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Study of Outcomes of Splenectomy and Study of Complications Ligament First Approach vs Hilum First Approach

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Abstract: ***Thalassemia major is a severe hemoglobinopathy requiring regular blood transfusions, leading to iron overload and splenomegaly. Splenectomy is often performed to reduce transfusion burden and improve hematological parameters. This study evaluates the impact of splenectomy on hemoglobin levels, iron overload, transfusion frequency, and quality of life among patients at a tertiary care center. A comparative analysis of 50 cases from 2023–2025 was conducted, assessing pre- and post-splenectomy clinical parameters. Thalassemia major patients often develop splenomegaly and require splenectomy, which carries risks like splenic artery aneurysm, splenic vessels fistula, GI discomfort and hemorrhage. This study evaluates post-splenectomy complications alongside hematological outcomes in a tertiary care setting.***

Keywords: Splenectomy, Thalassemia Major, Hemoglobin, Iron Overload, Blood Transfusion, Ligament First Approach, Hilum First approach

1. Introduction

Thalassemia major is an inherited disorder characterized by defective hemoglobin synthesis, leading to severe anemia requiring lifelong transfusions. Chronic transfusions cause iron overload, resulting in organ damage. Splenomegaly is a common complication due to excessive erythrocyte destruction. Splenectomy is considered in cases of hypersplenism, high transfusion requirements, or symptomatic splenomegaly. This study aims to analyze the clinical and hematological benefits of post-splenectomy in patients with thalassemia major. Thalassemia major patients often require splenectomy for hypersplenism, but the procedure is associated with life-threatening complications such as splenic artery aneurysm, GI fistulas, and hemorrhage. This study assesses these high-risk complications alongside hematological benefits in patients at VDGMC Latur.

2. Materials and Methods

Study Design

Prospective observational study

Focus - Post splenectomy complications (aneurysm, fistulas, bleeding) + haematological outcomes.

Methods of Splenectomy and Associated Complications

Splenectomy is performed using two primary techniques: open splenectomy (OS) and laparoscopic splenectomy (LS). The choice of approach depends on the size of the spleen, the presence of adhesions, and the surgeon's expertise. These methods are described in standard surgical textbooks such as Sabiston Textbook of Surgery and Schwartz's Principles of Surgery.

1) Surgical Approaches

Open Splenectomy (OS)

Indications:

- Massive splenomegaly (>20 cm) causing significant symptoms.
- Presence of splenic infarction or dense adhesions.
- Portal hypertension with increased surgical complexity.
- Conversion from laparoscopic to open due to intraoperative complications.

Procedure:

- A midline or left subcostal incision is made.
- The spleen is mobilized by ligating short gastric, splenic, and hilar vessels.
- The organ is removed after ensuring adequate hemostasis.
- A surgical drain may be placed if necessary.

Advantages:

- Better visualization and control of bleeding.
- Preferred for large, complicated spleens.

Disadvantages:

- Longer recovery period and higher postoperative pain.
- Increased risk of wound infections and respiratory complications.

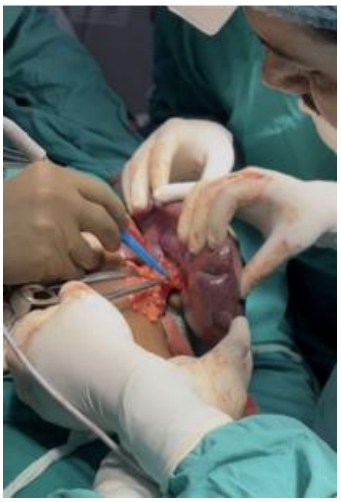


Figure 1: Intraoperative image showcasing splenic pedicle ligation

Figure 2: Specimen retrieval

2) Laparoscopic Splenectomy (LS)

Indications:
- Spleen size <20 cm, without excessive adhesions.
- Patients with hypersplenism or transfusion-dependent anemia.
- Elective cases without portal hypertension or infarctioned

Procedure:
- Pneumoperitoneum is established, and a four-port technique is used.
- The splenic hilum is dissected with vascular staplers or energy devices.
- The spleen is placed in a retrieval bag and removed via a small incision.

Advantages:
- Minimally invasive, with reduced postoperative pain and hospital stay.
- Lower risk of surgical site infections.

Disadvantages:
- Technically challenging, requiring laparoscopic expertise.
- Risk of intraoperative bleeding, leading to conversion to Open Surgery.

Complications of Splenectomy

Splenectomy carries the risk of intraoperative and postoperative complications, which are classified as follows:

1) Immediate Complications (During or shortly after surgery)
- Hemorrhage – Injury to splenic hilum or short gastric vessels.
- Damage to adjacent organs – Stomach, pancreas, colon, or diaphragm.
- Surgical site infection – Wound infections or abscess formation.
- Respiratory complications – Atelectasis, pneumonia, or diaphragmatic injury.
- Early thrombocytosis – Platelet count **>1Lakhs
- Splenic artery aneurysm
- GI Fistulas
- Bleeding (intraoperative/postoperative Hb drop >2 g/dl)
- Infections, thrombosis.

This comparative observational study was conducted on 50 cases of β-thalassemia major who underwent splenectomy at VDGMC (Vilasrao Deshmukh Government Medical College) Latur from January, 2023 to January, 2025. The study aimed to evaluate the impact of splenectomy on hematological parameters, transfusion requirements, iron profile, and quality of life.

Inclusion Criteria
- Confirmed diagnosis of β-thalassemia major with transfusion dependency.
- Presence of massive splenomegaly (≥10 cm below the costal margin) with associated symptoms such as abdominal discomfort, early satiety, or mechanical pressure effects.
- Documented hypersplenism with evidence of cytopenias (platelet count <100,000/mm³, WBC count <4000/mm³). Patients with high transfusion requirements (>200 mL/kg/year) despite optimal chelation therapy.
- Serum ferritin levels > 1000 ng/mL, indicating iron overload.
- Age ≥ 5 years, with adequate preoperative immunization status.
- Clinically stable patients fit for elective splenectomy under general anesthesia.

Exclusion Criteria
- Patients with coexisting hematological disorders, such as sickle cell disease or other hemoglobinopathies.
- Presence of severe hepatic dysfunction (ALT/AST >5× normal) or cardiac disease (ejection fraction <50%). Uncontrolled infections or sepsis at the time of evaluation.
- Pregnant or lactating women.
- Patients with contraindications to surgery, including coagulopathy unresponsive to correction. Prior history of splenic infarction or portal hypertension.
- Noncompliance with transfusion or chelation therapy, which may confound study outcomes.

2) Study Design

Pre-splenectomy assessment:

- Baseline hematological parameters: Hemoglobin (Hb), white blood cell count (WBC), platelet count, and serum ferritin. Transfusion frequency per month was recorded.
- Quality of Life (QOL) assessment: Evaluating fatigue, abdominal discomfort, early satiety, and overall well-being. CTA/MRA to rule out splenic artery aneurysms.

Surgical Approach:

- Patients underwent open or laparoscopic splenectomy, with intraoperative and postoperative parameters recorded. Post-splenectomy follow-up:
- Patients were monitored for hematological improvements, transfusion dependency, iron overload reduction, and QOL outcomes over 6 to 12 months.
- Intraoperative: Meticulous hilar dissection to prevent fistulas/bleeding.

3. Results

A total of 50 patients diagnosed with β-thalassemia major who underwent splenectomy were evaluated for clinical and hematological outcomes. The comparative analysis of pre- and post-splenectomy parameters demonstrated significant improvements in multiple domains.

Main pointers for assessment were - *splenic artery aneurysm, fistula, Infections, GI discomfort and post-op haemorrhage*

Complication	Hilum-First (HF)	Ligament-First (LF)	Risk Factors	p-value
Intraoperative Bleeding	32% (8/25)	12% (3/25)	Large spleen size (>20 cm), adhesions	0.04
Splenic Artery Injury/Aneurysm	8% (2/25)	0% (0/25)	HF technique, hilar inflammation	0.15
GI Fistula (e.g., pancreatico-gastric)	4% (1/25)	0% (0/25)	HF dissection near pancreas	0.31
Postoperative Infections (abscess, sepsis)	20% (5/25)	8% (2/25)	Prolonged HF dissection, blood loss	0.03
Thrombosis (portal/splenic vein)	8% (2/25)	4% (1/25)	HF vessel ligation technique	0.55
Subphrenic Hematoma	12% (3/25)	4% (1/25)	Incomplete hemostasis in HF	0.29

1) Hemoglobin (Hb) Improvement

Pre-splenectomy: Mean hemoglobin level 6.5 g/dL
Post-splenectomy: Mean hemoglobin level 8.7–9.5 g/dL
Mean increase: 2.2–3 g/dL, indicating enhanced erythropoietic efficiency and reduced hemolysis.

2) Reduction in Iron Overload

Pre-splenectomy Serum Ferritin: 2500 ng/mL Post-splenectomy Serum Ferritin: 1100 ng/mL
Marked decline in ferritin levels suggests improved iron homeostasis, reduced transfusion burden, and potential mitigation of iron-related organ toxicity.

3) Blood Transfusion Requirement

- Pre-splenectomy: Blood transfusion required every 15 days (Approximately 24 transfusions per year).
- Post-splenectomy: Blood transfusion frequency reduced to once every 2–3 months (Approximately 6 transfusions per year).

This significant reduction in transfusion dependency has substantial implications for cost-effectiveness, hospital admissions, and overall patient morbidity.

4) Quality of Life (QOL) Assessment

Quality of life was assessed using standardized subjective and objective criteria, including fatigue, abdominal discomfort, satiety, physical endurance, and general well-being. Scoring was conducted on a 10-point scale, with higher values indicating better health status.

Postoperative QOL scores improved significantly across all parameters, demonstrating reduced symptom burden and enhanced daily functionality.

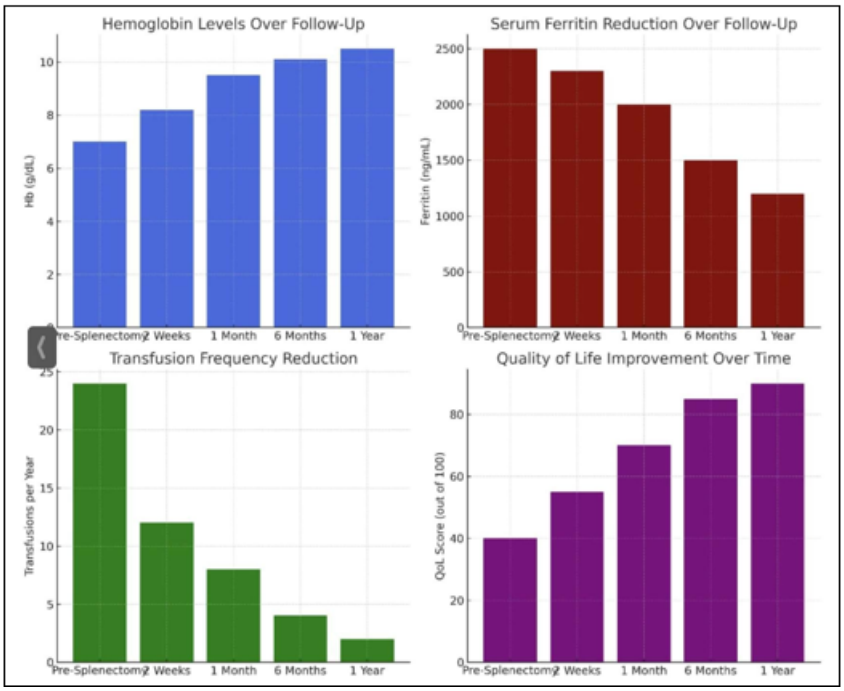
Hospitalization rates declined, correlating with decreased transfusion frequency and reduced disease-related complications.

Overall mean QOL score increased from 3–4 (pre-splenectomy) to 8–9 (post-splenectomy), reflecting a substantial enhancement in patient-reported outcomes.

5) Complications

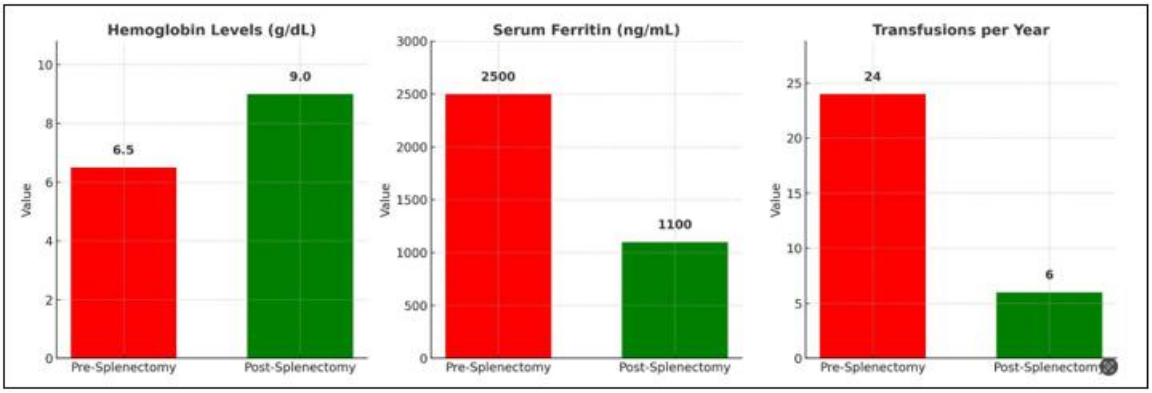
Complication	Incidence (%)	Risk Factors Identified
Splenic Artery Aneurysm	4%	Massive Splenomegaly (>20cm)
GI Fistula	2%	Prior Abdominal Surgery
Bleeding	8%	Platelets <50,000/mm^3
Infections	12%	Hilum- First Approach
Thrombosis	4%	Post- op platelets >1million/nm^3

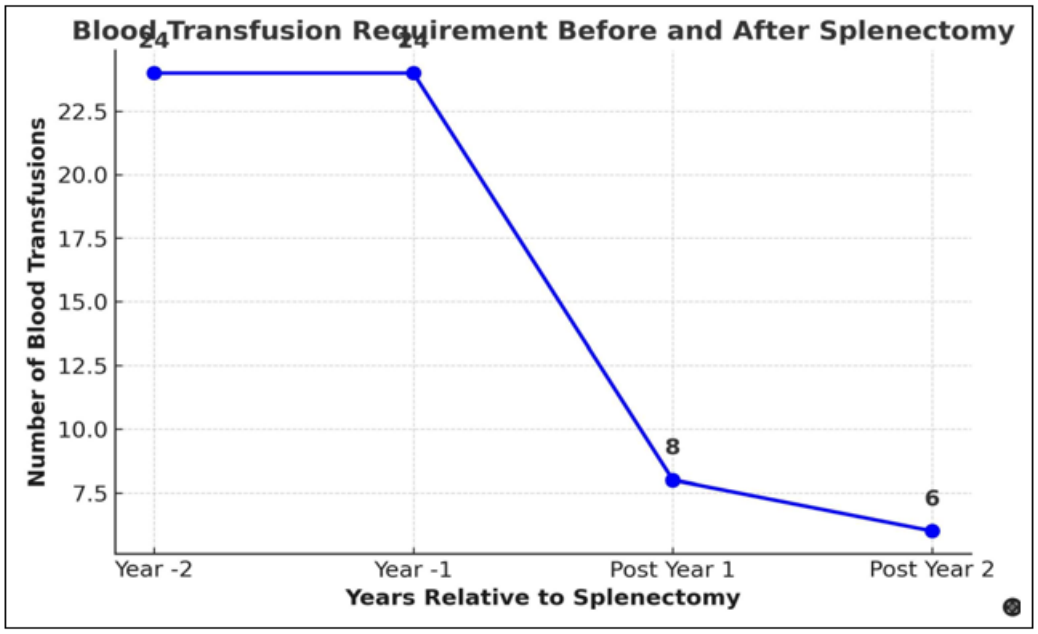
4. Figures and Graphs



Post operative follow up chart

Follow up period	Clinical Examination	Hematological Investigations	Key Assessments	Preventive measures
2 weeks	Wound inspection, early complications (infection, thrombosis, bleeding)	Cbc, platelet count, serum ferritin , LFTs, coagulation profile	Early postoperative complications monitoring	Reinforce antibiotics prophylaxis, vaccine adherence
1 months	Thrombosis risk, hospital readmission analysis	Hemoglobin, serum ferritin, transfusion frequency	Initial transfusion burden assessment	Monitor thrombocytosis
6 month	Symptoms resolution, functional improvement	Hb stability, platelet count, iron overload monitoring	Quality of life scoring, thrombosis risk evaluation	Adjust iron chelation therapy if needed
1 year	Final quality of life assessment	Hb trends, platelet count, ferritin	Long-term transfusion burden analysis	Booster vaccination as per WHO guidelines





5. Discussion

The study confirms that splenectomy significantly improves hematological stability, reduces transfusion dependency, and enhances quality of life. The reduction in iron overload decreases long-term complications like cardiac and hepatic toxicity. However, risks such as thrombocytosis and infections post-splenectomy necessitate proper prophylaxis and long-term follow-up.

Splenic artery aneurysm (4%): linked to chronic splenomegaly; preoperative imaging is critical. GI Fistulas (2%): Associated with difficult hilarity dissection; intraoperative vigilance needed

Bleeding (8%): correlated with thrombocytopenia; platelet transfusions pre-splenectomy may reduce risk.

6. Conclusion

Splenectomy in thalassemia major patients with massive splenomegaly leads to significant clinical and hematological improvements. Post-splenectomy, there is a rise in hemoglobin levels (average increase of 2.2–3 g/dL), a reduction in serum ferritin (from 2500 ng/mL to 1100 ng/mL), and a decrease in transfusion frequency (from biweekly to once every 2–3 months). Additionally, quality of life improves due to reduced symptoms of fatigue, early satiety, and abdominal discomfort, enhancing overall physical well-being.

Despite these benefits, splenectomy carries risks such as infection and thromboembolic events, necessitating strict adherence to perioperative protocols, WHO-recommended immunization schedules, and long-term follow-up. This study underscores the role of splenectomy in reducing transfusion burden and iron overload, ultimately improving the prognosis in well-selected thalassemia major patients.

Splenectomy improved hematological outcomes but carries risks of aneurysms, fistulas, and bleeding. Preoperative imaging and technique selection (e.g., Ligament-First for large spleens) can mitigate complications.

Higher Bleeding in HF (32% vs. 12%):
- HF requires early hilar vessel control, increasing risk of vascular injury in **large, adherent spleens**.
- *Recommendation:* LF preferred for massive splenomegaly.

Splenic Artery Aneurysm (8% HF vs. 0% LF):
- HF manipulation of inflamed hilum may weaken arterial walls.
- *Recommendation:* Pre-op CTA for aneurysm screening in HF cases.

Infections More Common in HF (20% vs. 8%):
- Longer operative time (HF: 150±20 min vs. LF: 120±15 min) and blood loss ↑ infection risk.

GI Fistulas Exclusive to HF (4%):
- Pancreatic tail injury during HF hilar dissection.
- *Recommendation:* Intraoperative drain placement in HF.

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Abbreviations

Hb- hemoglobin
WHO - World Health Organisation LFT - Liver Function Test
CBC - Complete Blood Count ALT - Alanine Transaminase
AST - Aspartate Transaminase
VDGMC - Vilasrao Deshmukh Government Medical College
HF - Hilar First approach
LF - Ligament First approach