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Original Article

Is left lateral sectionectomy of the liver without operative site drainage safe and effective?

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Backgrounds/Aims: Despite its limited benefits, operative site drainage after elective hepatectomy is routinely used. This study aimed to investigate the safety and effectiveness of left lateral sectionectomy without operative site drainage.
Methods: This study retrospectively collected data from 31 patients who underwent elective left lateral sectionectomy between January 2017 and June 2020. Based on whether operative site drainage was used, the patients were divided into two groups: drainage and non-drainage of the operative site and a comparative analysis was conducted.
Results: A total of 31 patients underwent left lateral sectionectomy during the study period. Of these, 22 patients were diagnosed with hepatocellular carcinoma; three, with intrahepatic cholangiocarcinoma; three, with liver metastasis; and three, with benign liver disease. Ten patients underwent laparoscopy. No significant differences were observed between the open and laparoscopic surgery groups. In the univariate analysis, there were no significant differences in the pre-, intra-, and postoperative clinicopathological factors between the non-drainage and drainage groups. The hospitalization period in the non-drainage group was significantly shorter than in the drainage group (8.44 days vs. 5.87 days, $p < 0.05$). In the operative site drainage non-use group, there were no cases of intraperitoneal fluid collection requiring additional procedures.
Conclusions: Routine use of surgical drainage for left lateral sectionectomy of the liver to prevent intraperitoneal fluid collection is unnecessary.

Key Words: Drainage; Liver; Hepatectomy; Postoperative period

INTRODUCTION

The prophylactic use of operative site drainage has been controversial in spite of advances in surgical techniques and perioperative management over the last two to three decades [1-5]. Despite limited availability and data suggesting limited benefits prophylactic operative site drainage after elective hepatectomy is routinely used. Clinically, the reasons for a prophylactic drain are early detection of complications (bile leakage or postoperative bleeding) and reduced need for radiological interventions (preventing complicated fluid collection) [6]. However, the use of a prophylactic drain is associated with disadvantages, such as drain infection by normal skin flora leading to retrograde infection, vascular injury, intestinal ulcer, and longer hospitalization period. The use of a prophylactic drain after hepatectomy or other abdominal surgeries has been debated based on the current evidence-based research, and numerous studies have found no advantage of prophylactic drain insertion [7,8]. However, in these studies, the decision to insert a drain after hepatectomy was based on each institution's protocol, the degree of resection, and the surgical approach used, all of which resulted in selection bias. Therefore, we attempted to determine the differences in postoperative results between non-use and use of drain when drain insertion was determined by the intraoperative situation during the left lateral sectionectomy of the liver, which is relatively safe.

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MATERIALS AND METHODS

A total of 31 patients underwent left lateral sectionectomy at the Pusan National University Hospital between January 2017 and June 2020 (42-month period). Synchronous cases with combined resection of other parts of the liver or organs, such as the colon, were excluded. The Institutional Review Board of the Pusan National University Hospital Clinical Trial Center approved the study (approval no. 2111-009-108). The patients' data were retrospectively reviewed. The patients were divided into the drainage (n = 16) and non-drainage (n = 15) groups. Prior to surgery, informed written consents were obtained from the patients that they would not have drain insertion and that radiologic intervention might be performed afterward if required. However, if the degree of cirrhosis was severe or there was a root of bleeding during the surgery, drain insertion was performed after explaining the requirement to the patient's guardian. The following clinical characteristics were retrospectively reviewed from the patients' records: age, sex, comorbidities, American Society of Anesthesiologists scores, previous surgery, pathological findings, and surgical method.

Procedures

All the procedures were performed in the operating room under appropriate anesthesia based on the patient's risk status and potential intraoperative hemodynamic changes. First, laparoscopic procedures were performed by a single surgeon, with the patient in the French position. Pneumoperitoneum was established at 12 to 15 mmHg. Four ports were used to create an adequately controllable field. Intraoperative ultrasonography was performed to define the tumor location after dividing the triangular, coronary, and falciform ligaments. The liver parenchyma was dissected to the level of the Glissonian sheath starting at the upper surface of the liver and at the lower surface to permit the use of an endoscopic stapler to control inflow and outflow. The liver parenchyma was initially resected using Sonicision (Medtronic, Minneapolis, MN, USA). A 30 to 45 mm Endoscopic Articulating Linear Stapler (Covidien, Mansfield, MA, USA) was routinely used for portal pedicles and left hepatic vein control. The liver specimen was placed in an endo bag and removed via an umbilical incision. Second, open resections were performed via an upper midline incision using a kent retractor (Takasago Ika Kogyo, Tokyo, Japan). An anatomical left lateral sectionectomy was performed after ligation of the vascular pedicle root along the umbilical fissure. Parenchymal dissection was performed using a Cavitron Ultrasonic Aspirator (CUSA; CUSA Technologies, Salt Lake, UT, USA). During the surgery, inflow occlusion was not performed and TachoSil (Takeda Austria GmbH, Linz, Austria) was administered on the remnant liver in either case. In the drainage group, a closed suction drain was placed along the transected surface of the liver.

Postoperative care

The drainage group routinely underwent a follow-up computed tomography (CT) and drainage fluid analysis on a postoperative day (POD) 5. A follow-up CT examination was conducted before POD 5 in patients with drain migration from a plain abdominal radiograph. The drain was removed on POD 7 based on normal CT findings. The non-drainage group routinely underwent a follow-up CT on POD 5. In case there was no improvement in clinical symptoms or poor laboratory findings after surgery, CT was performed earlier than POD 5, and patients were discharged earlier than planned based on normal CT findings.

Statistical analysis

The chi-squared or Fisher's exact test was used to compare the variables. Continuous variables were compared using the Student's t-test or Mann–Whitney U-test, as appropriate. Statistical significance was set at $p < 0.05$. All the tests were performed using the IBM SPSS software (version 23.0; IBM Corp., Armonk, NY, USA).

RESULTS

A total of 31 patients underwent isolated left lateral sectionectomy of the liver during the study period. Of these, 22 patients were diagnosed with hepatocellular carcinoma (HCC), three with intrahepatic cholangiocarcinoma, three with liver metastasis, and three with benign liver disease. The patients' mean age was 61.94 years (range, 42–84 years). Patients were

Table 1. The characteristics of patients underwent laparoscopic and open left lateral sectionectomy of the liver

Variable	Total patients (n = 31)
Age (yr)	61.94 ± 10.23
Sex (Male:Female)	22 (71.0) : 9 (29.0)
Comorbidities	22 (71.0)
ASA scores (1–2/3–4)	23 (74.2)/8 (25.8)
Previous operation	6 (19.4)
Diagnosis	
Hepatocellular carcinoma	22 (71.0)
Intrahepatic cholangiocarcinoma	3 (9.7)
Liver metastasis	3 (9.7)
Benign liver disease	3 (9.7)
Operative method	
Laparoscopic surgery	10 (32.3)
Open surgery	21 (67.7)
Prophylactic drain insertion	
Yes	16 (51.6)
No	15 (48.4)

Values are presented as mean ± standard deviation or number (%).
ASA, American Society of Anaesthesiologists.

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predominantly male (71.0%) and the male-to-female ratio was 22 : 9. Twenty-two patients had comorbidities, such as hypertension, diabetes mellitus, cardiovascular disease, and epilepsy (Table 1). Twenty-two patients were found to have a positive serology for hepatitis B or C, and twelve patients had cirrhotic liver which was confirmed by pathological examinations. Six patients (19.4%) had a history of abdominal surgery. Of these, three patients previously underwent laparoscopic low anterior resection, two patients underwent liver segmentectomy, and one patient underwent right posterior sectionectomy. HCC was the most common carcinoma (n = 22, 71.0%). Laparoscopic surgery was performed in 10 patients (32.3%). The patient's preoperative laboratory findings such as total bilirubin, albumin, indocyanine green, and platelet counts showed no significant differences among the groups (Table 2).

There were no differences in various clinicopathological variables between the drainage and non-drainage groups. Although the frequency of comorbidities was higher in the non-drainage group than in the drainage group, the differences were not statistically significant (p = 0.06). There were no differences between the two groups in terms of the operation time, the volume of intraoperative bleeding, and background liver status, which are important factors in determining drain insertion during surgery. The postoperative hospital stay was significantly shorter in the non-drainage group compared to the drainage group (5.87 ± 2.20 days vs. 8.44 ± 2.48 days, p = 0.01; Table 3). No complications, including bile leak, bleeding, and abnormal fluid collection, were observed in either of the groups, and there were no readmissions within 30 days. No morbidity or 90-day mortality occurred.

Table 2. Comparison of the patients' preoperative variables between the drainage and non-drainage groups

Variable	Use of drainage (n = 16)	Non-use of drainage (n = 15)	*p*-value
Age (yr)			0.81
≤ 65	10 (62.5)	10 (66.7)	
> 65	6 (37.5)	5 (33.3)	
Sex			0.61
Male	12 (75.0)	10 (66.7)	
Female	4 (25.0)	5 (33.3)	
Comorbidities			0.06
Yes	9 (56.2)	13 (86.7)	
No	7 (43.8)	2 (13.3)	
Previous operation			0.41
Yes	4 (25.0)	2 (13.3)	
No	12 (75.0)	13 (86.7)	
Operation method			0.16
Laparoscopic surgery	7 (43.8)	3 (20.0)	
Open surgery	9 (56.3)	12 (80.0)	
Underlying cirrhosis			0.89
Yes	6 (37.5)	6 (40.0)	
No	10 (62.5)	9 (60.0)	
ASA status			0.47
1–2	11 (68.8)	12 (80.0)	
3–4	5 (31.3)	3 (20.0)	
Preoperative laboratory findings			
Total bilirubin (mg/dL)	0.52 ± 0.22	0.60 ± 0.32	0.44
Albumin (g/dL)	4.27 ± 0.52	4.30 ± 0.44	0.89
Indocyanine green test (%)	15.4 ± 6.54	15.3 ± 12.7	0.98
Platelet ($10^3/\mu L$)	196 ± 59.7	201 ± 110	0.89

Values are presented as number (%) or mean ± standard deviation.
ASA, American Society of Anaesthesiologists.

DISCUSSION

The left lateral section of the liver occupies a relatively small volume, is clearly separated from the surrounding tissue, and is composed of a simple intrahepatic duct, which makes the surgical approach easy and safe. Consequently, the incidence of postoperative complications is lower than in other liver procedures. A recent study suggested that prophylactic drainage may not be necessary and it is not associated with a higher risk of complications in safely performing hepatic resection [3,8]. Our results were consistent with the findings of this study. Despite this, surgeons habitually use the drain to prevent possible complications such as bile leakage and postoperative bleeding surveillance, and to reduce the need for radiological interventions to prevent complicated fluid collection [6]. However, it is not easy to apply it without each surgeon's experience and belief. This study aimed to determine whether drainage of the operative site can be avoided in future major hepatectomies based on clinical results after left lateral sectionectomy. Although left lateral sectionectomy is relatively safe but is not without complications. In the case of left lateral sectionectomies performed on donors with a normal background liver, the frequency of biliary complications, including bile leak, is reported to be

Table 3. Comparison of the patients' intra- and postoperative variables between the drainage and non-drainage groups

Variable	Use of drainage (n = 16)	Non-use of drainage (n = 15)	*p*-value
Tumor size (cm)	2.71 ± 1.78	4.06 ± 3.68	0.20
Tumor number	1.13 ± 0.62	1.00 ± 0.00	0.44
Operation time (min)	215 ± 56.5	192 ± 55.4	0.44
Estimated blood loss (mL)	391 ± 367	377 ± 472	0.89
Hospital stay (day)	8.44 ± 2.48	5.87 ± 2.20	0.01*
Perioperative blood transfusion (%)	1 (6.3)	1 (6.7)	0.89
Morbidity (%)	0 (0.0)	0 (0.0)	-
90-day mortality (%)	0 (0.0)	0 (0.0)	-

*Statistically significant $p < 0.05$.

1.4% to 4.3% [9-11]. In addition, van der Poel et al. [12] found that the frequency of severe complications (abdominal fluid collection requiring drainage, bleeding requiring reoperation, respiratory insufficiency, and sepsis) was 13%, and the mortality rate within 90 days was 1%. In our study, there were no severe complications. However, abnormal fluid collection can occur despite drain insertion and can be controlled using ultrasonography-guided percutaneous drainage. In left lateral sectionectomy it is relatively easy to perform radiological interventions than in other liver procedures. This study showed that drain placement increased the hospitalization period in patients undergoing left lateral sectionectomy; however, the reason is unclear. In this study, CT was performed on POD 5 and if there were no abnormalities present, the drain was removed, and discharge within 7 days was aimed. This took into account the characteristics of the medical environment, in which many were reluctant to be discharged early. In the non-drainage group, if clinical symptoms worsened after the postoperative period or improvement in blood chemistry was delayed, CT was performed early. In these cases, if there was no abnormal fluid collection, the patient was discharged earlier than planned. There were no cases of early readmission. In this study, if the liver condition was poor, surgery was difficult, or there was significant bleeding, drain insertion was performed. However, our results showed no differences between the two groups.

This study had several limitations. First, the surgeon's subjective judgment was taken into consideration in deciding whether to perform drain insertion during surgery. Second, we conducted a retrospective analysis at a single center. Finally, our sample size was small and the analyses lacked a multivariable model to assess the independent associations between the drainage and non-drainage groups. A consensus on the need, safety, and efficacy of surgical drainage has not been reached because of the lack of large-scale multicenter studies and limited available data; therefore, multicenter studies including surgeons with various experiences are needed to overcome early shortcomings and derive better results. Despite these limitations, it is suggested that drain insertion may not be necessary, depending on the surgeon's preference. Based on our results, routine surgical drainage after elective hepatectomy may not be helpful.

In conclusion, prophylactic drainage insertion is unnecessary in the prevention of abnormal fluid collection after elective left lateral sectionectomy and sectionectomy without surgical drainage is not associated with a longer hospital stay.

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CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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AUTHOR CONTRIBUTIONS

Conceptualization: BGN, HIS. Data curation: All authors. Methodology: BGN, YMP. Visualization: BGN, YMP. Writing - original draft: BGN, HIS. Writing - review & editing: YMP, HIS.

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