

# Laparoscopic Hepatectomy for Mucinous Cystic Neoplasm of the liver: A Case Series of Six

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## Research Article

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# Abstract

## Background

Mucinous Cystic Neoplasm of the liver (MCN-L) is considered as a benign disease, but it has the possibility of malignant transformation. The advantages of minimally invasive surgery can alleviate the anxiety of patients with benign diseases. The purpose of this study is to determine the feasibility and safety of laparoscopic hepatectomy (LH) for patients with Mucinous Cystic Neoplasm of the liver.

## Methods

All patients who were pathologically diagnosed as MCN-L were retrospectively studied. Collect the surgical data of patients undergoing laparoscopic hepatectomy, and conduct a return visit.

## Results

There were 6 cases of LH for MCN-L. The mean operation time was  $176.3 \pm 20.6$  min, and the intraoperative blood loss was  $102.5 \pm 73.7$  mL. No serious complications occurred, and the mean length of hospital stay was  $5.8 \pm 1.5$  days. During the median follow-up time of 30.5 months, no recurrence occurred.

## Conclusions

LH for MCN-L is feasible and safe. The treatment principle of laparoscopic surgery for MCN-L should be consistent with laparotomy.

# Introduction

Mucinous Cystic Neoplasm of the liver (MCN-L) can also be called biliary cystadenoma (BCA)[1], is a rare hepatic cystic disease, accounting for less than 5% of intrahepatic cystic diseases[2]. There are many regimens to treat MCN-L, but about 80% of patients will relapse if the lesion is incompletely resected[3]. MCN-L is considered to be benign[4], but has the potential for malignant transformation. Complete resection of the tumor is the only radical treatment for MCN-L[5, 6].

With the innovation of laparoscopic instruments and the progress of technology, the number of laparoscopic hepatectomy (LH) is increasing rapidly[7]. LH is more advantageous than the open approach, and benign liver tumors such as hepatic hemangioma and focal nodular hyperplasia are considered to be ideal indications for LH [8].

Although LH has been widely accepted for benign liver tumors, the safety and feasibility of LH for MCN-L remains unclear. Due to the low incidence of the disease and inconsistent surgical treatment, there are few literatures of laparoscopic hepatectomy for MCN-L[9, 10]. In order to help clinicians select surgical options when they encounter this rare benign tumors, it is necessary to determine whether LH is safe to

treat such tumors that may worsen or recur. Therefore, we reviewed six cases of LH for MCN-L we treated and the relevant previous published articles.

## Material And Methods

### Patients

From 2011 to 2020, LH was performed in 6 patients with suspected MCN-L in two institutions (The Cancer Hospital of the University of Chinese Academy of Sciences (Zhejiang Cancer Hospital) and Zhejiang Provincial People's Hospital). Medical records of these patients were retrospectively and inclusion criteria were (1) age between 18 and 80 years (2) postoperative pathologic confirmation of MCN-L (3) patients with laparoscopic entire tumor resection. All patients were highly considered to be MCN-L after preoperative CT evaluation (Fig. 1). Written informed consent was obtained from all patient. This study was approved by institutional review board.

### Methods

Obtain the clinical characteristics, operative, postoperative, pathological, prognosis data of patients from the medical records, and conduct retrospective analysis. Clinical characteristics include sex, age, BMI and chief complaint. Operative data included operating time, intraoperative blood loss, conversion to laparotomy, intraoperative blood transfusion and type of hepatectomy. Pathological data included tumor diameter, location and tumor margin. The prognosis data included postoperative complications, length of hospital stay, in-hospital mortality, recurrence, progression-free survival (PFS) and overall survival (OS).

### Operative technique

Under general anesthesia, patients were placed in the supine position. Both legs were separated at about 45 ~ 60 degrees. Four Trocars were needed, including the observation port A(10mm) below the umbilicus, main manipulation port B(10mm) below the xiphoid process, assistant port C (5mm) at the midpoint of the line between the xiphoid process and umbilicus and assistant port D (5mm) at the right anterior axillary line, which can be adjusted according to the tumor location (Fig. 2). The main operator stood at the left side of the patient and the observer stood between the patient's legs.

The liver is mobilized before liver parenchyma is dissected. MCN-L is located in the liver right lobe (Fig. 3). A fine rubber tape is employed to block hepatoduodenal ligament by wrapping it without tension, which can be tightened by pulling the tape and immobilizing by a Hem-o-lok if it is necessary. According to the amount of intraoperative blood loss and the type of hepatectomy to determine whether it is necessary to block the first porta hepatis. Intraoperative ultrasonography is used to confirm bound line of tumor, and then an electric scalpel to draw a scheduled cutting line 1 cm outside the tumor boundary. Parenchymal dissection was performed with an ultrasonic scalpel and an aspirator. Careful dissection should be performed when encountering hepatic veins to avoid massive bleeding or even air embolism. A nonabsorbable clip was used to seal the vein and cut it off. The specimen was packed into a plastic bag

and was removed via the enlarged trocar incision. Irrigation and suction of the surgical field to exclude bile leakage and bleeding. A Jackson-Pratt drainage tube was placed in the surgical area at the end of the operation.

## Statistical analysis

All cases were retrospectively analyzed, and the results were presented as mean  $\pm$  standard deviation or median (range). Statistical analysis was performed using SPSS software version 25.0 (SPSS Inc., Chicago, IL).

## Results

### Patients and surgery characteristics

A total of 6 MCN-L patients met the inclusion criteria (Table 1). The mean age was  $49.5 \pm 15.8$  years and all of them were female. The mean BMI was  $22.8 \pm 3.0$ . Two patients found tumors on routine imaging, and four patients were hospitalized due to abdominal pain. All patients underwent laparoscopic hepatectomy. The mean operative time was  $176.3 \pm 20.6$  min and the mean intraoperative blood loss was  $102.5 \pm 73.7$  mL. No patients were converted to laparotomy or required intraoperative blood transfusion. 3 patient underwent left hemihepatectomy, and 3 patients underwent partial hepatectomy. All enrolled patients were confirmed to be MCN-L by pathological examinations. The mean tumor diameter was  $6.6 \pm 2.6$  cm. All patients had negative margins. Three tumors were located in the S4 hepatic segmental and remaining three are in the S5 hepatic segmental. Complications occurred in only 1 patient during hospitalization, which was fever, considered to be caused by surgical stress, and resolved after conservative treatment. The mean length of hospital stay was  $5.8 \pm 1.5$  days. There were no deaths during hospitalization. As of January 10, 2021, there was no recurrence or death in all patients, and the median PFS and OS were 30.5 (range2-114) months.

Table 1  
Patients, surgery, pathological and prognosis characteristics

Category	Result
Sex, n (Male/Female)	0/6
Age	49.5 ± 15.8
Chief complaint, n	
AP	4
IE	2
Length of surgery (min)	176.3 ± 20.6
Blood loss (mL)	102.5 ± 73.7
Type of hepatectomy, n	
PH	3
LH	3
Tumor diameter (cm)	6.6 ± 2.6
Morbidity (%)	16.7
LOS (days)	5.8 ± 1.5
PFS and OS (months)	Both 30.5
AP: Abdominal pain; IE: Imaging examination; PH: partial hepatectomy; LH: left hemihepatectomy; LOS: Length of hospital stay; PFS: Progression-free survival; OS: Overall survival.	

## Discussion

With the innovation of laparoscopic instruments and the accumulation of minimally invasive experience of surgeons, laparoscopic surgery has evolved to become the approach of choice for many abdominal procedures[11]. LH has developed rapidly in the past few decades, which has shown much advantages over open hepatectomy in terms of short-term recovery, such as less intraoperative bleeding, less postoperative complications and shorter in-hospital stays[12, 13]. In addition, for diseases such as MCN-L, which almost exclusively occur in women (all patients in this series were female)[14], the cosmetic effect of laparoscopy can alleviate the patient's fear of surgery. Although MCN-L has the risk of malignant transformation and recurrence, MCN-L is considered as a benign tumor[4]. The European Guidelines Meeting acknowledge the advantages of laparoscopic liver surgery in liver benign disease in 2017[15]. Compared with laparotomy, laparoscopy can greatly relieve the preoperative abdominal symptoms. A systematic review included 4061 patients (87% open and 13% laparoscopic resections) with benign liver tumors requiring hepatectomy. Two studies of the review found significant better quality of life scores following laparoscopic compared to open surgery[16]. 74.6% of patients with MCN-L were

symptomatic preoperatively[4]. Four patients in this series had abdominal pain. It can also be said that laparoscopy can relieve abdominal symptoms of benign tumors such as MCN-L compared with open surgery. The indications of laparoscopic hepatectomy for benign liver tumors have been expanding. Due to the extremely low incidence of MCN-L, it is not included in the guidelines as an indication for laparoscopic surgery. Many patients refuse surgery because of the huge scar of open surgery, leading to the progression of MCN-L to hepatic cystadenocarcinoma. For benign and indeterminate liver lesions, laparoscopic surgery is a safe choice, even if hepatectomy is required[11, 17–19]. There are few studies on the treatment of MCN-L with LH. Although the indicators of LH for the treatment of benign liver diseases are clear, the role of LH is still unclear for tumors like MCN-L that may become malignant. Therefore, this paper reviews and discusses the data and related literature.

The perioperative results and prognosis of this study suggest that LH for MCN-L is feasible and safe, and can provide a good prognosis. To ensure the safety of the surgery, the experience of this series is: 1) The integrity of the tumor must be guaranteed. This not only requires more than 5–10 years of experience in laparoscopic and open hepatectomy, but also careful operation throughout the procedure. When the specimen is taken out from the abdomen through trocar, the specimen bag should be used to avoid the cyst fluid flowing into the abdominal cavity due to the rupture of the tumor. 2) Ensure sufficient cutting edge. The principles of laparoscopic therapy should be consistent with open surgery. The resection line should be at least 1 cm outside the tumor to ensure the negative margin.

Table 2  
LH for MCN-L in previous literatures

Author	Published year	case	Operating time(min)	Blood loss (mL)	Clavien-Dindo ≥ III(%)	LOS (days)	Median PFS
Ratti et al[20]	2012	2	NA	NA	0	NA	NA
Banerjee et al[21]	2016	2	NA	NA	NA	NA	34
Smerieri et al[22]	2018	1	NA	NA	0	5	NA
Kim et al[10]	2019	1	240	70	0	7	NA
Yang et al[9]	2020	1	NA	NA	NA	NA	6
This series	/	6	Mean 176.3	Mean 102.5	0	Mean5.8	30.5

PFS: Progression-free survival; LOS: Length of hospital stay; NR: Not referred.

In order to objectively summarize whether MCN-L can be used as an indication for laparoscopic surgery, we conducted a review of the literatures about LH for MCN-L (Table 2). Most of the literatures does not

describe the operative, perioperative, and prognosis in detail. In 2012, Professor Ratti performed hepatectomy for 12 patients with MCN-L, including 2 cases of LH and 10 cases of open hepatectomy[20]. Unfortunately, the article does not provide specific data on LH for MCN-L. The hospital stay of 12 patients was 5 (4–8) days, the operation time was  $209 \pm 78$  min, and the intraoperative blood loss was  $260 \pm 130$  ml, which was similar to the data of this series. In the report of 2 cases of MCN-L treated with LH, both patients did not relapse after 28 months and 40 months of follow-up[21]. LH for MCN-L can obtain long-term good prognosis, which is consistent with our series. A case had a short-term recurrence after laparotomy cyst unroofing underwent laparoscopic left hepatectomy and was discharged 5 days after surgery[22]. A long-term and difficult adhesiolysis was performed, which also indicated the feasibility of LH for complex MCN-L. Based on the experience of our series, both laparotomy and laparoscopy are acceptable for MCN-L. The choice of surgical method depends on the patient's operation history, the location of the tumor, and whether the surgeon has the experience of LH and MCN-L.

To our knowledge, this study is the first case series of LH for MCN-L, with the largest number of cases. We combined the experience and reviewed the literatures, which may be an advantage of this series. However, because of the extremely low incidence rate of MCN-L, the number of cases in series is small which cannot be statistically analyzed. Retrospective review is another limitation.

## Conclusions

Hepatectomy for MCN-L can be selected in laparoscopic and open surgery. LH is feasible and safe for MCN-L, and the prognosis is considerable. Cautious operation and compliance with the principle of tumor-free are the fundamentals of LH for MCN-L. In the near future, MCN-L may be a new indication for laparoscopic therapy.

## Abbreviations

MCN-L: Mucinous Cystic Neoplasm of the liver; LH: laparoscopic hepatectomy; PFS: progression-free survival; OS: overall survival; AP: Abdominal pain; IE: Imaging examination; PH: partial hepatectomy; LH: left hemihepatectomy; LOS: Length of hospital stay.

## Declarations

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**Competing interests:** The authors declare that they have no conflict of interest.

**Authors' contributions:** All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Yizhen Chen, Youyao Xu, Jia Wu and Fang Han. The first draft of the manuscript was written by Yizhen Chen, the review and editing of the article were performed by Zhang Yuhua and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

**Ethics approval and consent to participate:** This study was approved by institutional review board. Written informed consent was obtained from all patient.

**Consent for publication:** Not applicable.

**Availability of data and materials:** The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

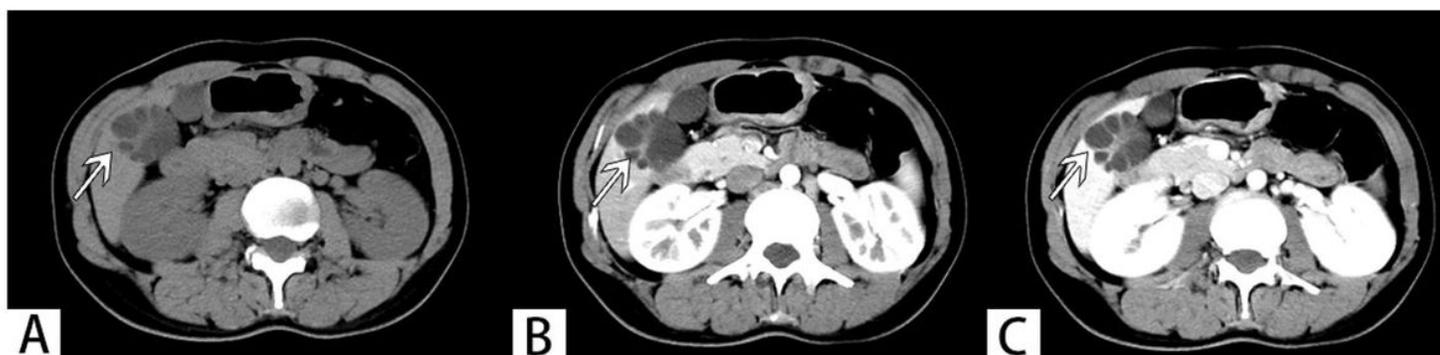
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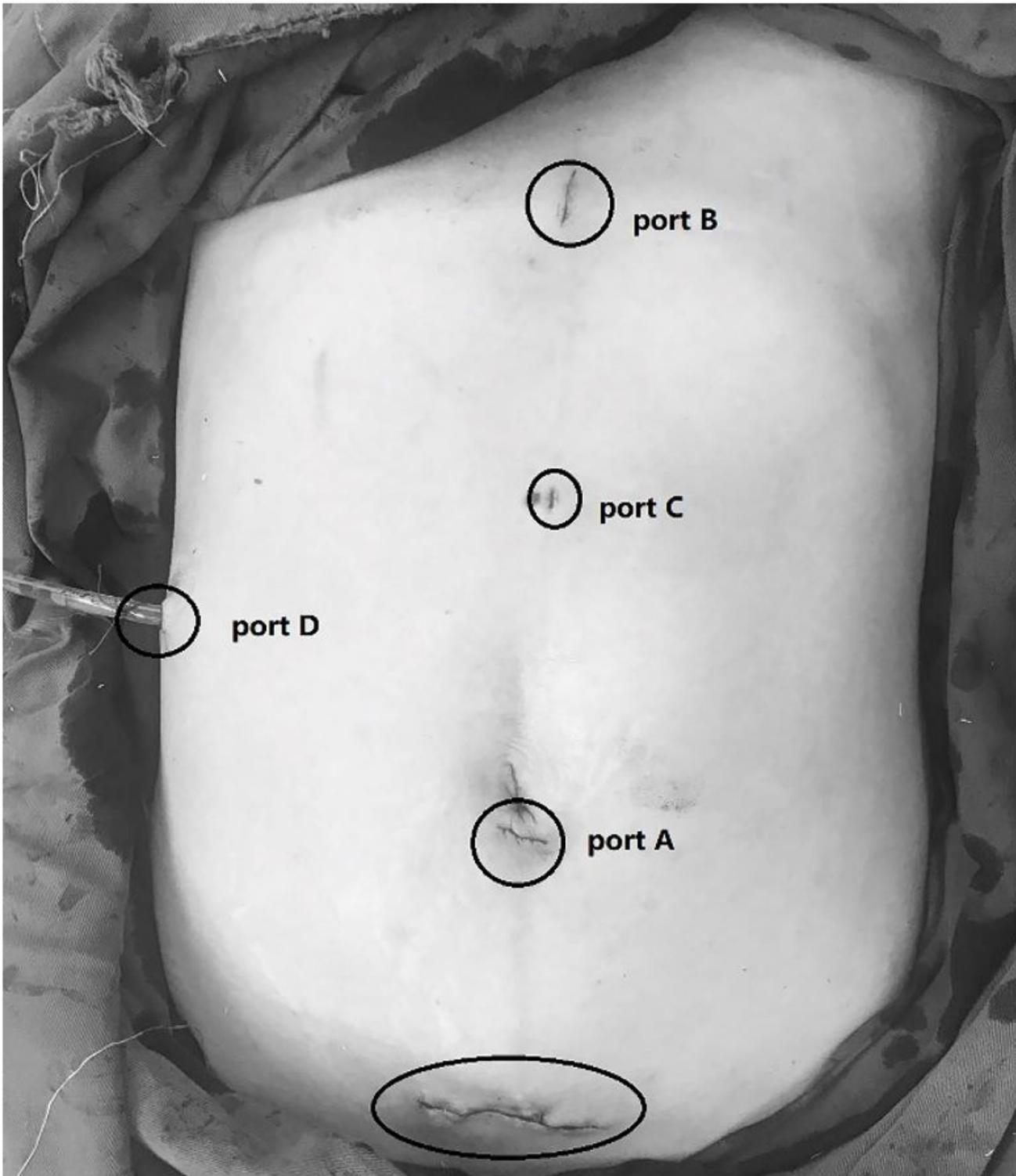
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## Figures



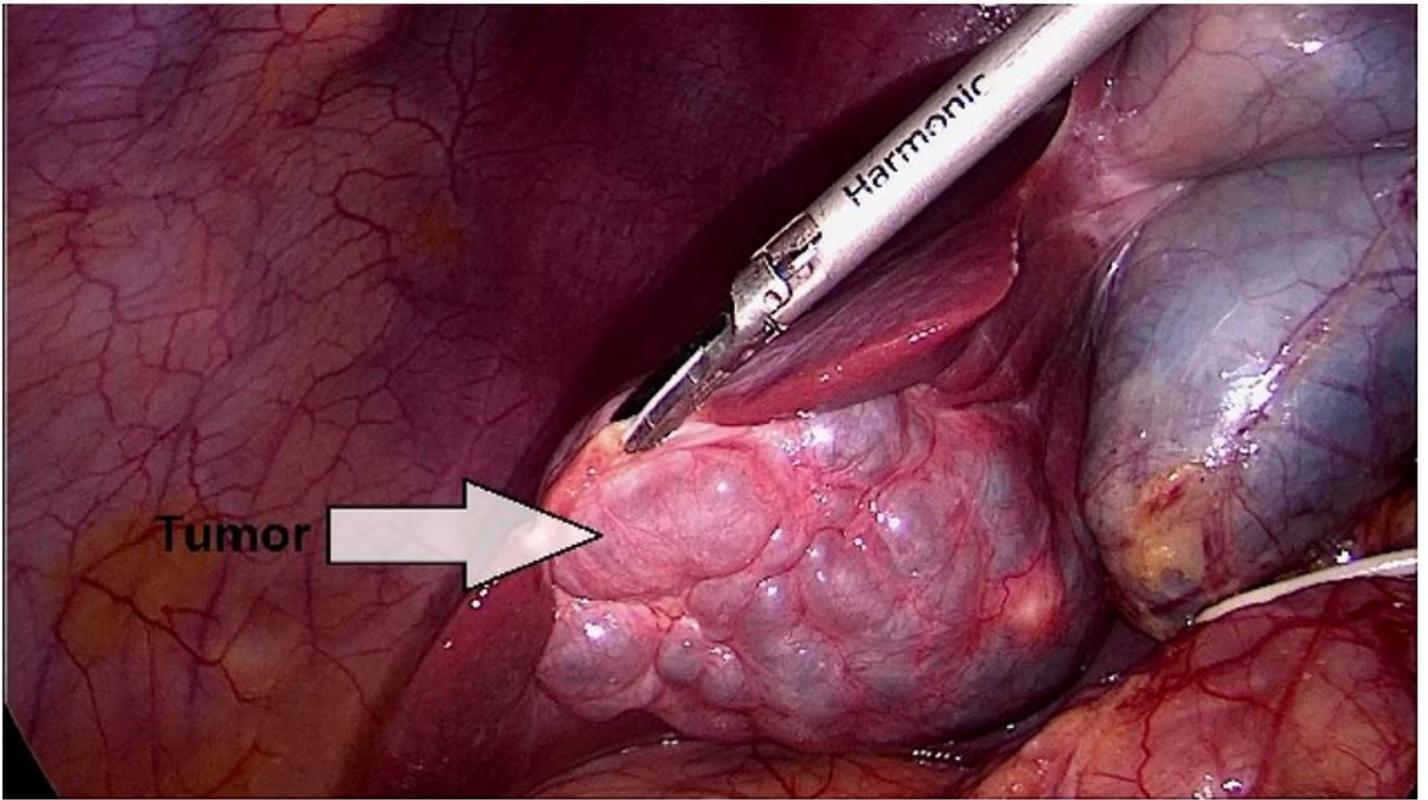
**Figure 1**

Preoperative CT evaluation. This figure depicts the preoperative CT evaluation. A is the plain phase of CT, B is the enhanced phase of CT, and C is the portal phase of CT.



**Figure 2**

Trocar's location of laparoscopic surgery. This figure depicts the Trocar's location.



**Figure 3**

Intraoperative tumor location. This figure depicts the location of the MCN-L