Deceased-Donor Liver Transplantation: 10 Years' Experience at Chang Gung Memorial Hospital-Kaohsiung Medical Center

Chee-Chien Yong, MD; Yaw-Sen Chen, MD; Shih-Hor Wang, MD; Chih-Che Lin, MD; Po-Ping Liu[1], MD; Yeuh-Wei Liu, MD; Chin-Hsiang Yang, MD; Kuo-Chen Hung, MD; Yuan-Cheng Chiang[2], MD; Tsan-Shiun Lin[2], MD; Yu-Fan Cheng[3], MD; Tung-Liang Huang[3], MD; Bruno Jawan[4], MD; Hock-Liew Eng[5], MD; Chao-Long Chen, MD; Chih-Chi Wang, MD

Background: The purpose of this study was to summarize the outcomes we achieved using deceased-donor liver transplantation (DDLT) in the past 10 years at Chang Gung Memorial Hospital-Kaohsiung Medical Center (CGMH-KMC).

Methods: Between March 1993 and March 2003, 53 DDLTs were performed at CGMH-KMC. Patients were divided into 2 stages: stage 1 (n = 22) from March 1993 to February 1998, and stage 2 (n = 31) from March 1998 to March 2003. Indications for transplantation, patient demographics, surgical procedures, and long-term outcomes were reviewed.

Results: Indications for transplantation were biliary atresia (16), post-hepatitis B/C viral cirrhosis with or without hepatocellular carcinoma (21), Wilson's disease (8), primary biliary cirrhosis (3), and miscellaneous (5). Two retransplants were carried out for secondary biliary cirrhosis using primary live-donor liver transplantation (LDLT). Ten patients received grafts from 6 split-liver transplantations. Over-all Kaplan-Meier 1-, 3-, and 5-year survival rates were 88.46%, 83.86%, and 79.87%, respectively. A significant improvement in patient survival was observed in stage 2. The Kaplan-Meier 1- and 5-year patient survival rates in stage 2 were 96.67% and 92.95%, respectively. Fifteen patients developed vascular complications. Nine patients died in this series for an overall mortality rate of 17%.

Conclusions: Deceased-donor liver transplantation is well established as the treatment of choice for acute and chronic liver failure in Taiwan. Satisfactory outcomes have been attained in those transplanted to date.

(Chang Gung Med J 2005;28:133-41)

Key words: deceased-donor liver transplantation, orthotopic liver transplantation.

Orthotopic liver transplantation (OLT) is a well-accepted therapeutic option for patients with end-stage liver disease. Survival rates after OLT have significantly improved due to refinement in surgical techniques, excellent anesthetic management, aggressive nursing care, and prompt detection and

From the Liver Transplant Program; [1]Department of Trauma Surgery; [2]Department of Plastic and Reconstructive Surgery; [3]Department of Radiology; [4]Department of Anesthesiology; [5]Department of Pathology, Chang Gung Memorial Hospital, Kaohsiung.
Received: Mar. 16, 2004; Accepted: Dec. 31, 2004
Address for reprints: Dr. Chih-Chi Wang, Department of Liver Transplant Program, Chang Gung Memorial Hospital. No. 123, Dabi Rd., Niausung, Shiang, Kaohsiung, Taiwan 833, R.O.C. Tel: 886-7-7317123 ext. 8000; Fax: 886-7-7324855; E-mail: ufe14996@ms26.hitnet.net

treatment of complications. A clinical program of liver transplantation was begun in Taiwan in 1984 after a period of animal experimentation. The first deceased-donor liver transplant was performed by Chen et al.[1,2] at Chang Gung Memorial Hospital (CGMH) on March 22, 1984. According to the Taiwan Organ Registry and Sharing Center, there have been 7 to 31 (mean, 18) deceased-donor liver transplant (DDLT) operations performed annually at 10 medical centers in the past 10 years in this country.

Chen initiated a new liver transplant program (LTP) at CGMH, Kaohsiung Medical Center (KMC) in 1993. On May 21, 1997, Chen and associates performed the first split-liver transplantation in Asia.[3] This innovative technique provides a potential increase in donors and sources of organs for pediatric patients. The objective of this study was to review the outcomes after DDLT at CGMH-KMC. Table 1 gives the annual statistics for liver transplants at CGMH-KMC.

METHODS

From March 1993 and March 2003, 53 patients received a DDLT at CGMH-KMC, Taiwan. All recipients were regularly followed-up through our outpatient department for at least 1 year (until March 2004). A retrospective review of all of their medical records was performed. Patients were divided into 2 stages: stage 1 (n = 22), from March 1993 to February 1998, represents the early stage of our program, and stage 2 (n = 31), from March 1998 to March 2003, represents the mature stage of our program. All recipients who received an OLT had clinical symptoms of end-stage liver disease: jaundice, coagulopathy, ascites, variceal bleeding, hepatic encephalopathy, repeated cholangitis, or failure to thrive. These candidates received preoperative evaluation from the LTP team, including a hepatologist, surgeon, pediatrician, anesthesiologist, social worker, and psychiatrist through weekly conferences. Patients with hepatitis B viral-related liver diseases received hepatitis B immunoglobulin and lamivudine prophylaxis after the OLT. Patients with hepatocellular carcinoma were within Milan[4] or UCSF[5] criteria for liver transplantation for hepatocellular carcinoma.

Table 1. Annual Statistics According to the Type of Graft for the Liver Transplantation Program at CGMH-KMC

Year	DDLT			LDLT		Total per year
	Full size	Reduced	Split	Left lobe	Right lobe	
1993	4	1	0	0	0	5
1994	3	0	0	1	0	4
1995	2	2	0	3	0	7
1996	2	0	0	7	0	9
1997	4	1	2	3	0	10
1998	3	0	0	8	0	11
1999	4	0	2	10	1	17
2000	5	0	2	16	8	31
2001	0	1	4	21	14	40
2002	9	0	0	16	19	44
2003	11	0	0	17	18	46
Total/Kind	47	5	10	102	60	224
Grand total		62		162		224

Abbreviations: DDLT: deceased-donor liver transplantation; LDLT: live-donor liver transplantation.

Surgical Technique. The donor operation followed the standard procedure described. Liver homografts were procured using an in situ perfusion technique and were preserved in cold Belzer's University of Wisconsin solution.[6] Five grafts were split via an ex vivo procedure, while 1 graft was split by an in situ procedure.

The diseased livers were removed by resecting the inferior vena cava (IVC) in the first 6 deceased-donor liver transplantations. The recipient surgery was performed without use of a veno-venous (V-V) bypass. There were 3 types of hepatic outflow (HO) reconstruction. Group 1 (n = 6) patients underwent a standard operation in which the IVC was removed and replaced with a grafted vena caval segment. In group 2 (n = 14), patients underwent either an end-to-side anastomosis of the graft hepatic vein (HV), IVC to the recipient HV, IVC with reduced-sized venoplasty, or a split transplantation with the IVC cross-clamped. In group 3 (n = 33), patients underwent piggyback with a side-to-side cavo-caval anastomosis with the IVC partially cross-clamped. The common trunk of the middle and left hepatic veins was closed with a 4-0 Prolene suture. A 5-cm longitudinal incision was made more to the right on the anterior wall of the IVC. The anastomosis was carried via an intraluminal eversion suture technique using 4-0 (in adult cases) or 5-0 (in pediatric cases) polydioxanone (PDS) sutures with growth factor in the whole graft. Our policy is to use the piggyback

with a side-to-side cavo-caval anastomosis for full-size and right-split grafts.

Portal anastomosis was accomplished in an end-to-end fashion with a growth factor of 15 mm in all patients except 4 recipients with an extensive thrombosis in the native portal vein. In those cases, the donor portal vein was anastomosed end-to-side to the superior mesenteric vein using an interposed iliac vein graft. The IVC was opened followed by portal reperfusion. Fifty-one patients received an end-to-end hepatic artery anastomosis under microsurgery. Two patients received an aorto-aortic anastomosis for hepatic artery reconstruction. Biliary reconstruction was performed via (1) a duct-to-duct anastomosis in an end-to-end fashion, with or without an external cholecystostomy, (2) hepatodocho-jejunostomy, or (3) a roux-en-Y hepaticojejunostomy without stent placement.

An intraoperative Doppler ultrasound (US) examination[7,8] was performed to document vascular flow patterns and velocities. After wound closure, a final check using Doppler US was made before transferring the patient to the intensive care unit. Doppler US graft surveillance was performed daily for 1 week and twice weekly thereafter until the patient was discharged from the hospital or as frequently as dictated by significant findings.

Immunosuppression (IM) Protocol. Before February 2001, cyclosporine (CyA), steroids, and azathioprine were used as the principal immunosuppressive formula. After February 2001, CyA-based IM was used for pediatric patients and tacrolimus (FK506)-based IM was used for adult patients. The target trough level for tacrolimus was set to between 5 and 10 ng/ml during the first month and then subsequently reduced on follow-up visits. Azathioprine was discontinued 3 months after transplantation. Acute cellular rejection (ACR) suspected through clinical and biochemical data was confirmed by liver biopsies before starting anti-rejection treatment.

Statistical Analysis. Records were analyzed based on patient demographics, indications for transplantation, intraoperative parameters, primary or retransplantation, and graft type. Categorical data were analyzed using the Chi-squared test. Continuous data were described as the mean (± SD) and analyzed using Student's t-test. Survival rates were described using the Kaplan-Meier method and analyzed by the Log rank test. A p value of < 0.05 was considered statistically significant.

RESULTS

In total, 53 DDLTs were performed. There were 34 male and 19 female recipients. The mean age for both genders was 28.0 ± 19.2 (range, 1~67) years. The mean body weight for both genders was 57 (range, 6.8~88) kg. Indications for liver transplantation were biliary atresia (n = 16), hepatitis B/C viral-related cirrhosis with or without hepatocellular carcinoma (n = 21), Wilson's disease (n = 8), primary biliary cirrhosis (n = 3), Budd-Chiari syndrome (n = 2), neonatal hepatitis (n = 1), autoimmune cirrhosis (n = 1), and hemangioendothelioma (n = 1). Two retransplants were carried out for secondary biliary cirrhosis after primary LDLT. The indications for primary LDLT were hepatitis B viral-related liver cirrhosis and biliary atresia, respectively.

The most-common indications for transplantation were hepatitis B viral-related liver diseases (n = 16) in adults and biliary atresia (n = 16) in children (Table 2). Thirty-eight recipients received whole grafts, 5 patients received reduced-sized, and 10 patients received split-liver grafts (Table 3). Six whole livers were split, and 10 split grafts were transplanted at our institute while 2 right grafts were transported and shared with other medical centers.[9]

Intraoperative data are summarized in Table 4. There were significantly more young patients in stage 1 than in stage 2 (21.5 ± 17.3 vs. 32.7 ± 19.4 years, p = 0.035). The mean operative times were

Table 2. Indications for Liver Transplantation

Indication	Stage 1	Stage 2	Total
Biliary atresia	10	6*	16*
Wilson's disease	5	3	8
Hepatitis B / (HCC)	1	15* (3)	16* (3)
Hepatitis C / (HCC)	3 (1)	2	5 (1)
Primary biliary cirrhosis	1	2	3
Budd-Chiari syndrome	1	1	2
Neonatal hepatitis	0	1	1
Autoimmune cirrhosis	1	0	1
Hemangioendothelioma	0	1	1
Retransplantation	0	(2*)	(2*)
Total	22	31	53

Abbreviation: HCC: hepatocellular carcinoma.
*One case of biliary atresia and 1 case of hepatitis B were retransplantations.

Table 3. Graft Types of Deceased-Donor Liver Transplantations

Type of graft	Stage 1 (n=22)	Stage 2 (n=31)	Total (n=53)
Whole graft	16	22	38
Reduced-size graft	4	1	5
Split graft	2	8	10

Table 4. Operative Parameters of Recipients

Parameter	Stage 1 (n=22)	Stage 2 (n=31)	Total (n=53)	*p*
Age (year)	21.5 ± 17.3	32.7 ± 19.4	28.0 ± 19.2	0.035*
Gender (F/M)	9/13	10/21	19/34	0.518†
Operative time (min)	995 ± 274	716 ± 165	829 ± 254	0.001*
Cold ischemic time (min)	577 ± 180	465 ± 140	510 ± 166	0.016*
Warm ischemic time (min)	58 ± 12	54 ± 28	56 ± 23	0.501*
Blood loss (ml)	2510 ± 2742	2830 ± 7456	2701 ± 5928	0.851*

Abbreviations: M: male; F: female.

* Statistically significant at $p < 0.05$ by Student's *t*-test.

† Statistically significant at $p < 0.05$ by Chi-squared test.

longer in stage 1 than in stage 2 (995 ± 274 vs. 716 ± 165 min, $p = 0.001$). This difference may be attributed to the learning curve attained during the mature stage of the program and to 4 additional surgeons with liver transplant training who participated in stage 2.

Mean cold ischemic times were longer in stage 1 than in stage 2 (577 ± 180 vs. 465 ± 140 min, $p = 0.016$). There were no significant differences with regard to gender, warm ischemic time, and blood loss in the 2 stages.

Six patients underwent IVC resections with an end-to-end anastomosis in stage 1; 14 patients (8 patients in stage 1 and 6 patients in stage 2) received an end-to-side hepatic vein or vena cava to a recipient hepatic venoplasty (for recipients receiving reduced-sized and split grafts); and 33 patients (8 patients in stage 1 and 25 patients in stage 2) received piggyback with a side-to-side cavo-caval anastomosis. Hepatic outflow (HO) obstruction developed in 7 (13%) of 53 patients. Four acute HO obstructions, which were detected during the operation, received whole deceased-donor grafts. All late HO obstructions were reduced-size or split grafts. Three patients developed a hepatic arterial thrombosis detected at the time of the operation. A redo of the arterial anastomosis salvaged those grafts. There was no graft or patient loss due to hepatic arterial complications. One patient received a repeat portal vein (PV) anastomosis for a redundant PV during the initial transplant operation. Two patients developed PV thrombosis on postoperative days 1 and 6, respectively. Grafts and patients were salvaged by a thrombectomy and Broviac catheter insertion into the inferior mesenteric vein for continuous heparin infusion. Four patients with an extensive native PV thrombosis received jump grafts. One pediatric patient received a deceased-donor reduced-size OLT for secondary biliary cirrhosis 6 years after the primary living-donor transplantation. She developed a PV thrombosis and received another LDLT. Unfortunately, she died from graft failure 3 days after the third retransplant.

Seventeen patients underwent biliary reconstruction with a duct-to-jejunum anastomosis. Thirty-five patients underwent duct-to-duct biliary reconstruction. One pediatric patient died of reperfusion injury before biliary reconstruction at the time of surgery. Twenty-eight patients received an external cholecystostomy. A cholecystectomy was performed in 21 patients. Three patients received T-tube insertion via the common bile duct for biliary drainage. A summary of bile duct reconstructions is shown in Table 5.

Allograft rejections are summarized in Table 6. In total, 21 biopsy-proven acute cellular rejections (ACRs) in 16 (30% of 53) patients were documented. Eleven episodes in 8 (50% of 16) patient were mild ACRs, while 8 episodes in 6 (37.5% of 16)

Table 5. Types of Biliary Reconstruction

Procedure	Stage 1	Stage 2	Total
Duct-to-duct	13	22	35
Duct-to-jejunum	8	9	17
Cholecystotomy	12	16	28
Cholecystectomy	6	15	21
T-tube from CBD	3	0	3

One patient died of reperfusion injury before biliary reconstruction.

Table 6. Histologically Proven Rejections

Type of rejection	Stage 1 (n = 22) Episode(s)/ Patient(s)	Stage 2 (n = 31) Episode(s)/ Patient(s)	Total Episode(s)/ Patient(s)
Mild	4/3	7/5	11/8
Moderate	2/2	6/4	8/6
Severe	2/2	0	2/2
Chronic	0	0	0
	8/7 (32%)	13/9 (29%)	21/16 (30%)

patients were moderate ACRs. Severe ACR was documented in 2 patients (12.5%). No patient developed steroid-resistant or chronic rejection episodes.

Four patients underwent a re-laparotomy for postoperative bleeding. One patient developed bowel perforation and died of multi-organ system failure due to sepsis 56 days after the transplant. Two patients developed biliary complications requiring surgical correction. In those 2 patients, the first patient developed choledochostomy stenosis resulting in repeated cholangitis and underwent a choledochoplasty, while the second patient developed common bile duct stones which required a choledocholithotomy.

The mean follow-up period was 109 ± 7.0 (range, 12~132) months. The Kaplan-Meier 1-, 3-, and 5-year patient survival rates in this series were 88.46%, 83.86%, and 79.87%, respectively. The Kaplan-Meier 1-, 3-, and 5-year graft survival rates in this series were 86.79%, 82.28% and 78.36%, respectively. The Kaplan-Meier 1- and 5-year combined patient and graft survival rates were 77.27% and 68.18% in stage 1 and 96.67% and 92.95% in stage 2 (p = 0.041 by the Log rank test). There was statistically significant improvement in patient survival rates between stage 1 and stage 2. Nine of 53 patients died for an overall mortality rate of 17%. The causes of mortality at various time intervals from the transplants are shown in Table 7. Seventy percent of deaths occurred within the first 6 months.

DISCUSSION

Liver transplantation is an accepted option for patients with end-stage liver disease. OLT survival rates have significantly improved over the past few decades. This improvement is attributed to judicious preoperative evaluation, excellent anesthetic management, refined surgical techniques, aggressive nursing care, and prompt detection and treatment of complications. Survival rates in our series are comparable with other international data. According to a UNOS report, 1- and 5-year survival rates after liver transplantation were 87% and 74%, respectively.[13] Our series presents 1- year and 5- year patient survival rates of 88.46% and 79.87%, respectively. Most of the mortalities after OLT occur during the first year, particularly within the first 3 months.[14,15] The cause of mortality is mainly due to vascular complications, primary graft dysfunction, and infection. During the same period of time, 150 live-donor liver transplantations (LDLTs) were performed at CGMH-KMC, and the 1- and 5- year survival rates were 97.9% and 96.0%, respectively.

A donor shortage limits liver transplantation in Taiwan. This is mainly due to traditional Chinese cultural influence and Buddhist practices “of burying the dead physically intact”. Recently, enhanced public awareness of the importance of organ transplantation has caused an increase in organ donations. However, even though there is much enthusiasm for donating organs, the number of deceased donors still fails to meet the demands of organ transplantation.

Improvements in surgical techniques have made it possible for a single organ to be shared by 2 recipients. Split-liver transplantation (SLT) is now recognized as a practical and meaningful procedure to decrease waiting times among pediatric patients in North America.[15] At CGMH-KMC, we have performed 10 SLTs (4 right and 6 left grafts) from 6 donors since 1997. The first experience with slit-liver transplantation in Asia took place in May 1997 at CGMH-KMC. The graft came from a 22-year-old, 68-kg, male donor who died from a penetrating head injury. In situ splitting was initially planned, but due to donor hemodynamic instability, this plan was aborted. The entire liver was harvested in a rapid-sequence method followed by ex vivo hepatic bipartition; the right graft was transplanted into a 15-year-old girl with Wilson’s disease, and the left graft was given to a 2-year, 11-month-old boy with biliary atresia. The girl receiving the right graft is currently alive with normal graft function. The boy developed

Table 7. Causes of Death and Survival Times of 9 Recipients

No.	Disease	Cause of mortality	Survival time
15	Autoimmune disease	AMI	8 days
16	BA	PTLD	4 years, 1 month
23	BA	Bowel perforation	56 days
24	BA	PTLD	5 months, 2 days
36	HCV/HCC	Lung malignancy	2 years, 2 months
41	BA	Hypoxemia	2 months
43	BA	Reperfusion injury	0 days
71	Hemangioendothelioma	Duodenal bleeding	103 days
118	BA	Sepsis	1 year, 5 months

Abbreviations: BA: biliary atresia; PTLD: post-transplant lymphoproliferative disorder; AMI: acute myocardial infarction.

refractory hypoxemia and died of respiratory failure 2 months post-transplantation. In other cases, a right graft was sent to Hong Kong[9] and another right graft was sent to National Taiwan University Hospital in Taipei. Three recipients each receiving a left graft died. Causes of death were due to massive duodenal bleeding, refractory hypoxemia, and sepsis.[11] There seems to be no difference in the incidences of complications with regard to the type of graft which is used (Table 3). However, the number is too small to draw significant statistical conclusions. Current practice has focused efforts on augmenting the deceased donor pool with liver grafts suitable for splitting.

Liver transplantation began with transplants being used for non-malignant end-stage liver diseases such as biliary atresia and Wilson's disease. During stage 2, more patients with hepatitis-related liver diseases with or without hepatocellular carcinoma were offered transplantations. It follows that the recipient ages in stage 1 were younger than those in stage 2.

Development of hepatitis B viral (HBV) graft infection is related to a recipient's pre-transplantation status of infection with HBV. The greatest recurrence is seen among patients positive for HBV-DNA at the time of transplantation.[17] Lamivudine and hepatitis B immunoglobulin (HBIG) are used to treat patients with HBV-related diseases. Our policy is to give lamivudine to patients with HBV-related disease to decrease the viral load while awaiting a transplant and to give both lamivudine and HBIG to those patients following the transplant.[18]

The occurrence of de novo HBV infection among patients having undergone a transplant using anti-HBc(+) donors has been established. Some transplant centers exclude anti-HBc(+) donors from their pool or limit their use to selected recipients.[18] In Taiwan, 15%~20% of the general population is HBsAg(+), and approximately 80% of adults are anti-HBc(+).[19] Therefore, use of anti-HBc(+) donors cannot be avoided. Our protocol is to give non-HBV-related recipients active pre-transplant immunization and to combine it with lamivudine postoperatively if they receive a graft from an anti-HBc(+) donor. Lamivudine has been widely used to prevent de novo hepatitis B infection.[17]

Vessel thrombosis, particularly hepatic artery thrombosis, is a serious complication resulting in graft failure and possibly retransplantation. Meticulous attention to the surgical technique must be practiced to avoid this serious morbidity. In our center, several strategies are used to maintain vascular patency. Hepatic arterial reconstruction is performed under microsurgery. Intraoperative Doppler ultrasound is routinely performed to check the vascular flow patterns and velocities. We perform liver transplantation without a veno-venous bypass during the hepatectomy. HO reconstruction is the key to a successful liver transplantation. HO obstruction uniformly causes graft failure and patient death. In subclinical HO obstruction, relatively decreased outflow tract problems might not cause alterations in liver graft function.

Hepatic outflow reconstruction evolved from removal of the retrohepatic vena cava as part of the recipient hepatectomy as a piggyback modification as described by Tzakis et al.[21] The piggyback procedure is extensively used in pediatric recipients with a reduced-size or split-liver graft. HO reconstruction includes an end-to-side or side-to-side cavo-caval anastomosis in whole grafts, and hepatic vein or donor IVC to the recipient HV or IVC venoplasty in reduced-sized or split-liver transplantation with cross-clamping of the IVC.

Four patients developed HO obstruction during the operation in our early experience with the piggyback procedure. Two patients required additional vascular anastomoses. Two patients received tissue expanders to reposition the malposed graft and keep the HO patent. Three patients developed HO obstruction from postoperative day 5 to postoperative week 5. All three cases used reduced-size or SLT left grafts. One patient died of bowel perforation after a re-laparotomy to correct an HO obstruction. One patient died of massive duodenal bleeding 1 month after the OLT. One patient died of sepsis of unknown origin. The overall incidence of HO obstruction was 13.2% in our series. This is higher than those of other reports.[22,23] Complications were markedly reduced after adoption of a large side-to-side cavo-caval anastomosis. Graft malpositioning due to a graft size mismatch may also contribute to OH obstruction.[24] Our protocol uses the piggyback procedure with a side-to-side cavo-caval anastomosis for whole-graft transplantations.

Native PV thrombosis is an obstacle in liver transplantation.[25] With greater experience, we have extended the indications for transplantation in

patients with native PV thrombosis by using a jump graft from the deceased donor. In our series, 4 patients with extensive PV thromboses received a jump graft from the same donor for use in the PV anastomosis. All except 1 patient had favorable results. In that patient with a postoperative PV thrombosis, salvage surgery was successful 6 days after transplantation. This is an encouraging observation among patients with a native PV thrombosis. This condition was formerly regarded as a contraindication for transplantation. In recent years, however, we have offered transplants to patients with extensive native PV thromboses.

A hepatic artery (HA) thrombosis is another serious complication which can result in early graft failure and patient mortality. The incidence of HA thrombosis has been reported to be 5%~12%.[26,27] In our series, no HA thrombosis occurred. Two key factors contributed to this result: (1) the HA anastomosis was performed using microsurgery, and (2) intraoperative and postoperative Doppler ultrasound was used. Our experience points to the use of Doppler ultrasound as the imaging method of choice for the early detection of vascular complications.

Patient survival rates in large liver transplant series report 1- and 5-year survival rates of 79% and 67%.[28,29] In our series, overall 1-, 3-, and 5-year patient survival rates were 88.46%, 83.86%, and 79.87%, respectively. Among our patients, the 1-, 3-, and 5-year graft survival rates were 86.79%, 82.28%, and 78.36%, respectively.

There was significant improvement in the survival rate of patients in stage 2 owing to better surgical techniques and perioperative management. The 1- and 5-year survival rates in stage 2 (after 1998) were 96.67% and 92.95%, respectively. The Pittsburgh group reported 1- and 5-year survival rates of only 86% and 72%. Thus, our OLT series provides excellent results when compared with other similar series.

Aside from immunosuppression protocols and leading indications of transplantation, there were no statistical differences in graft survival rates and rejection rates between the 2 stages.

Orthotopic liver transplantation is well accepted as a therapeutic option for patients with end-stage liver disease. Success with this type of transplant depends on a cognizant and competent multidisciplinary team, refined surgical techniques, excellent anesthetic management, aggressive nursing care, and prompt detection and treatment of complications.

REFERENCES

1. Chen CL, Wang KL, Hui YL, Shieh WB. Liver transplantation in Taiwan: the Chang Gung experience. Cancer Chemother Pharmacol 1992;31:S162-5.
2. Chen CL, Wang KL, Lee MC, Chuang JH, Jan YY, Lin JN, Chen MF, Chang CH, Lin DY, Liaw YF, Au C, Chu NS, Lee TY, Wong KM, Hui YL, Tan PPC. Liver transplantation for Wilson's disease-report of the first successful liver transplant in Taiwan. Jpn J Transplant 1987;22:178-84.
3. Chen CL, Liu PP, Chen YS, Wang CC, Chiang YC, Goto S, Cheng YF, Huang TL, Eng HL, Cheung HK, Jawan B. Initiation of split-liver in Taiwan. Transplantation Proc 1998;30:324-9.
4. Mazzaferro V, Regalia E, Doci R, Andreola S, Pulvirenti A, Bozzetti F, Montalto F, Ammatuna M, Morabito A, Gennari L. Liver transplantation for the treatment of small hepatocellular carcinomas in patients with cirrhosis. N Engl J Med 1996;334:693-9.
5. Francis Y. Yao, Linda Ferrell, Nathan M. Bass, Jessica J. Watson, Peter Bacchetti, Alan Venook, Nancy L. Ascher, and John P. Roberts. Liver transplantation for hepatocellular Carcinoma: Expansion of the tumor size limits does not adversely impact survival. Hepatology 2001;33:1394-403.
6. Belzer F, Southard J. Principles of solid organ preservation by cold storage. Transplantation 1988;45:673-6.
7. Someda H, Moriyasu F, Fujimoto M, Hamato N, Nabeshima M, Nishikawa K, Okuma M, Tanaka K, Ozawa K. Vascular complications in living related liver transplantation detected with intraoperative and postoperative Doppler US. Journal of Hepatology 1995;22:623-32.
8. Bolondi L, Gaiani S, Barbara L. Accuracy and reproducibility of portal flow measurement by Doppler US. Journal of Hepatology 1991;13:269-73.
9. de Villa VH, Chen CL, Chen YS, Wang CC, Wang SH, Chiang YC, Cheng YF, Jawan B, Cheung HK, Fan ST, Lo CM. International sharing of split liver grafts in Asia: initial experience. Clin Transplantation 2000;14:355-9.
10. de Villa VH, Chen CL, Chen YS, Wang CC, Tan KC, Suh KS, Lee SG, Tanaka K, Fan ST. Split liver transplantation in Asia. Transplantation Proc 2001;33:1502-3.
11. Chen CL, de villa VH. Split Liver Transplantation. Asian J Surg 2002;25:285-9.
12. de Villa VH, Chen CL, Chen YS, Wang CC, Tan KC, Suh KS, Lee SG, Tanaka K, Fan ST. Split Liver Transplantation in Asia. Transplant Proc. 2001;33:1502-3.
13. Smith CM, Beasley GG, Cheng Y, Ormond DB, Spain PG. Annual report of the U.S. organ procurement and transplantation network. 2000 OPTN/SR AR 1990-1999;191-237.
14. Shaw BW, Wood RP, Stratta RJ, Pillen TJ, Langnas AN.

Stratifying the causes of death in liver transplant recipients: an approach to improving survival. Arch Surg 1989;124:895-900.
15. Mora NP, Klintmalm GB, Solomon H, Goldstein RM, Gonwa TA, Husberg BS. Survival after liver transplantation in 300 consecutive patients: the influence of age, clinical status, and pretransplant disease. Transplant Proc 1992;24:156-7.
16. Busuttil RW, Goss JA. Split liver transplantation. Ann Surg 1999;229:313-21.
17. Samuel D, Muller R, Alexander G, Fassati L, Ducot B, Benhamou JP, Bismuth H. Liver transplantation in European patients with the hepatitis B surface antigen. N Engl J Med, 1993;329:1842-7.
18. Chen YS, Wang CC, de Villa VH, Wang SH, Cheng YF, Huang TL, Jawan B, Chiu KW, Chen CL. Prevention of de novo hepatitis B virus infection in living donor liver transplantation using hepatitis B core antibody positive donors. Clin Transplant 2002;16:405-9.
19. Dodson SF, Bonham CA, Geller DA, Cacciarelli TV, Rakela J, Fung JJ. Prevention of de novo hepatitis B infection in recipients of hepatic allografts from anti-HBc positive donors. Transplantation 1999;68:1058-61.
20. Sung JL. Hepatitis B virus infection and its sequelae in Taiwan. Gastroenterol Jpn 1984;19:363-6.
21. Tzakis A, Todo S, Starzl TE. Orthotopic Liver Transplantation with Preservation of the Inferior Vena Cava. Ann. Surg. 1989;210:649-52.
22. Busuttil RW, Shaked A, Millis JM, Jurim O, Colquhoun SD, Shackleton CR, Nuesse BJ, Csete M, Goldstein LI, McDiarmid SV. One thousand liver transplants: the lessons learned. Ann Surg 1994;219:490.
23. Emond JC, Herffron TG, Whitington PF, Broelsch CE. Reconstruction of the hepatic vein in reduced size hepatic transplantation. Surg. Gynecol. Obstet., 1993;176:11-7.
24. Inomata Y, Tanaka K, Egawa H, Uemoto S, Kiuchi T, Satomura K, Uyama S, Okajima H. Application of a tissue expander for stabilizing graft position in living-related liver transplantation. Clin Transplantation 1997;11:56-9.
25. Yerdel MA, Gunson B, Mirza D, Karayalcin K, Olliff S, Buckels J, Mayer D, McMaster P, Pirenne J. Portal vein thrombosis in adults undergoing liver transplantation. 2000;69:1873-81.
26. Lerut J, Tzakis AG, Bron K, Gordon RD, Iwatsuki S, Esquivel CO, Makowka L, Todo S, Starzl TE. Complications of venous reconstruction in human orthotopic liver transplantation. Ann Surg 1987; 205:404-14.
27. Tan KC, Yandza T, de-Hemptinne-B, Clapuyt P, Claus D, Otte JB. Hepatic artery thrombosis in pediatric liver transplantation. J Pedi Surg 1988;23:927-30.
28. Busuttil RW, Colonna JO, Hiatt JR, Brems JJ, el Khoury G, Goldstein LI, Quinones-Baldrich WJ, Abdul-Rasool IH, Ramming KP. The first 100 liver transplants at UCLA. Ann Surg 1987;206:387-402.
29. Jain A, Reyes J, Kashyap R, Dodson FS, Demetris AJ, Ruppert K, Abu-Elmagd K, Marsh W, Madariaga J, Mazariegos G, Geller D, Bonham CA, Gayowski T, Cacciarelli T, Fontes P, Starzl TE, Fung JJ. Long-term survival after liver transplantation in 4,000 consecutive patients at a single center. Ann Surg 2000;232:490-500.

屍肝移植在高雄長庚醫院的十年經驗之回顧

楊志權 陳耀森 王世和 林志哲 劉柏屏[1] 劉約維 楊景翔 洪國禎 江原正[2]
林燦勳[2] 鄭汝汾[3] 黃棟樑[3] 姚文聲[4] 邢福柳[5] 陳肇隆 王植熙

背 景： 本文概述過去十年屍肝移植在高雄長庚醫院的經驗。

方 法： 自1993年3月至2003年3月共10年，高雄長庚醫院一共完成53例屍肝移植。共分爲兩個時期，第一期 (n=22) 自1993年3月至1998年2月。第二期(n=31)自1998年3月至2003年3月。本文回顧肝臟移植的適應症，手術步驟及長期追蹤病人的結果。

結 果： 移植的適應症，包括膽道閉鎖(16)、B或C型肝炎合併有無肝癌(23)，威爾森氏症候(8)，原發性膽道肝硬化(3)及兩例活體肝臟移植後，次發性膽道肝硬化接受再次的肝移植(2)和其他(5)。53例病人存活率，在1年、3年及5年各爲88.46%、83.86%及79.87%。第二期病人存活率有顯著的進步，在1年及5年各爲96.67%及92.95%。共有15名發生血管併發症，到目前有9名病患死亡。

結 論： 肝臟移植在台灣已經成爲一種成熟的技術，來治療急性和慢性肝衰竭的病人，並獲至良好的成果。

(長庚醫誌 2005;28:133-41)

關鍵字： 屍肝移植，同位肝臟移植。

長庚紀念醫院　高雄院區　肝臟移植團隊，[1]外傷科，[2]整形外科，[3]放射診斷科，[4]麻醉科，[5]病理科
受文日期：民國93年3月16日；接受刊載：民國93年12月31日。
索取抽印 本處：王植熙醫師，長庚紀念醫院　肝臟移植團隊。高雄縣833鳥松鄉大埤路123號。Tel: (07) 7317123轉8000; Fax: (07)7324855; E-mail: ufe14996@ms26.hitnet.net