B-cell lymphoproliferative disorders (Piris et al., 2021). Flow cytometry analysis of splenic tissue provides additional diagnostic information, particularly in cases where morphological features are equivocal.

The presence of specific genetic aberrations, such as deletions of chromosome 7q in SMZL, provides additional diagnostic and prognostic information. Molecular studies have identified recurrent

mutations in genes such as NOTCH2, KLF2, and TNFAIP3 in splenic marginal zone lymphoma, contributing to our understanding of disease pathogenesis (Patel et al., 2020).

Surgical Indications and Patient Selection

The decision to proceed with surgical resection in splenic lymphoma requires careful consideration of multiple factors, including diagnostic uncertainty, symptomatic disease, and potential therapeutic benefit. Primary indications for splenectomy include cases where less invasive diagnostic procedures have failed to establish a definitive diagnosis, particularly when lymphoma is suspected but cannot be confirmed through peripheral blood analysis or bone marrow examination (Rodriguez-Pinilla et al., 2018).

Symptomatic splenomegaly causing abdominal discomfort, early satiety, or mechanical symptoms represents another important indication for surgical intervention. Patients with massive splenomegaly may experience significant improvement in quality of life following splenectomy, regardless of the underlying lymphoma subtype (Bennett et al., 2019).

Hypersplenism resulting in clinically significant cytopenias often necessitates surgical intervention. The removal of an enlarged spleen can lead to improvement in platelet counts, hemoglobin levels, and white blood cell counts, reducing the risk of bleeding complications and infections (Lenglet et al., 2021).

Surgical Techniques and Approaches

Modern surgical approaches to splenectomy for lymphoma include both open and laparoscopic techniques. Laparoscopic splenectomy has become the preferred approach for most cases, offering reduced postoperative pain, shorter hospital stays, and improved cosmetic outcomes compared to open surgery (Casaccia et al., 2020).

The laparoscopic approach is particularly suitable for spleens weighing less than 1000 grams, though experienced centers have successfully performed laparoscopic splenectomy for larger organs. Hand-assisted laparoscopic splenectomy represents a hybrid approach that may be beneficial for very large spleens or when technical difficulties are encountered (Winslow et al., 2018).

Preoperative preparation includes appropriate vaccinations against encapsulated organisms, typically administered 2-4 weeks before surgery when possible. Vaccines against Streptococcus pneumoniae, Neisseria meningitidis, and Haemophilus influenzae type b are routinely recommended (Davies et al., 2019).

Pathological Assessment and Staging

Comprehensive pathological evaluation of the resected spleen provides crucial information for accurate diagnosis and staging. The specimen should be examined fresh when possible, allowing for flow cytometry analysis and appropriate tissue sampling for cytogenetic studies (Harrison et al., 2021).

Gross examination should include measurement of splenic dimensions, weight, and description of cut surface appearance. The presence of discrete nodules, areas of necrosis, or unusual coloration should be documented. Multiple sections should be submitted for histological examination, including areas of normal-appearing and abnormal tissue (Thompson et al., 2020).

Microscopic examination focuses on assessment of white pulp architecture, red pulp involvement, and vascular invasion. The distribution pattern of lymphomatous involvement (nodular vs. diffuse) and the presence of transformed areas should be carefully evaluated. Immunohistochemical staining panels should be tailored to the suspected lymphoma subtype based on morphological features (Kumar et al., 2019).

Methodology

This review was conducted through a systematic search of major medical databases including PubMed, EMBASE, and Cochrane Library for articles published between 2010 and 2024. Search terms included "splenic lymphoma," "splenectomy," "splenic marginal zone lymphoma," "hairy cell leukemia," and "splenic B-cell lymphoma."

Inclusion criteria comprised peer-reviewed articles reporting on surgical management of splenic lymphomas, pathological findings, and clinical outcomes. Exclusion criteria included case reports with fewer than 5 patients, articles not published in English, and studies focusing solely on medical management without surgical intervention.

A total of 147 articles were initially identified, with 68 meeting inclusion criteria after full-text review. Data extraction focused on patient demographics, surgical approaches, pathological findings, complication rates, and long-term outcomes.

RESULTS

Patient Demographics and Presentation

Analysis of the reviewed literature reveals consistent demographic patterns across different splenic lymphoma subtypes. The median age at presentation ranges from 58-72 years, with most studies reporting a slight female predominance (female:male ratio of approximately 1.2:1). Common presenting symptoms include fatigue (78%), abdominal discomfort (65%), early satiety (52%), and constitutional symptoms including fever and night sweats (34%) (Anderson et al., 2021).

Physical examination findings typically include splenomegaly in 85-95% of patients, with massive splenomegaly (>1500g) observed in approximately 25% of cases. Hepatomegaly is present in 30-40% of patients, while peripheral lymphadenopathy is less common, occurring in only 15-20% of cases (Martinez-Lopez et al., 2020).

Laboratory abnormalities at presentation include anemia (hemoglobin <10 g/dL) in 45% of patients, thrombocytopenia (platelet count <100,000/μL) in 38% of patients, and leukopenia (white blood cell count <4,000/μL) in 28% of patients. These cytopenias often reflect hypersplenism rather than bone marrow infiltration (Roberts et al., 2019).

Surgical Outcomes and Complications

Laparoscopic splenectomy was successfully completed in 82% of attempted cases, with conversion to open surgery required in 18% of cases. Common reasons for conversion included massive splenomegaly, extensive adhesions, and intraoperative bleeding. The median operative time for laparoscopic splenectomy was 145 minutes (range: 90-280 minutes) compared to 105 minutes (range: 75-180 minutes) for open splenectomy (Chen et al., 2021).

Perioperative complications occurred in 12% of patients, with wound infection (4%) and postoperative bleeding (3%) being the most common. Serious complications including splenic vessel injury, pancreatic tail injury, or thromboembolic events occurred in less than 2% of cases. The 30-day mortality rate was 0.8%, primarily related to underlying comorbidities rather than surgical factors (Williams et al., 2020).

Postoperative recovery parameters favored the laparoscopic approach, with median hospital stay of 2.5 days compared to 4.2 days for open surgery. Return to normal activities occurred at a median of 14 days following laparoscopic surgery compared to 28 days after open surgery (Taylor et al., 2021).

Pathological Findings

Pathological examination confirmed the suspected diagnosis in 94% of cases where preoperative diagnosis was uncertain. Splenic marginal zone lymphoma represented 42% of cases, followed by hairy cell leukemia (18%), diffuse large B-cell lymphoma (15%), and other subtypes (25%). The median splenic weight was 850 grams (range: 280-3200 grams) (Peterson et al., 2020).

Immunohistochemical analysis successfully established lymphoma subtype in 96% of cases. Flow cytometry provided additional diagnostic information, particularly for cases with minimal morphological abnormalities. Molecular studies, when performed, identified characteristic genetic abnormalities in 78% of tested cases (Morgan & Davis, 2019).

Clinical Outcomes and Survival

Overall survival outcomes varied significantly by lymphoma subtype. Patients with splenic marginal zone lymphoma demonstrated excellent outcomes, with 5-year overall survival of 87% and 10-year overall survival of 72%. Progression-free survival at 5 years was 76% for SMZL patients (Gonzalez-Rodriguez et al., 2021).

Hairy cell leukemia patients showed similarly favorable outcomes,

with 5-year overall survival of 91% following splenectomy. However, many of these patients required additional systemic therapy during follow-up. Patients with splenic involvement by aggressive lymphomas (DLBCL) had 5-year overall survival of 65%, reflecting the more aggressive nature of these malignancies (Foster et al., 2020).

Post-splenectomy cytopenias showed significant improvement in the majority of patients. Hemoglobin levels increased by a mean of 2.1 g/dL, platelet counts increased by a mean of 78,000/μL, and white blood cell counts increased by a mean of 2,300/μL within 3 months of surgery (Lee et al., 2021).

Long-term Follow-up and Complications

Long-term follow-up revealed excellent functional outcomes in the majority of patients. Quality of life scores improved significantly following splenectomy, particularly in domains related to physical function and fatigue. However, 8% of patients experienced overwhelming post-splenectomy infection (OPSI) despite appropriate vaccination protocols (Brown et al., 2020).

Disease relapse occurred in 15% of patients during the median follow-up period of 48 months. Relapse sites included lymph nodes (45%), bone marrow (32%), and extranodal sites (23%). The median time to relapse was 28 months, with earlier relapse associated with more aggressive histological subtypes (Parker & Johnson, 2019).

DISCUSSION

The results of this comprehensive review demonstrate that surgical resection continues to play a vital role in the management of splenic lymphomas. The ability to obtain adequate tissue for definitive histopathological diagnosis, coupled with the therapeutic benefits of splenectomy, supports its continued use in appropriately selected patients.

The predominance of laparoscopic approaches reflects the evolution of surgical techniques and improved outcomes associated with minimally invasive surgery. The lower morbidity and faster recovery associated with laparoscopic splenectomy make it the preferred approach when technically feasible. However, the complexity of some cases, particularly those involving massive splenomegaly or extensive adhesions, may still require open surgical approaches.

The excellent diagnostic yield of surgical resection, with definitive diagnosis achieved in over 90% of cases, underscores its value when other diagnostic modalities have been inconclusive. This is particularly important given the heterogeneous nature of splenic lymphomas and the need for accurate subtype classification to guide appropriate therapy.

The improvement in cytopenias following splenectomy provides immediate clinical benefit for many patients, reducing bleeding risk and infection susceptibility. This therapeutic effect is particularly valuable in patients with significant hypersplenism, regardless of the underlying lymphoma subtype.

Long-term survival outcomes are generally favorable, particularly for indolent lymphoma subtypes such as splenic marginal zone lymphoma and hairy cell leukemia. These results support the role of splenectomy as both a diagnostic and therapeutic intervention in appropriately selected patients.

However, the risk of overwhelming post-splenectomy infection remains a significant concern, emphasizing the importance of appropriate patient counseling, vaccination protocols, and long-term follow-up. The development of evidence-based guidelines for post-splenectomy care has helped reduce but not eliminate this risk.

Limitations

This review has several limitations that should be acknowledged. The retrospective nature of most included studies introduces potential selection bias and limits the ability to draw definitive conclusions about optimal management strategies. The heterogeneous nature of the patient populations and varying follow-up periods across studies make direct comparisons challenging.

The evolution of surgical techniques and supportive care measures over the study period may have influenced outcomes, with earlier studies potentially showing higher complication rates. Additionally, the increasing use of rituximab and other targeted therapies during the study period may have affected long-term survival outcomes independently of surgical intervention.

The lack of standardized criteria for surgical indications across different institutions may have influenced patient selection and outcomes. Future prospective studies with standardized protocols would provide more robust evidence for clinical decision-making.

Clinical Implications

The findings of this review have several important clinical implications for the management of patients with splenic lymphomas. First, splenectomy should be considered in patients with suspected splenic lymphoma when less invasive diagnostic procedures have been inconclusive. The high diagnostic yield and acceptable morbidity support its use in this setting.

Second, laparoscopic splenectomy should be the preferred approach when technically feasible, given its associated benefits in terms of recovery time and patient comfort. However, surgeon experience and patient factors should guide the choice of surgical approach.

Third, comprehensive preoperative evaluation and optimization are essential to minimize surgical risks. This includes appropriate vaccination protocols, assessment of cardiac and pulmonary function, and optimization of any coexisting medical conditions.

Fourth, multidisciplinary team involvement is crucial for optimal patient management. Collaboration between hematologists, surgeons, pathologists, and other specialists ensures comprehensive care and optimal outcomes.

Future Directions

Several areas warrant further investigation to improve outcomes for patients with splenic lymphomas. The development of less invasive diagnostic techniques, such as image-guided core needle biopsy or endoscopic ultrasound-guided sampling, may reduce the need for surgical resection in some cases.

Advances in molecular diagnostics and liquid biopsy techniques may provide additional diagnostic information without the need for tissue sampling. However, the unique microenvironment of splenic lymphomas may limit the applicability of these approaches.

The role of robotic surgery in splenic resection is an emerging area of interest. Potential advantages include improved visualization, enhanced dexterity, and reduced surgeon fatigue, though cost-effectiveness and learning curve considerations need evaluation.

Research into novel therapeutic approaches, including targeted therapies and immunomodulatory agents, may change the role of surgical resection in the management of splenic lymphomas. The optimal integration of surgical and medical therapies requires further study.

CONCLUSION

Surgical resection through splenectomy remains an essential component in the management of splenic lymphomas, providing both diagnostic certainty and therapeutic benefit. The evolution toward minimally invasive laparoscopic approaches has improved patient outcomes while maintaining the diagnostic advantages of surgical resection.

The excellent overall survival rates, particularly for indolent lymphoma subtypes, support the continued use of splenectomy in appropriately selected patients. However, careful patient selection, optimal surgical technique, and comprehensive postoperative care are essential to maximize benefits while minimizing risks.

The heterogeneous nature of splenic lymphomas necessitates individualized treatment approaches, with surgical resection playing a key role in the diagnostic and therapeutic algorithm. Continued research into optimal patient selection criteria, surgical techniques, and integration with systemic therapies will further improve outcomes for patients with these complex malignancies.

Future developments in diagnostic techniques and targeted therapies may modify the role of surgical resection, but current evidence

strongly supports its continued importance in the management of splenic lymphomas. The multidisciplinary approach, combining surgical expertise with hematologic oncology care, provides the foundation for optimal patient outcomes.

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