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## International Journal of Surgery Case Reports

journal homepage: [www.casereports.com](http://www.casereports.com)

# Efficacy and surgical procedures of preoperative splenic artery embolization for laparoscopic splenectomy of a massive splenomegaly: A case report



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## ARTICLE INFO

## Article history:

Received 4 June 2015

Received in revised form

24 September 2015

Accepted 3 October 2015

Available online 8 October 2015

## Keywords:

Massive splenomegaly

Splenic artery embolization

## ABSTRACT

Here, we describe the case of a 58-year-old woman diagnosed with massive splenomegaly with a malignant lymphoma that had a maximum diameter of 24 cm. Splenectomy was indicated because of thrombocytopenia and abdominal distention. Therefore, a balloon catheter was inserted preoperatively through the splenic artery for embolization and continuous infusion to reduce the spleen volume. It enabled easy handling of the spleen and minimized bleeding. The volume of the spleen was estimated at 1896 g through the skin incision, as measured by volumetric computed tomography; thus, laparoscopy seemed difficult. However, the surgery was successfully performed only with laparoscopic surgery, and the volume of the resected spleen was 1020 g. This preoperative preparation is an effective alternative to laparoscopic removal of a huge splenomegaly.

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## 1. Introduction

Laparoscopic splenectomy (LS) was first reported in 1991 [1], and it is a safe and feasible procedure for patients with normal-sized spleens. Higher conversion and postoperative morbidity rates have been reported for LS used to manage splenomegaly compared with those for LS used to manage normal-sized spleens [2]. The peculiar vascularity of massive spleens makes them difficult to remove, which increases the risk of complications such as hemorrhage; most conversions of LS occur due to uncontrolled bleeding. Here, we report our surgical procedures of laparoscopic surgery for a massive splenomegaly that was performed safely.

## 1.1. Presentation of a case

The present case study has been reported in line with the CARE criteria (<http://www.care-statement.org/>). A 58-year-old Japanese woman visited our hospital complaining of general fatigue. Positron emission tomography/computed tomography showed massive splenomegaly in the left upper abdominal cavity, which was diag-

nosed as splenic malignant lymphoma. The spleen was palpated in the left subcostal region, and splenomegaly was confirmed.

Laboratory findings on admission showed severe leukocytosis (29,100/ $\mu$ L) and slight anemia (9.0 g/dL). The platelet count was 10,500/ $\mu$ L. The serum levels of interleukin-2 (917 U/mL) and  $\beta$ 2-microglobulin (5.1 mg/L) were considered in the high ranges.

Preoperative computed tomography showed a massively enlarged spleen (massive splenomegaly), with a maximum diameter of 24 cm (Fig. 1). Volumetric computed tomography before embolization indicated that the spleen was 1896 g. Thus, the risks and potential benefits of splenic artery embolization (SAE) were explained to the patient and her husband, and informed consent was obtained for the procedure. Intraoperative SAE was performed with a continuous splenic arterial infusion of epinephrine (0.1–0.2  $\gamma$ ) using the balloon transcatheter technique with the patient under general anesthesia. A balloon transcatheter (9-mm 5-French balloon catheter, Selecon MP Catheter II Rosch II, Terumo, Tokyo, Japan) was used to embolize the splenic artery. Subsequently, we performed laparoscopic surgery.

The patient was placed in the right semilateral position. Initially, intracorporeal procedures were performed in the laparoscopic view using five trocars (one 12-mm port and four 5-mm ports). The spleen was slightly dark red after embolization of the splenic artery (Fig. 2). The gastrosplenic ligament was opened from the caudal to the cranial side using an ultrasonically activated scalpel

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**Fig. 1.** Preoperative abdominal computed tomography findings. Preoperative computed tomography shows a massively enlarged spleen (massive splenomegaly).



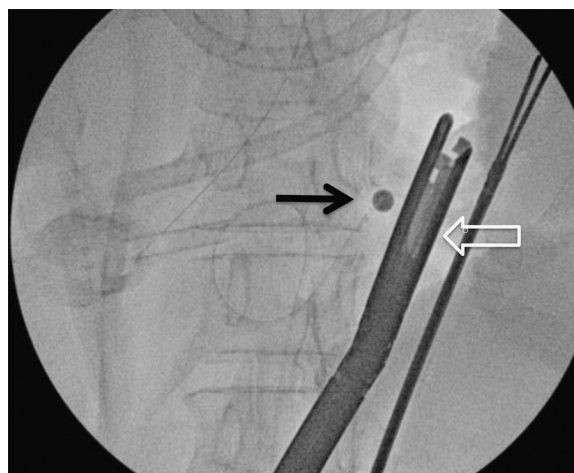
**Fig. 2.** Operative finding no. 1 the spleen has a slightly dark red color after splenic artery embolization (after 35 min).



**Fig. 3.** Operative finding no. 2 The gastrosplenic ligament is opened from the caudal to the cranial side using an ultrasonically activated scalpel. The splenic artery and vein are dissected at the splenic hilum.

(Harmonic ACE, Ethicon Endo-Surgery, Cincinnati, OH). In the laparoscopic view, splenic vessels at the splenic hilum were divided with an endoscopic auto suture device (Echelon 45-mm Gray, Ethicon Endo-Surgery) after checking the balloon transcatheter (Figs. 3 and 4). A 7-cm skin incision was made, and laparotomy was performed using a muscle splitting approach. Specimens were obtained from this 7-cm incision. The total operating time was 215 min, and the intraoperative blood loss was 50 mL.

The postoperative course was uneventful. The resected spleen (Fig. 5) weighed 1020g, and the maximum tumor diameter was 23.5 cm after embolization. Upon histological analysis, the



**Fig. 4.** Abdominal angiography findings after checking the balloon transcatheter, an endoscopic auto suture device is used to divide the splenic vessels (arrows).



**Fig. 5.** Macroscopic findings of the resected specimen The resected spleen weighs 1020g, and the maximum tumor diameter is 23.5cm (the spleen measures 23.5 × 15 × 5 cm<sup>3</sup> after embolization).

expanded marginal zone area at the white pulp of the spleen could be observed at a low-power view (×40), and this finding confirmed the diagnosis of splenic marginal zone lymphoma.

## 2. Discussion

LS for splenomegaly, especially for massive splenomegaly, is associated with a higher risk of hemorrhage compared with LS for normal-sized spleens because of the need for vascular control.

Numerous previous studies have shown that preoperative SAE before LS for controlling intraoperative blood loss reduces the need for perioperative transfusion during splenectomy for splenomegaly [3,4]. However, it has been reported that pancreatitis, pancreatic necrosis, or acute gastric ulcers may occur after SAE as severe complications [4]. Moreover, postembolic abdominal pain and adhesion of the spleen and the pancreas tail may occur in the long-term follow-up period after SAE. Toyoda et al. [5] concluded that if possible, SAE should be performed on the day before or on the day of the operation to avoid these complications. Therefore, in the present case, we performed intraoperative SAE with general anesthesia and successfully prevented postembolic abdominal pain and other severe complications.

There are two types of preoperative SAE: embolization with microcoils or gelatin sponges, and embolization with intraluminal balloon occlusion of the splenic artery. In the present case, we chose

to perform SAE using a temporary balloon transcatheter because the balloon transcatheter is only temporary, and there is no risk of embolic material, as in the case of microcoils or gelatin sponges, in the intraluminal vessels after SAE.

Although SAE has been demonstrated as an effective procedure for splenomegaly, there is no known advantage for using preoperative SAE for spleens <18cm in diameter [6]. In the present case, the spleen was approximately 24cm in maximum diameter, and SAE was performed to control intraoperative blood loss [7]. Bakovic et al. [8] concluded that the spleen volume started to decrease immediately after the onset of intravenous infusion of low-dose epinephrine. Accordingly, we found that the combination of embolization of the splenic artery and continuous epinephrine infusion for reducing the spleen volume was highly effective. The observed changes were remarkable, and our results indicate that during surgical procedures, embolization and the continuous administration of epinephrine into the splenic artery is a simple and effective procedure.

Based on the current case, we conclude that these procedures represent a safer and more feasible technique in cases of massive splenomegaly. We would like to increase the number of cases of SAE, as we hope to further evaluate this treatment technique in the future.

### 3. Conclusion

The combination of embolization of the splenic artery and a continuous epinephrine infusion is a safer and more feasible technique in cases of massive splenomegaly.

### Conflict of interest

None of the authors has any conflict of interest to declare.

### Ethical approval

Authors has gotten the ethical approval of this study by our ethics committee.

### Consent

We were explained to the patient and relatives, and informed consent was obtained.

### Authors contribution

Hematologist introduced to our surgeons. Radiologist prepared the IVR (temporary balloon catheter), and Anesthesiologist control the BP by epinephrine infusion. Obviously we surgeons perform this operation. This team combination of our hospital could perform these therapies.

### Guarantor

Author Toshikatsu Nitta.

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