

Hemi-hepatectomy in pediatric patients using two-surgeon technique and a liver hanging maneuver

Kyoko Mochizuki, Susumu Eguchi, Ryuichiro Hirose, Taiichiro Kosaka, Mitsuhsa Takatsuki, Takashi Kanematsu

Kyoko Mochizuki, Susumu Eguchi, Ryuichiro Hirose, Taiichiro Kosaka, Mitsuhsa Takatsuki, Takashi Kanematsu, Department of Surgery, Nagasaki University Graduate School of Biomedical Sciences, 1-7-1 Sakamoto, Nagasaki 852-8501, Japan

Author contributions: Mochizuki K, Eguchi S, Hirose R, Kosaka T, Takatsuki M and Kanematsu T performed the research; Mochizuki K and Eguchi S analyzed the data; Mochizuki K and Eguchi S wrote the paper.

Correspondence to: Susumu Eguchi, MD, FACS, FEBS, Department of Surgery, Nagasaki University Graduate School of Biomedical Sciences, 1-7-1 Sakamoto, Nagasaki 852-8501, Japan. sueguchi@nagasaki-u.ac.jp

Telephone: +81-95-8197316 Fax: +81-95-8197319

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Abstract

AIM: To evaluate the efficacy of the two-surgeon technique with the liver hanging maneuver (LHM) for hepatectomies in pediatric patients with hepatoblastoma.

METHODS: Three pediatric patients with hepatoblastoma were enrolled in this study. Two underwent right hemi-hepatectomies and one underwent a left hemi-hepatectomy using the two-surgeon technique by means of saline-linked electric cautery (SLC) and the Cavitron Ultrasonic Surgical Aspirator (CUSA; Valleylab, Boulder, CO) and the LHM.

RESULTS: The mean operative time during the parenchymal transections was 50 min and the mean blood loss was 235 g. There was no bile leakage from the cut surface after surgery. No macroscopic or microscopic-positive margins were observed in the hepatic transections.

CONCLUSION: The two-surgeon technique using SLC and CUSA with the LHM is applicable to even pediatric patients with hepatoblastoma.

INTRODUCTION

The safety and efficacy of saline-linked electric cautery (SLC) in hepatectomies has been described^[1,2]. A two-surgeon technique utilizing SLC and the Cavitron Ultrasonic Surgical Aspirator (CUSA) is used in the hepatic resections performed in our department, especially in living donor liver transplantations (LDLT), to reduce intraoperative hemorrhage and to prevent bile leakage from the cut surface^[3].

The liver hanging maneuver (LHM) was reported to be a safe approach for hepatectomies during parenchymal transections in many investigations including ours^[4].

We herein describe the hepatectomy procedure using this two-surgeon technique with the LHM in pediatric patients with hepatoblastoma.

MATERIALS AND METHODS

From January 2007 to December 2009, 3 hepatectomies for hepatoblastoma were performed in pediatric patients. Two underwent right hemi-hepatectomies, while one underwent a left hemi-hepatectomy.

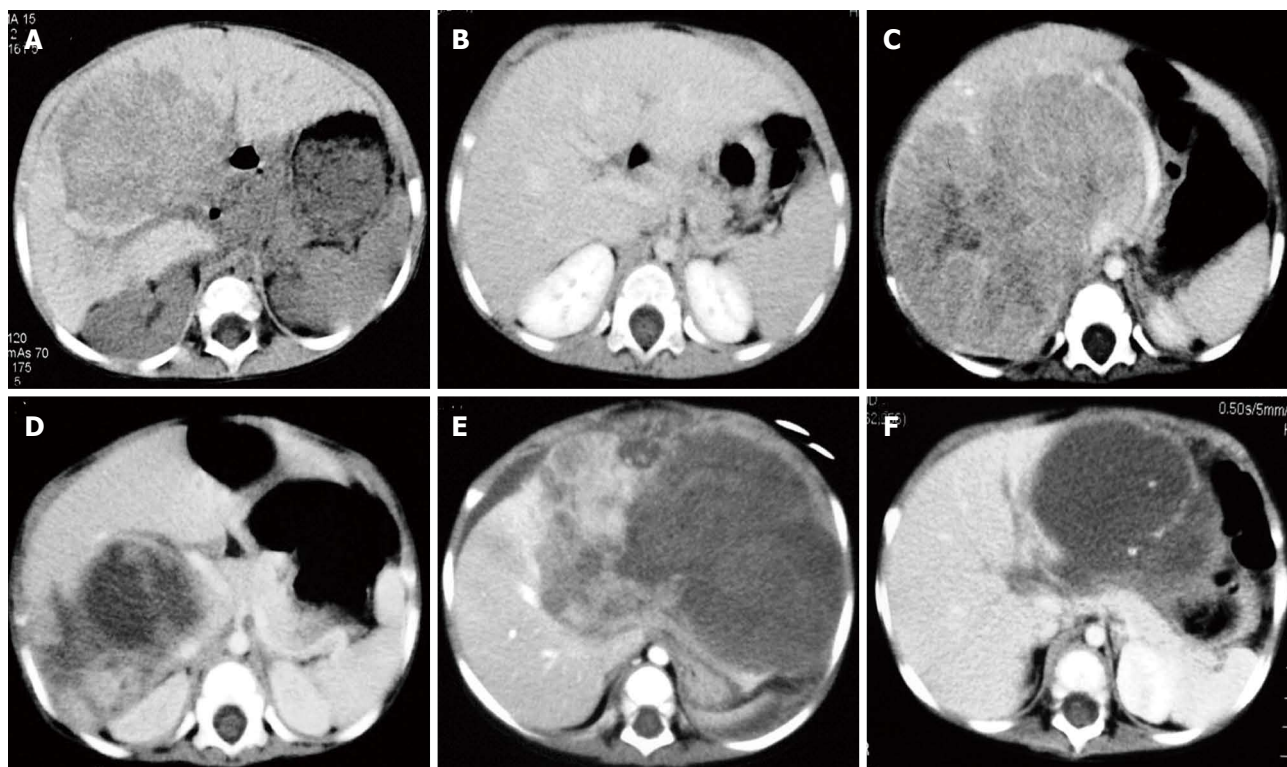


Figure 1 Each tumor location on contrast-enhanced computed tomography. A: Prechemotherapeutic computed tomography (CT) of case 1; B: Preoperative CT of case 1; C: Prechemotherapeutic CT of case 2; D: Preoperative CT of case 2; E: Prechemotherapeutic CT of case 3; F: Preoperative CT of case 3.

Following laparotomy, the upper surface of the liver was exposed up to the anterior surface of the suprahepatic inferior vena cava (IVC). The space between the right and middle hepatic veins was dissected and the tape was pulled upward and to the left to allow the exposure of the anterior surface of the infrahepatic portion of the IVC^[5]. In LHM, the mobilization of liver was not needed in adult patients^[5]. However, for right hemi-hepatectomies, we mobilized the right liver lobe prior to the dissection procedure since blind dissection between the liver and the IVC is challenging with a very narrow space, especially in pediatric cases. For the left hemi-hepatectomies, the middle hepatic vein was carefully encircled. Subsequently, tape was entered between the middle hepatic vein and the left hepatic vein and then placed along Arantius' ligament^[4].

The 3-0 polypropylene stay sutures were placed at the antero-caudal edge of the liver along the plane of intended transection. The chief surgeon dissected the hepatic parenchyma from the patient's right side using the CUSA System, while the assistant surgeon used the SLC device (Dissecting Sealer DS 3.5; TissueLink Medical, Inc, Dover, NH) from the patient's left side. The occlusion of the hepatic arterial and portal inflow was not used in any case. The liver parenchyma was dissected with CUSA, and the intraparenchymal vascular anatomy was defined so that a decision on the hemostatic technique could be made based on the vessel size. The SLC device was used to coagulate and divide the dissected vessels that were 3 mm or smaller in diameter. Vessels larger than 3 mm in diameter were ligated with 3-0 or 4-0 silk ties and were sharply di-

vided. The few larger vessels were ultrasonically dissected and controlled with 4-0 absorbable monofilament transfixing sutures, and were then sharply divided. The traction on the stay sutures was used to separate and to expose the deepening transection plane^[3].

During the parenchymal dissection, the upward traction on the tape (hanging maneuver) allowed the surgeon to follow a direct plane and facilitated the exposure and hemostasis of the deeper parenchymal plane in front of the IVC^[5].

A closed suction drain was inserted at the conclusion of each procedure.

RESULTS

Patient data were shown in Table 1. All patients were 1 year old and male. The mean height was 74 cm, and mean weight was 8.53 kg. Each tumor location was shown in Figure 1.

The results were shown in Table 1. The mean operative time was 292 min (range: 178-368 min). The mean operative time during the parenchymal transections was 50 min (range: 30-84 min). The number of vessel ligations during the parenchymal transections was 23 in the first patient, but only 9 in the 2 subsequent patients. The mean blood loss was 235 g (excluding irrigation saline). In case 2, the blood loss was increased in separation/adhesion between tumor and right adrenal gland. There was no bile leakage from the cut surface after surgery. There were no intraoperative or postoperative complica-

Table 1 Patient data and results

Case	Age (mo)	Gender	Height (cm)	Weight (kg)	Tumor location	Hepatectomy	Operative time (min)	Blood loss (g)	Parenchymal transection		Complication	Outcome	Follow up (mo)
									Operative time (min)	Number of ligation			
1	18	M	75	9.2	Right lobe	Right	368	125	84	23	None	CR	43
2	12	M	70	8.4	Right lobe	Right	178	420	38	9	None	CR	34
3	17	M	77	8	Left lobe	Left	330	160	30	9	None	CR	29

tions and no macroscopic or microscopic-positive margins were seen in any of the patients.

All 3 patients could restart projected postoperative chemotherapy treatments from postoperative day 7, and all had complete remissions and no recurrences during the writing of this manuscript.

DISCUSSION

Reducing blood loss is one of the goals in liver surgery, and several technical inventions have been introduced to achieve it including the Pringle maneuver^[6] and selective vascular occlusion^[7], among other techniques. CUSA has contributed to safe hepatectomies by making it easy to identify the vessels during parenchymal transections^[8]. However, because CUSA has no function in the sealing of tissues, meticulous ligation is required to avoid bleeding or bile leakage from the cut surface of the liver. SLC is another novel device that contributes to the ligation reduction during liver parenchymal transections with its effect on tissue sealing^[1]. To guard against these possible disadvantages, Aloia *et al.*^[2] introduced a two-surgeon technique in hepatectomies for neoplasms in adults with promising results. Palavecino *et al.*^[9] demonstrated the mean intra-operative blood loss was significantly decreased after introduction of the two-surgeon technique compared with other techniques (stapling alone, ultrasonic dissection alone, saline-linked cautery alone, and clamp-crush technique). There were no differences in mean operative time between our data (292 min) and those data reported by Tannuri *et al.*^[10] (290.4 min) using the CUSA or LigaSure electrocautery by the chief surgeon and bipolar electrocautery by the assistant surgeon. There were no differences in mean intraoperative blood loss between our data (235 g) and those reported by Liu *et al.*^[11] (221 cm³) using total hepatic occlusion.

We previously demonstrated that SLC could be safely adapted to living liver donor surgery without injuring either the graft or the remnant liver^[3]. In pediatric patients, SLC is more effective because the vessels are smaller than those in adult patients. On the other hand, the LHM is more difficult because the space between the right and middle hepatic veins is narrower. In our department, a safer and more comfortable technique is performed to encircle the liver using a surgical probe with smaller tape^[4]. In these pediatric patients, the reason why the number of vessel ligations and the operative time in parenchymal transection decreased with the latter two patients without increased blood loss was because we could make progress

developing the technique.

The two-surgeon technique using SLC and CUSA with the LHM is therefore considered to be a feasible and safe surgical modality for hepatectomies in pediatric patients.

COMMENTS

Background

A two-surgeon technique utilizing saline-linked electric cautery (SLC) and the Cavitron Ultrasonic Surgical Aspirator (CUSA), and a liver hanging maneuver (LHM) is reported to be a safe approach for hepatectomies.

Research frontiers

CUSA is an easy way to identify the vessels and SLC contributes to the ligation reduction with its effect on tissue sealing during liver parenchymal transections.

Innovations and breakthroughs

Recent reports have highlighted the safety and efficacy of a two-surgeon technique and a liver hanging maneuver for hepatectomies in adults. This study reports the feasibility and safety of the two-surgeon technique and the LHM for hepatectomies in pediatric patients.

Applications

This study shows that the two-surgeon technique and the LHM could become common therapeutic modalities in the hepatectomies of pediatric patients in the future.

Terminology

The SLC device is used to coagulate and divide the dissected vessels that are 3 mm or smaller in diameter. In the two surgeon technique, the chief surgeon dissects the hepatic parenchyma using the CUSA system, while the assistant surgeon uses the SLC device. In the liver hanging maneuver, the upward traction on the tape allowed the surgeon to follow a direct plane and facilitated the exposure and hemostasis of the deeper parenchymal plane in front of the IVC.

Peer review

The authors described their technique and outcomes of performing hepatectomy using two-surgeon technique and liver hanging maneuver (LHM) in children. Data regarding such technique in children is quite limited in literature.

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