Use of ETS-FLEX Endoscopic Linear Vascular Cutter in Donor Nephrectomy and Transplantation Surgery: A Single Institution's Experience

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Objectives: **We describe our experience with the use of ETS-FLEX endoscopic linear vascular cutter from January 2000 to October 2004 in live-donor nephrectomy and pancreatic bench work.**

Materials and Methods: **In live-donor nephrectomy, ETS-FLEX endoscopic linear vascular cutter (ELVC) is used for the stapling and division of renal vessels and ureter. When positioned on a vessel, the vascular cutter applies 3 staple lines proximally and 3 distally, and the vessel in between them is divided. In pancreatic graft bench work, ELVC is applied in 3 steps: the splenectomy, ligation of the mesenteric root, and the ligation of any peripancreatic lymphatic tissue or small vessels.**

Results: **From October 2000 to October 2004, we performed 80 living-donor nephrectomies in 56 men and 24 women (mean age, 39 years; range, 24-63 years). Thirty-one grafts were with multiple vessels. Mean warm ischemia time was 60 ± 5 seconds. Mean operative time was 60 ± 10 minutes. In all cases, there was no need for further hemostasis after removal of the kidney. There were no operative complications. All grafts were successfully revascularized with 100% graft survival (range of follow-up, 1-48 months). Patients' length of stay in hospital was 3 ± 1 days.**

We have used the ETS-FLEX ELVC in 30 pancreatic graft preparations since January 2000. Mean time taken for the bench work preparation including Y-graft anastomosis was 45 ± 10 minutes. Following revascularization, there was excellent perfusion with minimal and easily controllable bleeding that did not require blood transfusion.

Conclusions: **We believe that our use of the laparoscopic instrument, ETS-FLEX ELVC, with a mini-incision technique in live-donor nephrectomy and pancreatic graft preparation makes these complex and time-consuming procedures simple and fast, minimizing the chances of postoperative complications and resulting in excellent patient and graft survival.**

Key words: *Donor nephrectomy, Pancreatic bench work, ETS-FLEX endoscopic linear vascular cutter*

Kidney transplantation represents the treatment of choice for patients suffering from end-stage renal disease. Recently, transplantation results have dramatically improved owing to new immunosuppressive strategies, better preservation conditions, and refinements in surgical techniques, opening the way to successful transplantation of organs and leading more patients to seek transplantation as a cure for disease. It has been said that, "Kidney transplantation has become victim of its own success" [1]. Owing to increasing disparities between the number of donors and potential recipients—for example, in the United Kingdom, during 2002, 1778 renal grafts were implanted (1399 from cadaveric and 379 from living donors) while 5020 patients remained on waiting lists [2]—transplant centers have extended the boundaries of organ donation by using extended donor criteria: older and non–heart-beating donors, transplantation between unrelated individuals (spouses, partners, etc) [3], and transplantation of organs with anatomic anomalies [4].

In the case of patients with end-stage renal disease, a living donor may offer a shorter waiting time along with other advantages over cadaveric donors including immediate function, shortened length of stay, improved graft survival, and superior organ quality [5,6]. Unfortunately, although the intent to donate may exist, there are many disadvantages to living donation including surgical pain, cosmesis, potential death, and loss of income, all of

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which may be difficult to overcome for all but the most zealous of donors [7].

Pancreas transplantation has been regarded as the most effective way to achieve a euglycemic, insulin-independent state in patients with type 1 diabetes mellitus [8]. The role of pancreas transplantation for the treatment of diabetes mellitus has expanded dramatically. It has been established as a safe and successful procedure with good patient and graft survival and beneficial effects on recipient glucose metabolism and the course of diabetic complications [9]. This is due to refinements in organ retrieval and preservation technology, improvements in transplantation techniques, and advances in immunosuppression and posttransplantation management.

In this paper, we describe the use of the ETS-FLEX (articulating) endoscopic linear vascular cutter (ELVC) (Ethicon Endo-Surgery, Inc, Cincinnati, Ohio, USA) (Figure 1) at St Mary's Hospital, United Kingdom, in living-donor nephrectomy, and for preparation of the pancreatic graft during the bench work, which increases safety and simplifies these complex procedures.

Materials and Methods

We have been using the ETS-FLEX ELVC since October 2000 for living-donor nephrectomy. Every donor nephrectomy patient undergoes magnetic resonance angiography. Selection of the side of the donated organ depends on the imaging findings. The left kidney is selected when the donor has bilateral single vessel or bilateral multiple vessels. The operation is performed under general anesthesia. A Foley catheter is inserted, and prophylactic antibiotics are given. The patient is positioned on the right or left lateral position on the operating table.

Figure 1. ETS-FLEX ELVC

The kidney rest is elevated and the table flexed to maximize exposure to the flank. The kidney is approached through a mini-anterolateral flank incision (7 ± 2 cm), located at the last intercostal space, without resection of the rib. Using an OMNI-TRACT retractor (OMNI-TRACT SURGICAL, St. Paul, Minn, USA), an adequate operative field is created within the retroperitoneal space, which allows for sufficient handling of the kidney. For the stapling and division of the vessels and the ureter, the ETS-FLEX EVLC is used. When positioned on a vessel, the ELVC applies 3 staple lines proximally and 3 distally, and the vessel in between them is divided (Figure 2). The distal end of the ELVC that has the staples can be rotated in a way that allows it to fit perfectly on a vessel regardless of the angle. Before or after dissecting the vessels, the ureter is stapled and divided. The ELVC is then applied initially to the main renal artery and subsequently to smaller arteries if present and then to the main renal vein followed by smaller renal veins if present. The kidney is then flushed after removal of staple lines.

Preparation of the pancreatic graft during bench work consist of splenectomy, duodenal staple lines overrun with suture lines, peripancreatic lymphatic tissue and smaller vessel identification, and ligation

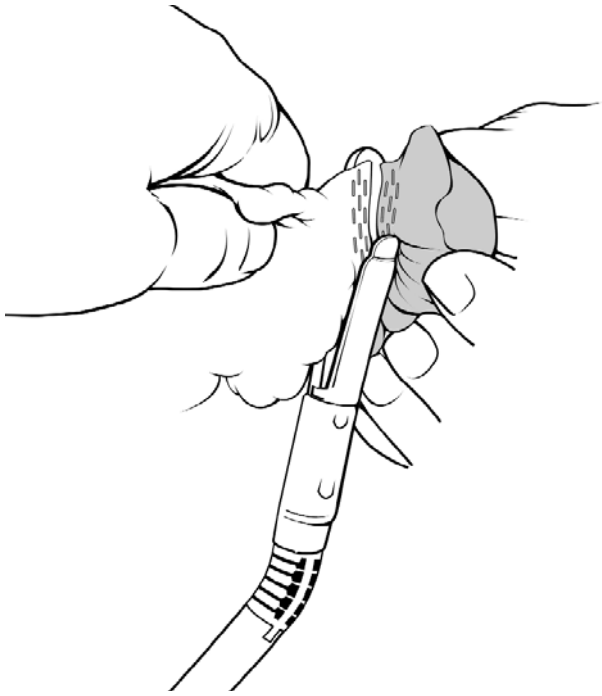

Figure 2. This figure graphically shows that when positioned on a struture, the ELVC applies 3 staple lines proximally and 3 distally and the structure in between them is divided. The distal end of the ELVC that has the staples can be rotated in a way that allows it to fit perfectly on a vessel regardless of the angle.

and vascular reconstruction using an extension iliac Y graft from the donor.

Since January 2000, we have used the ETS-FLEX ELVC for pancreatic graft bench work. The ELVC is applied in 3 steps: the splenic hilar vessels are stapled and divided, thereby performing a splenectomy; the mesenteric root, which already has been divided with a TA90 stapler during procurement, is restapled proximally; and any peripancreatic lymphatic tissue or small vessels that have not been ligated during procurement are controlled with the same stapler.

Results

From October 2000 to October 2004, we performed 80 living-donor nephrectomies in 56 men and 24 women (mean age, 39 years; range, 24-63 years). Thirty-one grafts were with multiple vessels. Mean warm ischemia time was 60 ± 5 seconds. Mean operative time was 60 ± 10 minutes. In all cases, there was no need for further hemostasis after removal of the kidney. There were no operative complications. All grafts were successfully revascularized with 100% graft survival (range of follow-up, 1-48 months). Patients' length of stay in hospital was 3 ± 1 days.

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Discussion

Laparoscopic donor nephrectomy addresses many donor disadvantages including pain, convalescence, and cosmesis. Many studies have demonstrated that laparoscopic donor nephrectomy is associated with decreased analgesic needs, improved cosmesis, shortened length of stay, and decreased time out of work [10,11]. However, the incidence of ureteral complications is significantly increased. Furthermore, it is well known from studies in animal models that creation of a pneumoperitoneum to 15 mm Hg is associated with an immediate 50% decrease in renal cortical blood flow and decreased urine output [12,13]. It is also notable that warm ischemia time during laparoscopic donor nephrectomy usually exceeds 4 minutes [14,15]. Our technique combines the use of laparoscopic instruments (ie, ETS- FLEX articulating ELVC) with a fast mini-open surgical incision technique. An endoscopic linear cutter is used in surgical procedures to provide hemostatic integrity while severing/separating anatomic structures (eg, appendix, bowel). More than 50 miniature stainless steel staples are formed, proceeded by a lacerating knife. This unique device features an innovative articulation mechanism for manipulation of the distal end.

Recent trends at our center using the ETS-FLEX ELVC show a significantly reduced mean warm ischemia time (60 ± 5 seconds) and mean total operative time (60 ± 10 minutes) allowing safe removal of the kidney through a small incision, especially when there are multiple renal vessels. Early discharge from the hospital and early return to work are other advantages of using the mini-incision technique.

Pancreas transplantation offers patients quality of life benefits and is widely regarded as the most effective way to achieve normoglycemia in patients with type 1 diabetes mellitus. However, it is not a life-saving procedure. Therefore, the operative technique must be quick and safe, guarantee a low rate of postoperative complications, and have good graft survival.

Traditional bench work is based on dissection and double ligation of all vessels. It requires extensive and time-consuming pancreatic graft manipulation, which is one of the factors associated with post-transplantation primary nonfunction and graft pancreatitis [16]. Use of the ETS-FLEX ELVC simplifies the bench work resulting in significantly shorter preparation time, minimal manipulation of the pancreatic graft, and minimal bleeding following revascularization.

In conclusion, we believe that our use of the laparoscopic instrument, ETS-FLEX ELVC, with a mini-incision technique in live-donor nephrectomy and pancreatic graft preparation makes these complex and time-consuming procedures simple and fast, minimizing the chances of postoperative complications and resulting in excellent patient and graft survival.

References

1. Koostra G. The asystolic, or non-heartbeating, donor. Transplantation 1997; 63: 917-921
2. UK Transplant Activity Report 2002-2003. Available at: http://www.uktransplant.org/

3. Andrews PA. Renal transplantation. BMJ 2002; 324: 530-534
4. Ramos E, Aoun S, Harmon WE. Expanding the donor pool: Effect on graft outcome. J Am Soc Nephrol 2002; 13: 2590-2599
5. D'Alessandro AM, Sollinger HW, Knechtle SJ, Kalayoglu M, Kisken WA, Uehling DT, et al. Living related and unrelated donors for kidney transplantation. A 28-year experience. Ann Surg 1995; 222: 353-632; discussion 362-364
6. Shaffer D, Sahyoun AI, Madras PN, Monaco AP. Two hundred one consecutive living-donor nephrectomies. Arch Surg 1998; 133: 426-431
7. Ratner LE, Hiller J, Sroka M, Weber R, Sikorsky I, Montgomery RA, Kavoussi LR. Laparoscopic live donor nephrectomy removes disincentives to live donation. Transplant Proc 1997; 29: 3402-3403
8. Odorico JS, Sollinger HW. Technical and immunosuppressive advances in transplantation for insulin-dependent diabetes mellitus. World J Surg 2002; 26: 194-211
9. Gruessner A, Sutherland DE. In: Terasaki P, Cecka J, eds. Clinical Transplantation 1996. Los Angeles, Calif, UCLA Tissue Typing Laboratory; 1996, p 7
10. Flowers JL, Jacobs S, Cho E, Morton A, Rosenberger WF, Evans D, et al. Comparison of open and laparoscopic live donor nephrectomy. Ann Surg 1997; 226: 483-489
11. Kuo PC, Johnson LB. Laparoscopic donor nephrectomy increases the supply of living donor kidneys: A center-specific microeconomic analysis. Transplantation 2000; 69: 2211-2213
12. Chiu AW, Chang LS, Birkett DH, Babayan RK. The impact of pneumoperitoneum, pneumoretroperitoneum, and gasless laparoscopy on the systemic and renal hemodynamics. J Am Coll Surg 1995; 181: 397-406
13. Chiu AW, Azadzoi KM, Hatzichristou DG, Siroky MB, Krane RJ, Babayan RK. Effects of intra-abdominal pressure on renal tissue perfusion during laparoscopy. J Endourol 1994; 8: 99-103
14. Montgomery RA, Ratner LE. The laparoscopic donor nephrectomy. In: Morris PJ, ed. Kidney Transplantation: Principles and Practice, 5th edition. Philadelphia, WB Saunders; 2001, pp 106-112
15. Hsu TH, Su LM, Ratner LE, Trock BJ, Kavoussi LR. Impact of renal artery multiplicity on outcomes of renal donors and recipients in laparoscopic donor nephrectomy. Urology 2003; 61: 323-327
16. Benedetti E, Coady NT, Asolati M, Dunn T, Stormoen BM, Bartholomew AM, et al. A prospective randomized clinical trial of perioperative treatment with octreotide in pancreas transplantation. Am J Surg 1998; 175: 14-17