

Selected Paper II

II-1

Standardization of Modified Right Lobe Grafts to Minimize Vascular Outflow Complications for Adult Living Donor Liver Transplantation

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Research Purpose: Numerous innovative surgical techniques have been presented to improve the outcomes of adult living donor liver transplantation (ALDLT), but vascular outflow complications occurred in not negligible proportions of patients and often led to serious graft dysfunction.

Materials and Methods: After encountering various anatomical variations of the donor livers through our experience of 2300 ALDLTs, we propose a model of standardized modified right lobe (RL) graft which can be universally applicable and may guarantee nearly the same outcomes regardless of experience.

Results: The key point is to make hemodynamics-based and regeneration-compliant hepatic outflow reconstruction, which consists of caudal-side deep incision and patch plasty of the graft right hepatic vein (RHV) to remove the acute angle between the RHV and inferior vena cava, uniform-shaped graft interposition to the middle hepatic vein (MHV) using large-sized allograft vessels or artificial grafts, and optional quilt venoplasty for multiple short hepatic veins. To evaluate whether this model can minimize the risk of hepatic outflow obstruction, a prospective case-controlled study was performed. Consecutive 225 ALDLTs using conventional modified RL grafts were used for control, in which any available homologous or autologous vessels were used and 3-month RHV and MHV stenosis requiring stent insertion occurred in 4% and 10%, respectively. In the study group of 167 cases during 7 months in 2010, they reduced to 1.2% (2

cases) and 6.6% (11 cases), respectively. When no sizable allograft was available, a ringed-Goretex graft of 10-12 mm in diameter combined with small human vessel patches was used. This Goretex-composite graft required unique time consuming back table work for MHV standardization, but recipient vascular reconstruction became reciprocally easier and faster due to no need for customized design. Three-month MHV stenosis occurred in 7.9% with sizable human vessels and 5.7% in Goretex-composite graft, showing the importance of large vessel size and availability rather than thrombogenic nature. Actuarial 3-month patient survival rate was 96.7%.

Conclusions: Standardization of modified RL graft as a universal graft model seems to be more effective and feasible than conventional RL graft often requiring case-by-case modification for tailored design.

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Development of a User-Centered Virtual Liver Surgery System: Work in Progress

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Research Purpose: The present study is to develop a specialized virtual surgery system called Dr. Liver which has clinical applicability and effectiveness to support liver surgery.

Materials and Methods: The major functions of Dr. Liver include (1) extraction of the liver, vessels, and tumors from abdominal CT images, (2) estimation of the standard liver volume of a patient, (3) volume of the extracted liver, vessels, and tumors, (4) segmentation of the liver based on the portal vein structure, and (5) support of surgery planning. A novel semi-automatic liver extraction algorithm was developed and implemented to Dr. Liver for time efficiency and accuracy of extraction. Dr. Liver was evaluated using MDCT data of three patients and compared to the OsriX system in terms of time and accuracy.

Results: Dr. Liver was found significantly better than the OsriX system by showing the average (SD) time of liver extraction=4.4 (0.6) min and the average difference between the volume of a manually extracted