

Partial Splenic Artery Embolization in Chronic Liver Disease

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ABSTRACT

Splenomegaly is a common sequela of cirrhosis, and is frequently associated with decreased hematologic indices including thrombocytopenia and leukopenia. Partial splenic artery embolization (PSE) has been demonstrated to effectively increase hematologic indices in cirrhotic patients with splenomegaly. This is particularly valuable amongst those cirrhotic patients who are not viable candidates for splenectomy.

Purpose: This study aims to discuss the role of partial splenic artery embolization in the treatment of the decreased hematologic indices including thrombocytopenia and leukopenia in chronic liver disease and the efficacy of this method in increasing of hematologic indices in cirrhotic patients with splenomegaly

Patients and methods: twenty-five patients with chronic liver disease were included.

All patients had chronic liver disease with hypersplenism and hyperactive bone marrow and all patients underwent PSE in one session then follow-up after one month was done.

Results: The mean age of the selected patients was about 46years old.

All patients showed significant increase in the platelet count after one session and remained at appropriate levels during the follow up period.

Postembolization syndrome was the most common complication and occurred in all patients (100%). Ascites developed in 4 patients (16%). Portal vein thrombosis developed in 2 patient (8%) Splenic abscess developed in 1 patient (4%). No other complications has been reported. None of the patients developed septic shock. No post procedure mortality occurred.

Conclusion: Partial splenic artery embolization is an effective method for the treatment of hypersplenism caused by chronic liver disease and more safe than splenectomy as it results in improvement of the hematological status with preservation of immunological role of the spleen.

Keywords: Splenic arterial embolization (SAE); Partial splenic arterial embolization (PSE); Hepatitis C Virus (HCV); Complete Blood Count (CBC); Ultrasound (US), Computed Tomography (CT).

INTRODUCTION

The spleen helps filter old and damaged cells from bloodstream. If the spleen is overactive, it removes the blood cells too early and too quickly. The spleen plays a key role in helping your body fight infections. Problems with the spleen can make you more likely to develop infections^[1].

Many patients with advanced liver disease (especially cirrhotic patients) develop portal hypertension that results in an enlarged spleen and subsequent platelet sequestration. The increase in resistance to portal blood flow (i.e. increased portal pressure) causes redistribution of blood to the spleen, subsequent pooling of platelets, and the increased clearance of platelets from the circulation^[2].

Symptoms of hypersplenism include easy bruising, increased liability of bacterial infection, fever, weakness, palpitations, ulcerations of the mouth, legs and feet, heavily bleeding from the nose or other mucous membrane. Most patients will develop an enlarged spleen, anemia, leukopenia or abnormally

low white blood cell counts, or thrombocytopenia, a deficiency of circulating platelets in the blood^[3].

Hypersplenism occurs in patients with chronic liver disease, and splenectomy is the definitive treatment. However, the operation may be hazardous in patients with poor liver function. In recent years, partial splenic embolization (PSE) has been widely used in patients with hypersplenism and cirrhosis. This study was conducted to assess the safety and efficacy of PSAE in the management of hypersplenism in cirrhotic patients.

Splenic embolization was first introduced in 1973, when autologous blood clot was used by Maddison to produce splenic artery embolization for hypersplenism treatment. Seven years later, transcatheter partial splenic embolization (PSE) was developed by Spigos et al., which has been proved as a safe and effective method of vascular occlusion. Since then, PSE has ever been gaining its indications and is popularly used in the world, nowadays, and increasingly performed to treat various clinical

conditions from salvaging patients with blunt splenic injury to facilitating interferon therapy in patients with chronic hepatitis virus infection^[4].

PATIENTS AND METHODS

- Study place: Interventional radiology unit, Egyptian Railway Hospital – Cairo – Egypt.
- Sample size : 25 patients
- Inclusion criteria: adult Egyptian patients with chronic liver disease and clinical features of hypersplenism as splenomegaly, anemia and bleeding tendency.
- Exclusion criteria: very old patients with bad general condition as marked ascites, renal failure and presence of active infection.
- Equipments: Monoplane angiographic machine - 5 French cobra catheter – hydrophilic guide wire 150 cm – Iodinated contrast – Embolizing material (Emboshere particles or Gelfom).
The study was approved by the Ethics Board of Ain Shams University.

Indications of partial splenic artery embolization in chronic liver disease

- Hypersplenism with hyperactive or normal bone marrow

Technique and methods of partial splenic artery embolization

Complete sterile conditions during the procedure were followed and a femoral artery approach was used for the selective catheterization of the splenic artery. Generally, the catheter tip was placed as distally as possible in the splenic artery.

Selective catheterization may avoid unintentional embolization of the pancreatic artery.

Parenchymal phase angiography is performed to estimate the volume of the remaining viable splenic tissue, and embolic particles are injected. Additional branches then may be catheterized, and the embolization repeated until the desired effect was attained^[5].

About 50 % of the vascular bed was occluded with Gelfoam or Emboshere.

Partial splenic artery embolization can be done by one of two methods selective and non-selective:-

(Non-Selective partial embolization was done):

The catheter tip was placed in the main splenic artery but beyond the origin of major pancreatic

branches. Embolic particles are injected until the parenchymal blush was reduced^[6]. After finishing

the maneuver, catheter and sheath were removed and manual compression was done for hemostasis.

Post embolization care

The patient was given analgesics and antibiotic for 10 days. Patients were followed up after one month of the procedure by clinical examination, CBC and abdominal sonar.

The study was approved by the Ethics Board of Ain Shams University.

RESULTS

The most common causes of chronic liver disease were HCV infection and bilharzial disease. In this study HCV infection founded in 16 patients (64%), bilharzial disease in 5 patients (20%) and mixed HCV and bilharzial infection in 4 patients (16%).

Bleeding tendency was found in 25 patients (100%), while anemic manifestations was found in 15 patients (60%), hematemesis or melena was found in 14 patients (56%), abdominal enlargement was found in 6 patients (24%) and abdominal pain was found in 18 patients (72%).

Postembolization syndrome was the most common complication and occurred in all patients (100%). Ascites developed in 4 patients (16%). Portal vein thrombosis was developed in 2 patient (8%) Splenic abscess was developed in 1 patient (4%). No other complications has been reported.

Appreciable increase in the platelet count were noticed and the results were all statistically highly significant (P value <0.001). Mean platelet count was $39,280 \pm 10,348/\text{uL}$ before the maneuver and changed to $94.680 \pm 42,250/\text{uL}$ after one month follow up.

Appreciable increase in the WBC count were noticed and the results were all statistically highly significant (P value <0.001). Mean WBC count was $4.096 \pm 1.752 (x10^3/\text{uL})$ before the maneuver and changed to $6.556 \pm 4.510 (x10^3/\text{uL})$ after one month follow up.

Appreciable increase in the RBC count were noticed and the results were all statistically significant (P value <0.05). Mean RBC count was $4.27 \pm 0.70 (x10^6/\text{uL})$ before the maneuver and changed to $4.43 \pm 0.73 (x10^6/\text{uL})$ after one month follow up.

Table (1): Demographic criteria of the studied patients as regard age and sex

<i>Demographic data</i>		Number	Percentage
Sex	<i>Male</i>	22	88%
	<i>Female</i>	3	12%
Age	<i>30-50y</i>	10	40%
	<i>>50y</i>	15	60%

Table (2): Causes of chronic liver disease and hypersplenism

<i>Causes of chronic liver disease and hypersplenism</i>	Number	Percentage
<i>HCV infection</i>	16	64%
<i>Bilharzial infection</i>	5	20%
<i>Mixed HCV and Bilharzial infection</i>	4	16%

Table (3): Symptoms of the studied patients.

<i>Symptoms</i>	Number	Percentage
<i>Bleeding tendency</i>	25	100%
<i>Anemic manifestation</i>	15	60%
<i>Hematemesis or melena</i>	14	56%
<i>Abdominal enlargement</i>	6	24%
<i>Abdominal pain</i>	18	72%

Table (4): Complications after the maneuver.

<i>Complications</i>	Number	Percentage
<i>Postembolization syndrome</i>	25	100%
<i>Ascites</i>	4	16%
<i>Splenic abscess</i>	1	4%
<i>Portal vein thrombosis</i>	2	8%
<i>Pancreatitis</i>	-	-
<i>Left side effusion</i>	-	-

DISCUSSION

Liver disease can be caused by a variety of factors that damage the liver, such as viruses and alcohol use. Over time, damage to the liver results in scarring (cirrhosis), which can lead to liver failure.

Patients with chronic liver disease (especially cirrhotic patients) may develop portal hypertension that results in splenomegaly and subsequent platelet sequestration. The increase in resistance to portal blood flow (i.e. increased portal pressure) causes redistribution of blood to the spleen, subsequent pooling of platelets, with decreased hematologic indices including thrombocytopenia and leukopenia [2].

Thrombocytopenia is the most common symptom of hypersplenism and can cause spontaneous bleeding, complicating the successful

control of variceal bleeding. Thrombocytopenia prevention can be achieved by decreasing splenic volume in patients with hypersplenism. In addition, PSE decreases the incidence of gastrointestinal bleeding caused by esophageal and fundal variceal rupture in patients with cirrhosis and portal hypertension [7].

In recent years, splenic arterial embolization is increasingly performed to treat hypersplenism. Although, patients treated with total splenic embolization were developed serious complications such as splenic abscess, splenic rupture and septicemia, yet those who were managed by partial embolization were greatly reduced the incidence of such complications [8].

Partial splenic embolization is an effective therapeutic modality for the treatment of hypersplenism secondary to chronic liver disease. It is a simple, rapid procedure that is easily performed under local anesthesia; and it allows preservation of adequate splenic tissue to safeguard against overwhelming infection^[9].

Characteristics of the study and details of the procedure

This study done to evaluate the effect of partial splenic artery embolization on blood elements in patients with hypersplenism due to chronic liver disease and to assess safety of the maneuver.

The study include twenty five patient with thrombocytopenia due to hypersplenism caused by chronic liver disease.

A full clinical assessment was done, CBC, liver functiontests and abdominal sonar or CT before and after the procedure.

Partial splenic artery embolization done by non-selective method

After mapping the anatomy of the celiac axis and the splenic artery, the catheter is secured at the site of embolization. In the proximal, nonselective, approach the catheter was placed immediately distal to the origins of the pancreatic and short gastric arteries, and an embolic agent was released. Embolic agents were dispersed throughout the spleen and small, diffuse, randomized infarcts occur.

About 50% of the vascular bed was occluded with gelfoam or Embosphere

Comparison between the current study results with other nearly similar studies

a) Regarding platelet count

Mean platelet count was $39,280 \pm 10,348/\mu\text{L}$ before the maneuver and changed to $94,680 \pm 42,250/\mu\text{L}$ after one month follow up. Appreciable increase in the platelet count was noted and the results were all statistically highly significant (P value<0.001).

This agrees with other authors that used gelfoam in partial splenic artery embolization in patient with liver cirrhosis and hypersplenism. Mean platelet count was $47.06 \pm 14.85/\mu\text{L}$ before the maneuver and changed to $113.2 \pm 17.6/\mu\text{L}$ after one month follow up^[10].

So, results of this study showed that PSE was highly effective in improving thrombocytopenia in patients with chronic liver disease.

b) Regarding WBCs count

Mean WBC count was $4.096 \pm 1.752 (x10^3/\mu\text{L})$ before the maneuver and changed to $6.556 \pm 4.510 (x10^3/\mu\text{L})$ after one month follow up. Appreciable increase in the WBC count was noted and the results were all statistically highly significant (P value <0.001).

This agrees with other authors. Mean WBC count was $2.3 \pm 0.47 (x10^3/\mu\text{L})$ before the maneuver and changed to $6.53 \pm 1.74 (x10^3/\mu\text{L})$ after one month follow up^[11].

So, results of this study showed that PSE was highly effective in improving white blood cell count in patients with chronic liver disease.

c) Regarding RBCs count

Mean RBC count was $4.27 \pm 0.70 (x10^6/\mu\text{L})$ before the maneuver and changed to $4.43 \pm 0.73 (x10^6/\mu\text{L})$ after one month follow up. Appreciable increase in the RBC count was noted and the results were all statistically significant (P value <0.05). So, results of this study showed that PSE was effective in improving red blood cell count in patients with chronic liver disease.

Complications that may follow the procedure

1. Post-embolisation syndrome

Post-embolization syndrome (PES) is one of the commonest side effects of transarterial embolization. It comprises of a constellation of fever, nausea/vomiting, and pain. It usually occurs within the first 72 hours after embolization and then starts to subside after 72 hours. It is not to be mistaken for a predictor of impending infection. Hence performing blood cultures in the absence of other factors is unnecessary^[12].

Treatment is symptomatic relief; analgesia, IV fluids and TLC from a caring nursing. It is normally self-limited. Prophylactic use of antipyretic and antiemetic therapy may be considered^[13].

2. Pancreatitis

Inadvertently extensive embolization of the SA following splenic trauma. Owing to subsequent ischemia in the most distal pancreas, acute necrotizing pancreatitis developed^[6].

3. Splenic abscess

Once the diagnosis of a splenic abscess has been made, the patient must be admitted to the hospital and treated. Treatment depends on the patient's overall condition and comorbidities, as well as the size and topography of the abscess^[14].

Percutaneous drainage has gained acceptance as an effective and less invasive treatment method than

surgical intervention in selected patients. The reported success rate of percutaneous drainage ranges from 67% to 100%. Such drainage preserves the spleen and avoids the risk of overwhelming postsplenectomy sepsis (OPSS). Percutaneous drainage can also be used as a bridge to elective surgery in patients who are clinically unstable or in patients who have multiple comorbidities.

Early diagnosis and percutaneous drainage can increase the chance to preserve the spleen and, hence, its immunologic function^[15].

4. Pulmonary complications

Pulmonary complications of PSE include pneumonia, atelectasis, and pleural effusion. These complications are usually found present in the left side of the body and after the upper pole of the spleen is embolized, which are related to the restriction of breathing caused by the left upper quadrant pain after PSE, pleural reaction, and inadequate lymph drainage of inflammatory effusions. Mild and moderate pleural effusion might be absorbed after effective antibiotics and pain alleviation therapy, while thoracentesis should be performed for great pleural effusion. Selective embolization of the middle part or the lower pole of the spleen should reduce the incidence of these kinds of complications^[5].

5. Ascites

Transient ascites could result from hepatic decompensation secondary to splenic necrosis and usually resolves rapidly after diuretic therapy^[16].

6. Portal vein thrombosis

Rapid increase in platelet count and decreased portal vein flow after excessive embolization may cause portal vein thrombosis^[17].

CONCLUSION

Partial splenic embolization is an effective alternative method to splenectomy for the treatment of hypersplenism. It is a simple, rapid procedure that is easily performed under local anesthesia and results in improvement of the hematological indices with minimal morbidity and with preservation of the immunological role of the remaining non-infracted splenic parenchyma. There was statistically significant improvement in blood elements count before and after embolization.

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