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Review

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Systematic review of 241 laparoscopic isolated liver segment VII resections

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ABSTRACT

Laparoscopic liver resections are performed with increasing frequency; however, they are less preferred for the deep parts of liver because of difficulty in reaching a posterior superior segment and working in a narrow area. The aim of this study is to analyze the outcomes of laparoscopic segment 7 resections with two new patients and previously published 239 patients.

PubMed, Scopus, and Google Scholar databases were scanned for the topic with several keywords. Eligible studies were selected for the analysis and reference cross-check was added to the search. Surgical technique details (application of Pringle maneuver, using Cavitron ultrasonic surgical aspirator (CUSA), patient position, Glissonean approach, and intercostal trocar (ICT) placement) were examined for the outcomes (operating time, blood loss, conversion to open surgery, and post-operative complications).

Total data of 239 cases were collected from 27 studies and we added two more cases from our clinic. Lateral decubitus patient position was with less post-operative complications when compared to the supine position (8.4% vs. 50.0%, p=0.01). ICT placement seemed to have less conversion rate (1.3% vs. 7.3%, p=0.07) and less post-operative complications (4.5% vs. 19.1%, p=0.05). Glissonean approach increased the operating time but had no effect on blood loss. Using CUSA for parenchymal transection lowered the rates of post-operative complications (4.4% vs. 19.5%, p<0.05) but it was not useful for blood loss or operating time. Application of Pringle maneuver had no effect on these outcomes.

Laparoscopic isolated segment 7 liver resection is a feasible surgical procedure for selected patients in centers with experienced surgeons on advanced laparoscopy. Lateral decubitus patient position, ICT placement, and using CUSA for parenchymal transection seem beneficial to decrease conversion to open surgery and complication rates. Pringle maneuver or Glissonean approach were not found as useful for the outcomes.

Keywords: Hepatectomy; laparoscopy; minimal invasive surgery; segment seven; segmentectomy.

Introduction

Since the first laparoscopic liver resection was reported in the 90s, laparoscopic approaches to liver have become more common.[1] Compared to open resections, laparoscopic liver resections are more comfortable in the post-operative period, and there are no differences in oncologic outcomes.[2] Laparoscopic resections are more frequently performed in easily visualizable segments of liver

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(segments 2, 3, 4B, 5, 6), while limitations remain for the segments that are difficult to reach (segments 1, 4A, 7, 8).[3] The liver is surrounded by diaphragm and ribs, which results in a narrow operation area; difficulty in accessing the posterior segments, revealing the lesion, resection with appropriate surgical margin, and control the bleeding[2] (Fig. 1a, b). However, with the development of laparoscopic techniques, technological devices, and experience, approach to posterior liver segments has become more applicable.

The aim of this article is to present two patients who underwent isolated laparoscopic segment 7 resection and investigate the effects of surgical technique details; including application of Pringle maneuver, Cavitron ultrasonic surgical aspirator (CUSA) usage, patient's position, Glissonean approach, and intercostal trocar (ICT) placement, on surgical and clinical outcomes; operating time, blood loss, conversion to open surgery, and post-operative complications with a systematic literature review.

Case 1 – A 26-year-old male patient had a history of the right hemicolectomy at the age of 15 years old for colon cancer, followed by chemotherapy. There was no additional feature in his and family's medical history. Physical examination revealed a median incision scar from the previous operation. Contrast-enhanced abdominal tomography and dynamic magnetic resonance imaging showed a 60 mm × 50 mm sized solid mass with lobulated contours at segment 6–7, which appeared in recent year (Fig. 2 a). Laboratory examination revealed; CEA: 0.89, CA19-9: 32.5, and hydatid cyst antigens were negative. Percutaneous biopsy was performed but pathological examination was not diagnostic, and malignancy could not be ruled out. The patient was scheduled for laparoscopic liver resection.

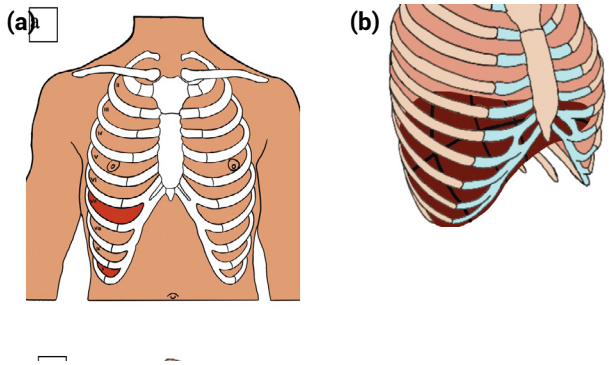

Figure 1. Location of segment 7 in liver.

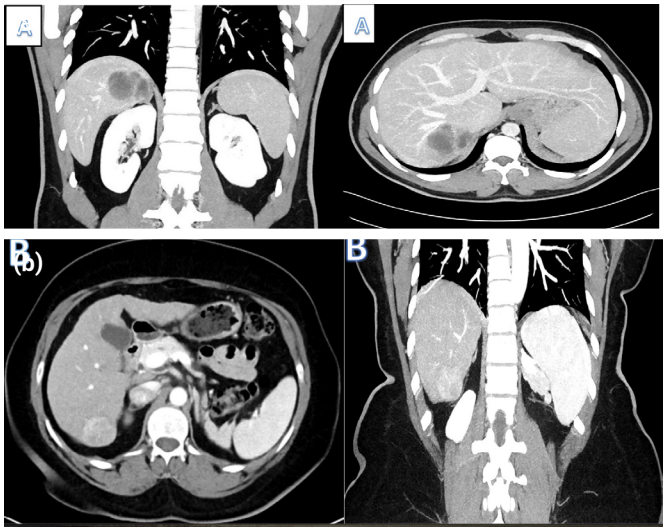

Figure 2. (a) Enhanced abdominal tomography showed 60 mm × 50 mm mass in segment 7 (patient 1). **(b)** Enhanced abdominal tomography showed 35 mm × 28 mm mass in segment 7 (patient 2).

The patient was placed in the left semi-lateral position, with the right side up at an angle of 45°, legs open, and the monitor at the head. After providing pneumoperitoneum (13 mmHg) with a Veress needle from the upper left quadrant (Palmer point). A 10–12 mm trocar was applied with open technique 2 cm above the umbilicus from the point of previous incision scar. Other three 10–12 mm trocars were placed below the rib, through the subcostal line. Moreover, two 5 mm non-ballooned trocars were inserted through the 9th and 10th intercostal spaces. Cholecystectomy was performed after exploration of the abdominal cavity. The Rummel tourniquet was placed to hang hepatoduodenal ligament for the Pringle maneuver. Falciform ligament was divided and, right triangular and coronary ligaments were released from the liver. The patient was turned to the left lateral decubitus position. By tilting the liver to the left with the help of gravity, we reached the mass. Intraoperative ultrasonography (USG) was not performed. First, the short hepatic veins were separated from the liver using Hem-o-lock clips. The mass was transected from the liver parenchyma by preserving the right hepatic vein by intermittent Pringle maneuver (15 min clamped, 5 min non-clamped). Laparoscopic CUSA was used for parenchymal dissection, Ligasure (Covidien, Mansfield, USA) for division of parenchyma, and Aquamantys System (Medtronic, Minneapolis, MN, USA) for hemostasis. The hepatocaval ligament was separated by laparoscopic linear stapler blue cartridge (Endo Gia, 60 mm, Covidi-

en, Norwalk, CT, USA, or 60 mm Echelon) and the mass was resected. Glissonian approach was not used. Specimen was removed using previous upper midline incision through endobag. Fibrin sealant was applied to the cut surface following hemostasis (Tisseel, Baxter Deerfield, US). The amount of intraoperative hemorrhage was 300 cc. Pneumothorax was not observed. The ICT entrance sites were not sutured. The operation time was 480 min. Hemodynamic parameters were normal in the post-operative period. Blood transfusion was not required. On the 1st post-operative day, patient's bowel movements started, and liquid food was allowed. Bile leakage was not observed. The drain was removed on the 4th post-operative day. The patient was discharged on the 5th post-operative day. The pathological examination reported a 6.5 cm × 5 cm × 4.5 cm mass consistent with Fasciola hepatica. Post-operative anti-parasitic treatment was not given. Sixth month follow-up showed no complications.

Case 2 – A 53-year-old female patient underwent laparoscopic resection in another center for hepatocellular cancer (HCC) due to hepatitis C virus (HCV)-induced liver cirrhosis. After the failure of this operation, the patient was referred to our center. Medical history of the patient revealed HCV positivity diagnosed 2 years ago and HCV-RNA returned to negative with anti-viral treatment. On physical examination, there was one trocar entry site under the umbilicus and three trocar entry sites throughout the right subcostal line. Contrast-enhanced abdominal tomography showed 35 mm × 28 mm sized solid mass in segment 7 of liver (Fig. 2 b). Laboratory examination showed HCV antibody: (+), HCV-RNA: (–), AFP: 2563 ng/ml, CEA 0.84 ng/ml, and CA19.9: 39.7 U/ml. The patient with Child class A cirrhosis was scheduled for surgery.

The patient's position was the same as the first case presented. After pneumoperitoneum (13 mmHg) was obtained from the old umbilical trocar side, 12 mm port was applied for camera in that hole and, one 10–12 mm trocar was inserted 2 cm below the xyphoid, three of 10–12 mm trocars were placed throughout the subcostal line. A non-ballooned 5 mm trocar was inserted through the 10th intercostal space. Additional two 10–12 mm trocars were inserted between ICT and anterior iliac crest. Abdominal cavity was explored, falciform ligament was divided and right triangular and coronary ligaments were released. The Rummel tourniquet was suspended for the Pringle maneuver. The patient was turned to the left lateral decubitus position, and the liver was tilted to left by gravity. The tumor was visualized with the help of this maneuver. Intraoperative USG was not performed before the resection. CUSA was used for parenchymal dissection, Ligasure (Covidien, Mansfield, USA) was used for sealing the minor vessels, and Aquamantys (Medtronic, Minneapolis, MN, USA) was used for hemostasis as same as the first patient. Glissonian approach was not used. The specimen was removed from the suprapubic incision through endobag. Fibrin sealant (Tisseel, Baxter Deerfield, USA) was applied to the cut surface. Intraoperative hemorrhage was 3000 cc. One package of erythrocyte suspension was transfused intraoperatively. The 5 mm ICT site was not sutured. The operation time was approximately 10 h. Hemodynamic parameters were normal in the early post-operative period. Patient's oral nutrition was started on the 2nd post-operative day. On the post-operative day 4, one package of erythrocyte suspension was transfused. Pneumothorax or bile leakage was not observed. The drain was removed on the 4th post-operative day. The patient was discharged on the 5th post-operative day. Pathological examination showed HCC.

Materials and Methods

The PubMed, Scopus, and Google Scholar databases were scanned in July 2019 with the keywords "laparosco* (hepatectomy OR liver resection) (segment 7 OR segment VII OR posterosuperior OR posterolateral)" and 179 potential articles were selected for search. After exclusions and reference cross-check, we collected 27 eligible studies including 239 patients. We added our two patients to the systematic review (Fig. 3). Country, year, number of patients, age, gender, tumor size, patient position, intraoperative ultrasound usage, ICT usage, number and location of ICT, methods used for bleeding control (Glissonean approach, Pringle maneuver), usage of CUSA in parenchymal dissection, fibrin glue application on the cut surface, operation time, blood loss, blood transfusion, conversion to open surgery, complications, length of hospital stay, and pathological results were recorded (Tables 1–3).

Written informed consents were obtained from our patients. No Institutional Review Board approval was required for this report.

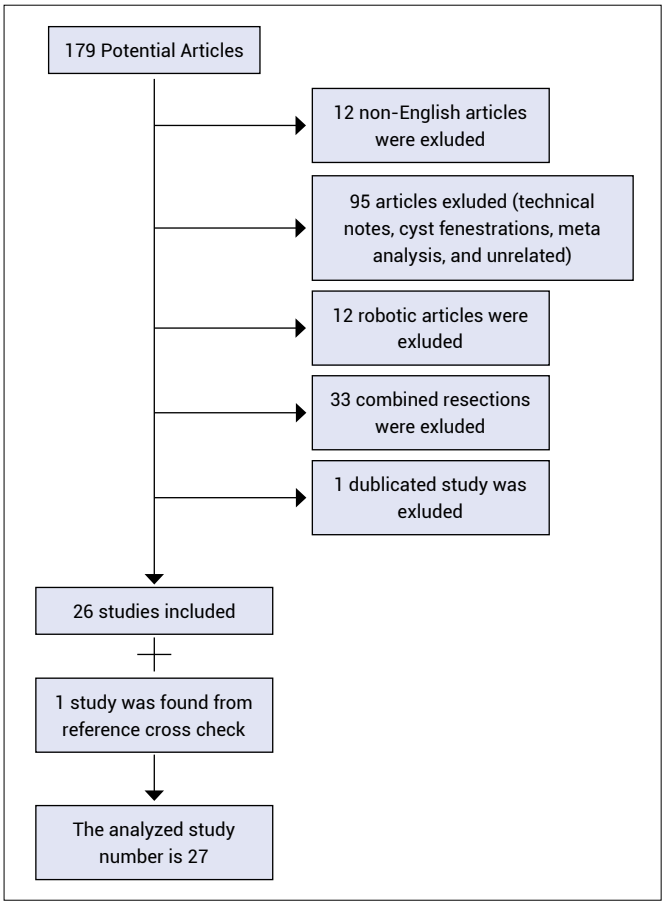

Figure 3. Flowchart of the literature review.

Statistical Analysis

For the studies which had reported median and range, the estimated mean and standard deviations were calculated using the method described by Hozo et al.[28] Basic calculations were used for total numbers of dichotomous outcomes and weighted means for continuous outcomes. The Chi-square test or the Fisher's exact test (if expected values were <5) and the Student's t-test were used for statistical analysis of dichotomous and continuous variables, respectively (SPSS 13.0). P<0.05 was considered statistically significant.

Results

A total of 241 patients were included in this systematic review and the mean age was 60.3±11.9 years old (61.5% male). The mean diameter of liver mass was 2.8±1.4 cm. The left lateral decubitus position was preferred at a rate of 75.6%. ICT was used in 39% of patients and, 7th and 10th (73.3%) intercostal port spaces were the most preferred ones. Intraoperative ultrasound was used in 81.3% of the operations. In parenchymal transection, CUSA was preferred in 33.6% of the patients. The use of Pringle maneuver rate was 13.4%. The rate of Glissonean approach was 13.4%. The mean operation time was 302±629 min, and the mean blood loss was 249±460 ml. The mean complication rate was 12%, whereas bile leakage and pneumothorax were not reported in any. Mean hospitalization time was 7.9±3.3 days. Major morbidity or mortality was not reported in any of 241 cases. In the pathology reports, metastatic masses (44.2%) were the second most common lesion after HCC (47.7%) (Table 4). The complication rates in of operations with patients in lateral decubitus position were significantly lower than with patients in supine position (8.4% vs. 50%, p=0.01). In ICT placed group, conversion to open surgery (1.3% vs. 7.3%, p=0.07) and complication (4.5% vs. 19.1, p=0.05) rates were lower than in non-ICT placed group. Although ICT use was not statistically significant on these parameters, it was suggestive. Glissonean approach increased the operating time (335±20 min vs. 226±89 min, p=0.02) but had no significant effect on blood loss. Using CUSA for parenchymal transection lowered the rates of post-operative complications (4.4% vs. 19.5%, p<0.05) but it had no significant effects on blood loss or the operating time. Application of Pringle maneuver had no effects on evaluated outcomes (Table 5).

Discussion

In this study, we presented two patients and systematically reviewed with the data of 239 patients previously reported, who underwent isolated laparoscopic segment 7 liver resection.

This study showed that complication rates were lower in patients operated in lateral decubitus position. However, lateral decubitus position had no significant effects on the operating time, blood loss, or conversion to open surgery. Laparoscopic surgical procedures for posterosuperior segments of the liver are less preferred than other segments, especially because of the difficulty in bleeding control and working in a narrow space. The position of the patient is very important for reaching the deepest part of the liver, segment 7. Although the left lateral decubitus position is generally preferred for visualization, there were also studies using supine and semi-prone positions in the literature.[24,25] Ikeda et al.[8] reported that patients operated in semi-prone position had less intraoperative blood loss and length of hospital stay than patients operated in supine position.

The use of CUSA in parenchymal transection did not af-

Table 1. Publications and pre-operative patients' details

Authors	Year	Country	No	Age	Gender	Tumor diameter	Patient position
Hilal et al.[4]	2009	UK	1	60	M	30	NA
Cho et al.[5]	2009	Korea	2	NA	NA	NA	Left semi-lateral decubitus
Cheng et al.[6]	2010	China	1	60	M	26	NA
Kazaryan et al.[1]	2011	Norway	13	NA	NA	NA	Left lateral decubitus
Ishizawa et al.[7]	2012	Japan	6	NA	NA	NA	Left lateral decubitus
Ikeda et al.[8]	2014	Japan	17	NA	NA	NA	Semi-prone
Long et al.[9]	2014	Vietnam	7	NA	NA	NA	Left lateral recumbent
Coles et al.[10]	2014	UK	7	65(±7.5)	5 M/2 F	13(±6.9)	Left semi-lateral decubitus
Lee et al.[11]	2014	Korea	3	NA	NA	NA	Left semi lateral decubitus
Okuda et al.[12]	2015	Japan	6	58.75(±5.75)	1 M/5 F	15.5(±4.5)	Left semi-lateral decubitus
D'Hondt et al.[13]	2015	Belgium	14	NA	NA	NA	Semi-prone
Ogiso et al.[2]*	2015	USA	15	NA	NA	NA	Left semi-lateral decubitus
	2015	USA	11	NA	NA	NA	Left semi-lateral decubitus
Lim et al.[14]	2016	Japan	7	NA	NA	NA	Left lateral decubitus
Okuda et al.[15]	2017	Japan	3	53.5(±12.5)	3 M	35(±2.5)	Left semi-lateral decubitus
Zhang et al.[3]	2017	China	19	NA	NA	NA	Left semi-lateral decubitus
Inoue et al.[16]#	2017	Japan	15	64.75(±12.75)	8 M/7 F	NA	Left lateral decubitus
	2017	Japan	14	63.75(±9.75)	6 M/8 F	NA	Left lateral decubitus
Hirokawa et al.[17]&	2017	Japan	14	NA	NA	NA	Left lateral decubitus OR LSLD
	2017	Japan	9	NA	NA	NA	Left lateral decubitus OR LSLD
Chen et al.[18]	2017	China	4	NA	M	NA	Left Jack-knife
D'Hondt et al.[19]	2017	Belgium	7	NA	NA	NA	Semi-prone
Giuliani et al.[20]	2017	Italy	1	60	M	30	Right lateral decubitus
Ichida et al.[21]	2017	Japan	4	NA	NA	NA	Left lateral decubitus
Murata et al.[22]	2018	Japan	1	28	M	18	NA
Lainas et al.[23]	2018	France	1	70	M	37	Left lateral decubitus
Li et al.[24]	2018	China	12	NA	NA	NA	Supine
Mashchenko et al.[25]	2018	Grenada	7	50.75(±9.75)	5 M/2 F	44.5(±1.25)	Supine
Kim et al.[26]	2019	Korea	1	76	M	52	Supine
Lee et al.[27]	2019	Korea	17	60.35(±11.36)	12 M/5 F	2.6(±1.0)	Left lateral decubitus
Our case 1	2019	Turkey	1	26	M	65	Left lateral decubitus
Our case 2	2019	Turkey	1	53	F	35	Left lateral decubitus

*This article compared combined lateral and abdominal approach with only abdominal approach. # and &: These articles compared ICT and without ICT usage. No: Number of patients; NA: Not available data.

Table 2. Operative procedures details.

Authors	ICT No.	ICT place	Pringle maneuver	Glissonean approach	Intraop. USG	CUSA	Fibrin glue	Operation time	Blood loss (ml/g)	Blood transfusion (min)	Conversion
Hilal et al.[4]	NA	NA	NA	NA	1	0	NA	NA	NA	NA	0
Cho et al.[5]	0	0	0	0	0	1	1	NA	NA	NA	1
Cheng et al.[6]	0	NA	NA	NA	NA	NA	NA	510	800	0	0
Kazaryan et al.[1]	0	0	0	0	1	0	0	NA	NA	NA	NA
Ishizawa et al.[7]	2	NA	1	0	1	0	1	180–240	100–1100	0	0
Ikeda et al.[8]	1	7th	0	1	0	0	0	NA	NA	NA	0
Long et al.[9]	0	0	0	1	NA	0	NA	NA	NA	NA	NA
Coles et al.[10]	0	0	1	0	1	1	1	252 (±69)	400 (±493)	NA	0
Lee et al.[11]	2	7th and 9th	1	0	1	1	1	NA	NA	0	0
Okuda et al.[12]	1	9th	1	0	0	1	0	250 (±45)	75.5 (±32.5)	0	0
D'Hondt et al.[13]	0	0	0	0	1	0	1	NA	NA	NA	0
Ogiso et al.[2]*	2	NA	1	0	1	0	0	NA	NA	NA	0
	0	0	NA	0	1	0	0	NA	NA	NA	0
Lim et al.[14]	NA	NA	NA	0	NA	NA	NA	NA	NA	NA	0
Okuda et al.[15]	1	6th and 8th	1	1	0	1	0	336 (±24)	264 (±128)	0	0
Zhang et al.[3]	0	0	1	0	1	0	0	NA	NA	NA	NA
Inoue et al.[16]#	2	7th and 10th	1	0	1	0	0	216 (±39)	157 (±120)	1	1
	0	0	1	0	1	0	0	241 (±77.5)	100 (±62.5)	1	6
Hirokawa et al.[17]&	1 or 2	7th and 10th	1	0	1	1	0	NA	NA	NA	NA
	0	0	1	0	1	1	0	NA	NA	NA	NA
Chen et al.[18]	1	11th	0	1	1	0	1	NA	NA	0	0
D'Hondt et al.[19]	0	0	0	0	1	1	1	NA	NA	NA	0
Giuliani et al.[20]	0	0	0	0	1	0	0	240	220	0	0
Ichida et al.[21]	1 or 2	8th or 9th	1	0	1	0	1	NA	NA	NA	0
Murata et al.[22]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 2. CONT.

Authors	ICT No.	ICT place	Pringle maneuver	Glissonean approach	Intraop. USG	CUSA	Fibrin glue	Operation time	Blood loss (ml/g)	Blood transfusion (min)	Conversion
Lainas et al.[23]	2	NA	0	0	1	0	NA	167	150	0	0
Li et al.[24]	0	0	1	0	0	0	0	NA	NA	NA	0
Mashchenko et al.[25]	0	0	1	0	1	1	0	272.5 (±44.5)	291 (±57.5)	1	0
Kim et al.[26]	NA	NA	0	1	1	1	0	330	300	0	0
Lee et al.[27]	0	0	1	0	1	1	0	151 (±63)	294 (±281)	0	0
Our case 1	2	9th and 10th	1	0	0	1	1	480	300	0	0
Our case 2	1	10th	1	0	0	1	1	600	3000	1	0

ICT: Intercostal trocar; ICT No.: Intercostal trocar count; Intraop USG: Intraoperative ultrasonography; CUSA: Cavitron ultrasonic surgical aspirator; NA: Not available data.

fect the duration of operation, blood loss, and conversion to open surgery rates. We detected that CUSA usage only lowered the complication rates. Finally, Pringle maneuver had no effect on duration of surgery, blood loss, conversion to open surgery, and complications rates.

Surgeons had thought that the use of ICT may be successful to facilitate manipulation in a narrow space.[16,17] The most preferred intercostal spaces were 7th and 10th and, the most common complications related to ICT placement were bleeding and pneumothorax. In our study, none of the patients had pneumothorax due to ICT. The usage of balloon trocars and closure of port holes had also been recommended to prevent pneumothorax.[17] In our study, placement of ICT reduced the rate of conversion to open surgery and complications, although this was significant but recommended.

Bleeding in liver resections is directly proportional to post-operative morbidity and mortality.[29] It is also known that bleeding is the most important factor affecting conversion to open surgery in laparoscopic liver resections.[30] Pringle maneuver is the most common and oldest method preferred for bleeding control in liver resections. Pringle maneuver reduces bleeding by limiting blood flow to the liver by total clamping of the hepatoduodenal ligament. For isolated laparoscopic segment 7 resections, in a study comparing continuous semi-Pringle and intermittent Pringle maneuvers, semi-Pringle maneuver was shown to reduce operation time and bleeding.[3] In this systematic review, Pringle maneuver was the most preferred method for bleeding control. However, Pringle maneuver had no significant effect on operation time and amount of bleeding. Glissonean approach, another inflow reduction method, is also preferred in laparoscopic liver resections. In Glissonean approach, Glisson pedicles are selectively isolated of at the entry site of liver and the portal triad of the relevant liver section is blocked to reduce blood flow.[31] The disadvantage of this method is the possibility of iatrogenic injuries while looking for the intrahepatic isolations of segment 7 vascularity's.[32] In this study, Glissonean technique prolonged the duration of surgery significantly. There was not any other significant relation between Glissonean approach, and the other surgical outcomes evaluated.

Parenchymal transection of liver is the bloodiest part of liver resections. Although many bleeding reduction methods are tried, the crush-clamp technique is the most effective method to reduce the amount of bleeding and additionally the duration of surgery.[33] However, crush-clamp method could not be used in laparoscopic liver resections effectively, and CUSA is an alternative device. CUSA breaks down and aspirates the parenchyma with ultrasonic waves to reveal vascular and bile structures, with no effects on coagulation.[34] Appéré et al.[35] presented that CUSA prolonged the duration of surgery and had no effect on the amount of bleeding, in their study comparing CUSA

Table 3. Details of post-operative outcomes.

Authors	Bile leak	Pneumothorax	Dindo-Clavien I	Dindo-Clavien II	Dindo-Clavien III	Post-operative stay (day)	Pathology
Hilal et al.[4]	NA	0	NA	NA	NA	NA	Hepatic splenosis
Cho et al.[5]	0	0	NA	NA	NA	NA	HCC/benign
Cheng et al.[6]	0	0	0	0	0	6	HCC
Kazaryan et al.[1]	NA	0	NA	NA	NA	NA	NA
Ishizawa et al.[7]	0	0	0	0	0	NA	NA
Ikeda et al.[8]	0	0	NA	NA	NA	NA	NA
Long et al.[9]	NA	NA	NA	NA	NA	NA	HCC
Coles et al.[10]	0	0	2	0	0	4.6(±2.5)	NA
Lee et al.[11]	0	0	0	0	0	NA	CRLM
Okuda et al.[12]	0	0	0	0	0	6(±0.5)	MET
D'Hondt et al.[13]	NA	0	NA	NA	NA	NA	NA
Ogiso et al.[2]*	NA	0	NA	NA	NA	NA	NA
	NA	0	NA	NA	NA	NA	NA
Lim et al.[14]	NA	NA	NA	NA	NA	NA	NA
Okuda et al.[15]	0	0	0	0	0	9(±1.5)	2 CRLM/ 1 HCC
Zhang et al.[3]	NA	0	NA	NA	NA	NA	NA
Inoue et al.[16]#	NA	0	0	1	0	11(±2.5)	4 HCC/ 11 MET
	NA	0	1	0	0	9.2(±3.25)	7 HCC/ 7 MET
Hirokawa	0	0	NA	NA	NA	NA	NA
et al.[17]&	NA	0	NA	NA	NA	NA	NA
Chen et al.[18]	0	0	0	0	0	NA	HCC
D'Hondt et al.[19]	NA	0	NA	NA	NA	NA	NA
Giuliani et al.[20]	0	0	0	0	0	5	CRLM
Ichida et al.[21]	0	0	0	0	0	NA	NA
Murata et al.[22]	NA	NA	NA	NA	NA	NA	Parasite
Lainas et al.[23]	0	0	0	0	0	4	HCC
Li et al.[24]	NA	0	NA	NA	NA	NA	NA
Mashchenko et al.[25]	0	0	0	2	2	9.5(±4.5)	4 HCC, CRLM, ADE, HEM
Kim et al.[26]	0	0	0	0	0	5	HCC
Lee et al.[27]	NA	0	0	0	2	6.1(±1.5)	9 HCC, 7 MET, 1 FNH
Our case 1	0	0	0	0	0	5	Fasciola hepatica
Our case 2	0	0	1	0	0	5	HCC

HCC: Hepatocellular carcinoma, CRLM: Colorectal liver metastasis, MET: Metastatic tumor, ADE: Adenoma, HEM: Hemangioma, FNH: Focal nodular hyperplasia, NA: Not available data.

with ultrasonic scalpel in laparoscopic right hepatectomy. This systematic review showed, only the complications rates were reduced significantly by the use of CUSA. In our opinion, this controversial result may be explained by the design of the study; patients with blood loss undergoing conversion due to hemorrhage were excluded and only patients with blood loss who had a completed laparoscopy were enrolled.

Table 4. Results of all available data

Parameters	Outcomes (%)	Parameters	Outcomes (%)
Age (n=77)	60.3±11.9	8th or 9th	4
Gender (n=78)	61.5% male	Pringle maneuver (n=220)	153 (69.5)
Tumor size (n=48)	2.8±1.4 cm	Glissonean approach (n=238)	32 (13.4)
Patient position (n=238)		Intraoperative USG (n=225)	183 (76.8)
Lateral (complete or semi) decubitus	180 (75.6)	CUSA (n=232)	78 (33.6)
Semi-prone	30 (15.9)	Fibrin sealant (n=223)	49 (21.9)
Supine	20 (8.4)	Operating time (n=75)	302±629 min
Intercostal trocar (n=231)		Intraoperative blood loss (n=81)	249±460 ml
No	141 (61)	Blood transfusion (n=81)	37 (45.6)
Yes	90 (38.9)	Conversion (n=178)	8 (4.5)
One trocar	31 (34.4)	Post-operative complications (n=92)	11(12)
One or two trocars	41 (45.5)	Dindo-Clavien 1	4
Two trocars	18 (20)	Dindo-Clavien 2	3
Intercostal trocar locations (n=90)		Dindo-Clavien 3	4
6th	3	Postoperative bile leak/fistula (n=79)	0
7th	35	Pneumothorax (n=226)	0
8th	3	Length of hospital stay (n=75)	7.9±3.3 days
9th	10	Pathologies (n=86)	
10th	17	Benign	7 (8.1)
11th	4	HCC	41 (47.6)
7th or 10th	14	Metastasis	38 (44.1)

Table 5. Statistical analysis of technical procedures on surgical outcomes.

	Operating time (min)	P	Blood loss (ml)	P	Conversion	P	Complication	P
Patient position								
Lateral decubitus	(n=66) 226±90	0.10	(n=66) 250±391	0.76	(n=118) 8	0.13	(n=83) 7	0.01
Supine	(n=8) 280±46		(n=8) 292±53		(n=20) 0		(n=8) 4	
Semi-prone	NA		NA		(n=38) 0		NA	
Intercostal trocar placement								
Yes	(n=27) 259±98	0.09	(n=27) 261±559	1.00	(n=76) 1	0.07	(n=44) 2	0.05
No	(n=47) 220±91		(n=47) 261±280		(n=93) 7		(n=47) 9	
Glissonean approach								
Yes	(n=4) 335±20	0.02	(n=4) 273±106	0.92	(n=32) 0	0.35	(n=8) 0	0.59
No	(n=70) 226±89		(n=70) 253±406		(n=151) 8		(n=83) 11	
CUSA								
Yes	(n=43) 236±107	NA	(n=43) 341±497	NA	(n=55) 1	0.44	(n=46) 9	<0.05
No*	(n=31) 266±60*		(n=31) 133±97*		(n=155) 7		(n=45) 2	
Pringle maneuver								
Yes	(n=72) 232±91	0.79	(n=71) 255±404	0.80	(n=111) 7	0.44	(n=84) 11	0.59
No	(n=3) 246±82		(n=3) 223±75		(n=47) 1		(n=7) 0	

In this review, the pathological examinations showed that the majority of liver resections were made for HCC and colorectal liver metastasis. We reported a case of Fasciola hepatica, a parasitic lesion, which had mimicked colorectal metastasis and a case of HCC, which developed on HCV-induced cirrhotic liver. It should be kept in mind that parasitic diseases may also be confused with colorectal cancer metastasis. Our case was the second parasitic lesion which was misdiagnosed as a tumor on liver segment 7.

One of the limitations in this study was that most of the included studies' data were not solely for segment 7 liver lesions and the data of the patients who underwent laparoscopic segment 7 resection could not be reached clearly. Moreover, the second limitation was, not excluding liver resections combined with other organ resections.

Conclusion

This systematical review showed that lateral decubitus is the most chosen position that decreases the complication rates like using CUSA for parenchymal transection. In addition, the use of the ICTs for segment 7 liver resections decreases conversion to open surgery rates and may increase surgeon's manipulation capacity. We believe that laparoscopic resection of liver segment 7 may safely be performed in experienced centers using these technical features.

Disclosures

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

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