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Which Incision Is Better for Living-Donor Right Hepatectomy? Midline, J-Shaped, or Mercedes

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ABSTRACT

Incision-related morbidity for donors is a major concern in living-donor right hepatectomy (LDRH). Open approaches use midline, J-shaped, and Mercedes incisions for LDRH. We retrospectively studied 95 consecutive donors who underwent LDRH between January 2009 and November 2010. They underwent midline (n = 32), J-shaped (n = 28), or Mercedes (n = 35) incisions. We studied resection times, perioperative bleeding, postoperative hospital stay, and postoperative pain assessed by the visual analog scale (VAS) and by analgesic requirements as well as laboratory data and complications. Postoperative analgesic requirements and postoperative VAS scores were significantly lower in the midline group ($P < .05$) upon univariate but not multivariate analyses. The postoperative complications as well as other parameters were similar between the groups. In conclusion, compared with a J-type shaped or not for Mercedes incision, a donor hepatectomy can be satisfactorily performed via a midline incision by experienced surgeons without increased risk.

LIVING-donor liver transplantation (LDLT) is currently the gold standard to treat end-stage liver disease in countries with cadaveric organ shortages. Despite impressive results, living-donor right hepatectomy (LDRH) is a complicated, technically demanding procedure, creating considerable controversy related to donor safety since the reported morbidity is between 20% and 30%.[1–3] There has been a consistent evolution of the technique, and postoperative care. The dissections of the posterior segments from the neighboring diaphragm, adrenal gland, and inferior vena cava require adequate exposure demanding an incision that provides sufficient exposure. However, without compromising the safety of the operation, there is a need to use a smaller incision to achieve better cosmetic results and reduce analgesic requirements. The most common approaches for LDRH are midline (ML), J-shaped (J), and Mercedes (MR) incisions.[4,5] In this article we have retrospectively compared the operative and postoperative parameters of patients who underwent these three types of incisions.

MATERIAL AND METHOD

Our LDLT program that began in 2004 has a single team to perform all of the operations. From January 2004 to January 2012, we performed 500 liver transplantations, including 328 living-donor operations: 277 right and 51 left lobe procedures.

MR incisions were mainly used at the beginning of the LDRH program. Starting in 2009, we deliberately used ML and J incisions as well. Herein, we have analyzed retrospectively 95 consecutive LDRHs performed between January 2009 and November 2010.

The primary endpoints of our study were resection time, perioperative bleeding, postoperative hospital stay, postoperative liver function tests (aspartate transaminase, alanine transaminase, and total bilirubin) and postoperative complications (ie, bleeding, pleural effusion, biliary leakage, incisional hernia, or wound infection). Secondary endpoints were the visual analog scale (VAS) results and duration of analgesic use with tramadol for pain relief.

Categorical and continuous variables were compared using the chi-square test and one-way analysis of variance, for univariate analysis, respectively. For multivariate evaluation we used a general linear model (GLM) where applicable; $P < .05$ was considered significant.

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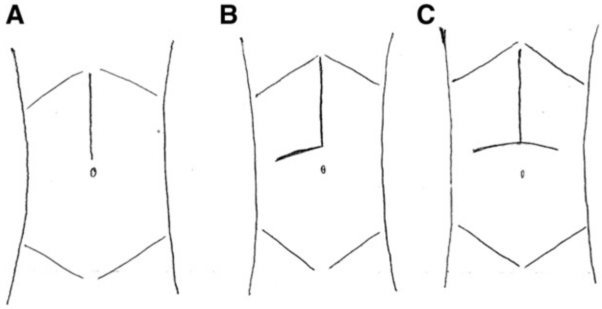

Fig 1. The shape of the incisions midline **(A), (B)** J-shaped, and **(C)** Mercedes.

SURGICAL TECHNIQUE

All liver donors were administered endotracheal anesthesia in the supine position. A jugular venous catheter, a radial artery catheter, a nasogastric tube, and a Foley catheter were inserted before incision for all patients. All of the operations were performed by a single team of surgeons with the same primary/secondary members. Nursing and anesthesiology staff were same for all procedures as well.

The ML incision was performed from the xyphoid process to the umbilicus on the sagittal plane (Fig 1A). The MR incision included a transverse incision with a midline extension incising both rectus abdominis muscles (Fig 1B). The J incision only transected the right rectus abdominis muscle (Fig 1C). After opening the linea alba, we ligated and divided the falciform ligament through the anterior surface of the liver to the suprahepatic vena caval junction. A Thompson retractor was used to retract the abdominal wall for the dissection of the liver from surrounding structures, including the diaphragma, adrenal gland, and inferior vena cava (IVC). The coronary and right triangular ligaments were divided using monopolar cautery. The inferior edge of the right lobe was examined and gently mobilized to prevent a capsular tear due to the peritoneal attachment between the liver and the omentum. The right lobe of the liver was retracted gradually to the left and anteriorly by the first assistant using gauze seeking to expose the posterior surface of the organ. We dissected, ligated, and divided the adhesions and veins between the adrenal gland and liver. The short hepatic veins between the IVC and the liver were dissected, ligated, and divided as the organ was retracted towards the left and anteriorly. Hepatic veins greater than 5 mm in diameter were dissected and preserved. The hepatocaval ligament that was cautiously dissected with a right-angled clamp was ligated with silk sutures and divided from the liver. After the right lobe of the liver was freed from the IVC and the right lobe was mobilized, a right-angled clamp was passed between the right and the middle hepatic veins with great care. A tape was seized with the clamp from the upper edge between right (RHV) and middle hepatic vein to be taken out from the posterior surface for the liver hanging maneuver. In cases of preserved short hepatic veins (larger than 5 mm), the tape was taken beyond them and placed under the caudate lobe in the middle of the IVC. Long gauzes were placed on the posterior portion of the liver and under the right hemidiaphragm to facilitate the exposure of the hepatoduodenal ligament and the anterior surface of the liver.

After a cholecystectomy was performed, the right side of the hepatoduodenal ligament was incised longitudinally, allowing the right hepatic artery to be dissected without damaging other structures within the ligament. After the right portal vein was dissected, the vessels were encircled with a vascular sling. Using a bulldog clamp, we clamped temporarily both the right hepatic artery and the right portal vein to visualize the demarcation between the right and the left lobes. Once designated, the bulldog clamps were released and the hepatic parenchymal transection initiated with The Cavitron Ultrasonic Surgical Aspirator (CUSA, Valleylab, Colorado, United States) and bipolar cautery. Hepatic vascular inflow was not occluded during the dissection and transection phases (Fig 2).

After the transection, an intraoperative cholangiogram was performed to assess variations that were not seen on the preoperative imaging of the bile ducts by magnetic resonance cholangiopancreatography. If there was no anatomical biliary variation on the cholangiogram, the right hepatic bile duct was cut with the stump oversewn using 6-0 monofilament nonabsorbable suture. Then, the distal end of the right hepatic artery was ligated and clipped, and the proximal portion was cut. Consequently, the right portal vein was controlled with a vascular clamp and cut, while the RHV was clamped and cut, completing the transection of the right hepatic lobe. The RHV stump was sutured with 4-0 monofilament, and the right portal vein stump, with 6-0 monofilament suture. After the transection, a drain was placed near the cut surface. The abdominal incisions in all three groups were closed with #1 polydioxanone sutures, and the skin, with 4/0 polyglycolic acid intracutanous sutures.

On the back table, the right lobe liver graft was perfused with Custodiol HTK (Histidine-Tryptophan-ketoglutarate)

Fig 2. Transection of the donor liver through midline incision.

solution (Chemie GmbH, Germany) via the right portal vein at 4°C. The graft was reconstructed with iliac vein grafts (if necessary) at the bench for the recipient operation.

RESULTS

There were 32, 28, and 35 patients in the ML, J, and MR incision groups, respectively. The groups were similar regarding age, sex, and other preoperative parameters (Table 1). All donors recovered uneventfully and returned to their daily lives without comorbidity. None required a blood transfusion during or after LDRH.

Resection time was shorter in the ML group, although the difference did not reach significance. Similarly, perioperative bleeding was less and hospital stay shorter in the ML group without significance. Postoperative liver function test results were similar among the three groups. The three groups did not differ with regard to postoperative complications. Postoperative analgesic requirements and postoperative VAS scores were significantly lower among the ML group (Table 1). According to the Tukey test comparing the incisions versus each other, the VAS score was significantly lower in the ML group (2.63) versus the other incision groups ($P = .002$ compared to the J group [VAS: 3.43]; $P = .0001$ compared to the MR group [VAS: 3.69]). The difference in VAS score among the J and MR groups was not significant. Duration of analgesic use was longest in the J group (5.4 days; $P = .003$ compared with the ML group, and $P = .001$ compared to the MR group). Durations of analgesic use in the ML and MR groups was similar. Using a GLM, the multivariate analysis showed that the type of incision significantly affected VAS (*P:* .0001) and duration of analgesic use (*P:* .009). Duration of analgesic use was a mean of 1.37 days longer in the J group (*P:* .014; 95% confidence interval [CI] 0.28–2.45), and VAS was a mean of 1.1 higher in the MR group (*P:* .0001, 95% CI 0.57–1.61). These wide CIs showed that the differences were not significant.

DISCUSSION

Without LDLT, patients with end-stage liver disease cannot survive in countries with shortages of cadaveric organs. The complicated, technically demanding LDRH has created serious doubts related to donor safety. Trotter et al reported 19 living-donor deaths caused by complications after LDRH.[1] The morbidity has been reported to be between 20% and 30%.[1–3] Although the number of patients awaiting liver transplantation continues to increase according to the

Table 1. Perioperative and Postoperative Variables of the Three Groups

Variables	Upper Midline (n = 32)	J-Shaped (n = 28)	Mercedes (n = 35)	*P* Value
Perioperative				
Male gender (n; %)	24; 75%	15; 53%	24; 69%	NS
Age (y)	33.2 ± 10.4	39.1 ± 11.8	34.4 ± 8.2	NS
Body mass index (kg/m²)	24.3 ± 3.2	26.2 ± 3.8	25.1 ± 3.2	NS
Resection time (min)	58.8 ± 21.1	70.1 ± 28.8	64.4 ± 3.1	NS
Blood loss (mL)	298.4 ± 197.7	401.2 ± 178.2	355.7 ± 208.2	NS
Graft weight (g)	889.9 ± 137.5	901.6 ± 190.2	951.8 ± 123.1	NS
Postoperative				
AST (IU/L)				
POD 1	180.7 ± 96.7	216.1 ± 101.6	205.8 ± 101.9	NS
POD 7	49.4 ± 21.6	50.2 ± 20.6	59.9 ± 38.1	NS
Peak	180.7 ± 97.0	215.8 ± 101.6	207.7 ± 101.1	NS
ALT (IU/L)				
POD 1	217.6 ± 110.9	262.5 ± 149.5	224.1 ± 101.5	NS
POD 7	74.5 ± 54.2	71.1 ± 25.1	81.4 ± 61.6	NS
Peak	220.3 ± 112.5	262.5 ± 149.5	235.2 ± 112.6	NS
Total Bilirubin (mg/dL)				
POD 1	3.0 ± 1.1	3.4 ± 1.7	2.7 ± 1.4	NS
POD 7	1.8 ± 1.8	1.6 ± 1.2	1.9 ± 2.4	NS
Peak	4.1 ± 1.9	4.0 ± 2.1	3.9 ± 2.6	NS
Hospital stay (d)	8.9 ± 2.5	9.8 ± 3.7	10.6 ± 8.8	NS
Duration of analgesic use (d)	3.9 ± 1.4	5.5 ± 2.1	5.7 ± 2.2	<.05
Complications				
Bleeding (n; %)	0	1	0	NS
Pleural effusion (n; %)	1	1	1	NS
Biliary leakage (n; %)	1	1	1	NS
Incisional hernia (n; %)	1	0	0	NS
Wound infection (n; %)	3	2	3	NS
Visual analog scale (n; %)	2.7 ± 0.9	3.3 ± 1.2	3.4 ± 1.2	<.05

Continuous variables are represented as mean ± standard deviation, whereas categorical variables are represented as percentage.
Abbreviations: AST, aspartate aminotransferase; POD, postoperative day; ALT, alanine aminotransferase; NS, nonsignificant.

United Network for Organ Sharing data, there is no treatment method other than LDLT. This creates a dilemma considering donor safety and morbidity. Without compromising donor safety it was possible to perform a LDRH through a smaller incision with better cosmetic results and lower analgesic requirements.

The most common approaches for LDRH are ML, J, and MR incisions.[4,5] Usually, the incision type used depends on the surgeon's choice and experience. The distance between the xyphoid and umbilicus and the patients' body mass index (BMI) are the most important factors for the surgeon's selection. Dissection of the posterior segments of the liver from neighboring structures, especially in patients with a high BMI and a short height, is difficult due to the proclivity to liver injury. J and MR incisions have been frequently used for adequate exposure of the liver from neighboring structures despite their longer healing periods and poorer cosmetic outcomes.[6] In contrast, the ML incision has been reported to provide faster healing and a better cosmetic outcome as it is limited to the sagittal plane.[6] It is also possible to perform the dissection of the posterior segments of the liver through an ML without serious morbidity.[4]

To gain full access to the posterior segments of the liver and dissect the short hepatic veins, conventional J and MR incisions have been used for decades. The division of the abdominal muscles, leading to poorly aesthetic scar formation (especially for young donors), wound complications, and prolonged hospital stays have forced surgeons to develop less invasive incisions for this type of procedure without jeopardizing the safety and the optimal exposure. Kim et al[4] reported the use of an ML incision to result in a shorter operative duration, and analgesic use as well as less wound pain.

The ML incision resulted in lower VAS scores compared with the MR or J incisions in our study. Duration of analgesic use was similar for the ML and MR incision groups, but highest among subjects with J incisions albeit that the reasons were not clear. Nevertheless, patients with ML incisions needed less analgesia compared with the other two types of incisions, albeit not significantly.

We concluded that the ML incision could be safely used for LDRH without compromising the safety and efficacy of the procedure, it also securing to lessen the pain and lower the analgesic requirements.

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