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Robotic single-port plus one assist port splenectomy in an adult: a case report with video

Su Hyung Park[1,2], Sung Hyun Kim[1,2], Chang Moo Kang[1,2]

[1]Division of Hepatobiliary and Pancreatic Surgery, Department of Surgery, Yonsei University College of Medicine, Seoul, Korea,
[2]Pancreatobiliary Cancer Center, Yonsei Cancer Center, Severance Hospital, Seoul, Korea

Minimally invasive techniques are increasingly used in hepatobiliary and pancreatic surgeries, but robotic single-port (SP) splenectomy remains uncommon due to the rarity of splenic diseases. We present a case of a 57-year-old woman with left upper quadrant pain and a 4.3-cm splenic mass suggestive of hamartoma. Due to persistent symptoms and cosmetic concerns, robotic SP splenectomy was performed using the da Vinci SP system (Intuitive Surgical, Inc.) via a transumbilical incision, with an additional assist port in the left abdomen. The procedure lasted 264 minutes with minimal blood loss, and the patient was discharged without complications on postoperative day 9. Histopathology confirmed a splenic hamartoma. This case highlights the feasibility and safety of robotic SP splenectomy in adults, suggesting potential for wider application with further experience and refinement.

Keywords: Robotics, Robotic surgical procedures, Minimally invasive surgical procedures, Surgical instruments, Splenectomy

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Corresponding author
Sung Hyun Kim
Division of Hepatobiliary and Pancreatic Surgery, Department of Surgery, Yonsei University College of Medicine, 50-1 Yonsei-ro, Seodaemun-gu, Seoul 03722, Korea
E-mail: ohliebe@yuhs.ac
https://orcid.org/0000-0001-7683-9687

INTRODUCTION

Minimally invasive surgery has been widely adopted in various surgical fields, particularly in hepatobiliary–pancreatic surgery. With the recent introduction of the robotic single-port (SP) system, its application has expanded owing to its exceptional cosmetic outcomes and enhanced flexibility of its articulated robotic arms. This has led to its increased use in various hepatobiliary surgeries [1–3].

Despite these technical advancements, the application of robotic SP systems in splenic surgery remains limited to selected cases. Owing to the relatively low incidence of splenic diseases that require splenectomy, the significant learning curve associated with mastering this technique beyond a certain number of cases has been delayed. This has contributed to the limited widespread adoption of robotic SP splenectomies.

However, with continuous improvements in surgical instruments, many surgeons have tried to adopt the robotic SP splenectomy in the clinical field to maximize its advantages, especially cosmetic outcomes for pediatric patients or young female

populations [4]. Based on this trend, herein, we report a case of robotic SP splenectomy in an adult patient with a splenic mass suspected to be a splenic hamartoma based on preoperative imaging. In this study, we aimed to compare the advantages and limitations of the robotic SP system with those of the conventional robotic multiport system for splenectomy.

CASE

A 57-year-old female patient with vague left upper quadrant abdominal pain for several months visited our outpatient department. Esophagogastroduodenoscopy revealed extrinsic compression, which prompted further evaluation using abdominal computed tomography and magnetic resonance imaging. Imaging studies revealed a mass measuring 4.3 cm, which led to a diagnosis of splenic hamartoma (Fig. 1A). Owing to persistent abdominal discomfort and pain, surgical resection was decided. Considering the patient's cosmetic concerns, robotic SP plus one-port splenectomy using the da Vinci SP system (Intuitive Surgical, Inc.) was planned. The surgery was performed on September 13, 2024.

After placing the patient in a 15° reverse Trendelenburg position, the robotic SP system was docked via a transumbilical incision. A 12 mm assist trocar was inserted in the left middle quadrant (Fig. 1B). During division of the gastrocolic ligament, any encountered vessels were ligated by the assistant surgeon using clips applied via the assist port, followed by division with an energy device. Traction was achieved by fixing the stomach to the abdominal wall using nylon tape to obtain a clear surgical view. Next, the short gastric vessels were controlled by applying clips to both the stomach side and the specimen side using the SP robotic system's clip applier, followed by transection with the monopolar curved scissors. Subsequently, the splenocolic and gastrosplenic ligaments were dissected using a bipolar Maryland forceps, which provided hemostasis during dissection to maintain a clear operative field without bleeding (Fig. 1C). Finally, at the splenic hilum, the splenic artery and vein were ligated and divided by individually clipping their tributaries using the robotic clip applier. After specimen retrieval, a Silastic drain was placed in the operating bed and delivered through the assist trocar. The incision site was closed layer-by-layer (Supplementary Video).

The total operative time was 264 minutes, with minimal estimated blood loss. The patient reported mild voiding difficulty on postoperative day 3 but maintained a stable general condition without complications. The patient was discharged on postoperative day 9, without any significant adverse events. The final pathological examination confirmed the diagnosis of splenic

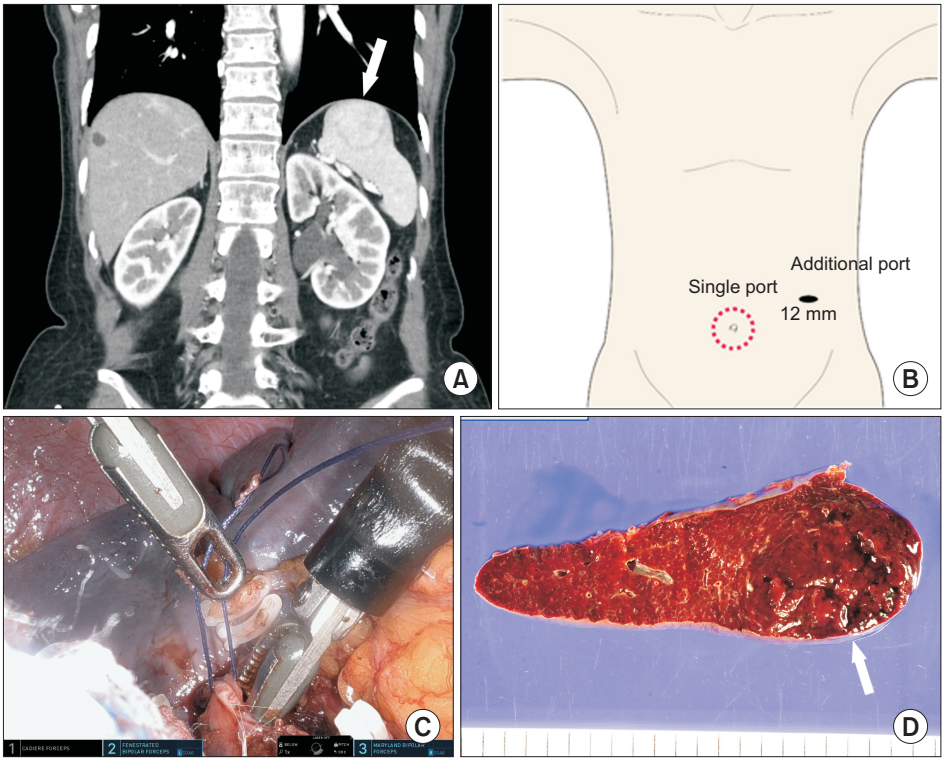

Fig. 1. (A) Preoperative computed tomography scan of splenic lesion (white arrow). (B) Position of the robotic single port and assist port. (C) Bird's-eye view of the robotic single-port system showing the splenic hilum. (D) Gross specimen of splenic hamartoma (white arrow).

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hamartoma (Fig. 1D).

DISCUSSION

Here, we report a case of robotic SP splenectomy. To our knowledge, this is the first academic case report of robotic SP splenectomy in Korea that showed the possibility of general adaptation and differences compared with multiport robotic splenectomy.

One of the distinctive features of the robotic SP system is its highly flexible, articulated joint structure [5,6]. In contrast, conventional da Vinci Xi systems have a semirigid structure, making the dissection of some parts challenging and interfering with the pancreas, especially in patients with a deep splenic bed. However, the robotic SP system offers greater freedom of movement than the conventional system, allowing the surgeon to perform key surgical maneuvers at various camera angles, such as a bird's-eye view. This increased flexibility enables meticulous dissection of the splenic hilum, facilitating precise ligation of the splenic vessels. Additionally, it helps minimize damage to surrounding structures when dissecting the suspensory ligaments of the spleen, thereby contributing to a safe and controlled surgical approach.

Although a flexible SP camera platform offers various angles during surgery, a crucial aspect of this procedure is ensuring a stable surgical field, with optimal visualization [7,8]. First, securing a clear view of the stomach is essential. During surgery, the stomach was anchored to the abdominal wall using a straight needle to provide adequate traction and facilitate better exposure to the operative field. Sufficient dissection and proper traction of the colon are crucial. The first assistant utilized a laparoscopic grasper to maintain steady traction of the colon, ensuring adequate exposure. Additionally, the patient was placed in the reverse Trendelenburg position to allow gravitational assistance to pull the colon downward, thereby improving access to the spleen. Accurate patient positioning before robot docking is essential.

The role of the assistant surgeon is also crucial in this procedure. An additional port placed in the patient's left middle quadrant is frequently required for vessel clipping, tissue division using an energy device, and other essential tasks. Given these technical demands, it is imperative to have a surgical first assistant who fully understands the procedure and can accurately perform the necessary maneuvers using a two-dimensional imaging system [9].

Despite its cosmetic benefits and movement flexibility, several notable limitations restrict the independent use of the robotic SP system in splenectomies. First, the system does not accommodate small clips, which necessitates alternative methods for vessel control. In such cases, hemostasis must be achieved either using a bipolar energy device or with the aid of an assistant surgeon utilizing small laparoscopic clips through an additional port. Also, the current SP robotic system does not support robotic stapler deployment, which prevents en bloc stapling of the splenic hilum. As a result, individual ligation of the splenic vessels is required, increasing the operative time and technical complexity. The incorporation of a compatible stapler in the SP platform may simplify the procedure and potentially improve efficiency. Another notable limitation is that the range of motion of the SP system may be insufficient for procedures that require broad operative fields. For instance, during the traction of the colon, an essential step for adequate exposure of the splenic hilum, a robotic arm may need to be dedicated to maintaining traction, thereby significantly limiting the maneuverability of the remaining instruments. Nevertheless, a previous study showed that robotic SP splenectomy could be performed without an additional port [4]. However, this could be time-consuming and limit its efficiency, particularly in cases of obesity. Therefore, an assist port is considered acceptable in robotic SP splenectomy to enhance procedural safety and reduce the operative time.

In conclusion, the robotic SP system offers cosmetic outcomes superior to those of conventional robotic platforms and is safe and feasible. Additionally, its unique advantages suggest the potential for better adoption and expansion of the indications for the procedure. However, further studies and accumulated clinical experience are necessary to optimize its application.

Notes

Ethics statement

This study was approved by the Institutional Review Board of Yonsei University Health System, Severance Hospital, Seoul, Korea (IRB No. 4-2024-1655). Written informed consent was obtained from the patient for participation in this case report and for the publication of accompanying clinical images and video material.

Authors' contributions

Conceptualization, Funding acquisition, Project administration, Resources: SHK

Data curation, Visualization: SHP

Formal analysis, Investigation, Methodology: SHP, SHK
Software: SHP, SHK
Supervision: CMK
Validation: SHK, CMK
writing–Original Draft: SHP
Writing–Review & Editing: All authors

Conflict of interest

All authors have no conflicts of interest to declare.

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Data availability

The data presented in this study are available upon reasonable request to the corresponding author.

ORCID

Su Hyung Park, https://orcid.org/0009-0004-2461-5920
Sung Hyun Kim, https://orcid.org/0000-0001-7683-9687
Chang Moo Kang, https://orcid.org/0000-0002-5382-4658

Supplementary materials

Supplementary materials can be found via https://doi.org/10.7602/jmis.2025.28.4.209.

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