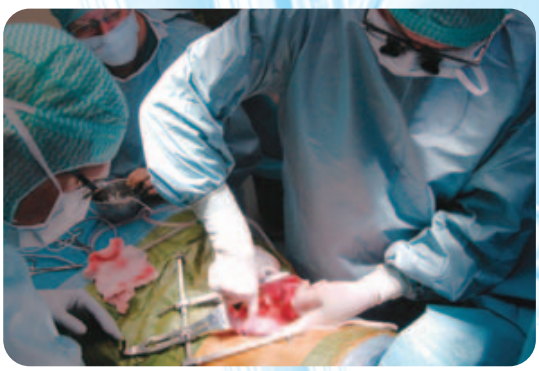
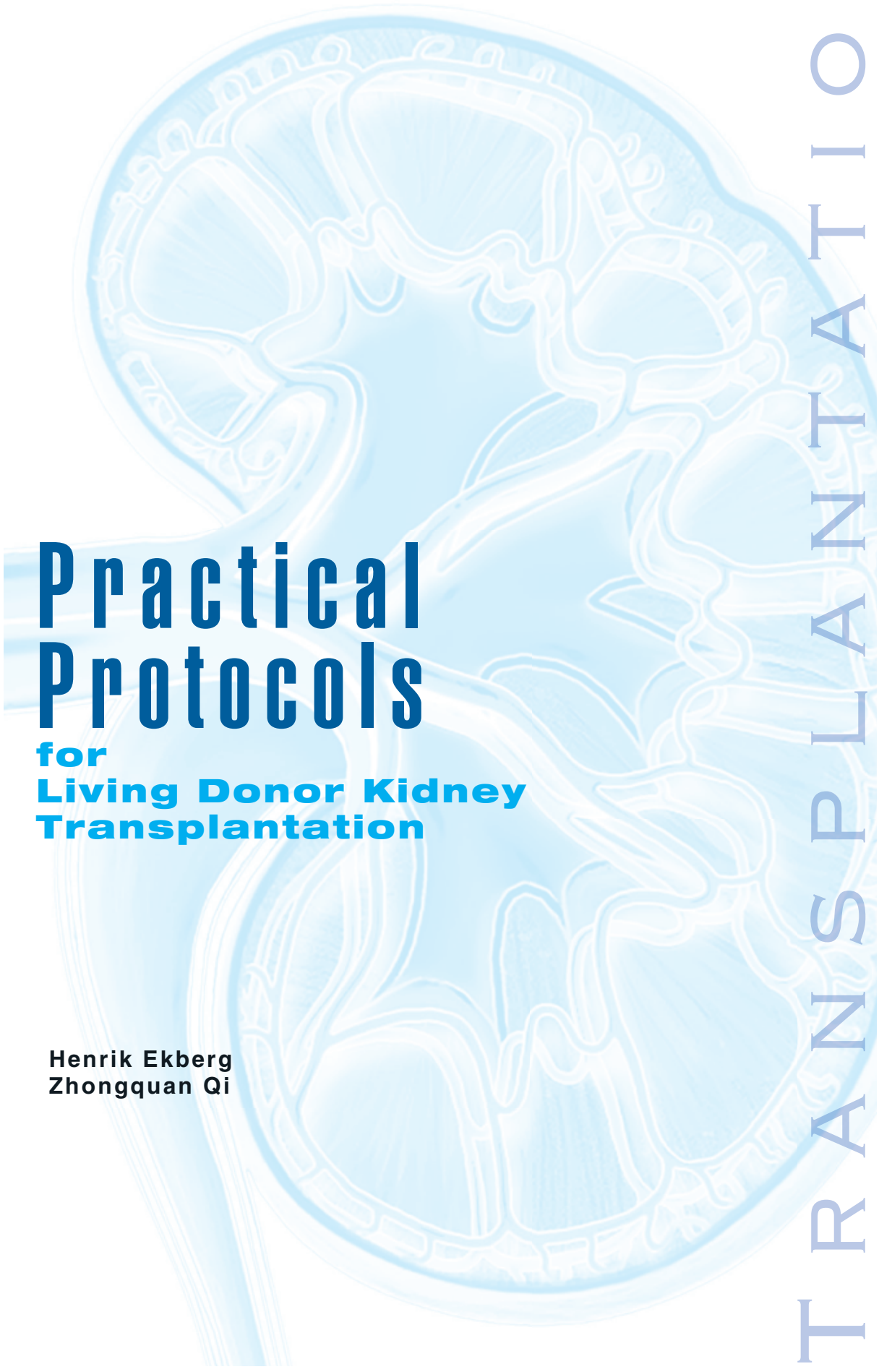
Practical Protocols

for Living Donor Kidney Transplantation

Henrik Ekberg
Zhongquan Qi



TRANSPLANTATION



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TRANSPLANTATION

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Why do we need protocols?

Every transplant centre needs to make decisions on their routine practice, to decide on a set of protocols for the transplant surgeons and physicians at the centre. The reason for this is that all patients should be given the best possible care. These protocols should be based on current transplantation research and they should be updated at regular intervals. The objective is to reach the highest international standard of outcome after kidney transplantation.

For whom is this book written?

This book is a collection of protocols that are based on current transplantation science and experience. They are currently used at the transplant centres of the authors. We have written this book for anyone who is working as a doctor or nurse at a kidney transplant centre, and recommend that you use it for critical discussions and decisions on the protocols used at your centre. You will need to make regular updates of the protocols in the future if you are to keep your practice current.

How to make your own protocols

With this book you should find a CD. Open the CD on your computer and you will find the text of this book in two versions: a pdf file (Adobe) and a doc file (Microsoft Office Word). If you want to make a print out of the same text as in the book, use the pdf file. If you want to make your own protocols, similar to what we have suggested but with an update or with local application, use the doc file and make your revisions in Word.

We hope that you will use this book with the CD and take advantage of the possibilities for local application, which combined with regular updates will be a useful tool for your patients and for your clinical practice.

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Authors

Dr Henrik Ekberg is Senior Transplant Surgeon at the University Hospital in Malmö, and Professor of Transplant Surgery at Lund University, Sweden. His main research interest concerns immunosuppression in renal transplantation. He has had an active role in a large number of multicentre clinical trials; for example the CAESAR and the Symphony studies. He was a contributor to the European Best Practice Guidelines in Renal Transplantation, published in 2000 (part 1) and 2002 (part 2). He has also participated in the working groups for the KDIGO Guidelines (2009). Dr Ekberg is Associate Editor of the American Journal of Transplantation and member of the editorial board of Transplantation, Clinical Transplantation and Transplant International. He has been Vice-President of the European Society of Organ Transplantation and was also Councillor for The Transplantation Society for a few years.

Dr Zhongquan Qi is Professor of Surgery and Vice-Dean at the Medical Faculty of Xiamen University in Xiamen, P.R. China, Director of the Transplant Institute at the same faculty and Senior Consultant at the Zhong Shan Hospital in Xiamen. He completed his MD at Harbin Medical University in 1984 and was appointed specialist in general surgery and lecturer at this institution in 1991. Two years later he moved to Sweden and became a PhD student of Dr Henrik Ekberg, focusing on research in experimental transplantation. In 1995 he passed his PhD (Doctor of Medical Sciences) at Lund University in Sweden. He continued to contribute to transplantation clinical and research work in Sweden for a few years and then returned to China to take up his current positions in 2006. He has also been active as professor and supervisor in surgical research at Harbin Medical University in China since 2001.

A message from The Transplantation Society

Professor Jeremy Chapman is Director of Renal and Transplant Medicine, Westmead Hospital, University of Sydney, NSW, Australia, and
President, The Transplantation Society 2008-2010.

This book provides the practical elements needed for a modern transplantation programme. It is absolutely essential in today's clinical transplant programmes that all the professional staff work as a unit – surgeons, physicians, nurses, pharmacists, coordinators, dieticians and physiotherapists alike. Without protocols covering the most important aspects of transplant care there is no cohesion or collaboration. These Practical Protocols provide all transplant units the opportunity to build their own protocols easily and on a sound basis of international best practice. Prof Henrik Ekberg and Prof Zhongquan Qi are to be congratulated for the work that they have done and for the inspired step of providing a CD with the book, to allow each transplant unit to custom design their own protocols.

The Transplantation Society

TTS is the premier global society of professionals involved in organ transplantation – we hold many meetings around the world designed to educate and to share new knowledge in our field. We are increasingly turning to the internet to provide information of use to specialist transplant surgeons and physicians, and tts.org will supply a wealth of information.
We welcome new members from around the world and members from China, but our ethics statement – which is reproduced below – makes it clear that we will not support individuals involved in commercial transplantation or in transplantation of organs from executed prisoners. If you are not involved in these practices then please consider carefully applying for membership to The Transplantation Society – you can apply online at www.tts.org

The Transplantation Society

MEMBERSHIP STATEMENT

Ethics Committee of The Transplantation Society

The Transplantation Society is the leading international society of physicians, surgeons and scientists involved in the transplantation of organs and tissues. The membership should be active in promoting organ donation from deceased as well as from live donors. The Society is proactive in the development of international transplant policy, the monitoring of transplantation activities and in supervision of the adherence to proper principles of practice.

It is a fundamental principle for The Transplantation Society that donors of organs and tissues are not exploited and that consent for donation must be obtained without coercion. The Transplantation Society opposes the buying and selling of organs.

Two models of authorization for organ donation from the deceased donor, explicit consent or registered objection, are practiced. In countries using the system of registered objection, extensive efforts should be taken in order to ascertain that the public knows its right to object. Members of The Transplantation Society must not be involved in obtaining or transplanting organs from executed prisoners or other donors where there is a risk that an autonomous consent for donation is lacking.

The applicant for membership in The Transplantation Society should review the Policy and Ethics Statement at the following TTS website: http://www.transplantation-soc.org/policy.php

Applicants for membership in The Transplantation Society should also be aware of the following positions of the Society:

1. All countries with donation and organ and tissue transplantation activities should have relevant legislation ensuring transparency, safety and effective monitoring of the procedures.

2. All countries should enact legislation prohibiting exploitation of donors by commercial trafficking in organs and tissues.

3. All countries should have a system for approval and certification of transplant centres and physicians by relevant government and/or medical professional authorities.

4. All countries should have methods for registration and tracking of all organ and tissue donors.

5. All countries should have systems to ensure that the allocation of organs is transparent and governed by medical criteria.

6. All countries obtaining organs from deceased individuals should legally define death and the criteria to diagnose death. The determination of death should be independent of a direct interest in a subsequent organ transplant procedure. No organs or tissues should be removed unless the individual is declared dead.

7. In the case of live donation, all countries should be guided by relevant legislation and monitoring to ensure that:

   a) only individuals with the cognitive capacity to understand the risks and benefits of being a live donor are accepted as donors;

   b) potential donors receive the relevant and sufficient information about the procedure to make an autonomous decision;

   c) the decision to donate is voluntary, free of exploitation and coercion;

   d) all donors receive a complete medical and psychosocial evaluation and are cared for throughout the postoperative recovery period;

   e) donor's access to long-term follow-up is promoted.

Scientific studies and clinical activities should be performed in keeping with the ethical principles delineated in the following policy documents:

For Live Kidney Donation - The Consensus Statement of the Amsterdam Forum (*Transplantation* 79(6): S53-S66, 2005)

For Live Donation of Extrarenal Organs - The consensus Statement of the Vancouver Forum (*Transplantation* 81(4): 1373-1385, 2006)

For Studies of Xenotransplantation - The International Xenotransplantation Association Ethics Committee Position Paper on "The Ethics of Xenotransplantation" (*Xenotransplantation* 10:194-203, 2003)

For research involving human subjects - The Helsinki Declaration of The World Medical Association.

I HEREBY ACCEPT TO PRACTICE ACCORDING TO THE POLICY AND ETHICS STATEMENT OF THE TRANSPLANTATION SOCIETY (http://www.transplantation-soc.org/policy.php) AND THE POSITIONS OF THE TRANSPLANTATION SOCIETY STATED ABOVE.

_____ _____

SIGNATURE DATE

_____

PRINT NAME

Living Donor Kidney Transplantation

I. Introduction

Kidney Transplantation – Optimal Treatment

Kidney transplantation is the treatment of choice for most patients with renal insufficiency leading to terminal uraemia. The outcomes after transplantation include improved quality of life, reduction of cardiovascular risk factors and, as a consequence, prolongation of patient survival.

Kidney Transplantation – Reduction of Costs

The alternative treatment for terminal uraemia, haemodialysis, is an expensive procedure. It is estimated that the cost of haemodialysis (3 times per week) at a dialysis unit in Sweden amounts to the equivalent of 100,000 USD per year (in 2009). The overall cost of a living donor kidney transplantation is estimated at 40,000 USD. The follow-up after kidney transplantation amounts to a level of about 5-10,000 USD per year, including medication and follow-up visits. Consequently, with the investment of less than 6 months' dialysis costs – for the transplantation – the savings for the health care provider (in Sweden) amounts to at least 90,000 USD per year thereafter. Similar calculations may be done in different countries.

Transplant Centre Objectives

The primary objective of the kidney transplant centre should be to offer the living donor kidney transplantation procedure to any citizen who is in need of renal replacement therapy and who has a living donor willing to give a kidney. The recipient shall be examined and determined to have no contraindications or unacceptably increased risks for transplantation. The living donor shall also be examined and determined to have no contraindications and no identified risk factors for the procedure or for future health after kidney donation. The living donor shall be a family member, and give consent without coercion and without financial incentive to the procedure. The objective is to perform these procedures at internationally accepted high standards.

II. The Living Donor

At the present time the living related donor is an important source of kidneys for transplantation. This is a novel procedure to many people and not very well known by the general public. Therefore, information and education about the existence of the transplant centre and possibility of kidney donation and transplantation are initially very important steps. Information should be given to the general public through mass media; and to dialysis patients via their nephrologists, educational symposia with dialysis nephrologists' participation, and written

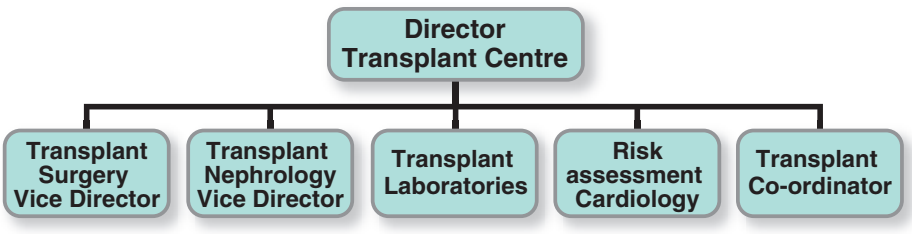
booklets about kidney donation given to the patients, especially new patients with renal insufficiency. Dialysis patients should themselves inform their family about kidney donation as a possibility; potential donors should be invited to the out-patient clinic to receive detailed information before they make their decision.

There should be no financial incentive for the donor; conversely, there should be no cost for the donor. The family member who donates his or her kidney makes a great contribution leading to a great reduction in the costs for the health care provider. The insurance company makes the greatest economical benefit. Consequently, it is logical for the donor not to pay anything for the kidney donation procedure. This should preferably be solved by the insurance company taking full responsibility for the costs associated with the donation. Further financial motivation for the family of the recipient would be that the amount spent for one year of dialysis treatment now may be spent for transplantation, leading to much reduced treatment costs in the future.

The major incentive for the family of the recipient is of course the increased quality of life for the patient. It should also be emphasized that the long-term prognosis, the life expectancy, would significantly improve. Concerning the operative risk for both the donor and the recipient, it is the obligation of all experts at the transplant centre to fulfil the procedures according to international high standards with every measure taken to avoid donor mortality and ensure minimal morbidity after kidney donation. The goals for very high success rates for the kidney recipient should be 95% graft survival and 98-100% patient survival at one year.

III. Structure of the Transplant Centre

There are of course several solutions on the question of the structure of the transplant centre. Here we present a suggestion. The head of the transplant centre will be the Director and he or she will report directly to the President of the hospital. The Board of the transplant centre, including experts in transplant surgery, transplant nephrology and the transplant laboratories, will assist the Director. The first two members of the Board will also be Vice Directors, able to replace the Director during an absence. Other important members of the board will be a cardiologist and the transplant co-ordinator. The head nurse of the transplant ward should always be present at the board meetings.



The procedures of transplantation are truly inter-disciplinary, using facilities and expertise from other departments, such as anaesthesiology, operation rooms, intensive care unit, nephrology out-patient clinic, dialysis unit, ultrasound unit, cardiovascular interventional laboratory, clinical chemistry, clinical immunology, infectious diseases and histopathology.

IV. Duties and Responsibilities of the Transplant Team Members

The Director of the transplant centre is responsible for all activities of the centre. He/she is assisted by the Vice Directors and the other members of the Board. There may be a meeting of the Board, chaired by the Director or one of the Vice Directors, every day after the ward round, with at least the transplant nephrologist, the transplant surgeon, the transplant co-ordinator, the head nurse and a young nephrology specialist, all of whom also attended the ward-round. This meeting is to further discuss clinical problems with current patients.

Once every week, there should be a Board meeting with the presence of all board members. The agenda of this meeting should include current patient progress, general affairs of the transplant centre, and presentation and acceptance of future living donor / renal recipient couples. The meeting could also include a journal club (presentation and discussion of novel international clinical studies in the field of transplantation).

The transplant nephrologist (Vice Director) is in principle responsible for the work up (preparatory examinations) of the living donor and the recipient. In practice, in order to avoid conflict of interest in assessment of donor and recipient it is preferable to have two nephrologists for each couple, one for the donor and one for the recipient. The transplant nephrologist is the main responsible senior physician for the patients admitted to the transplant ward. He is also responsible for the long-term follow-up of the donor and the recipient.

The transplant surgeon. There should preferably be two, one responsible for the living donor operation and the other responsible for the recipient operation. The transplant surgeon who is also Vice Director will take part in all ward-rounds post-operatively and in the Board meetings.

The cardiologist will be responsible for the operative risk assessment of both the living donor and the recipient. This includes evaluation of the examination results of ECG, echocardiography, myocardial scintigraphy, coronary angiography, and CT-angiography.

The head of the transplant laboratories will be responsible for the analyses and evaluation of results of HLA tissue typing, cross-matching, clinical chemistry tests, CMV, BK virus and hepatitis virus tests, and tacrolimus concentration measurements.

The transplant co-ordinator will be responsible for the information and educational activities; contacting the potential recipient and donor during work up; contacting the insurance company and informing the patient about costs; and scheduling the patient operation after acceptance by the Board, making sure there are surgeons and operating rooms and bed space available, and possibly pre-operative dialysis facilities. Following the operation, the transplant co-ordinator helps educate the patient in medication adherence and other behaviour important for the success of the transplantation. They also co-ordinate the schedule of initial follow-up after transplantation. Finally, the co-ordinator is responsible for entering data into the clinical database.

The head nurse of the transplant ward is responsible for the transplant nursing staff, their availability and competence, and making sure that all protocols and nursing procedures are followed as intended. She/He should be present at ward rounds and Board meetings. She/He should report to the Board if there is any need for an update of procedures or further training of her/his nursing staff.

V. External Assistance of Special Importance

The ultrasound department will be responsible for ultrasound investigations of the recipient. The first examination should routinely be performed within 24 hours after transplantation. If the graft is non-functioning, it should be done immediately if there is to be any chance of saving the graft that has a compromised blood supply, to ensure that there is sufficient circulation to the graft. Ultrasound will also be used for guidance of graft biopsy in case of suspected acute rejection. In cases of out flow obstruction of urine, a percutaneous nephrostomy should be placed into the kidney pelvis. If the obstruction has not spontaneously disappeared after a few days, balloon dilatation and insertion of a double-J catheter placed from the pelvis to the bladder should be considered. Examination reports should be given at the ultrasound department in the presence of the transplant team.

The histopathology department will be responsible for the preparation and evaluation of the kidney graft biopsy in cases of suspected acute rejection. Examination reports should be given at the histopathology department in the presence of the transplant team.

A legal advisor should be employed to assist the Board in legal matters and ensure that national legislation is adhered to, most

importantly concerning the family relationship between the living donor and the recipient. Also, advice may be needed concerning possible insurance matters and patient complaints.

VI. The Patient's Journey from Dialysis to Transplantation

1. The recipient and his or her living donor will be examined during the work-up phase by the nephrologists at the out-patient clinic.
2. The patients will visit the surgeons who are going to be responsible for the donor operation and the transplantation, respectively.
3. The clinical data of the donor and recipient are presented to the Board of the transplant centre. The Board decides to accept or reject the patients for donation and transplantation. If accepted, the transplant co-ordinator schedules the admission and operations.
4. Patients are admitted to the transplant ward and seen pre-operatively by the nephrologists in charge, the operating surgeons and the anaesthetist.
5. Day of operation. The donor operation is performed by Dr no.1 and the recipient operation is performed by Dr no. 2. It is suggested that Dr no. 3 will assist during the donor operation until the kidney is retrieved. Then he takes the kidney to the operating room of the recipient, where he will assist Dr no. 2 who has already started the recipient operation.
6. Post-operatively, when the recipient is extubated, awake and stable, the first 24 hours are spent in an intensive care bed of the transplant ward, then one or two weeks are spent in a normal bed. The donor should be discharged at one week.
7. Follow-up is performed in the out-patient clinic of the nephrology department. The donor should be contacted by telephone by the transplant co-ordinator one week after discharge, and should then visit the out-patient clinic at one month, six months and one year. The recipient should be seen three times per week initially, then twice a week, then once a week, then once in two weeks. At four months one visit every month is adequate if all is well.

VII. Clinical Follow-up Database

A database for clinical follow up after kidney transplantation should be established at the transplant centre. This will enable the centre to report short- and long-term transplant outcome taking into consideration numerous clinical parameters. The results may be compared to international standards and may also be reported to the hospital or city authorities and the Ministry of Health.

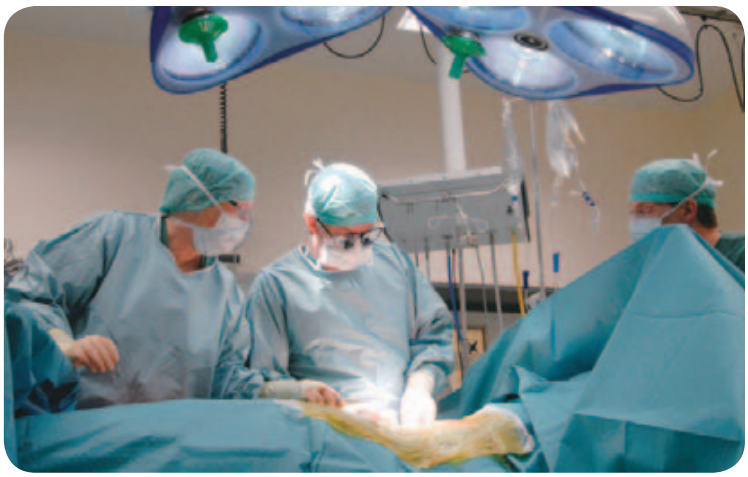
VIII. Education and Further Training of Doctors and Nurses

During the start-up phase of transplant activities at the transplant centre it is important that all personnel, including both doctors and nurses, are well aware of all details of the clinical protocols. Therefore, educational activities should be organised concerning various issues and for various sections of the staff. Courses and seminars of a few hours to a day in duration should be given. Some of these activities should be repeated when needed, especially for incoming nursing staff.

IX. Internet Publication of Protocols and Transplant Results

The transplant centre may have an internet web page. Here, all protocols in this book with local applications may be published so that they are easily accessible for all staff of the hospital. Any updates will be easy to make. The Board of the transplant centre should be responsible for updating the protocols of this book at least once every year.

Also, with time, transplant results including graft and patient survival, and complication rates may be published on the transplant centre web page. Making this combination of the methods, procedures, protocols and clinical results available will create total transparency, and the objective of the transplant centre – to perform living donor kidney transplantation to high international standards – may be assessed.



1. Kidney Recipient Work Up

Referral to the Transplant Centre

Name of patient:_____ Name of nephrologist:_____

A summary of the medical history of the patient should include the following information:

Social conditions: Profession, living standards, family, smoking status.

Previous medical history: Any abdominal operations, urological and genital diseases, ulcer disease, malignancy, infections.

Present medical history: Original kidney disease, dialysis history, access history, remaining diuresis mL per day, problems urinating, previous transplantation.

Risk assessment: Specific problems associated with transplantation, especially cardiovascular symptoms, tests and evaluation.

Allergy

Contagious disease: Tuberculosis, hepatitis B, hepatitis C, HIV

Physical examination: Height, weight, blood pressure.

Evaluation: The referring nephrologist's opinion about the patient as a candidate for transplantation. Possibilities for a living donor; how far has the living donor work up proceeded; name of the potential donor and relationship to the patient.

Patients who are scheduled for renal transplantation shall receive (if they need a blood transfusion) blood which is filtered to reduce leucocytes in order to avoid sensitisation.

The following work up of the recipient should be done before referral and copies of all examinations should be attached to the referral documents:

☐ Blood group ☐ Tissue typing, HLA-A,B,DR ☐ HLA-antibodies, PRA ☐ APC resistance ☐ Clinical chemistry list ☐ Lipids, Ca, PTH **Viral serology** ☐ HIV ☐ HBsAg, HepBcAb, HepBsAb ☐ Hepatitis C ☐ Hepatitis C PCR, if HCV positive ☐ CMV ☐ Varicella Zoster ☐ Herpes Simplex ☐ Epstein-Barr ☐ Syphilis	☐ Electro cardiogram (ECG) ☐ Ultrasonographic cardiogram (UCG) ☐ Myocardial scintigraphy if known heart condition, diabetes, smoker, long-term dialysis or hypertension, family history or >50 years old ☐ Coronary angiography, if myocardial scintigraphy showed reversible ischemia ☐ Chest X-ray (within 12 months) ☐ Cardiology consultation ☐ Dentist (prevention of dental or oral infection) ☐ Vaccination against pneumococci ☐ Current list of medication

Kidney Recipient Work Up
Check List for Referral

Name and date of birth of patient: _____

Summary and evaluation of the recipient work up findings:

1. Cardiac evaluation: a standard work up includes ECG and UCG; in case of diabetes, long-term history of smoking, known cardiovascular disease or age >60 years, extended work up including myocardial scintigraphy, coronary angiography and cardiologist consultation may be done.

- ☐ Standard work up was done and no significant pathology found
- ☐ Extended work up was done

2. Parathyroid function: P-PTH, calcium and phosphate should be evaluated for any suspicion of secondary/tertiary hyperparathyroidism and indication for parathyroidectomy. Operation should be performed before kidney transplantation.

- ☐ No suspicion of secondary/tertiary hyperparathyroidism
- ☐ There is a suspicion and further treatment / operation is planned

3. Glucose tolerance: patients who do not have diabetes should be tested with an oral glucose tolerance test (OGTT). If they have reduced glucose tolerance, steroid-free immunosuppression should be considered.

- ☐ Insulin-treated diabetes mellitus
- ☐ Known reduced glucose tolerance (e.g. on a diet)
- ☐ OGTT showed reduced glucose tolerance
- ☐ OGTT was normal

4. APC-resistance: if the test for APC resistance was positive, the patient should have prolonged prophylaxis of thrombosis.

- ☐ No APC resistance
- ☐ APC resistance

5. PRA: the presence of HLA antibodies should be tested with both cytotoxic and flow cytometric tests. Presence of HLA antibodies might influence the choice of immunosuppression.

- ☐ PRA cytotoxicity test done and negative
- ☐ PRA flow cytometry test done and negative
- ☐ One or both of the two tests was positive

6. Dentist: the recipient should go to the dentist for an examination and treatment of any teeth that may have an increased risk of infection.

- ☐ Dentist examination is done

7. Antibody screening: for HIV, HBsAg, HepBcAb, HepBsAb, hepatitis C (and hepatitis C PCR, if HCV positive), syphilis, CMV, varicella zoster, herpes simplex, and Epstein-Barr. Screen for latent tuberculosis and give appropriate treatment to infected patients.

- ☐ Tuberculosis HIV, syphilis, hepatitis B and C done and negative
- ☐ CMV, VZV, HSV, EBV done

8. Vaccination: patients should be vaccinated before transplantation (if not done previously) for polio, hepatitis A, tetanus, diphtheria, mumps, measles, rubella, hepatitis B, pneumococcus, influenza, meningococcus, VZV, and hemophilus influenza B.

☐ Vaccinations considered and done

9. Computerized Tomography without contrast medium: extensive calcifications of the iliac arteries might make the operative procedure difficult or impossible. In patients with known or suspected vascular disease a CT of iliac arteries should be done.

☐ Indication for CT not present

☐ CT indicated and done

Date and name of nephrologist in charge:_____

signature:_____

2. Living Donor Work Up

General strategy and objectives

1. The family of the recipient is informed about the possibility of living donation.
2. Meet potential donors individually and perform psycho-social evaluation. Potential donors must be given time to decide, and it must be a truly voluntary decision.
3. Undertake medical work up and evaluation concerning operative risk (cardiovascular and pulmonary).
4. Undertake nephrological evaluation concerning long-term risk after unilateral nephrectomy (hereditary for kidney disease, current GFR, risk factors for kidney disease).
5. The living donor work up should be performed by a different nephrologist than the one responsible for the recipient. Before the living donor work up is started, the recipient should be evaluated and accepted as a future candidate for kidney transplantation.

Primary work up

Step 1: –Identify potential living donors
–Hand out written information about donation (Protocol 19)
–Perform blood group test

Step 2: –Potential donor visits with nephrologist for oral information and physical examination plus ECG.
–Donor visits with social worker (experienced in LD)
–Collect blood and urine samples according to the check list; include tissue typing, cross match no. 1 and FACS cross match. Perform ultrasound of kidneys.

Step 3: –The nephrologist responsible for the donor makes a summary of the visits to the physician and social worker, the results of the blood and urine tests and ECG. The potential donor(s) are informed about the work up thus far and told if the work up will continue or be stopped at this point. If there are several potential living donors, one is chosen for further work up.

Secondary work up

Step 4: –Order continued work up according to the check list, with additional examinations if indicated. CT angiography of renal arteries to be done early.

Step 5: –Donor visits responsible nephrologist for summary of results.
–Donor visits social worker for the second time.
–Donor receives a referral to the transplant surgeon with a

summary report on the work up and copies of all examination results.

Final work up and decisions

- Donor visits the transplant surgeon and receives information about the surgical procedures.
- The case is presented to the Board of the transplant centre for decision.
- The timing of the donation and transplantation is decided.
- Cross match no. 2 is performed two weeks before the day of operation.

Check List for Kidney Living Donation – page 1

Donor

Name: Date of birth:

Address:

Telephone: Mobile:

Recipient

Name: Date of birth:

Primary Work Up

Step 1

- ☐ Written information
- ☐ Blood group

Step 2

- ☐ Visit to nephrologist
  - Medical history (incl heredity, previous operations, smoking)
  - Physical examination
  - Height and weight (BMI)
  - List of medication
  - Allergy
- ☐ ECG
- ☐ Clinical chemistry (attached list)
- ☐ GFR measurement
- ☐ Oral Glucose Tolerance Test
- ☐ Echocardiography including kidney and renal artery ultrasound
- ☐ Visit to the social worker (no. 1)

Step 3

- ☐ Responsible nephrologist summarises the test results
- ☐ Inform the potential donor
- ☐ Inform the recipient's nephrologist

Check List for Kidney Living Donation – page 2

Secondary Work Up

Step 4

- ☐ Chest X-ray
- ☐ Myocardial scintigraphy (if the donor is >50 years old)
- ☐ CT angiography
- ☐ Additional investigations

Step 5

- ☐ Visit to the responsible nephrologist, summary of test results
- ☐ Visit to the social worker (no. 2)
- ☐ Referral to the transplant surgeon, including:
  - Summary of the medical history
  - Clinical chemistry results
  - Social worker's report
  - Blood group
  - Cross match
  - Tissue type
  - ECG
  - Myocardial scintigraphy (if applicable)
  - Chest X-ray
  - GFR

There is no contraindication against kidney donation:

_____

Place and date

_____ _____

Name of responsible nephrologist Signature

Final Work Up and Decisions

- ☐ Date of operation is decided
- ☐ Cross match no. 2 is performed two weeks before the operation

Check List for Kidney Living Donation – page 3

Clinical chemistry of potential kidney living donor

Blood	Results
Haemoglobin	
Leucocytes	
Platelets	
Plasma	
CRP	
Bilirubin	
ALP	
GT	
AST	
ALT	
Albumin	
PK	
APT-time	
Creatinine	
Sodium	
Potassium	
Calcium	
Phosphate	
Base excess	
Urate	
Fasting blood sugar	
HBA1c	
Triglycerides	
HDL-cholesterol	
LDL-cholesterol	
	Separate reports on the following tests are attached to the referral documents
Plasma electrophoresis	
Urine Electrophoresis	
Tissue type	
Cross match; serology and FACS	
Serology for HbsAg, anti-HBs, anti-HBc, HCV, HIV	
Serology for CMV, herpes, varicella, Epstein-Barr	
Urine sedimentation	
Urine culture	
Urine dip test	

Evaluation of laboratory findings:

- ☐ Normal findings
- ☐ Acceptable for kidney donation
- ☐ Not acceptable for kidney donation

Place & date: _____

Signature: _____

Name of Dr: _____

3. Consent to Kidney Donation

Hereby, I give my consent to donate one of my kidneys.

This consent is limited to the fact that the kidney shall be transplanted to: _____.

I have received verbal and written information about kidney donation from Dr._____.

I certify that this donation is done willingly, without any coercion and without any financial reward on my side.

Place and date: _____.

Signature: _____.

Name: _____.

Relationship with the kidney recipient: _____.

4. Protocols for the Doctor: Admission of the Recipient Before Transplantation

☐ **Write the medical report with focus on the most recent events**
- Pre-operative need for dialysis?
- Current infection?
- Pre-operative IV fluids needed?
- Current diuresis (mL/day)?
- Physical examination of heart and lungs. Blood pressure.
- Examination of pulse in femoral arteries. Auscultation of murmur?
- Current list of medication.

☐ **Order pre-operative immunosuppression (Protocol 14)**
- Tacrolimus and mycophenolate mofetil (MMF) are given orally in the ward pre-operatively.
- Induction therapy (basiliximab or antithymocyte globulin [ATG]) is given in the ward or in the operating rooms.
- Methylprednisolone 500 mg IV is given at the start of the operation.
- Prednisolone 100 mg IV is given 8 hours after the start of the operation.

☐ **Order thrombosis prophylaxis**
using low molecular weight heparin, enoxaparin sodium 20 mg daily, starting before the operation.

☐ **Order antibiotic prophylaxis;**
e.g. cefuroxim 1.5g in a single pre-operative dose. In cases of allergy to penicillin, clindamycin may be given.

☐ **Order co-medication;**
iron and erythropoietin can be withdrawn, but not vitamins (vitamin D or B12).

☐ **Order the operation**
and have the patient report to the anaesthetist.

☐ **Wait for and check**
the pre-operative blood sample and chest X-ray results.

☐ **Decide which side**
The transplant surgeon should decide and mark the left or right groin of the patient for transplantation.

☐ **Cross match**
Final check that the cross match was negative.

5. Protocols for the Nurse: Admission of the Recipient Before Transplantation

☐ Find the patient's medical records.

☐ Find previously prepared forms, or prepare a collection of referral forms for laboratory and X-ray.

☐ Blood samples:

1. Urgent blood tests: plasma (P)-sodium, P-potassium, P-creatinine, P-albumin, P-calcium, P-CRP, blood (B)-haemoglobin, B-leucocytes, B-thrombocytes, B-erythrocyte volume fraction, P-glucose, P-TCO2, P-PK, P-APTT.
2. Routine blood tests: P-bilirubin, P-AST, P-ALT, P-GT, P-pancreas amylase, P-urate, B-differential count, P-phosphate, P-magnesium, B-MCHC, B-MCV.
3. Virus tests: HBsAG, anti-HBV, anti-HBC, anti-HIV, anti-CMV, anti-EBV, anti-HSV, anti-VZV.
4. Blood group: check previous blood group test and make sure it is still valid.
5. Cross match: take blood samples for making the cross match against the donor.

☐ Blood transfusion: order two units of blood, filtered to avoid CMV, to be prepared if needed.

☐ Weight and height.

☐ Chest X-ray and ECG.

☐ Preparations for the operating theatre. Shower, shaving, clothing.

☐ Immunosuppression: give medication according to the doctor's orders.

☐ Medical record: make sure that the medical records are being updated after the patient has been seen by the doctor.

☐ CAPD catheter: patients having peritoneal dialysis should empty the abdomen of fluids before going to the operating theatre.

6. Doctor's Orders: Pre-operative Management in Kidney Transplantation

Immunosuppression

Refer to Protocol 14 concerning initial immunosuppression.

Confirm the decision regarding which protocol the patient shall follow: normal risk, high risk or steroid free.

Calculate the dose of ATG. Ampoules contain 25 mg. Give entire ampoule; the dose should be 50, 75, 100, 125 or 150 mg. The first dose is given at the start of the transplantation.

The dose of basiliximab is 20 mg at the time of operation and 20 mg 4 days later.

Tacrolimus is given in the evening the day before transplantation, 6 am and 8 pm the day of operation, and post-operatively at 8 am and 8 pm (at the same dose). Tacrolimus trough levels are taken before the dose at 8 am and the dose is adjusted to levels according to Protocol no. 14.

Tacrolimus should not be given IV. If the patient cannot swallow, use a naso-gastric tube, open up the capsule of tacrolimus, mix the powder with some water and infuse it down the naso-gastric tube. Keep the same dose and follow trough levels as usual.

MMF is given at doses of 1 g BID, with the first dose in the evening before transplantation. If necessary, MMF can be given IV with no change in dosing.

Steroids: administer methylprednisolone 500 mg IV at the start of the transplant. Give prednisolone 100 mg IV 8 hours after the start of the operation.

Prophylaxis against thrombosis

Administer low molecular weight heparin (enoxaparin sodium) 20 mg subcutaneous injection once daily starting the day before transplantation.

Antibiotics

Give cefuroxim 1.5 g IV pre-operatively as a one-dose treatment. If an allergy to cefuroxim is present, clindamycin 600 mg IV should be given pre-operatively and at 12 and 24 hours post-operatively.

Prophylaxis against CMV

Recipients who are CMV-negative and receive a kidney from a CMV-positive donor should receive CMV prophylaxis for 3 months or until they have converted to being CMV-positive. Prophylaxis is started with valganciclovir 450 mg once daily at the time of transplantation. GFR should be measured within a week, and if GFR >60 (Cockcroft-Gault), the dose should be increased to 900 mg x 1.

Patients who are CMV-positive and are being treated for acute rejection should also receive CMV prophylaxis.

7. Anaesthetist: Intra-operative Management of Kidney Transplantation

Central venous catheter (CVC)

CVC is inserted by the anaesthesiologist in the operating room before the operation, after the patient has been put to sleep.

Intravenous fluids

Ringer-actetate is used depending on dehydration status, usually 1.5 – 2.5 litres during the transplant operation. If the patient is dehydrated (dialysis within 24 hours, low CVP, falling blood pressure at start of anaesthesia) give 2.5 litres.

Antibiotics

Cefuroxim 1.5 g IV pre-operatively as a one-dose treatment. If an allergy to cefuroxim is present, clindamycin 600 mg IV should be given pre-operatively and at 12 and 24 hours post-operatively.

Mannitol

Mannitol 200 mL IV is given at the end of the formation of the arterial anastomosis. Note this time point in the records.

Urine output

Urine output is recorded by the hour during and after transplantation.

Blood transfusion

Not routinely given. If necessary, always use CMV-negative blood.

Peritoneal Dialysis catheter

If the patient has a PD catheter, this is taken out at the end of the operation after the transplantation is finished.

8. Post-operative Management After Kidney Transplantation
(in the ICU or an Intensive Care Bed in the Transplant Ward)

☐ General management

- P-creatinine and B-haemoglobin are measured when the patient arrives in the intensive care unit or transplant ward.
- Urine production is measured every hour.
- Blood pressure is measured every hour at least during the first 12 hours.

☐ Parenteral IV fluids after operation

- Basic infusion: buffered glucose (50 mg/mL) at 50 mL/hour.
- Replacement of urine production: in addition to the basic infusion, the urine production is replaced by 100% of its volume given as Ringer-acetate.
  - If the urine volume every hour for 3-5 hours is more than 250 mL and there is a good venous volume (e.g. as measured by central venous pressure) the replacement volume may be reduced to 250 mL/hour, at least for a few hours (so as not to lose too much fluid).
  - If the urine volume is <100 mL/hour and there are signs of insufficient venous filling, additional volume is given with Ringer-acetate (250-500 mL) or 5% albumin (250 mL).
  - If the urine volume is low and the patient has a good venous filling (not believed to be dry) then diuretics may be given (furosemide 40 mg IV).
  - The day after transplantation, 2 litres of Ringer-acetate is the standard replacement if the kidney has started functioning.

☐ By mouth

- If the patient has no post-operative problems with nausea, the patient can eat and drink carefully and take oral medication 4 hours post-operatively. Concerning diet, the same diet restrictions, e.g. potassium and calcium, should be followed until kidney function is well established. Thereafter, normal food (or diabetic diet) may be given.

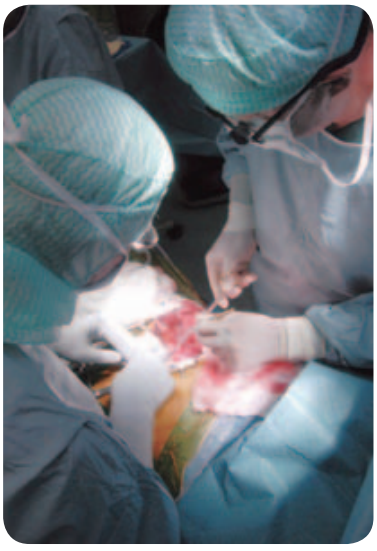
☐ Medication

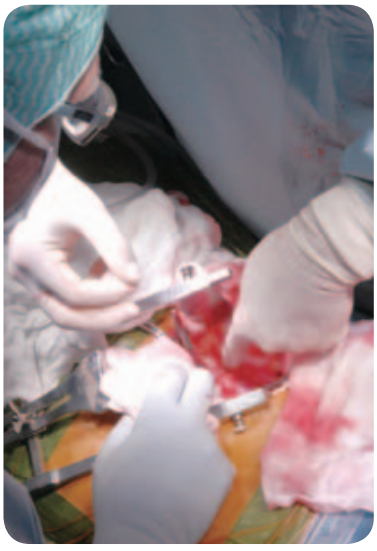
- Immunosuppression according to separate orders.
- Prophylaxis of thrombosis: low molecular weight heparin 20 mg once daily.
- Prophylaxis of infection: cefuroxim single dose is given pre-operatively. In cases of allergy to cefuroxim, clindamycin 600 mg should be given pre-operatively and after 12 and 24 hours.

- Nystatin 100,000 IU/mL mixture is given in 1 mL doses 4 times daily, as prophylaxis against mouth fungus.
- Famotidine 20 mg at night is given as prophylaxis against gastritis and ulcer.
- ACE-inhibitors for blood pressure are avoided during the first post-operative days.
- NSAID medication should not be used at all.

☐ Drainage and catheters

- If there is a drain at the wound, it should be drawn 12-24 hours after operation.
- Central venous line should be drawn about 48 hours after operation.
- Urinary bladder catheter should normally be drawn on day 4 after operation.





9. Routine Blood Samples After Kidney Transplantation For the Nurse in the Transplant Ward

Daily at 6 am and urgently tested:

P-potassium, P-creatinine, P-CRP, B-haemoglobin, P-leucocytes, B-thrombocytes, P-glucose

Monday, Wednesday and Friday:

Trough levels to be measured at 6-8 am (before the morning dose).
If the patient is on tacrolimus: B-tacrolimus
If the patient is on cyclosporin: B-cyclosporin

Monday and Thursday:

P-sodium, P-albumin, P-calcium, P-phosphate, P-bilirubin, P-AST, P-ALT, P-alkaline phosphatase, P-lactate dehydrogenase, P-pancreatic enzymes, P-total CO2, P-urea, P-PK.

Urine samples for culture, and dipsticks

10. Flow Chart of Events of Nursing After Kidney Transplantation

Name of responsible nurse and her/his code number		
Daily events	● Blood samples at 6 am ● Body weight ● Measurement of fluid intake and urine production ● Blood pressure, heart rate and body temperature; morning and afternoon ● Inspection of wound ● Shower	
Day 1 (day after operation)	● Ultrasound of kidney ● Wound drain (if any) taken out ● Mobilisation and breathing exercises (with physiotherapist) ● Start to drink and eat	Date/Sign
Day 2	● Central venous catheter taken out **Nurse to teach patient about:** ● Which medication to take ● Which tablet is which ● When and how many to take	Date/Sign
Day 3	**Exercises on the stairs and information about continued exercises provided by the physiotherapist** **Nurse to check that the patient knows:** ● Which medication to take ● Which tablet is which ● When and how many to take **Nurse to teach the patient about:** ● How medication acts ● Potential side effects **Nurse to inform patient about:** ● Signs of complications such as delayed function, infection, acute rejection	Date/Sign Date/Sign
Day 4	● Urine catheter is taken out ● The patient handles medication with support of the nurse ● Exercises (bicycle) according to physio-therapist's instruction	Date/Sign
Day 5	Continued exercises and practice	Date/Sign
Day 6	**Nurse checks that patient knows:** ● How medication acts ● Common side effects ● Common signs of complications **Test by physiotherapist before going home** **Meeting with the transplant co-ordinator before being discharged**	Date/Sign Date/Sign Date/Sign

11. Flow Chart of Events of Nursing in Kidney Donation

Name of responsible nurse and her/his code number	
Day before kidney donation	● Admission by nurse ● Admission by doctor ● Evaluation by anaesthetist ● Pre-operative information given by physiotherapist (how to get out of bed after operation, etc) ● Shower and clean well twice in the evening (4 hours apart) ● Shaving and nail cleaning ● Thrombosis prophylaxis (LMW heparin) at 8 pm
Day of operation	● Premedication, to operating rooms at 7 am ● Return from OR in the afternoon ● Fluid: 1 Litre slowly during the night ● Pain relief and anti-emetics ● Heart rate, blood pressure and oxygen saturation checked at return, once in the evening and once at night (more if needed) ● Check surgical wound
Day 1 (day after operation)	● Blood samples: haemoglobin, leucocytes, CRP, creatinine ● Mobilization and breathing exercises with physiotherapist ● Urine catheter is taken out (when patient is out of bed) ● Fluids IV: 2 L of 10% Glucose (incl. 80Na, 40K) ● Drink and eat as wanted ● Fluid balance and heart rate + blood pressure twice
Day 2	● Continued fluid balance and blood pressure measurements
Day 3	● Blood samples: haemoglobin, leucocytes, CRP, creatinine ● Staircase exercises with physiotherapist ● Redressing of surgical wound ● Preparations for discharge; medication, sick leave, transportation to home, return visit
Day 4, 5 or 6	● Discharged when the patient wants to go home

12. Long-term Follow-up After Kidney Donation

The transplant co-ordinator phones the patient one week after discharge from the ward. This is to ask if the donor has had any problems.

A return visit is planned at about one month after kidney donation. It may be with the transplant surgeon or a transplant nephrologist at the transplant centre. At this visit the general condition of the donor, the healing of the operative wound and laboratory tests such as haemoglobin, creatinine and CRP are checked. Blood samples should be taken a few days before the visit so that the results are ready at the visit. At this visit the patient is referred back to the transplant nephrologist who performed the work up of the donor before the operation.

The patient should be called for a return visit to the nephrologist who performed the work up 6 months after kidney donation. At this visit a general check up is undertaken including body weight and blood pressure. Laboratory samples include calculated or measured GFR, P-creatinine, urine dipsticks, urinary albumin, P-glucose, B-haemoglobin, P-triglycerides, P-low-density lipoproteins (LDL), P-high-density lipoproteins (HDL).

The donor is advised to have yearly check ups at his/her nephrology department, checking general health, blood pressure and creatinine. One reason to do this is to treat possible hypertension; however, there is no clear evidence in the literature that the donor has an increased risk of hypertension. Therefore it is not obligatory, but a service to the donor.

The kidney donation and all check ups thereafter should be done at no cost to the donor.

13. Antibiotics and Kidney Transplantation

A. Prophylaxis

Prophylactic antibiotics after renal transplantation include cefuroxim 1.5 g as a single IV dose; or, if the patient has an allergy to penicillin, clindamycin 600 mg IV.

For prophylaxis during invasive urological procedures (cystoscopy, nephrostomy, insertion of double-J-catheter), give ciprofloxacin 500 mg as a single oral dose before the procedure.

Antibiotic prophylaxis for puncture of lymphoceles is not given routinely.

B. Treatment

Treatment of urinary tract infection:

Asymptomatic infection: diagnosed in recently transplanted recipients by routine urine culture; administer antibiotics according to culture results.

Symptomatic infection: give ciprofloxacin 250-500 mg BID until culture results become available (sensitivity).

Septic infection: give IV broad-spectrum antibiotics, e.g. piperacillin/tazobactam or ceftacidim. Change antibiotics according to results of culture (sensitivity).

14. Initial Immunosuppression After Kidney Transplantation

An Overview

	Normal risk (1)	Normal risk (2)	NODAT risk (3)	NODAT risk (4)	High risk (5)	High risk (6)
Induction	basiliximab	none	basiliximab	basiliximab	basiliximab	ATG
Tacrolimus trough	5 – 8	8 – 10	8 – 10	3 – 7	8 – 10	10 – 12
Tacrolimus start dose mg/kg BID	0.05	0.06	0.06	0.05	0.06	0.07
MMF g BID	1	1	1	1	1	1
Predni-solone mg/day	15 + 5	15 + 5	10 for 1 week, then 0	10	15 + 5	15 + 5
Protocol number below	1	2	3	4	5	6

Comments:

The standard protocol for a normal-risk patient is suggested to be basiliximab induction + low-dose tacrolimus (trough level 5-8 ng/mL), MMF 2 g/day and prednisolone, starting at 15 mg in the morning and 5 mg in the evening. The starting dose of tacrolimus is 0.05 mg/kg twice a day until trough levels are acheived.

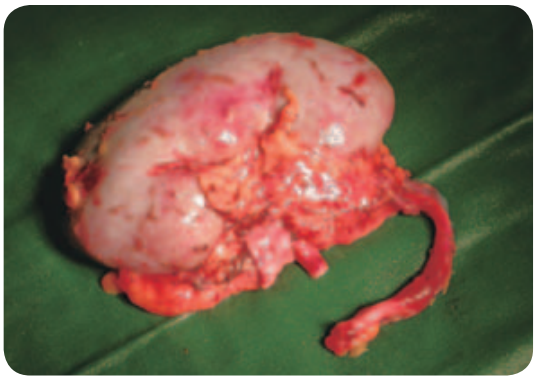
If basiliximab induction should be avoided (to reduce cost, for example) it is recommended that trough levels of tacrolimus be increased to between 8 – 10 ng/mL. If the kidney has a delayed graft function, a return to the normal risk (1) protocol is advisable. The risk for delayed function should, however, be minimal in LD transplants, since the cold ischemia time is very short and the kidney should be very good (coming from a healthy donor).

Patients who have an increased risk of diabetes after transplantation (NODAT) are elderly (>60 years old), obese, or have an OGTT with a blood glucose level at 2 hours of >7.0 mmol/L (=126 mg/dL). There are two suggested protocols for these patients: one with slightly higher levels of tacrolimus and no steroids, and the other using low-dose steroids and low-dose tacrolimus. Yet another alternative would be low-dose cyclosporine (50-100 ng/mL), MMF 2g per day, standard steroids and basiliximab induction.

High-risk patients may have a slightly elevated or a very high immunological risk. Therefore, there are two suggested protocols, with more intense immunosuppression in the second protocol, which includes ATG.

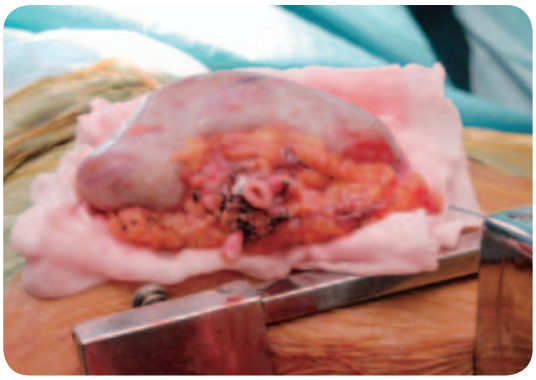
Initial Immunosuppression After Kidney Transplantation - 1. Normal-risk patient (with basiliximab induction)

Normal-risk patient 1st kidney transplant, PRA=0%, 0-1 DR mismatch, no cardiovascular disease, no diabetes or increased risk for diabetes	
Evening (8 pm) the day before transplantation	● Tacrolimus 0.05 mg/kg (e.g. 3.5 mg) ● MMF 1000 mg
Morning of the day of transplantation (6 am)	● Tacrolimus 0.05 mg/kg ● MMF 1000 mg
At the start of transplantation in the operating room	● Methylprednisolone 500mg IV ● Basiliximab 20 mg IV
In the evening (8 pm) of the day of transplantation	● Tacrolimus 0.05 mg/kg ● MMF 1000 mg ● Prednisolone 100 mg IV
Every day after transplantation (8 am and 8 pm) Days 1 – 30	● Tacrolimus 0.05 mg/kg x 2 (target concentration 5 - 8 ng/mL) ● MMF 1000 mg x 2 ● Prednisone 15 mg at 8 am and 5 mg at 8 pm ● Day 4: basiliximab 20 mg IV
Days 30-60	● Tacrolimus (target concentration 5 - 8 ng/mL) ● MMF 750 mg x 2 ● Prednisolone 15 mg at 8 am
Days 60-90	● Tacrolimus (target concentration 5 – 8 ng/mL) ● MMF 750 mg x 2 ● Prednisolone 10 mg at 8 am
Days 90 and after	● Tacrolimus (target concentration 5 – 8 ng/mL) ● MMF 750 mg x 2 (or azathioprine 75 – 100 mg x 1) ● Prednisolone 5 mg at 8 am



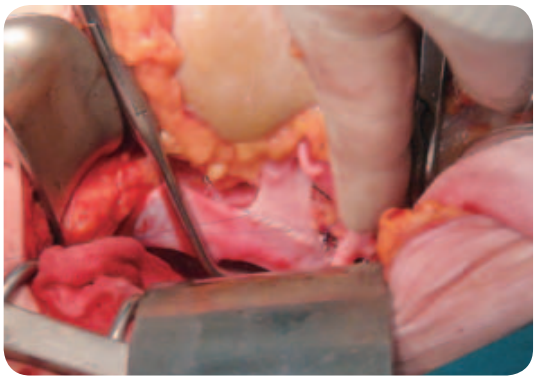
Initial Immunosuppression After Kidney Transplantation - 2. Normal-risk patient (with no induction)

Normal-risk patient 1st kidney transplant, PRA=0%, 0-1 DR mismatch, no cardiovascular disease, no diabetes or increased risk for diabetes	
Evening (8 pm) the day before transplantation	● Tacrolimus 0.06 mg/kg (e.g. 4 mg) ● MMF 1000 mg
Morning of the day of transplantation (6 am)	● Tacrolimus 0.06 mg/kg ● MMF 1000 mg
At the start of transplantation in the operating room	● Methylprednisolone 500mg IV
In the evening (8 pm) of the day of transplantation	● Tacrolimus 0.06 mg/kg ● MMF 1000 mg ● Prednisolone 100 mg IV
Every day after transplantation (8 am and 8 pm) Days 1 – 30	● Tacrolimus 0.06 mg/kg x 2 (target concentration 8 - 10 ng/mL) ● MMF 1000 mg x 2 ● Prednisone 15 mg at 8 am and 5 mg at 8 pm
Days 30-60	● Tacrolimus (target concentration 8 – 10 ng/mL) ● MMF 750 mg x 2 ● Prednisolone 15 mg at 8 am
Days 60-90	● Tacrolimus (target concentration 5 – 8 ng/mL) ● MMF 750 mg x 2 ● Prednisolone 10 mg at 8 am
Days 90 and after	● Tacrolimus (target concentration 5 – 8 ng/mL) ● MMF 750 mg x 2 (or azathioprine 75 – 100 mg x 1) ● Prednisolone 5 mg at 8 am



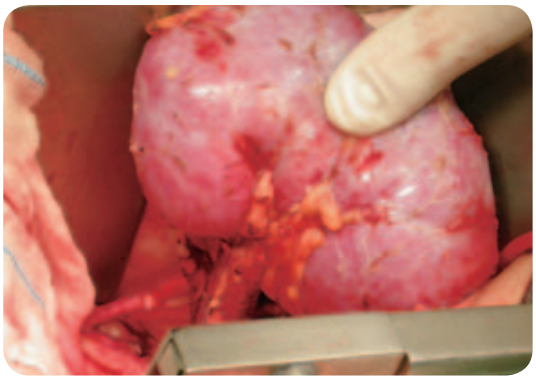
Initial Immunosuppression After Kidney Transplantation – 3. NODAT risk (steroid avoidance)

Patient with risk for CVD or Diabetes Patient with cardiovascular disease, diabetes or increased risk for diabetes. 1st transplant and PRA = 0%, and 0-1 DR mismatch	
Evening (8 pm) the day before transplantation	● Tacrolimus 0.06 mg/kg (e.g. 4 mg) ● MMF 1000 mg
Morning of the day of transplantation (6 am)	● Tacrolimus 0.06 mg/kg ● MMF 1000 mg
At the start of transplantation in the operating room	● Methylprednisolone 500mg IV ● Basiliximab 20 mg IV
In the evening (8 pm) of the day of transplantation	● Tacrolimus 0.06 mg/kg ● MMF 1000 mg ● Prednisolone 100 mg IV
Every day after transplantation (8 am and 8 pm) Days 1 – 30	● Tacrolimus 0.06 mg/kg x 2 (target concentration 8 - 10 ng/mL) ● MMF 1000 mg x 2 ● Day 4: basiliximab 20 mg IV ● Prednisolone 10 mg at 8 am for 7 days, then no steroids
Days 30-60	● Tacrolimus (target concentration 8 - 10 ng/mL) ● MMF 1000 mg x 2
Days 60-90	● Tacrolimus (target concentration 5 – 10 ng/mL) ● MMF 750 mg x 2
Days 90 and after	● Tacrolimus (target concentration 5 – 8 ng/mL) ● MMF 750 mg x 2 (or azathioprine 75 - 100 mg x 1)



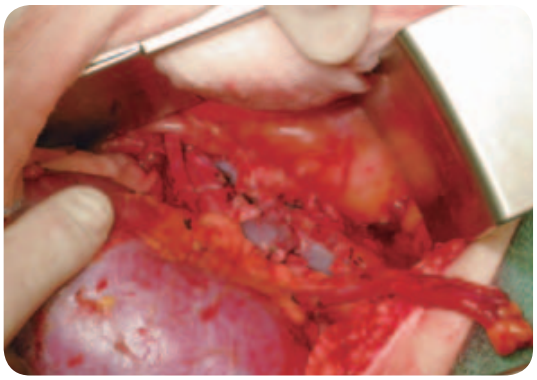
Initial Immunosuppression After Kidney Transplantation – 4. NODAT risk (low-dose steroids)

Patient with risk for CVD or Diabetes Patient with cardiovascular disease, diabetes or increased risk for diabetes. 1st transplant and PRA = 0%, and 0-1 DR mismatch	
Evening (8 pm) the day before transplantation	● Tacrolimus 0.05 mg/kg (e.g. 3 mg) ● MMF 1000 mg
Morning of the day of transplantation (6 am)	● Tacrolimus 0.05 mg/kg ● MMF 1000 mg
At the start of transplantation in the operating room	● Methylprednisolone 500mg IV ● Basiliximab 20 mg IV
In the evening (8 pm) of the day of transplantation	● Tacrolimus 0.05 mg/kg ● MMF 1000 mg ● Prednisolone 100 mg IV
Every day after transplantation (8 am and 8 pm) Days 1 – 30	● Tacrolimus 0.05 mg/kg x 2 (target concentration 3 - 7 ng/mL) ● MMF 1000 mg x 2 ● Day 4: basiliximab 20 mg IV ● Prednisolone 10 mg/day
Days 30-60	● Tacrolimus (target concentration 3 - 7 ng/mL) ● MMF 1000 mg x 2 ● Prednisolone 5 mg/day
Days 60-90	● Tacrolimus (target concentration 3 - 7 ng/mL) ● MMF 750 mg x 2 ● Prednisolone 5 mg/day
Days 90 and after	● Tacrolimus (target concentration 3 - 7 ng/mL) ● MMF 750 mg x 2 (or azathioprine 75 - 100 mg x 1) ● Prednisolone 5 mg/day



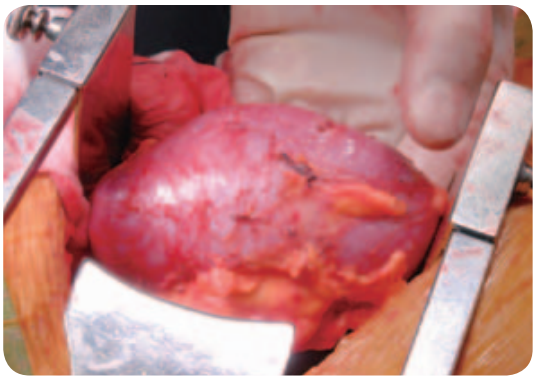
Initial Immunosuppression After Kidney Transplantation – 5. High risk (with basiliximab induction)

High risk patient 2nd kidney transplant, or PRA > 0%, or 2 DR mismatch	
Evening (8 pm) the day before transplantation	● Tacrolimus 0.06 mg/kg (e.g. 4 mg) ● MMF 1000 mg
Morning of the day of transplantation (6 am)	● Tacrolimus 0.06 mg/kg ● MMF 1000 mg
At the start of transplantation in the operating room	● Methylprednisolone 500mg IV ● Basiliximab 20 mg IV
In the evening (8 pm) of the day of transplantation	● Tacrolimus 0.06 mg/kg ● MMF 1000 mg ● Prednisolone 100 mg IV
Every day after transplantation (8 am and 8 pm) Days 1 – 30	● Tacrolimus 0.06 mg/kg x 2 (target concentration 8 - 10 ng/mL) ● MMF 1000 mg x 2 ● Prednisone 15 mg at 8 am and 5 mg at 8 pm ● Day 4: Basiliximab 20 mg IV
Days 30-60	● Tacrolimus (target concentration 8 – 10 ng/mL) ● MMF 1000 mg x 2 ● Prednisolone 15 mg
Days 60-90	● Tacrolimus (target concentration 5 – 10 ng/mL) ● MMF 750 mg x 2 ● Prednisolone 10 mg
Days 90 and after	● Tacrolimus (target concentration 5 – 8 ng/mL) ● MMF 750 mg x 2 (or azathioprine 75 - 100 mg x 1) ● Prednisolone 5 mg



Initial Immunosuppression After Kidney Transplantation – 6. High risk (with ATG induction)

High risk patient 2nd kidney transplant, or PRA > 50%, or 2 DR mismatch. Consider pre-operative plasmapheresis.	
Evening (8 pm) the day before transplantation	● Tacrolimus 0.07 mg/kg (e.g. 5 mg) ● MMF 1000 mg
Morning of the day of transplantation (6 am)	● Tacrolimus 0.07 mg/kg ● MMF 1000 mg
At the start of transplantation in the operating room	● Methylprednisolone 500mg IV ● ATG 2 mg/kg IV (maximum 150 mg)
In the evening (8 pm) of the day of transplantation	● Tacrolimus 0.07 mg/kg ● MMF 1000 mg ● Prednisolone 100 mg IV
Every day after transplantation (8 am and 8 pm) Days 1 – 30	● Tacrolimus 0.07 mg/kg x 2 (target concentration 10 - 12 ng/mL) ● MMF 1000 mg x 2 ● Prednisone 15 mg at 8 am and 5 mg at 8 pm ● Day 1: ATG 1.5 mg/kg IV (maximum 150 mg)
Days 30-60	● Tacrolimus (target concentration 8 – 10 ng/mL) ● MMF 1000 mg x 2 ● Prednisolone 15 mg
Days 60-90	● Tacrolimus (target concentration 5 – 10 ng/mL) ● MMF 750 mg x 2 ● Prednisolone 10 mg
Days 90 and after	● Tacrolimus (target concentration 5 – 8 ng/mL) ● MMF 750 mg x 2 (or azathioprine 75 - 100 mg x 1) ● Prednisolone 5 mg



15. Transplant Biopsy

Indication

The responsible nephrologist or transplant surgeon makes the decision about indication for transplant biopsy. This should be done when there are clinical signs of acute rejection or chronic deterioration of graft function. The parameter that most commonly indicates a change in graft function is serum creatinine. A slight increase in serum creatinine, that is clinically relevant and has no other obvious cause, should be enough to indicate a need for a biopsy.

Contraindications against transplant biopsy include increased risk of bleeding, such as warfarin treatment or thrombocytopenia.

Referrals to the ultrasound department and the histopathology department are written.

Biopsies (one or two) are taken with ultrasound guidance to avoid bleeding. One biopsy is put in formalin (for hematoxiline-eosine staining) and the other one in a wet cloth (for immunological staining such as for BK virus or C4d).

The patient is brought back to the transplant ward in a wheelchair and ordered to rest for 4 hours, either in the chair or in bed. The patient should produce urine without haematuria before he/she is allowed to move normally.

Results

The results of the biopsy should be received from the histopathologist in the afternoon of the same day (the biopsy should be taken before lunch time). A decision about anti-rejection treatment (methylprednisolone 500 mg IV daily for 3 days) should be made and the patient informed.

The doctor who is responsible for the patient should examine the ultrasound result by visiting the ultrasound department and the biopsy result by visiting the histology department before making his/her decision.

16. Treatment of Acute Rejection

Biopsy result: Acute rejection, borderline or Banff grades I – II with elevated s-creatinine

- Methylprednisolone 500 mg IV immediately and the same dose on the following two (2) days.

S-creatinine is not reduced within 5 days or continues to increase despite treatment with methylprednisolone

- ATG for 7 days

Biopsy result: acute rejection Banff grade III or serious clinical signs such as oliguria or anuria

- ATG for 7 days

Late acute rejection or BK virus nephropathy

Suspected acute rejection more than 3 months after transplantation – always take blood PCR for BK virus. If the biopsy shows suspicion of BK virus nephropathy, consider waiting for the PCR result before making a decision on treatment. If PCR BK virus is positive, do not give anti-rejection treatment, but reduce immunosuppression by 50% (both tacrolimus and MMF doses).

ATG

The patient should be in the intensive care unit during administration and for a couple of hours after because of the risk for cytokine release syndrome and other side effects.

ATG should be prepared according to the manufacturer's instructions, then diluted with normal saline or glucose.

The dose for treatment of acute rejection is 1.25 – 2.5 mg/kg per day for 7 days (maximum 150 mg/day). Use the entire ampoule with doses of 50, 75, 100, 125 or 150 mg.

One half hour (30 minutes) before the dose of ATG, give methylprednisolone 250 mg IV and clemastine 2 mg IV or orally, in order to reduce side effects.

ATG should be given IV through a central venous catheter for 4-6 hours total infusion time.

The patient should be connected to cardiac surveillance. Blood pressure, heart rate and body temperature are measured at the start of treatment, and then again every 15 minutes for the first hour, and every 30 minutes thereafter.

Possible side effects include anaphylaxia, serum sickness, fever, tremor, joint pain, thrombocytopenia, leucocytopenia. If necessary, ATG infusion may be stopped and adequate treatment of side effects given.

17. Long-term Follow-up After Kidney Transplantation

The following are suggestions on timing and frequency of clinical and laboratory examinations after kidney transplantation in patients with an uneventful course:

Time after transplantation	Clinical exams	Labs
0 – 1 month	2-3 times every week	2-3 times every week
1 – 3 months	Every 2 weeks	Every week
3 – 6 months	Every month	Every 2 weeks
6 – 12 months	Every 2 months	Every month
Thereafter	Every 3 months	Every 6 weeks

We suggest the following laboratory tests be included:

Basic labs	Desired labs
Creatinine	All those listed as basic, plus:
Estimated GFR	Fasting blood glucose
Potassium	Electrolytes
Blood glucose	Calcium
Haemoglobin	Phosphorous
White blood cell count	Magnesium
Urinalysis	Liver function tests
Therapeutic drug level monitoring of immunosuppressive medications (tacrolimus or cyclosporine)	Blood lipid profile
	Quantification of urinary protein (if any)
	Measured GFR
	Serum PCR of BK virus

18. Responsibilities of Surgeon and Nephrologist at the Transplant Centre

Suggestions as a basis for discussion

"Surgeon" in the table below is a surgeon who has transplant surgery experience or who would like to train in the field of transplantation and take on the responsibilities of the transplant surgeon at the centre.

"Nephrologist" in the table below is a nephrologist who has transplant nephrology experience or who would like to train in the field of transplantation and take on the responsibilities of the transplant nephrologist at the centre.

Procedures	Responsibilities
Identify potential living donor couples, i.e. the patient with kidney disease and a living donor	Nephrologist
Work up of recipient: protocol no. 1	Nephrologist
Work up of living donor: protocol no. 2	Nephrologist
Decision to operate on the recipient	Surgeon / Cardiologist risk assessment and Transplant Board
Decision to operate on the donor	Surgeon / Cardiologist risk assessment and Transplant Board
Admission of the recipient to the transplant ward: protocol no. 4, no. 6 and no. 14	Nephrologist
Admission of the donor to the transplant ward	Surgeon
Living donor nephrectomy	Surgeon / Anaesthetist
Kidney transplantation: protocol no. 7	Surgeon / Anaesthetist
Post-operative care of donor, first 24 hours and a week in the ward: protocol no. 11	Surgeon / Nephrologist *
Post-operative care of recipient, first 24 hours: protocol no. 8	Surgeon / Nephrologist *
Post-operative care of recipient, a week in the ward: protocols no. 8, 9, 10, 13 and 14	Nephrologist / Surgeon **
Check-up of donor in out-patient clinic at 1 month: protocol no. 12	Nephrologist / Surgeon **

Check-up of recipient in out-patient clinic in the long term: protocol no. 14 and 17	Nephrologist
Diagnosis and treatment of recipient in case of acute rejection, complications, infections, hospitalisation in the transplant ward: protocols no. 14, 15 and 16	Nephrologist / Surgeon **

* Primary responsibility of the surgeon, assisted by the nephrologist.
** Primary responsibility of the nephrologist, assisted by the surgeon.

19. The Gift of a Kidney – Information for the Potential Donor

This brochure will give you information about what it means to donate a kidney. You probably have someone in your family who has a kidney disease, and that is why you have received this brochure.

How do the kidneys function?

The most important functions of the kidneys are to rid the body of toxic products, to regulate water and salt balance, and to regulate blood pressure.

There are many causes of kidney disease. Sometimes the kidney disease will lead to uraemia (chronic kidney insufficiency).

What are the alternatives of treatment for uraemia?

There are 3 alternative treatments for uraemia:

1. Haemodialysis. During haemodialysis, the blood is cleaned with the help of a dialysis machine (artificial kidney). The treatment is given in the hospital 3 times per week, for 4-5 hours each time. The patient needs to have a fistula of blood vessels.

2. Peritoneal dialysis. During peritoneal dialysis, a solution is put into the abdomen through a thin tube. Inside the body the solution collects salt and toxic products that should normally go out with the urine. The solution should be changed 4 times per day and the treatment can be given at home. The patient needs to have a thin tube into the belly.

3. Kidney transplantation. This may be done if there is a donor who can donate one of his or her kidneys.

Kidney transplantation is performed at the transplant centre of the hospital.

If a kidney is donated from a family member, the operation can be planned ahead of time so that it suits both the donor and the recipient. This is a valuable advantage for the patient with kidney disease. One can also expect the procedure to have very good results, both in the short and the long term.

What does it mean to donate a kidney?

It is very important that the person who is going to donate his or her kidney does this based on his or her own decision and free will. This is a gift, and it is prohibited by law to pay for the donation. It is also very important that the donor has received and understood the information

about what a kidney donation is and what kidney transplantation means.

Can I donate a kidney without any risk?

Normally, we all have two well-functioning kidneys. This means that we have a large reserve capacity. A person can live quite normally with only one kidney.

Follow-up studies on people who have donated a kidney have shown that there is no increased risk for disease or death in the long term after kidney donation.

The risk of a complication immediately after the operation is very small. In large international studies it is reported to be one death in 3000 cases. This may be compared with going to work by car or going somewhere in an airplane.

What are the advantages of receiving a kidney from a living donor?

- The operation can be planned ahead of time and the waiting time is short.
- Sometimes the operation can be planned so that there is no need for dialysis before transplantation.
- By definition, it is certain that the patient receives a healthy kidney because the donor has been very well examined and is definitely healthy.
- There is a great chance that the kidney will function well for a long time into the future.

Who can be a kidney donor?

The donor must in essence be healthy. This is ascertained by careful medical investigation. Older age does not need to be a problem; the health status is the most important.

The most common situation is that a mother or father, a brother or sister, or a husband or wife will donate a kidney. The decision to donate must be made by the donor, without any pressure from the recipient, other family members or from the hospital.

How are the examinations of the potential donor performed?

The doctor who is taking care of the donor is usually not the same doctor as the one taking care of the recipient. This is because every patient should have a doctor specifically looking after his or her interests.

When it is known that the blood groups of the donor and recipient are compatible (although some hospitals also do incompatible blood group transplantations), the donor visits the out-patient clinic of the hospital.

At this visit, the donor has the chance to ask questions and discuss with the doctor about kidney donation and transplantation. Before deciding to donate a kidney to a family member, there are many aspects that need to be discussed.

Then a series of examinations are performed, such as blood tests and X-rays. This is to make certain that the donor is quite healthy and has two well-functioning kidneys. All this may take some time.

It is possible for the donor to change his or her mind up until the day of the operation.

Does it cost money to donate a kidney?

Basically, the donor should not receive any money for the donation and he or she should also not pay any money for the procedure.

Where do I go if I am considering donating a kidney to my family member?

The best option would be to talk to Dr X in the Department of Nephrology at the <<name of hospital>> (tele: xxx xxx xxx).

20. Further Reading

Recommendations for the outpatient surveillance of renal transplant recipients. American Society of Transplantation. Kasiske B, Vazquez M, Harmon W, Brown R, et al. J Am Soc Nephrol 2000; 11 (Suppl 15): S1-86.

European best practice guidelines for renal transplantation (Part 1). Berthoux F, Abramowicz D, Bradley B, Ekberg H, et al. Nephrology Dialysis Transplantation 2000; 15 (Suppl 7): S1-85.

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Caring for Australians with Renal Impairment (CARI). The CARI guidelines. CMV disease and kidney transplant: treatment of cytomegalovirus disease in renal transplant recipients. Nephrology 2004; 9 (Suppl 3): S37-40.

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Guidelines for the prevention and management of infectious complications of solid organ transplantation. Am J Transplant 2004; 4 (Suppl 10): S5-166.

A report of the Lisbon Conference on the care of the kidney transplant recipient. Abbud-Filho M, Adams P, Alberú J, Cardella C, et al Transplantation 2007; 83 (8 Suppl): S1-22.

Kidney Disease: Improving Global Outcomes (KDIGO) Transplant Work Group. KDIGO clinical practice guideline for the care of kidney transplant recipients. American Journal of Transplantation 2009; 9 (Suppl 3): S1–S157 (available at www.tts.org).

The photographer in the operating theatres during the living donor kidney transplantation was Mr Jimmy Wahlstedt. The photo of the kidney on page 38 was taken by Dr. Zhongquan Qi, and the photos of the flowers, representing the donor and the recipient, were taken by Dr. Henrik Ekberg.

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