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Minimally Invasive Video-Assisted Kidney Transplantation (MIVAKT)

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Background. **Minimally invasive surgery has been applied to nearly all fields of surgery due to its advantages such as reduced morbidity, a better cosmetic outcome, and early recovery. The recent advances in its technique have allowed us to use modified minimally invasive surgery technique in the field of kidney transplantation.**

Materials and methods. **From January 2004 to March 2006, minimally invasive video-assisted kidney transplantation was carried out in 20 patients. Many clinical variables were compared with the conventional method. The operative procedure began with a 7 to 8 cm skin incision. A laparoscopic balloon dissector was used to create the retroperitoneal space for the placement of the grafted kidney. Vascular anastomosis and ureteroneocystostomy were performed under direct vision and with video-assisted TV monitoring.**

Results. **The average length of the wound was 7.8 cm and it was placed below the belt line. The average operating time was 186 min. Less analgesic was given compared with conventional methods. There was one postoperative complication, a mild lymphocele. All patients showed normalized serum creatinine levels within 4 d. All grafted kidneys showed normal findings on the postoperative ultrasound and renal scans.**

Conclusions. **Minimally invasive video-assisted kidney transplantation is technically feasible and may offer benefits in terms of better cosmetic outcomes, less pain, and quicker recuperation than conventional kidney transplantation.**

Key Words: **minimally invasive surgery; kidney transplantation.**

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INTRODUCTION

Minimally invasive surgery (MIS) has become the preferred choice for the management of surgery on any part of the body because of recent rapid advancement and innovation in surgery techniques. It is now commonly used not only for benign diseases but also for malignant diseases as well. However, there are still some limitations to use this technique for transplantation of abdominal organs. Although laparoscopic nephrectomy for kidney donation has been tried in many centers, there has been no report on the use of minimally invasive technique in kidney transplantation (KT), and one of the reasons for this is that very delicate surgical procedures is thought to be impossible. Most surgeons use a 20 ~ 25 cm curvilinear incision in KT for the purpose of performing delicate vascular anastomosis. However, we successfully carried out 20 cases of KT using only a 7 ~ 8 cm incision with the help of a laparoscopic instrument and videoscope. The purpose of this study is to introduce this new surgical technique and to validate its feasibility and efficacy.

PATIENTS AND METHODS

From January 2003 to Mar 2006, minimally invasive video-assisted kidney transplantations (MIVAKT) were performed in 20 patients (Table 1). Another 20 patients receiving conventional kidney transplantation (CKT) from a living donor in the same period were randomly selected. The inclusion criteria of MIVAKT include non-obese patients (BMI < 35 kg/m^2), no atherosclerotic change of the external iliac vessels where the vascular anastomosis is to be performed, age <50 y old. The exclusion criteria include history of lower abdominal surgery, deeply situated external iliac vessels (more than 5 cm from the skin surface). All patients received the kidney of a living donor. Except for the operative techniques, the preoperative evaluation and postoperative care were the same as the CKT. A special device for pain control (1702KP 2 day Infusor; Baxter International Inc., Chicago, IL) was used in all patients postoperatively.

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TABLE 1

Characteristics of the 20 Patients of MIVAKT

Clinical characteristics	Mean (range)
Age (y)	36.8 (18–45)
Gender (male/female)	5/6
Body mass index (kg/m2)	29.7 (25.6–34.1)
Cause of ESRD (number)	
Glomerulonephritis	14
Diabetic nephropathy	5
Others	1
Preoperative BUN (mg/dL)	67.1 (44.4–103.4)
Preoperative Cr (mg/dL)	9.6 (6.8–12.4)
Method of dialysis (numbers)	
Peritoneal	6
Hemodynamic	14
Duration of dialysis (y)	6.8 (3.6–10.1)

MIVAKT = minimally invasive video-assisted kidney transplantation; ESRD = end stage renal disease; BUN = blood urea nitrogen; Cr = creatinine.

When the patients requested more analgesics, pethidine hydrochloride was injected intramuscularly and we checked the total dosage of pethidine that was used during the first postoperative day. The degree of pain was calculated by visual analog scale at 8 h, 16 h, 24 h, and 48 h postoperatively. The patient's restricted diet was resumed on the first postoperative day unless there was some problem preventing food intake. Immunosuppression was achieved by using triple agents: cyclosporine or tacrolimus, mycophenolate mofetil, and steroids. The time of administration and dosage were the same as the immunosuppression regimen that was previously used for CKT. For the evaluation of the grafted kidney, ultrasound examinations were performed on day 5 postoperatively. A renal scan was also done on the day 7 postoperatively. The duration between the operation and the independent normal physical activity was recorded. Physical activity refers to the activity needed for the patient's usual daily life (Table 2). The time until the return to work was also checked. Total hospital cost was calculated at the time of discharge. Clinical data of MIVAKT were compared with that of CKT performed in the same period. Data were analyzed using a $\chi 2$ analysis, and P values < 0.05 were considered significant.

Operative Technique

The location and course of the external iliac vessels, the contour of the urinary bladder, and lateral margin of the rectus muscle were marked preoperatively with an ultrasound. A 7 to 8 cm linear incision was made from the imaginary line of the external iliac vessels to that of the urinary bladder. The length of the incision was the same as the diameter of the grafted kidney (Fig. 1). After the aponeurotic confluence of the three abdominal muscles, between the rectus muscle and three abdominal muscle, was opened about 2 cm, a laparoscopic balloon dissector was inserted into the retroperitoneal space and 250 ~ 300 mL of room air was insufflated to make a retroperitoneal space for the placement of the grafted kidney (Fig. 2). The telescope was inserted through the trocar of the balloon dissector and we investigated whether the space was large enough or if any complications such as bleeding or the perforation of peritoneum existed. After the retroperitoneal space was created, the incision was extended vertically along the aponeurotic confluence of the three abdominal muscles, and the rectus muscle was partially cut at the lowermost part of the skin incision. The peritoneum was retracted toward the medial side and a retractor with specially designed blades was positioned for securing the operative field as much as possible

TABLE 2

Results of MIVAKT

Characteristic of the patients	Mean value (range)		
	MIVAKT (n = 20)	CKT (n = 20)	P
Age (y)	36.8 (18 ~ 45)	40.1 (32 ~ 52)	0.60
Body mass index (kg/m2)	29.7 (25.6 ~ 34.1)	35.5 (26.9 ~ 38.2)	<0.001
Incision length (cm)	7.8 (7 ~ 8)	21.2 (16 ~ 23)	<0.001
Distance between belt line and most upper point of incision (cm)*	−0.2 (−0.6 ~ 0.3)	5.2 (4.2 ~ 5.8)	<0.001
Operative time (min)	178 (156 ~ 210)	159 (129 ~ 205)	0.78
Narcotic use (mg)†	45 (25 ~ 150)	85 (25 ~ 200)	0.04
Visual analogue scale‡			
8 h postoperatively	8.5 (8 ~ 10)	9.2 (8 ~ 10)	0.04
16 h postoperatively	8.3 (7 ~ 9)	8.9 (8 ~ 10)	0.03
24 h postoperatively	6.9 (4 ~ 8)	8.1 (7 ~ 9)	0.02
48 h postoperatively	5.3 (3 ~ 7)	7.3 (5 ~ 8)	0.02
The length of hospital stay (d)	21.4 (18 ~ 24)	23.6 (19 ~ 37)	0.08
Complications	1 lymphocele	1 infection 2 lymphocele	
Creatinine at 4th operative days	1.1 (1.0 ~ 1.2)	1.0 (1.0 ~ 1.1)	0.97
Resuming the normal activity (d)§	2.2 (2 ~ 5)	5.7 (4 ~ 13)	<0.001
Duration of returning to work (d)	41.2 (32 ~ 49)	59.6 (38 ~ 65)	<0.001
Total hospital cost (× 1000 $)	17.4 (14.2 ~ 19.8)	18.1 (14.1 ~ 20.3)	0.95

MIVKT = minimal invasive video-assisted kidney transplantation; CKT = conventional kidney transplantation.

* A minus means that the most upper point of the incision is located below the belt line and a positive means it is located above the belt line.

† Pethidine hydrochloride was used for analgesic.

‡ 0: no pain, 10: maximal pain.

§ Normal activity includes washing, dressing, brushing of the teeth, making up, using the bathroom, eating, etc.