ASERNIP-S

Australian Safety and Efficacy Register of New Interventional Procedures – Surgical

Consumer summary

Laparoscopic live donor nephrectomy (Second update and re-appraisal)

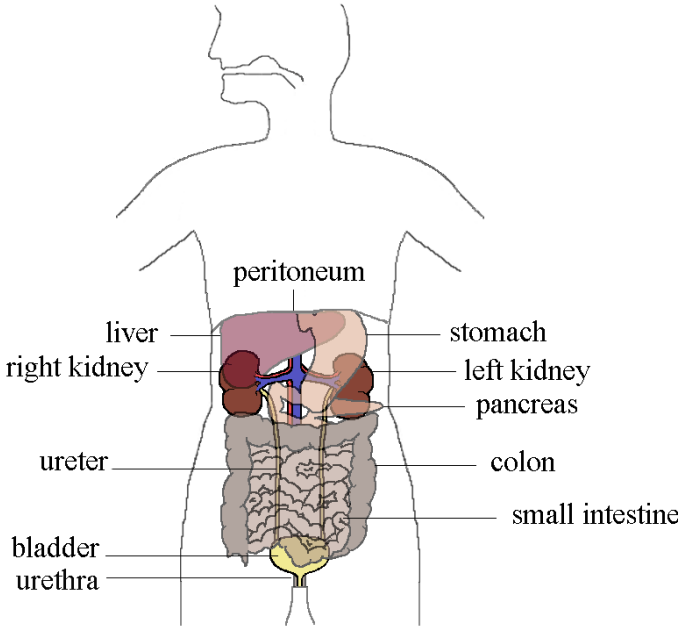
To navigate the document in Word, click on the word (underlined in blue) to link to the glossary.

Laparoscopic live donor nephrectomy is a surgical technique that has been developed to remove a kidney from a living donor for transplantation. ASERNIP-S has reviewed the available published evidence to compare the safety and effectiveness of this technique with the more traditional 'open' method of live donor nephrectomy.

Why are kidneys transplanted?

People normally have two kidneys, which are vital organs. They filter the blood, control the level of some chemicals in the blood, and eliminate waste in the form of urine. The waste passes through tubes called ureters into the bladder and empties through the urethra to the outside of the body (see figure 1). A person may live a normal life with one healthy kidney. Kidney or renal failure may occur and can be due to several causes, the most common being glomerulonephritis or diabetes mellitus. When both kidneys fail, either dialysis or a kidney transplant is required. While dialysis artificially takes over the kidney's role of filtering the blood, the patient must undergo major changes in lifestyle and the procedure can be very expensive.

Figure 1: Kidneys and bladder



Transplantation of a kidney or kidneys can be performed on suitable individuals, to eliminate the need for dialysis. A person receiving a transplanted kidney is called a recipient.

Increasing numbers of patients with end-stage renal failure are candidates for kidney transplantation. However, there are not enough kidneys available for donation. The number of Australians on a waiting list for kidney transplantation in January 2003 was approximately 1500, yet in 2002 only 612 kidney transplantations occurred. Until relatively recently, kidney transplantation relied solely on the availability of kidneys from deceased individuals, referred to as cadaveric kidneys. Families now have the opportunity to consider live donation; this occurs when a living relative (usually a brother, sister, parent or any relative) or unrelated donor (often a spouse, but could be a concerned friend) donates a kidney. In Australia the popularity of live donor transplants is increasing; in 2002, 39% of transplants were from living donors.

Kidneys from live donors have a better long-term survival rate than those from deceased individuals. The five-year survival of a transplanted kidney from a live

donor is 76% (i.e. 76 of every 100 transplanted kidneys from a live donor will still be working effectively five years after transplantation), compared with 59% grafts from deceased individuals.

What is live donor nephrectomy?

Live donor nephrectomy is the surgical removal of an intact kidney without any damage from a healthy living donor. The blood vessels supplying the kidney and enough length of ureter must also remain attached to the removed kidney for the transplantation to be a success.

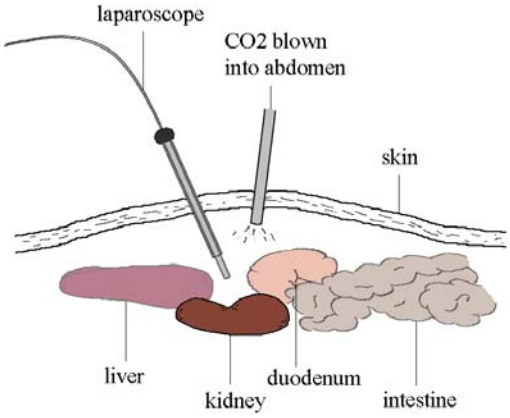
Open Nephrectomy

In the past, kidney transplants have usually been performed by a procedure known as 'open nephrectomy'. In this operation, a large cut is made through the skin and abdominal muscles to remove the kidney from the donor. This operation has been associated with high rates of complications for the donor (between 8% and 17%, with major complications between 1% and 8%), which can mean donors may need a long time to recover and return to normal daily activities.

Laparoscopic Nephrectomy

Laparoscopic live-donor nephrectomy (LLDN) was first performed on humans in 1996. During the procedure the surgeon usually approaches the kidney through the abdominal cavity (trans-abdominal), or less commonly from behind the abdominal cavity (retroperitoneal). A specialised instrument called a laparoscope is inserted into the abdominal cavity through a small cut. The camera on the end of the laparoscope allows the surgeon to 'see on a TV monitor' into the abdominal cavity. Carbon dioxide (CO_2) gas may be blown into the abdominal cavity to make it expand so that the surgeon has a better view of the kidney and more space to use the surgical instruments. This is known as CO_2 insufflation (see figure 2).

Figure 2: Laparoscopic live donor nephrectomy with CO_2 insufflation



A hand-assisted approach, in which the surgeon's hand reaches into the abdominal cavity (to separate the kidney), is used in a small number of cases; alternatively the surgeon uses surgical tools to place the kidney in a specimen bag for removal. Sometimes surgical instruments are used to hold back the tissue (retraction) inside the abdomen instead of inflating the abdomen with CO_2. Once the kidney is located, the surgeon frees it from other organs, cuts the blood vessels and ureter and removes the kidney with these remaining attached. The kidney is removed through a small cut (4-6cm). The kidney is immediately cooled by running a special fluid maintained at 4 degrees C through the blood vessels to wash out the blood and preserve its function. It is then transplanted into the recipient.

How does laparoscopic live donor nephrectomy compare with the open procedure?

The evidence available on LLDN and open nephrectomy was rated according to the ASERNIP-S Classification System as being of average quality. The ASERNIP-S review group considers that more long-term data on these procedures is needed. The following may be used as a guide.

Safety

Any major surgical procedure could result in death as a direct or indirect result of the operation, anaesthesia or events following the operation. Anecdotally at least six deaths have been reported after living donor nephrectomy since 1999, not necessarily the open or laparoscopic operation (JAMA, July 9, 2003; 290(2): 181). In the studies reviewed in the systematic review, no patient deaths were reported during or shortly after LLDN (total of 3666 patients) or the open procedure.

In some cases of LLDN, surgeons needed to convert from the laparoscopic to the open procedure (0% to 13% of patients), often to maintain the safety of the donor or the kidney. Donor complication rates were similar for the two procedures, ranging from 2% to 31% following LLDN compared with 4% to 38% after the open procedure. For LLDN patients the most common types of complications were injury to organs such as the spleen and/or bowel during surgery and other injuries caused by the stapler used to cut the blood vessels. Patients undergoing open surgery were more likely to experience pulmonary complications, fever, pain and/or nausea. Both groups experienced similar rates of wound complications. The amount of blood loss was also similar following the two procedures.

Overall, complication rates reported for recipients in the studies reviewed were similar for the two procedures. For patients receiving a kidney removed from the donor by LLDN, complication rates ranged from 0% to 31% (4 out of 13 patients in one study) of patients, whereas for those receiving a kidney removed in an open procedure the range was 0% to 19% of patients. (These percentages show the overall number of all types of complications recorded in a particular study divided by the number of patients in that study. Thus a study with a smaller number of patients can produce a higher percentage when in fact fewer patients experienced complications.)

Effectiveness

In terms of effectiveness, the technical difficulty of the laparoscopic approach meant that in general it took longer than the open nephrectomy procedure, with some studies reporting the LLDN operation took twice as long. Hand-assisted LLDN appeared to take less time than standard LLDN. Studies included in this review suggested that donors recover more quickly after the laparoscopic than the open procedure.

Compared to open nephrectomy, LLDN, which involves a smaller cut or incision, offers significant benefits to the donors – they have less pain (measured by use of pain-relieving drugs), shorter stays in hospital and an earlier return to normal activities (whether to home duties or paid work).

LLDN is a slower operation with longer warm ischaemia times (which may delay the function) than for the open procedure. Standard LLDN resulted in longer warm ischaemia times than hand-assisted LLDN. However, the levels of creatinine were found to be similar in recipients up to three months after the LLDN and the open procedure.

There was no statistically significant difference between the procedures in either the functioning of the transplanted kidney or in the percentage of transplanted kidneys rejected by the recipient. Graft survival was still comparable one year after the operations, and was similar in two studies at two years and one study at five years. Unfortunately the latter three studies were the only studies on long-term (greater than one year) graft survival available. One year after the operation, more than 97% of recipients had survived following LLDN compared with at least 93% after the open procedure.

What are the recommendations of the Royal Australasian College of Surgeons?

The review group concluded that LLDN was at least as safe as open nephrectomy for donors in the short-term, although long-term complication rates have not yet been fully established. LLDN was considered to be at least as effective as the open procedure for donors, *with faster recovery times*. Graft function and survival appeared to be similar for recipients in the short term but long-term effectiveness could not yet be determined.

Furthermore, the following clinical and research recommendations were made:

1. More comparative studies should be conducted and long-term follow-up data published.
2. The Transplant Section of the Royal Australasian College of Surgeons should define the training and accreditation process for this procedure.

3. As the technique is no longer considered to be new, the Australian LLDN audit (which has been managed by ASERNIP-S to date) is to be handed over to the Australian Transplant Registry.
4. This review should be updated within two to five years.

Acknowledgments

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Key words: laparoscopic live (living) donor nephrectomy, laparoscopic live (living) donor kidney transplantation

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Important Note The information provided is based on up-to-date research. However, it is not intended to replace the advice of your medical practitioner. Please ask your doctor if you have any further questions about the management of this condition.

For further information about ASERNIP-S
Contact Professor Guy Maddern, ASERNIP-S Surgical Director, PO Box 688, North Adelaide, SA 5006, ph. (08) 82391144, fax (08) 82391244, or visit the website (www.surgeons.org/asernip-s). If you would like to provide feedback on this consumer summary, please contact us at consumer.asernip@surgeons.org .

ASERNIP-S is a programme of the Royal Australasian College of Surgeons (RACS).

CONSUMER INFORMATION GROUP MEMBERS

ASERNIP-S Director
Professor Guy Maddern
Surgical Director
ASERNIP-S
PO Box 668 NORTH ADELAIDE SA 5006

Protocol Surgeon
Mr Mohan Rao
Transplant Consultant Surgeon,
Department of Surgery/Renal Unit
The Queen Elizabeth Hospital WOODVILLE SA 5011

Other Speciality Surgeon
Mr Franklin Bridgewater
Consultant Surgeon
Pennington House NORTH ADELAIDE SA 5006

Consumer Representatives
Barbara Beacham
Primary Health Care Research Information Service
Department of General Practice
Flinders University, Adelaide BEDFORD PARK SA 5042

Jane Doyle
Channel Seven Adelaide Pty Limited
45 Park Terrace GILBERTON 5081

ASERNIP-S Programme Manager
Dr Wendy Babidge
ASERNIP-S
PO Box 688 NORTH ADELAIDE SA 5006

ASERNIP-S Researcher
Ms Rebecca Tooher
ASERNIP-S
PO Box 668 NORTH ADELAIDE SA 5006

ASERNIP-S Project Officer
Ms Eleanor Ahern
ASERNIP-S
PO Box 668 NORTH ADELAIDE SA 5006

The ASERNIP-S Classification System

Evidence Rating

The evidence (i.e. studies included in the review) for ASERNIP-S systematic reviews is rated as *Good*, *Average* or *Poor*, according to the:

- quality of the evidence. High quality evidence comes from a study that has a low risk of bias and no other major flaws (such as lack of enough follow-up data or big differences between the patients selected for the groups).
- availability of the evidence. This refers to how much evidence there is to obtain.

Good

Most of the evidence is either from:

- a high quality systematic review of all relevant randomised controlled trials, or
- at least one large high quality randomised controlled trial.

Average

Most of the evidence is from:

- high quality quasi-randomised trials, and/or
- comparative studies, without major flaws, in which the patients are placed into groups without being randomized, and/or
- an inconclusive systematic review based on small randomised controlled trials, and/or
- randomised controlled trials that are of moderate or uncertain quality.

The results of these studies are more likely to be influenced by other factors compared to high-quality randomised controlled trials. However, these studies show to some extent that there is still a reasonable chance (moderate probability) that outcomes are valid.

Poor

Most of the evidence is from:

- case series
- studies mentioned above, with major flaws or a high risk of bias
- studies in which there is not enough evidence.

Safety and Efficacy Classification

SAFETY

- *At least as safe compared to comparator* procedure(s)*
  The systematic review shows that the new procedure is as safe as, or safer than, the comparator.
- *Safety cannot be determined*
  There is not enough evidence to determine the safety of the new procedure.
- *Less safe compared to comparator* procedure(s)*
  The new procedure is not as safe as the comparator.

EFFICACY

- *At least as efficacious compared to comparator* procedure(s)*
  The systematic review shows that the new procedure is as effective as, or more effective than, the comparator.
- *Efficacy cannot be determined*
  There is not enough evidence to determine the effectiveness of the new procedure.
- *Less efficacious compared to comparator* procedure(s)*
  The new procedure is not as effective as the comparator.

RESEARCH RECOMMENDATIONS

The Review Group may recommend that more data be collected through an audit or a controlled (ideally randomised) clinical trial.

CLINICAL RECOMMENDATIONS

The Review Group may make recommendations regarding the use of the new procedure in clinical practice to ensure the procedure is performed on appropriate patients by sufficiently qualified/experienced centres.

*A comparator may be the current ”gold standard” procedure, an alternative procedure, a non-surgical procedure or no treatment.

Glossary

abdomen: the part of the body between the chest and pelvis

abdominal cavity: the space between the inner walls of the abdomen and pelvis and the organs of the body. This space is lined by a layer of cells called the peritoneum.

audit: In surgical practice this refers to the process of measuring and monitoring the diagnosis, investigation, surgical treatment, resulting outcomes and follow-up of patients.

bias: The influence of other factors, i.e. those not being measured, on the results of a study.

cadaveric: from a corpse

case series: A series of single patients, usually treated at the same centre within a particular timeframe. This often reflects the historical experience of that centre.

creatinine: a waste product of protein metabolism which is removed from the blood by the kidneys. Thus blood levels of creatinine are a measure of kidney function.

diabetes mellitus: a condition in which the body doesn't produce enough insulin

dialysis: filtering the blood, cleansing it, by passing it through membranes outside the body

evidence: the studies included in the review

glomerulonephritis: inflammation of the glomeruli (tiny blood vessels through which urine is filtered) of the kidneys

graft survival: how long a transplanted kidney keeps working

insufflation: the blowing of gas into a body cavity

laparoscope: long thin tube with a telescope on the end, used to see inside the abdomen

laparoscopic: the use of a laparoscope to see inside the abdomen. The tube is inserted through a small cut in the abdominal wall.

LLDN: laparoscopic live donor nephrectomy

nephrectomy: surgical removal of a kidney

peritoneum: layer of cells lining the space (peritoneal cavity) between the inner walls of the abdomen and pelvis and the organs of the body

pulmonary: pertaining to the lungs

quasi-randomised trial: A trial using a method which is not completely randomised of placing patients into treatment groups. There is a greater risk of selection bias in quasi-random trials where placement is not adequately concealed compared with randomised controlled trials with adequate allocation concealment.

randomised controlled trial: A study in which researchers randomly place participants in groups. The new surgical procedure will be performed on one group of patients, while the other group of patients will undergo the conventional operation. Researchers measure and compare the outcomes of the patients from the different groups.

renal: pertaining to the kidneys

retraction: the use of a surgical instrument, often used in pairs, to hold surgical cuts open or to keep tissue out of the way for the operating surgeon

retroperitoneal: behind the peritoneal membrane of the abdomen

statistically significant difference: The term 'statistically significant difference' relates to the scientific notion of probability. This notion accepts that small and imperceptible variations can cause different results, but that if the same result occurs with a particular frequency (i.e. more than 95 times out of 100) then that result probably did not happen by chance, but may represent some 'true' difference. Scientists and researchers use special statistical techniques (tests of significance) to calculate the probability that a result happened by chance, or may represent some 'true' difference. When they calculate what may be a 'true' difference they call this a statistically significant difference.

systematic review: ASERNIP-S conducts literature reviews on the safety and effectiveness of new surgical techniques before they are widely accepted into the health care system. Each review collects all relevant information, or evidence, on new and standard techniques used to treat a medical condition. The quality of evidence is assessed. ASERNIP-S then makes recommendations on the safety and effectiveness of the procedures that are then endorsed by RACS.

trans-abdominal: across the abdomen

ureter: the tube that carries urine downward from each kidney to the bladder

warm ischaemia time: the time that the kidney for transplant is cut from its arterial blood supply and removed from the body, before it is cooled to 4 degrees C by running cold fluid to prevent damage. The kidney is then ready for transplant into the recipient. A longer warm ischaemia time may result in delayed function of the transplanted kidney.