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Original Article

Predictive factors of platelet increase and complications after percutaneous trans-arterial partial splenic embolization for hypersplenism in chronic liver disease patients

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ABSTRACT

Purpose: To identify predictive factors for platelets normalization and major complications associated with partial splenic embolization (PSE) in patients with chronic liver disease and hypersplenism.

Methods and materials: A prospective study included 30 patients were subjected to pre-embolization abdominal US and laboratory testing (WBC, Hemoglobin, Platelet Count, T. Bilirubin, AST, ALT, S. Albumin). PSE were done by super-selective catheterization of splenic artery and embolization by Polyvinyl alcohol with targeted therapeutic splenic infarction rate (>30% to <70–80%). CECT was performed before and 2 weeks after to assess complications (post embolization syndrome, ascites, peritonitis,pleural effusion, and splenic abscess) and infarction size. CBC, liver function tests was done after 2 weeks, 6 months. Platelet count done on the next day after the embolization.

Results: Multiple logistic regression analysis showed that the infarction rate could be used as a predictor for platelets normalization (p value = 0.005, OR = 1.493). ROC curve showed that infarction rate above 76% had 100% specificity for platelets normalization after 6 months; infarction rate above 67% had 92.3% specificity. S. Albumin (2.7–3.2 mg/L), Child Score >8 remained significant predictors for major complication (p = 0.035).

Conclusion: Platelet count normalization could be achieved by increasing infraction rate to 67–76%. Child Score and serum albumin are the predictive factor for complications.

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1. Introduction

Egypt has higher rates of chronic hepatitis (6–27%). Hypersplenism occurs in up to 64% of those patients [1]. It results from splenic pooling and sequestration of corpuscular blood elements as a result of splenic congestion [2]. Low platelet count is the most essential abnormality in hypersplenism, it occurs in (14–70%) of patients [3]. As much as 89% mortality rate from hypersplenism was reported in some series [4]. Hypersplenism is also an obstacle to radiofrequency ablation of hepatocellular carcinoma, surgeries, antiviral treatment, interferon treatment and chemotherapy in cirrhotic patients [5].

A number of therapies are available for treating thrombocytopenia due to hypersplenism includes splenectomy, partial splenectomy, partial splenic embolization (PSE), trans-jugular intra-hepatic porto-systemic shunts (TIPS) [6], where partial splenic embolization appears to be efficacious in reducing episodes of variceal bleeding, improving hematologic parameters, and portal hemodynamics, enhancing hepatic protein synthesis, and reducing the severity of hepatic encephalopathy [7].

PSE is considered to be a safe procedure for treatment of hypersplenism. The mortality rates of PSE ranges from 0 to 12% percent. The rate of severe complications after PSE ranges between 0 and 16%. These figures are less than that of laparoscopic splenectomy which shows a morbidity rate of 11–36% and a mortality rate 0% [8,9].

Many materials used for embolization, such as; stainless steel coils, gelatin sponge, silk suture, autologous blood clot and polyvinyl alcohol (PVA). It was reported that there was no difference among stainless steel coils, gelatin sponge, and PVA regarding the short-term therapeutic effects [10].

Most of the previous reported studies concerns about the efficacy, complications, long term outcome and technique of PSE

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[11–13]. However, little ones demonstrate the predictive factors for increase platelet count after PSE [9]. So, our study aimed to identify the predictive factors for normalization of platelet and major complications associated with partial splenic embolization (PSE) in chronic liver disease patients with hypersplenism.

2. Patients and methods

2.1. Patients

Our prospective study included 30 adult patients with hypersplenism due to chronic liver diseases were referred to the interventional radiology unit for PSE over a period of 2 years from June 2013 to June 2015. Our protocol was approved by the local institutional ethics committee, and all patients provided written informed consent.

Inclusion criteria were adult patient ($\geqslant$18 years) with chronic liver disease and proved hypersplenism by platelet count <100,000/μL, and/or white blood cell count (WBC) <3500/μL in conjunction with splenomegaly and hypercellular or normocellular bone marrow [14,15].

Exclusion criteria included patients with portal or splenic vein thrombosis, reversed flow of portal vein on color Doppler US [16], allergy to contrast media, aortoiliac or bilateral femoral artery occlusion, hypocellular bone marrow with average sized spleen are excluded [15].

Patients fulfilling the inclusion criteria were admitted at least 1 day before the procedure at Mansoura university hospitals (Gastroenterology Center- internal medicine hospital).

2.2. Pre-embolization preparation

- All patients were subjected to abdominal ultrasound (US), CECT, and laboratory testing. Abdominal US was performed to assess ascites, portal and splenic vein patency, and splenic volume calculated using equation of (length × width × thickness × 0.523). Laboratory testing include platelet count, WBC, hemoglobin, INR, AST, ALT, total bilirubin and serum albumin.
- Prophylactic antibiotics: amoxicillin-clavulanate (3 g/day) was taken 2 days before the procedure.

2.3. Partial splenic embolization procedure (PSE)

Under strict aseptic conditions, a percutaneous femoral artery approach was used for superselective catheterization of the splenic artery under local anesthesia using xylocaine 2%. The puncture was done using a puncture needle (18 gauge). Once good pulsatile blood returned through the needle, the stylet was removed, and a guidewire (0.032 in.) was gently advanced up to the lower abdominal aorta under fluoroscopic guidance, and a 5F sheath was inserted along the guidewire.

A five copra head catheter was advanced along the guidewire with selective catheterization of the celiac axis and splenic artery. A preliminary splenic angiogram was obtained to determine the configuration of splenic artery and the location of its pancreatic branches. The arterial phase showed the tortuosity and branches of the splenic artery. These data were important to predict the difficulty of the procedure. The capillary phase was used to show the size of the spleen. The catheter was then advanced so its tip distal to the last major pancreatic branch to minimize the risk of pancreatitis.

The embolic agent used in this study was polyvinyl alcohol (PVA) in contour particles (Boston Scientific, Natick, MA, USA) ranging from 250 to 355 μm. The embolic agent was gently injected through the catheter, where the injection was done very slowly to avoid its reflux.

During embolization, small amounts of contrast material were periodically injected through the catheter to monitor the flow distribution in the spleen. The targeted therapeutic endpoint was a splenic infarction rate of <70–80% and >30%. The extent of embolization was assessed by evaluation of the peripheral amputation of segmental branches in the arterial phase and the parenchymal defects in the venous phase on digital subtraction angiography.

2.4. Post-embolization regimen

2.4.1. Hospital stays and post procedure treatment

- All patients had remained in the hospital after the procedure until the post embolization syndrome or any significant complications disappear.
- Supportive care include appropriate hydro-electrolytic infusions, antibiotics, using amoxicillin-clavulanate (3 g/day) and ofloxacin (400 mg/day) for at least 5 days after the procedure, and analgesic (paracetamol, morphine or even pethidine if needed).

2.4.2. Follow-up CT and laboratory tests

- Contrast enhanced CT was done after 2 weeks. CT volumetric assessment and measurement of the splenic infarction was done as the following:
  CECT scans were routinely performed before and two weeks after the procedure. Based on enhanced CT images, we measured and compared the pretreatment splenic volume and the post-embolization residual splenic volume using volumetric analysis software. The enhanced splenic tissue in each image was traced with the cursor, the infarcted splenic volume (mL) was calculated by subtracting the non-infarcted splenic volume from the pretreatment volume. The splenic infarction rate was calculated by dividing the infarcted splenic volume by the pretreatment volume (×100%).
- Peripheral blood count and liver function tests were done after 2 weeks and 6 months respectively. Platelet count was done on the next day after the embolization.

2.5. Data collection

The examined variables were obtained for each patient upon admission; within 1 week before the procedure: Age, sex, Child-Pugh classification, White blood cell count, hemoglobin, Platelet count, INR, total bilirubin, AST, ALT, Albumin and pretreatment splenic volume.

2.6. Statistical analysis

Data are expressed as mean ± standard deviation for continuous variables and frequencies for categorical variables. Differences between groups were assessed using chi-square statistics for categorical variables, and group means for continuous variables with normal and non-normal distributions were compared using student's t-tests and Mann-Whitney *U* tests, respectively. P value <0.05 was considered significant.

Pearson's correlation coefficient analysis using significant variables was performed to assess correlation between continuous variables. Unvaried and multiple logistic regression analysis were performed to investigate predictors of normalizing the platelet count levels and major complication occurrence. Statistical analy-

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