



# Laparoscopy-Assisted Spleen-Preserving Distal Pancreatectomy for Living-Donor Pancreas Transplantation

S. Date<sup>a</sup>, H. Noguchi<sup>a</sup>, K. Kaku<sup>a</sup>, K. Kurihara<sup>a</sup>, Y. Miyasaka<sup>a</sup>, Y. Okabe<sup>a,\*</sup>, U. Nakamura<sup>b</sup>, T. Ohtsuka<sup>a</sup>, and M. Nakamura<sup>a</sup>

<sup>a</sup>Department of Surgery and Oncology, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan; and <sup>b</sup>Department of Medicine and Clinical Science, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan

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## ABSTRACT

**Background.** Living pancreas transplantation plays an important role in the treatment of patients with severe type 1 diabetes. However, pancreatectomy is very invasive for the donor, and less-invasive surgical procedures are needed. Although some reports have described hand-assisted laparoscopic surgery for distal pancreatectomy in living-donor operations, less-invasive laparoscopy-assisted (LA) procedures are expected to increase the donor pool. We herein report the outcomes of four cases of LA spleen-preserving distal pancreatectomy (Warshaw technique [WT]) in living pancreas donors.

**Patients and Methods.** Four living pancreas donors underwent LA-WT at our institution from September 2010 to January 2013. All donors fulfilled the donor criteria established by the Japan Society for Pancreas and Islet Transplantation.

**Results.** The median donor age was 54 years. Two donors underwent left nephrectomy in addition to LA-WT for simultaneous pancreas–kidney transplantation. The median donor operation time for pancreatectomy was 340.5 minutes. The median pancreas warm ischemic time was 3 minutes. The median donor blood loss was 246 g. All recipients immediately achieved insulin independence. One donor required reoperation because of obstructive ileus resulting from a port-site hernia. Another donor developed a pancreatic fistula (International Study Group of Pancreatic Fistula grade B), which was controlled with conservative management. After a maximum follow-up of 73 months, no clinically relevant adverse events had occurred. These results were comparable with those of previous studies concerning living-donor pancreas transplantation.

**Conclusion.** The LA-WT is a safe and acceptable operation for living-donor pancreas transplantation.

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**S**INCE the first pancreas transplantation was performed at the University of Minnesota by Kelly et al [1], many centers have performed this operation and outcomes have improved as a result of better surgical techniques and advanced immunosuppressants. Pancreas transplantation has become the most successful treatment for patients with type 1 diabetes. Living-donor pancreas transplantation (LDPT) was first reported in 1979 at the University of Minnesota [2,3]. LDPT decreases the morbidity and mortality of patients on the waiting list who have potential living donors. The procedure has several advantages over deceased-donor pancreas transplantation, including better

HLA matching, shorter ischemic and waiting times, less need for immunosuppression, availability of more intensive desensitization, and lower risk of infection [4]. In 1999, in an attempt to decrease the morbidity associated with open distal pancreatectomy (DP), Gruessner et al [5] performed the first laparoscopic donor DP. Donor outcomes were

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\*Address correspondence to Yasuhiro Okabe, Department of Surgery and Oncology, Graduate School of Medical Sciences, Kyushu University, 3-1-1 Maidashi, Fukuoka 812-8582, Japan. E-mail: [y-okabe@surg1.med.kyushu-u.ac.jp](mailto:y-okabe@surg1.med.kyushu-u.ac.jp)

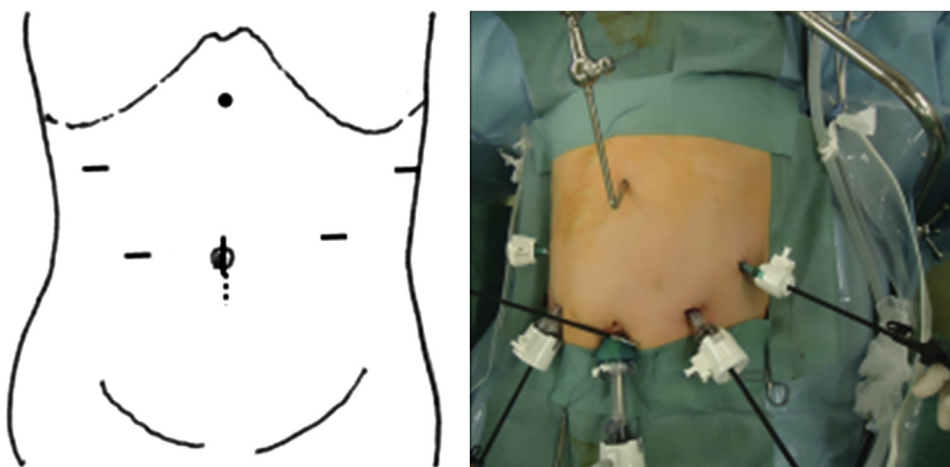


Fig 1. Trocar placement for LA-WT.

considered acceptable when stringent donor criteria concerning endocrine function were used. Less-invasive laparoscopic procedures are expected to increase the donor pool. Several reports have described laparoscopic donor pancreatectomy since the introduction of the technique. However, these reports have described hand-assisted laparoscopic (HALS) DP with or without splenectomy [6–8]; complete laparoscopic donor pancreatectomy has not been reported. Moreover, spleen-preserving DP has been proposed to reduce the risk of postsplenectomy infection and late hematologic disorders and malignancy [9–12]. In this study we reviewed the outcomes of laparoscopy-assisted (LA) spleen-preserving DP (Warshaw technique [WT]) for living donors at our institution.

## PATIENTS AND METHODS

The records of four living pancreas donors who underwent LA-WT at Kyushu University Hospital from September 2010 to January 2013 were retrospectively reviewed regarding donor characteristics and clinical outcomes. All donors fulfilled the following donor criteria established by the Japan Society for Pancreas and Islet Transplantation [13]: (1) age  $\leq 65$  years (desirable); (2) no family history of hereditary diabetes within two degrees of relationship except for the recipient; and (3) normal endocrine function. Normal endocrine function was defined as the following: normal pattern on the 75-g oral glucose tolerance test, with all plasma glucose levels  $< 180$  mg/dL; insulinogenic index  $\geq 0.4$ ; homeostasis model assessment beta cell function  $\geq 40\%$ ; normal (desirable) intravenous glucose tolerance test; HbA1c  $< 5.5\%$ ; homeostasis model assessment ratio  $< 2.5$ ; negative for anti-GDA, IA-2, and insulin antibodies; and body mass index  $< 25$  kg/m<sup>2</sup>.

### Operative Procedure

After induction of general anesthesia, the donor was placed in open leg position. In the simultaneous pancreas–kidney transplantation (SPK) cases, the donor operation was initiated with left nephrectomy followed by LA-WT. After nephrectomy, we changed the patient's position from lateral decubitus to supine. A 12-mm laparoscopic trocar was inserted into the abdominal cavity through a midline umbilical

incision. Next, 5-mm trocars were inserted at the subcostal region bilaterally, and 12-mm trocars were inserted at the level of the umbilical incision bilaterally (Fig 1). A Nathanson liver retractor (Yufu Itonaga Co., Tokyo, Japan) was also inserted through an epigastric incision to retract the lateral segment of the liver and the stomach. The operator stood on the right side of the donor. The greater omentum was divided toward the spleen while preserving the left gastroepiploic vessels and short gastric vessels. The upper border of the distal pancreas was mobilized to explore the splenic artery and common hepatic artery, and then these two arteries were encircled (Fig 2A). The superior mesenteric vein (SMV) was explored at the inferior part of the neck of the pancreas and then tunneling was performed along the SMV to the portal vein (Fig 2B). Taping of the pancreas parenchyma was subsequently performed. Branches of the splenic artery and vein were divided at the hilum. Next, the distal pancreas was completely mobilized from the retroperitoneum (Fig 2C), and the pancreas was divided at the level of the estimated division line (usually at the left border of the SMV) using a linear stapler (ECHELON 60-mm green cartridge; Ethicon Endo-Surgery, Inc. Cincinnati, OH, USA) with the peri-firing compression method, as previously reported [14] (Fig 2D). To shorten the warm ischemic time (WIT) of the graft, further procedures were performed via small laparotomy. The umbilical incision was extended to 6 cm. After intravenous injection of heparin (2000 U/body), the splenic artery was divided with an Endo TA 30 stapler (COVIDIEN) and then the splenic vein was divided with a linear stapler (Endo-GIA white cartridge; COVIDIEN). Finally, the surgeon gently extracted the graft by hand. A drain was placed in the pancreatic bed close to the pancreatic stump.

## RESULTS

The median donor age was 54 years (range, 27–69 years) and the median body mass index was 23.1 kg/m<sup>2</sup> (range, 18.5–24.9 kg/m<sup>2</sup>). The donors were close family members of the recipients (one mother, one father, one brother, and one sister). Two donors underwent SPK; the other two underwent pancreatectomy alone. The median total donor operation time was 432 minutes (range, 348–490 minutes); median total blood loss was 271 g (range, 70–610 g). Median operation time for nephrectomy was 340.5 minutes (range, 307–391 minutes) and blood loss was 246 g (range, 70–510 g).

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