

## SECTION II: Evaluation and selection of donors

### II.1 Cadaveric heart-beating donors

#### Guidelines

#### II.1.1 Selection of donors

**A. Any comatose patient with irreversible cerebral damage who appears likely to progress to brain death prior to terminal circulatory failure must be considered as a potential donor, regardless of age.**  
(*Evidence level C*)

**B. Physicians caring for the potential donors should be encouraged to make early contact with the organ procurement team for assistance in the further management of the donor and the donor's family.**  
(*Evidence level C*)

**C. Absolute contra-indications against organ donation are based on risk of disease transmission and include a history of cancer other than non-invasive tumours, HIV-positive serology, acute hepatitis, tuberculosis, severe untreated systemic sepsis and viral infection. Persons who have been engaged in activities with a high risk of HIV infection should not be considered as organ donors.**  
(*Evidence level B*)

**D. Relative contra-indications against organ donation are based on the quality of the potential graft and include suboptimal to non-acceptable renal function or presence of risk factors. It is recommended that each procurement centre formulates its standards and follow up on the effects of their implementation.**  
(*Evidence level C*)

**E. The aim of the procurement team should be to increase the acceptance rate of potential donors without risking unacceptably poor graft function and survival.**  
(*Evidence level C*)

**F. At this time and in the absence of a 'gold standard' it is recommended that donors be evaluated on the basis of renal function (calculated creatinine clearance, CrCl), age and vascular disease. Limits may be set as CrCl > 60 ml/min as acceptable, 50–60 ml/min as marginal and < 50 ml/min as non-acceptable for single kidney transplantation. Non-acceptable kidneys may be considered for dual transplantation. High donor age (70+) and vascular risk factors such as long-term history of hypertension, severe vascular disease, long-term diabetes or proteinuria, or findings of vascular changes or extens-**

**ive glomerular sclerosis on procurement biopsy may add negatively to the evaluation.**  
(*Evidence level B*)

**G. Recipients of sub-optimal kidneys or dual kidneys should have given their informed consent prior to transplantation**  
(*Evidence level C*)

#### Commentary on Guideline II.1.1: Selection of donors

##### *Contra-indications*

The ideal kidney donor is a previously healthy individual aged 10–55 years, brain dead due to trauma or intracerebral bleeding, with no ongoing infection and with excellent organ function. However, the majority of potential donors do not belong to this category. Increasing age, previous medical history and current medical state of the donor all raise a number of considerations that might contra-indicate donation. It is not uncommon for the transplant centre to accept only 50–75% of the offers of organ donation made by the units caring for the potential donors. There are several absolute and relative contra-indications to donation, the former to avoid transferring intercurrent disease to the recipient and the latter to prevent less than optimal function of the transplanted organ.

*Absolute contra-indications* include previous or current history of cancer except non-invasive brain tumours, non-melanotic non-metastasizing skin tumours and *in situ* cervical cancer. HIV-positive serology or a history of activities with high risk for HIV infection are contra-indications; also uncontrolled or untreated septicaemia or septicaemia of unknown origin. Hepatitis B-positive antigenaemia is a contra-indication for hepatitis B-negative recipients where negativity is defined as HBsAg negative or hepatitis B antibody-negative. However, hepatitis B-positive antigenaemia is not a contra-indication for HBsAg-positive recipients.

*Relative contra-indications* may include very elderly donor (>70 years of age), severe vascular disease, long-term insulin-dependent diabetes mellitus (IDDM), hypertension, or other conditions that may have impaired renal function. However, there is no consensus on these limitations between centres or clinicians. In severe cases such as long-standing IDDM, malignant hypertension, or renal and systemic disease such as amyloidosis, the contra-indication is not con-

troversial. It is noteworthy that a potential donor may be excluded from kidney donation but may remain an optimal liver donor.

The lack of kidney donors implies a need for the limits of the relative contra-indications to be widened, to accept kidneys with less than optimal function. In general, the aim of renal transplantation is long-term graft survival for 10–20 years. If the acceptance criteria are widened to include older donors or those with vascular disease, reduced renal function or glomerulosclerosis in a zero biopsy, the prognosis after transplantation may be more limited. These marginal kidney grafts should not be given to young recipients but preferably to elderly patients with a limited life-expectancy who express a preference and provide informed consent for a suboptimal donor kidney as an alternative to prolonged dialysis.

#### *Social history*

The donor must not be in a high-risk group for HIV infection. This group includes intravenous drug users and those who engage in unsafe sexual activities. A history of heavy smoking could contra-indicate donation of the heart and lungs, and would also increase the risk of atherosclerosis with impaired renal function. A history of alcohol abuse has less impact on kidneys, heart and lungs but is of great importance when considering donation of liver or pancreas.

#### *Medical history*

It is mandatory to rule out previous history of *cancer* in a potential donor. Any malignancy (except those of extremely low risk of metastasis, such as skin cancer) contra-indicates donation even though the potential donor may have been considered healthy for several years and the risk of metastases to the kidney may be extremely low. This is because the recipient is immunosuppressed and is therefore more likely to develop recurrence of the malignancy. With intra-cranial tumours it is vital to know the exact diagnosis, since those that are confined to the brain do not constitute an absolute contra-indication, unlike those that might have metastasized (Table II.1).

In most European countries, age of donor has slowly increased over recent years, as has the proportion of donors with intra-cranial bleeding as the cause of death. Cause of death (cerebral vascular disease or trauma) and ongoing medication are key questions. The most important intercurrent disease in the donor is severe *vascular disease*, with a possible reduction of renal function as a consequence of atherosclerosis and nephrosclerosis.

Cardiovascular disease, such as a previous myocardial infarction, coronary by-pass operation or angina are important factors. History of hypertension and its treatment, number of years on treatment, number and kind of medication, and success of treatment should be noted. In addition, any pathological changes associated with hypertension or vascular disease, such as

presence of retinal capillary changes, left ventricular hypertrophy on the electrocardiogram and proteinuria, should be investigated.

The final series of events leading to death of the potential donor may have induced renal (and liver) damage. Factors such as length of intensive care, stability of blood pressure, resuscitation, signs of infection and antibiotic treatment or prophylaxis should all be noted. Current and, if possible, historical laboratory values of renal and liver function should be evaluated.

#### *Renal function*

The potential donor's history of plasma creatinine (SCr) and the level at admission indicate the baseline donor renal function. The acute medical situation of hypotension caused by dilatation of the vascular bed as a consequence of brain death may have led to a deterioration in donor renal function. Following admission, the serum creatinine level usually increases and it is important to verify a shift towards normalization after intravenous fluid compensation. Normal or high urine production is early evidence of adequate compensation.

SCr varies with muscular mass as well as with renal function. There is no 'gold standard' test for the evaluation of donor renal function, but CrCl calculated according to the Cockcroft–Gault formula [1] is often used. It is a better estimate of glomerular filtration rate than SCr alone, particularly in elderly and critically ill patients [2]. In a report from Barcelona [3], elderly donors aged 60–87 years were accepted whenever CrCl, calculated from the best admittance SCr,  $\geq 60$  ml/min, 24-h urine proteinuria was  $< 0.5$  g, and renal size and morphology were normal on ultrasound. No biopsies were evaluated. Graft survival at 5 years post-transplantation was similar compared to when donor age was  $< 60$  years (81 vs 85%), but the mean SCr was significantly higher (205 vs 133  $\mu\text{mol/l}$ ).

A low CrCl, in the range 50–60 ml/min, would indicate a suboptimal donor with prognosis of an inferior graft function. Donor kidneys with functional levels below this range should not be used or should be transplanted as a pair in the same recipient with the objective of reaching acceptable results. Dual transplantation of kidneys is a novel procedure used to increase the transplanted nephron mass. The Stanford group [4] have suggested that the two kidneys from donors aged 60 years or more with calculated CrCl  $< 90$  ml/min should be used for dual kidney transplants. With these standards, their objective is to achieve similar results with expanded donor criteria as those achieved with single renal transplants. However, the use of double kidney transplantation halves the number of potential transplants, and in view of the shortage of donors, some centres prefer the use of single kidneys from older donors.

The use of a procurement renal biopsy to exclude a potential donor is controversial. In a large sample of 200 donors there was no overall correlation between histological findings (i.e. glomerulosclerosis or vascular

changes) and prognosis after transplantation [5]. In another study using a small cohort of eight patients [6] with >20% of the kidney affected by glomerulosclerosis, a high risk of delayed onset of function and early loss of the graft was observed.

In a recent Canadian study [7], the clinical outcome of 57 kidney transplants from 34 donors over 60 years of age, with hypertension and/or vascular disease, was compared with 57 historical recipients of low-risk donor kidneys. Graft survival at 1 year was similar (87 vs 85%) but the proportion of patients with SCr >200  $\mu\text{mol/l}$  at 1 year was 46 vs 16%, respectively. A combination of CrCl <100 ml/min and a high vessel score in the procurement biopsy evidenced by severe arteriolar narrowing or arterial sclerosis, was predictive of a poorer prognosis. At 1 year, all such patients had SCr >200  $\mu\text{mol/l}$ . The authors therefore suggest that in all high-risk older donors, a CrCl should be calculated and a biopsy taken. If CrCl is >100 ml/min and biopsy changes are minor, conventional renal transplantation should be performed. Donors with CrCl <100 ml/min and >20% glomerulosclerosis or severe vascular changes may be considered for dual transplantation. In contrast to these recommendations, donors with CrCl 50–100 ml/min are at many centres accepted for single kidney transplantation with excellent results, independent of histology.

When the potential donor is younger than 50 years, with a normal SCr at admission, no history of vascular disease or current episode of hypotension, it is seldom needed to calculate CrCl or take a biopsy. In elderly or marginal donors, however, careful evaluation of renal function, possibly including a procurement biopsy, is important. This may be used to determine non-acceptance of the donor or to indicate the possibility of using dual kidney transplantation.

#### *Donor age*

Is donor age *per se* a criterion for determining acceptance of a potential donor? Renal function decreases with increasing age. It is therefore not surprising that donor age is one of the strongest factors affecting outcome after renal transplantation [5,8,9]. In the elderly, a major decrease in glomerular filtration rate is uncommon in the absence of disease [10] but the variation is great. Living donor renal transplantation with highly selected older donors aged over 70 years is quite successful. It is therefore difficult to set an absolute age limit without the risk of losing some grafts with good potential.

Nevertheless, donor age is still a widely used criterion. Donors over the age of 60 years are rarely accepted in the United States. With the adoption of expanded criteria, the proportion of donors over 50 years has increased from 12% in 1988 to 25% in 1995. However, the percentage of donors over the age of 60 years has increased to a lesser degree, from 5% in 1991 to only 8% in 1996 [11,12]. In the Scandinavian countries, the median donor age is approaching 60 years and occasionally donors over the age of 70 are

accepted. In The Netherlands, donors up to the age of 75 years are acceptable. Within Eurotransplant, donors over the age of 65 may be accepted but the kidneys are generally used locally and not shared.

When evaluating elderly potential donors, especially those aged over 70, it is important that risk factors other than age are absent or minimal. These may include history of severe vascular disease, long-term hypertension or diabetes, findings of retinal vascular changes or proteinuria, and episodes of hypotension or oliguria during the stay in the intensive care unit (ICU). If the elderly donor kidney is considered suitable for transplantation, it is of consequence that the cold ischaemia time is reduced to a minimum.

#### *Eliminating the risk of infection*

The potential donor should be tested for HIV, HTLV1, hepatitis B and C, and cytomegalovirus (CMV). During the incubation period before the development of antibodies, these tests may give false negative results. Furthermore, many donors are given large volumes of 'safe' blood as part of the resuscitation process and subsequent serology may then be ambiguous or even negative due to dilution of the donor's blood [13]. In the past, HIV has been transmitted from an infected blood donor via a multi-organ donor to several transplant recipients. These are problems that should be considered carefully in connection with a social history of unsafe sexual activities or drug abuse, and if infection in the preceding 2 months cannot be ruled out, the donor organs should not be used. Tests for hepatitis may give false negative results throughout the incubation period of up to 6 months. Hepatitis B-positive donors may be accepted for transplantation to seropositive recipients. Hepatitis C-positive donors may be accepted for seropositive recipients if the PCR for HCV is also positive [14].

The donor should also be tested for CMV serology. The high probability of transferring CMV *de novo* or inducing CMV recurrence has led to the selection of recipients with CMV compatibility, if possible. With recent improvements in CMV prophylaxis, the importance of CMV compatibility has been reduced. Epstein-Barr virus (EBV) is also tested for since there is a substantial risk of a lymphoproliferative disorder following a primary infection. However, EBV-negative adult recipients are quite rare [15].

Bacterial infections are commonly seen during long periods in the ICU. Appropriate antibiotic treatment should ideally be given before organ retrieval, and then subsequently to the recipient for 3–5 days. This was the practice undertaken in a recent retrospective multicentre study [16] of 212 recipients of organs from 95 bacteraemic donors. There were no cases of transmission of pathogens or possible pathogens, no primary non-function, and a similar patient and graft survival rate when compared with transplants from non-bacteraemic donors. This study does not justify the use of donors with profound systemic signs of sepsis, since these donors would not have been accepted and

were therefore not included in the study. However, the results do suggest that potential donors with positive blood cultures may be acceptable. Finally, there is a need for extra caution in cases of positive *Pseudomonas* cultures because of an increased risk of rupture of arterial anastomoses associated with this micro-organism [17].

#### *Eliminating the risk of cancer*

A cancer may be transmitted to a recipient from a donor who has had a malignancy in the past. It may also be transmitted if a malignancy is found during the retrieval operation or when intracranial malignancy is the cause of death.

Careful attention must first be paid to the donor history. Donation is contra-indicated with a past treatment for a diagnosed malignancy.

A recent history of symptoms that might be related to an undiagnosed malignancy should be questioned. Menstrual irregularities following pregnancy or abortion in a female of child-bearing age could indicate a metastatic choriocarcinoma. If suspected, a highly positive pregnancy test would support the diagnosis.

During organ retrieval the surgeon should carefully examine the intra-abdominal and intra-thoracic cavities to exclude neoplastic disease. If a suspicious nodule is found, a biopsy and histopathological examination should be performed before any organs may be transplanted.

If the cause of death is a brain tumour or a suspected brain malignancy without histopathological diagnosis, an autopsy should be performed after the retrieval operation and before transplantation of any of the organs. If it is not possible to determine the histopathological diagnosis, the potential donor should be excluded from donation.

Autopsy should always be encouraged following organ retrieval to account for unsuspected diagnoses of malignancy. In the rare case when an unforeseen malignancy is found, transplantectomy is indicated if at all possible (such as in the renal transplant patients).

The Council of Europe has recently published an international consensus on the prevention of neoplastic disease in transplantation. In this document [18], primary brain tumours were classified according to acceptability for organ donation as shown in Table II.1.

#### *Selection criteria*

In summary, a cadaveric donor may be accepted for kidney donation if the following criteria are met:

- *Absence of cancer* other than primary non-invasive brain tumours, non-melanotic non-metastasizing skin tumours and cancer *in situ* of the uterine cervix.
- *Absence of infections* such as HIV, acute hepatitis, tuberculosis, severe untreated systemic sepsis and viral infection. Donors must not have been engaged in activities with a high risk of HIV infection.

**Table II.1.** Brain tumors and organ donation

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#### *Tumours that do not exclude the donor from organ donation*

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Benign meningiomas  
 Pituitary adenomas  
 Acoustic schwannomas  
 Craniopharyngiomas  
 Piloicytic astrocytomas (astrocytomas grade I)  
 Epidermoid cysts  
 Colloid cysts of the third ventricle  
 Choroid-plexus papillomas  
 Haemangioblastomas (not associated with von Hippel-Lindau syndrome)  
 Ganglionic cell tumours (gangliomas, gangliocytomas)  
 Pineocytomas  
 Low-grade oligodendrogliomas (Schmidt A and B)  
 Ependymomas  
 Well differentiated teratomas

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#### *Tumours where the donor can be considered for organ donation depending on characteristics*

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Low-grade astrocytoma (grade II)  
 Gliomatosis cerebri

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#### *Tumours where the donor should not be considered for organ donation*

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Anaplastic astrocytoma (grade III)  
 Glioblastoma multiforme  
 Medulloblastoma  
 Anaplastic oligodendroglioma (Schmidt C and D)  
 Malignant ependymomas  
 Pineoblastomas  
 Anaplastic and malignant meningiomas  
 Intracranial sarcomas  
 Germ-cell tumours (except well differentiated teratomas)  
 Chordomas  
 Primary cerebral lymphomas

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- *Absence of renal disease* or impaired renal function (calculated creatinine clearance > 60 ml/min and no or minimal proteinuria).
- *Donor age below 70 years.*

#### *Expanded selection criteria*

Selection criteria for acceptance of donors may be expanded to include marginal or suboptimal donors as suggested below. However, at present, there is not enough support in the literature for firm recommendations. Centres are advised to define their standards and perform quality control to evaluate their implementation. Suboptimal but acceptable donor criteria may include:

- Donor age > 70 years, with presence of minimal or no other risk factors other than age.
- Donor age > 60 years, and few or moderate risk factors of impaired renal function including history of severe vascular disease, long-term hypertension or diabetes mellitus, or findings of proteinuria or retinal vascular changes.

- Several indicators of impaired renal function, irrespective of age.
- Donor calculated creatinine clearance of 50–60 ml/min may be considered suboptimal but still suitable for single kidney transplantation. Further impaired donor renal function (<50 ml/min) may imply dual transplantation or non-acceptance for kidney donation.

In cases of dual transplantation to one patient, the necessity of informed consent from the recipient is mandatory. However, informed consent should also routinely be obtained from recipients of single suboptimal donor kidneys. A shorter graft survival after transplantation may be expected and should be balanced against a further period of time on dialysis waiting for an optimal donor kidney. Young and otherwise healthy renal patients would benefit more from waiting for a kidney with a good long-term prognosis. Elderly patients, with a shorter life expectancy, might prefer to have a transplant as soon as possible despite a prognosis of good function for only a few years.

It is important that the transplant centre or the region define the objectives of prognosis after transplantation of kidneys retrieved from marginal donors. Criteria for donor acceptance are expanded to transplant a greater number of patients. This will inevitably be associated with a reduction of the quality of post-transplant results, such as SCr of 200  $\mu\text{mol/l}$  at 1 year and 50–60% graft survival at 5 years. In the US, this does not yet appear to be an accepted policy, and ‘expanded criteria’ at American centres include donors that are considered normal at most European centres (i.e. hypertension and donor age > 50 years) [19].

## II.1.2 Determination of brain death

### Guideline

**A. It is recommended that the procurement centres encourage standardization of the management of the brain-dead donor including easy-to-use forms to assist the responsible physician in the emergency situation, and in line with national (or regional) laws and regulations which determine the criteria and methods for diagnosing terminal and irreversible loss of brain functions, i.e. brain death.**

*(Evidence level C)*

### Commentary on Guideline II.1.2: Determination of brain death

Any comatose patient with irreversible cerebral disease who appears to have progressed to brain death should be considered a potential donor and should be adequately assessed. There are two procedures to determine whether a patient with cerebral damage and preserved circulation supported by a ventilator has

proceeded to brain death. These procedures are clinical neurological examination and cerebral angiography. The tests should be performed and the diagnosis made by specialist physicians independent of the transplant unit. The use of these tests vary according to laws and regulations in various countries. For instance, in The Netherlands, a cerebral angiogram is forbidden unless the apnoea test is associated with <80 mmHg systolic pressure. In the Czech Republic, brain death is always diagnosed with angiography. In the UK, cerebral angiography is not mandatory, but brain death must be confirmed by areflexia of the brainstem reflexes and persistent apnoea tested by strict criteria. In Sweden, clinical examination is the rule, i.e. angiography is used in cases of hypothermia or intoxication/sedation. The clinical neurological examination is described and discussed in some detail below.

### *Clinical neurological examination*

Certain parts of the clinical neurological examination may be performed with some variation. It is important that the transplant centre ensures that a fixed routine for the examination is used in all units within the region and that all responsible doctors are informed. An example of a check list for the examination (currently being implemented throughout Sweden) is given in Table II.2.

*Basic criteria for clinical neurological examination to be used:*

- Known cerebral disease that can cause total cerebral infarction.
- Normal body temperature (>33°C).
- Poisoning, sedation, and metabolic, electrolyte or acid/base disturbances are ruled out.

If any of the above factors is absent, or if there is any doubt, cerebral angiography should be performed for the diagnosis of brain death.

*Clinical criteria:*

- Unconscious. No reaction to speech, touch or pain.
- Spontaneous breathing absent.
- Spontaneous muscular movements in area innervated by cranial nerves absent. Spinal reflexes in trunk or extremities may be seen.
- Defensive movements of head, extremities and trunk on painful stimuli absent. Spinal reflexes may be present.
- Reactions of pupils to light absent.
- Corneal reflexes absent bilaterally.
- Doll’s eye movements absent.
- Cardiocerebral reflexes absent (eye bulb pressure).
- Blinking reflexes on sound stimuli absent.
- Laryngeal reflexes absent.
- Apnoea test shows absence of spontaneous breathing.

*Supportive criteria:*

- Masseter reflexes absent.
- Glabellar and snout reflexes absent.

**Table II.2.** Clinical neurological determination of brain death

An example of a checklist for the examination. Two examinations should be performed at least 2 h apart.		
	Exam no. 1	Exam no. 2
Date:		
Time:		
Glasgow Coma Scale = 3	<input type="checkbox"/>	<input type="checkbox"/>
Body temperature $\geq 33^{\circ}\text{C}^*$	<input type="checkbox"/>	<input type="checkbox"/>
No poison or sedation, or serious metabolic, electrolyte or acid/base disturbances*	<input type="checkbox"/>	<input type="checkbox"/>
No reaction to pain within trigeminal innervated area	<input type="checkbox"/>	<input type="checkbox"/>
No spontaneous movements of eyes, jaws, face, tongue or larynx	<input type="checkbox"/>	<input type="checkbox"/>
No pupillary reaction to light	<input type="checkbox"/>	<input type="checkbox"/>
No corneal reflex	<input type="checkbox"/>	<input type="checkbox"/>
No blink reflex	<input type="checkbox"/>	<input type="checkbox"/>
No laryngeal or cough reflex	<input type="checkbox"/>	<input type="checkbox"/>
No reflexive eye movements on turning the head	<input type="checkbox"/>	<input type="checkbox"/>
No heart rate changes associated with pressure on eyes or carotid sinus	<input type="checkbox"/>	<input type="checkbox"/>
No spontaneous breathing	<input type="checkbox"/>	<input type="checkbox"/>
aB- $p\text{CO}_2$ level (should be $\sim 5$ kPa before and increased by at least 3 kPa after apnoea test)	_____/_____ before/after	_____/_____ before/after
No spontaneous breathing on apnoea test	<input type="checkbox"/>	<input type="checkbox"/>
Examination no. 1 performed by	Dr _____	
Examination no. 2 performed by		Dr _____
<b>*If uncertain, cerebral angiography should be performed.</b>		
When all parts above have been checked, the patient may be declared deceased.		

- Progressive poikilothermia present.
- Isoelectric electroencephalogram.

**Apnoea test:**

- Calibrate the ventilator minute volume to reach normocapnia (arterial carbon dioxide pressure [aB-CO<sub>2</sub>] at 5 kPa).
- aB-CO<sub>2</sub> before test is registered.
- Ventilate with the above minute volume and 100% oxygen for 5 min.
- Turn off the ventilator but let the oxygen flow down the endotracheal tube or tracheal cannula.
- Continue 5–10 min. Monitor blood pressure and pulse frequency. Stop if signs of hypoxia are seen (e.g. arrhythmia).

In cases of serious pulmonary damage, PaO<sub>2</sub> cannot be elevated above 10–12 kPa, and the apnoea test can only be performed for  $\sim 1$  min. If the apnoea test cannot be performed for  $> 5$  min, cerebral angiography should be carried out.

### II.1.3 Support of the potential donor and optimization of organ function

#### Guidelines

**A. Any comatose patient with irreversible cerebral disease should be identified as a potential donor and**

**monitored carefully awaiting determination of brain death, evaluation and consent of organ donation and the final event of retrieval.**

*(Evidence level C)*

**B. The management of a potential donor should be basically similar to normal intensive care but with important variations, i.e. the objectives are to support future function of renal, cardiac and/or pulmonary grafts.**

*(Evidence level C)*

**C. A simplified goal for management of the donor may be to maintain a central venous pressure of 10 cm H<sub>2</sub>O, a systemic blood pressure of 100 mmHg and a urine output of 100 ml/h.**

*(Evidence level C)*

#### Commentary on Guidelines II.1.3: Support of the potential donor and optimization of organ function

Transplant results depend to a large extent on the quality of the transplanted organ, which in turn depends on age and previous medical history as well as on intensive care management at the time of death. Following identification of the potential donor, full support of intensive care should be given with the objective to optimize organ function although a decision against donation might be made at a later stage.

Most donors die because of herniation of the brain and brainstem leading to cessation of cerebral blood circulation and brain death. This diagnosis is based on the verification of absence of all brain and brainstem functions or absence of cerebral circulation, and may be performed by means of a clinical neurological test or angiography as described above. While the deceased patient is on a ventilator, the blood is sufficiently oxygenated, and circulation is maintained in organs such as the kidneys, liver, pancreas, heart and lungs, which will remain viable for a limited time. During this period retrieval for transplantation may be performed. Metabolic changes occur during and after brain and brainstem herniation, and these changes may impair organ function. The progress of these changes may be modulated to some extent.

The process of herniation has been studied primarily in experimental animals. At the time of herniation there is an increase in blood levels of epinephrine, norepinephrine and dopamine [20,21], the size of the increase depending on how fast intracranial pressure rises. The catecholamines induce an increase in peripheral vascular resistance and an increase in cardiac work load. Despite this increase in cardiac work load, some studies have shown a reduction in cardiac output because of the increased peripheral vascular resistance. The increased cardiac work load is associated with an imbalance between oxygen demand and oxygen supply in the heart. Therefore, there are often signs of ischaemia and arrhythmias on the electrocardiogram (ECG) at the time of herniation.

When peripheral circulatory control has disappeared as a consequence of herniation, blood pressure and heart rate both decrease and reduced amplitudes of the QRS complexes may be seen on the ECG. Autopsy may show small areas of necrosis within the myocardium and the amount of intracellular energy-containing compounds (ATP, glycogen, ...) may be reduced. The overall result of these factors is a slightly reduced cardiac function.

A lack of intracellular energy-containing compounds develops following herniation. With normal cerebral function, this deficiency would rapidly be counterbalanced by increased synthesis, but for reasons that are still unclear this does not occur in brain-dead patients. Studies in experimental animals show that supplementation with hormones such as corticosteroids, insulin and triiodothyronine may reverse the condition in the heart [22]. Clinical studies, however, have not been convincing and hormonal substitution is not generally recognized.

After herniation, the release of antidiuretic hormone from the pituitary is interrupted, causing a state of diabetes insipidus and dehydration of the donor. Substitution with common electrolyte solutions will induce disturbances of water and electrolyte balance (oedema and hyperosmolarity; hypernatraemia and hypokalaemia) with deterioration of cell membrane and organ function. Treatment with vasopressin or synthetic analogues to restore normal urine output has been shown to reduce these disturbances. Large volumes (200–1000 ml/h) of sodium-free fluids, preferably sterile water, may be needed to correct the water deficit and hypernatraemia.

In brain death, circulation is characterized by bradycardia and hypotension. The hypotensive state is due primarily to a moderate cardiac insufficiency combined with hypovolaemia. There may also be an absolute hypovolaemia secondary to diabetes insipidus, and a relative hypovolaemia secondary to reduced peripheral vascular resistance and increased vascular capacity. Hypotension may lead to hypoperfusion of various organs. Ischaemia in the kidneys, due to prolonged hypotension, is considered one of the main causes of damage to the kidneys in brain death. Preventing hypotension has been shown to improve renal function after transplantation [23].

Donor management aims to optimize the circulation and oxygenation of the organs that are to be transplanted. There are several excellent overviews on this subject [24,25]. In brief, the guidelines should include the following:

- Increase the blood volume with crystalloids and colloids to a central venous pressure of 10 cm H<sub>2</sub>O.
- The goal is a systemic arterial pressure of 100 mmHg. If this cannot be reached using fluids alone, dopamine may be added as an inotropic support. In cases of lung donation, colloids are preferred to crystalloids. Avoid hypothermia by using warmed fluids.

- A reduced urine output at the time of herniation is most often normalized after restoration of the blood volume, then followed by a state of diabetes insipidus. The best treatment for diabetes insipidus is vasopressin or one of its analogues. The goal should be to reduce the urine output to ~100 ml/h. With this treatment, electrolyte disturbances and development of peripheral oedema are to some extent avoided.
- The aim of ventilator therapy should be to achieve normal values of blood gas analysis. To retard the development of atelectasis, a positive end expiratory pressure of 5 cm H<sub>2</sub>O is advisable.

## References

1. Cockcroft DW, Gault MH. Prediction of creatinine clearance from serum creatinine. *Nephron* 1976; 16: 31–41
2. Robert S, Zarowitz BJ, Peterson EL, Dumlér F. Predictability of creatinine clearance estimates in critically ill patients. *Crit Care Med* 1993; 21: 1487–1495
3. Sola R, Guirado LL, Lopez Navidad A *et al.* Renal transplantation with limit donors. To what extent should the good results obtained be attributed? *Transplantation* 1998; 66: 1159–1163
4. Alfrey EJ, Lee CM, Scandling JD, Pavlakis M, Markezich AJ, Dafoe DC. When should expanded criteria donor kidneys be used for single versus dual kidney transplants? *Transplantation* 1997; 64: 1142–1146
5. Pokorna E, Vitko S, Chadimova M, Schuck O, Ekberg H. Proportion of glomerulosclerosis in procurement wedge renal biopsy cannot alone discriminate for acceptance of marginal donors. *Transplantation* 2000; 69: 36–43
6. Gaber LW, Moore LW, Alloway RR, Amiri MH, Vera SR, Gaber AO. Glomerulosclerosis as a determinant of posttransplant function of older donor renal allografts. *Transplantation* 1995; 60: 334–339
7. Karpinski J, Lajoie G, Cattran D *et al.* Outcome of kidney transplantation from high-risk donors is determined by both structure and function. *Transplantation* 1999; 67: 1162–1167
8. Vianello A, Mastrosimone S, Calconi G *et al.* Influence of donor age on cadaver kidney graft function and survival: Univariate and multivariate analyses. *Nephron* 1993; 65: 541–548
9. Hariharan S, McBride MA, Bennett LE, Cohen EP. Risk factors for renal allograft survival from older cadaver donors. *Transplantation* 1997; 64: 1748–1754
10. Fliser D, Franek E, Ritz E. Renal function in the elderly—is the dogma of an inexorable decline of renal function correct? *Nephrol Dial Transplant* 1997; 12: 1553–1555
11. Cecka JM, Terasaki PI. The UNOS Scientific Renal Transplant Registry. In: Terasaki PI, Cecka JM, eds. *Clinical transplants* 1996. Los Angeles: UCLA Tissue Typing Laboratory, 1997
12. Cecka JM. The UNOS Scientific Renal Transplant Registry. In: Cecka JM, Terasaki PI, eds. *Clinical transplants* 1998. Los Angeles: UCLA Tissue Typing Laboratory, 1999
13. Scheinkestel CD, Tuxen DV, Cooper DJ, Butt W. Medical management of the (potential) organ donor. *Anaesth Intens Care* 1995; 23: 51–59
14. Morales JM, Campistol JM, Castellano G *et al.* Transplantation of kidneys from donors with hepatitis C antibody into recipients with pre-transplantation anti-HCV. *Kidney Int* 1995; 47: 236–240
15. Eastlund T. Infectious disease transmission through cell, tissue, and organ transplantation: Reducing the risk through donor selection. *Cell Transpl* 1995; 4: 455–477
16. Freeman RB, Giatras I, Falagas ME *et al.* Outcome of transplantation of organs procured from bacteremic donors. *Transplantation* 1999; 68: 1107–1111
17. Nelson PW, Delmonica FL, Tolkoff-Rubin NA *et al.* Unsuspected donor *Pseudomonas* infection causing arterial

- disruption after renal transplantation. *Transplantation* 1984; 37: 313–314
18. Council of Europe International Consensus. Committee of Experts on the organisational aspects of co-operation in organ transplantation. Standardisation of organ donor screening to prevent transmission of neoplastic diseases (1997)
  19. Lee CM, Scandling JD, Pavlakis M, Markezich AJ, Dafeo DC, Alfrey EJ. A review of kidneys that nobody wanted. Determinants of optimal outcome. *Transplantation* 1998; 65: 213–219
  20. Novitzky D, Wicomb WN, Rose AG, Cooper DK, Reichart B. Pathophysiology of pulmonary edema following experimental brain death in the chacma baboon. *Ann Thorac Surg* 1987; 43: 288–294
  21. Shivalkar B, van Loon J, Wieland W *et al.* Variable effects of explosive or gradual increase of intracranial pressure on myocardial structure and function. *Circulation* 1993; 87: 230–239
  22. Novitzky D, Cooper DKC, Zuhdi N. Change from aerobic to anaerobic metabolism after brain death, and reversal following triiodothyronine therapy. *Transplantation* 1988; 45: 32–36
  23. Caroll RPN, Chisholm GD, Shackman R. Factors influencing early function of cadaver renal transplants. *Lancet* 1969; ii: 551–552
  24. Soifer BE, Gleb AW. The multiple organ donor: Identification and management. *Ann Intern Med* 1989; 110: 814–823
  25. Nygaard CE, Townsend RN, Diamond DL. Organ donor management and organ outcome; a 6-year review from a Level 1 Trauma Center. *Trauma* 1990; 30: 728–732

## II.2 Cadaveric non-heart beating donors (NHBD)

### Guidelines

**A. Non-heart beating donors should be considered as a valuable source of kidneys for transplantation, despite shorter graft survival and higher serum creatinine in recipients compared with those transplanted from classical cadaveric donors.**

(Evidence level B)

**B. Young donors who die from trauma can be safely considered as non-heart beating donors.**

(Evidence level B)

**C. To optimize this promising alternative, it is recommended that centres start and accumulate experience.**

(Evidence level C)

### Commentary on Guideline II.2: Cadaveric non-heart beating donors (NHBD)

*Guideline A.* To expand the number of cadaveric kidneys available for transplantation, several units have used kidneys from donors without a beating heart. Initial experience was performed in Europe, mainly in the Netherlands [1–3], and Japan, where brain death was not recognized. Encouraging results were obtained and this possibility for transplantation has been adopted by groups around the world [4,5].

Kootstra *et al.* established four categories of non-heart beating donor:

1. Death on arrival; mostly victims of an accident outside the hospital.
2. Unsuccessful resuscitation, where resuscitation is taken over by the hospital team.

3. Awaiting cardiac arrest; ‘this includes patients who die in the intensive care unit and the family have agreed with organ donation’.
4. Cardiac arrest while brain dead: including ‘patients who suffer an unexpected cardiac arrest in the process of being diagnosed of brain death or after the determination of brain death, but before they are taken into the operating room’. [2].
5. Recently, Sanchez-Fructuoso *et al.* added category 5: unexpected cardiac arrest in intensive care unit [6,7].

The principal ethical problem is represented by category 3. Kootstra *et al.* considered a period of 10 min of no intervention very important: 10 min of asystole without blood circulation results in irreversible damage of the brain at room temperature. Kidneys from patients of category 4 can be used when heart function cannot be restored.

Using NHBDs could increase the number of donors by 20% and the number of transplants by 16%. In the centre with most experience in Spain, despite the fact that ~10% of kidneys from NHBDs were discarded due to poor arterial perfusion, NHBD kidneys were used in 32% of all transplants performed in 1999 [7]. Therefore, renal transplantation from NHBDs represents a promising alternative to enlarge the donor pool. In the Netherlands and Spain consensus documents have been finished to improve this method of obtaining organs for transplantation.

*Guideline B.* Experience from several countries [2–4,7–9] have shown that patients who received an organ from a NHBD had reduced [3,8,9] or similar graft survival [2,4,7] compared with matched patients who received kidneys from heart beating donors (HBD). However, in these studies, donor characteristics were very different and therefore it was difficult to make comparisons. Interestingly, in the largest multi-centre series reported by Cho *et al.*, survival rate at 1 year was higher for grafts from NHBDs who died of trauma (young people) compared with grafts from HBDs who died of other causes [5]. NHBDs should ideally be under 55 years of age [7].

The largest series in Spain, recently published, showed similar results with 1- and 5-year graft survival among NHBD compared with HBD grafts (85 and 83% vs 87 and 84%, respectively). Negative predictive factors for NHBD graft survival were the type of NHBD and the presence of corticosteroid-resistant acute rejection [7]. Results from Japan with CsA or FK506 as basic immunosuppression showed good results: patient survival rates of 97, 95, 93 and 89% at 1, 3, 5 and 10 years, respectively, and graft survival rates of 83, 72, 65 and 49% at 1, 3, 5 and 10 years, respectively [4].

The most important problem is the high incidence of post-transplant acute tubular necrosis requiring dialysis. This was between 50 and 70% in several series, and was associated with a 5.73-fold increase in the incidence of delayed graft function in the Madrid experience [3–7]. Also, primary failure of the graft is

between 4 and 14% compared with the percentage for kidneys from HBDs [2–5]. Delayed graft function in NHBD groups is influenced by the warm ischaemia time, which is directly related to the number of days to achieve a serum creatinine of <300 mmol/l [3]. Also, the number of days of hospitalization after transplantation is higher. In general, renal function is lower in patients who receive kidneys from NHBDs [2–5], although Sanchez-Fructuoso *et al.* reported similar serum creatinine levels at 1 and 5 years after transplantation [7].

**Guideline C.** Transplantation using kidneys from a NHBD requires: first, an organizational structure to detect and to maintain donors; secondly, technical experience to maintain perfusion of the kidneys; and thirdly, careful local guidelines and consideration of the ethical issues of particular importance in these types of donors [1,3,7]. As discussed previously, the organization of transplant co-ordination is very important to detect all possible NHBD and subtypes. Particularly in type I NHBDs, a relationship with the municipal emergency service should be developed to ensure transfer to hospital of all possible donors who die suddenly on the street and after unsuccessful cardiopulmonary resuscitation. It is necessary to support these donors during transfer with external cardiac massage, mechanical ventilation and intravenous fluids [7].

Cardiopulmonary bypass involving extracorporeal circulation, external oxygenation and intense hypothermia are required to maintain grafts from the moment of cardiac arrest until the procurement of kidneys. It is clear, therefore, that an effective organization and training for the transplant team is mandatory. Data from the Hospital Clinico San Carlos in Spain is an example of this: results with NHBD have clearly improved with experience developed over the years [7].

Great caution should be taken with respect to legal problems in organizing the harvesting of cadaveric NHBDs, depending on the nation and its specific legislation, if any.

## References

- Wijnen RMH, Booster MH, Stubenitsky BM, de Boer J, Heineman E, Kootstra G. Outcome of transplantation of non-heart-beating donor kidneys. *Lancet* 1995; 345: 1067–1070
- Kootstra G, Daemen JHC, Oomen APA. Categories of non-heart-beating donors. *Transplant Proc* 1995; 27: 2893–2894
- Gonzalez Segura C, Castela AM, Torras J *et al.* A good alternative to reduce kidney shortage: kidneys from non-heart beating donors. *Transplantation* 1998; 65: 1465–1470
- Hoshinaga K, Shiroki R, Fujita T, Kanno T, Nadie Y. The fate of 359 renal allografts harvested from non-heart beating cadaver donors at a single center. In: Terasaki PI, Cecka JM, eds. *Clinical transplantation* 1998. Los Angeles, UCLA Tissue Typing laboratory, 213
- Cho YW, Terasaki PI, Cecka JM, Gjerston DW. Transplantation of kidneys from donors whose hearts have stopped beating. *N Engl J Med* 1998; 338: 221–225
- Alvarez J, Del Barrio M. Experiencia del Hospital Clinico San Carlos en donantes a corazón parado. En Donantes a corazón parado. Alvarez J and Del Barrio M, eds. *Editorial Computense* 1997; 103–141
- Sanchez-Fructuoso AI, Prats D, Torrente J *et al.* Renal transplantation from non-heart beating donors: a promising alternative to enlarge the donor pool. *J Am Soc Nephrol* 2000; 11: 350–358
- Valero R, Sanchez J, Cabrer C *et al.* Organ procurement from non-heart-beating donors through in situ perfusion or total body cooling. *Transplant Proc* 1995; 27: 2899–2900
- Nicholson ML, Horsburg T, Doughman TM *et al.* Comparison of the results of renal transplant from conventional and non-heart-beating cadaveric donors. *Transplant Proc* 1997; 29: 1386–1387

## II.3 Living kidney donors

### Guidelines

**A. Use of kidneys from ‘living donors’ is recommended for renal transplantation whenever possible and is supported by the especially favourable results obtained after transplantation.**

*(Evidence level B)*

**B. Before being selected as a ‘living donor’, careful information should be provided to the potential donor and he or she should undergo a careful medical and physical evaluation, as listed in Table II.3.**

*(Evidence level A)*

**C. After complete evaluation of the donor, formal written consent (often legal) must be obtained from the donor.**

*(Evidence level A)*

**D. Special care must be taken to ensure that a potential ‘living related donor’ does not fulfil any of the exclusion criteria listed in Table II.4.**

*(Evidence level A)*

**E. The use of ‘living non-related donors’ may be justified if the donor is a spouse, an unmarried life-long partner, a step parent or in some occasions a close friend, and if it is ensured that the donation is purely altruistic, and if commercial transactions are excluded.**

*(Evidence level B)*

**F. Commercially motivated kidney transplantation is not acceptable and all procedures must comply with existing national (regional) and EU laws.**

*(Evidence level A)*

**G. ‘Living non-related donors’ require the same level of information, consent and evaluation as ‘close related living donors’.**

*(Evidence level B)*

**H. It is desirable that the ‘living donor’ should be offered long term follow-up at regular intervals. Steps should be taken to ensure against the rare development of late complications.**

*(Evidence level B)*

**I. The ‘living donor’ should always be left with the best kidney.**

*(Evidence level B)*

**Table II.3.** Evaluation of the potential living kidney donor

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ABO blood typing  
HLA-A, -B and -DR tissue typing  
Cross-match

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*Initial medical evaluation:*


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History and physical examination  
Blood pressure  
Psychosocial evaluation (optional)  
Electrocardiogram, optional echocardiography  
Chest radiograph, optional pulmonary function tests  
Complete blood count, platelet count, prothrombin time, partial thromboplastin time  
Cardiovascular evaluation (including echocardiography and/or scintigraphy) for donors older than 50 years or with a history of heavy smoking or with mild hypertension  
Chemistry: blood urea nitrogen, s-creatinine, sodium, potassium, bicarbonate, fasting blood glucose, calcium, phosphorus, albumin, total protein, uric acid, liver enzymes, bilirubin, fasting cholesterol, triglycerides, high- and low-density lipoproteins

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*Further renal assessment:*


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Urinalysis, microscopy of urinary sediment  
Urine culture  
Twenty-four-hour urine for creatinine clearance or a direct evaluation of the GFR by CrEDTA or iothexol or inulin clearance  
Radionuclide determination of glomerular filtration rate, as a separate evaluation of the function of the two kidneys, renography (optional)  
Twenty-four-hour urine for total protein  
Urine for microalbuminuria (optional)  
Ultrasound examination of the kidneys and the abdomen  
Intravenous pyelogram (optional)  
Renal arteriogram

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*Additional screening tests*


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CMV antibodies (Ab) titres, HBsAg, HCV antibody, HIV antibody, EBV Ab titres, herpes simplex virus (HSV) Ab, varicella zoster virus (VZV) Ab, Toxoplasma Ab, and syphilis test  
In females: pregnancy test, if relevant, gynaecological examination when older than 40 years  
In males: PSA when older than 50 years

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**Commentary on Guideline II.3: Living kidney donors**

Despite the improvement in immunosuppression and better graft and patient survival in cadaver kidney transplantation, the use of living donors for kidney transplantation still results in a slightly superior graft and patient survival, and less morbidity due to fewer rejection episodes, less immunosuppression and better immediate graft function.

Furthermore, the number of cadaver grafts available is far less than is needed in order to transplant the increasing number of uraemic patients on the waiting lists. Therefore, the need for kidneys from other sources than cadaveric donors is ever rising and consequently the use of related donors and unrelated living donors has increased.

In the United States, practice guidelines have been formulated on the basis of consensus and literature reviews [1,2]. The British Renal Association (BRA) has produced EBP Guidelines for treatment of adult patients with renal failure from November 1997 [3]. Their standards of recommendation are that patient survival should be at least 95% 1 year after grafting

and that >90% of the grafts from living kidney donors should be functioning at 1 year. The British Transplant Society (BTS) has in November 1998 published their guidelines: 'Towards standards for organ and tissue transplantation in the United Kingdom' [4]. Their recommendations are at least 99% patient survival at 1 year after grafting and 95% at 5 years. Ninety-five percent of live donated kidney allografts should still be functioning at 1 year and >80% at 5 years. It should, however, be stated that these recommendations will be difficult to live up to, when doing transplantations between older living donors and older recipients. BTS and BRA new 2000 guidelines have just been released [5].

**II.3.1 Related living kidney donors**

In general, it is recommended that the first contact between the potential living kidney donor and the transplant team should be initiated by the potential donor. Counselling given to the donor should focus on the risks of donation and not especially on the benefits for the recipient.

**Table II.4.** Exclusion criteria for a potential living kidney donor*Kidney disease:*


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Reduced GFR, in comparison to normal range for age  
 Proteinuria of > 300 mg/day  
 Microhaematuria, except when an urologic evaluation and a possible kidney biopsy are normal  
 Multiple kidney stones  
 Multiple cysts  
 Three or more arteries  
 Family history of autosomal dominant polycystic kidney disease (ADPKD), unless ultrasound or CT scan is normal and donor age is > 30 years  
 Bilateral fibromuscular arterial dysplasia

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*Other exclusion criteria:*


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ABO incompatible  
 Cross-match positive  
 Hypertension without good control  
 Diabetes mellitus  
 Cardiovascular disease  
 Pulmonary insufficiency  
 Abuse of morphine, heroin or cocaine  
 HIV positive  
 Hepatitis B antigen-positive to a negative recipient (or unprotected)  
 Hepatitis C-positive to a negative recipient  
 Other severe infections  
 Malignancy  
 Long-term use of nephrotoxic drugs  
 Age < 18 years  
 Previous severe abdominal surgery

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*Information to the donor*

The potential kidney donor should be informed of the following:

1. There is no guarantee involved. Although an extensive examination is performed, there is no guarantee of successful outcome of the transplant. Early and late possible complications in renal transplantation should be mentioned.
2. A potential family donor can always withdraw his or her consent.
3. The potential donor will have to undergo a careful medical examination in order to ensure that he or she is healthy, and that surgery can be performed with a minimum risk [6]. Despite such examinations, the mortality risk was estimated to be 0.03% and the risk of morbidity 0.23% in large studies from donor operations performed in the 1980s [7].

The potential, but unlikely risks of kidney donation include:

- Short-term surgical risks.
- Theoretical and extremely unlikely long-term risks of impaired kidney function and hypertension.
- Loss of time and money.
- Psychological risks.

It should be stressed, however, that the long-term risk of kidney donation is very low and that the 'living donor' has a longer life survival than the general population, possibly due to the positive selection.

*Consent to donation*

Great care should be taken during the information procedure to ensure that the kidney donation is truly voluntary and in no way coerced. The potential kidney donor should receive direct personal information as well as written information. The potential kidney donor should sign a statement allowing the transplant surgeon to perform the nephrectomy and acknowledging the appropriate verbal and written information.

*Evaluation of the potential living kidney donor*

The aims of the investigations performed to evaluate the potential living kidney donor are:

1. To ensure that the donor decides by him/herself, that he or she really wants to go through the procedure and that the donor is not forced or obliged to do it.
2. To ensure that there will be a minimum of risk for anaesthesia and surgical intervention.
3. To ensure that the donor is healthy and that there is no risk of transmitting disease.
4. To ensure that the unilateral nephrectomy will have no negative effects on the long-term renal function of the donor.
5. To make the decision on alternative surgical procedures; left or right nephrectomy performed by open surgery or laparoscopic technique.

To ensure that the autonomy of the potential donor is protected, the physician carrying out the primary evaluation should ideally be independent of the recipient's team and should not be a member of the transplant team. However, this is not always possible and in that case, the potential donor should be evaluated by the surgeon who will be performing the nephrectomy. Only then should the decision on eventual donation be made. However, in practice many donors refer directly to the transplant physician or transplant surgeon to ask for advice.

The very first test to be performed is often an ABO blood group test. If compatible, a complete medical history and physical examination should be done together with further examinations as presented in Table II.3. The medical history should include presence of any sign of renal disease, such as hypertension, nephrolithiasis, proteinuria, haematuria, oedema and renal parenchymal infections. Furthermore, a thorough investigation should be conducted to detect cardiovascular risk factors, diabetes mellitus, malignancy and systemic diseases. Psychological problems or diseases and medication given should be included. It should be emphasized that this information and the results of the examinations are designed to prevent harm to the donor by detecting possible renal disease, to ensure that the recipient receives a normal kidney, to ensure that the potential donor may retain one normal kidney and to ensure a normal kidney function after the nephrectomy. Finally, angiography is performed to exclude vascular disease and as a basis for the decision on which kidney should be retrieved.

A number of exclusion criteria of live kidney donation are presented in Table II.4. Special emphasis should be made on the possible presence of hereditary renal diseases, as presented in Table II.5. Donors should be offered life-long follow-up with check-up examinations once a year.

### II.3.2 Unrelated living kidney donors

#### *Acceptability of donors*

A living organ donation programme requires great care to ensure that donation is altruistic, without coercion or reward, that the risk to the donor is minimized, and that the requirements of the Human Organ Transplantation Act from 1989 are met in all respects. Permission from the local ethical committee has to be obtained in some countries, while in other countries it is necessary to obtain permission from the court. Clearly defined protocols of investigation and management are essential, and such transplants should

not be carried out in centres where they constitute an occasional event [1].

The use of highly motivated, but unrelated living donors, such as spouses, unmarried life-long partners, step-parents or even close friends is becoming widely accepted, and graft survival rates obtained are comparable to those of living related kidney donors and superior to cadaver kidney grafts [8].

The provisions of the Human Organ Transplants Act 1989 are specifically designed to prevent abuse in this area. Nonetheless, coercion remains a great concern. A particular risk occurs when a potential donor needs a translator in order to understand the questions and issues being put to him or her by clinicians [4].

The arguments for and against the use of emotionally related living kidney donors have been carefully presented in several publications [9–14]. **Commercially motivated renal transplantation must not be accepted, despite the occurrence in some countries [15], and the International Society of Transplantation strongly opposes this practice.**

Besides a careful evaluation of the possibility of pressure put on the potential unrelated living kidney donor and a careful attempt to ensure absence of coercion of any kind, the evaluation of this type of kidney donor should follow the scheme presented above in Tables II.3, II.4 and II.5.

### References

1. Kasiske BL, Bia MJ. The evaluation and selection of living kidney donors. *Am J Kidney Dis* 1995; 26: 387–398
2. Bia MJ, Ramos EL, Danovitch GM *et al.* Evaluation of living renal donors: the current practice of US transplant centers. *Transplantation* 1995; 60: 322–333
3. The British Renal Association. Treatment of adult patients with renal failure—Recommended standards and audit measures. Second Edition; 38–113, November 1997
4. British Transplantation Society. Towards standards for organ and tissue transplantation in the United Kingdom; 1–65, November 1998
5. British Transplantation Society. United Kingdom Guidelines for Living Donor Kidney Transplantation; 1–82, January 2000
6. Lumsdaine JA, Wigmore SJ, Forsythe JLR. Live kidney donor assessment in the UK and Ireland. *Brit J Surg* 1999; 86: 877–881
7. Johnson EM, Remucal MJ, Gillingham KJ, Dahms RA, Najarian JS, Matas AJ. Complications and risks of living donor nephrectomy. *Transplantation* 1997; 64: 1124–1128
8. Terasaki PI, Cecka JM, Gjertson DW, Takemoto S. High survival rates of kidney transplants from spousal and living unrelated donors. *N Eng J Med* 1995; 333: 333–336
9. Thiel G. Emotionally related living kidney donation: pro and contra. *Nephrol Dial Transplant* 1997; 12: 1820–1824
10. Said MAR, Curtis JJ. Living unrelated renal transplantation: Progress and potential. *J Am Soc Nephrol* 1998; 9: 2148–2152
11. Daar AS, Land W, Yahya TM, Schneewind K, Gutmann T, Jakobsen A. Living-donor renal transplantation: evidence-based justification for an ethical option. *Transplant Rev* 1997; 11: 95–109
12. Binet I, Bock AH, Vogelbach P *et al.* Outcome in emotionally related living kidney donor transplantation. *Nephrol Dial Transplant* 1997; 12: 1940–1948
13. Cecka JM. Kidney donation from unrelated living donors. *Saudi J Kidney Dis Transplant* 1999; 10: 464–469
14. Khajehdehi P. Living non-related versus related renal transplantation—its relationship to the social status, age and gender

**Table II.5.** Screening for familial renal disease:

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Diabetes mellitus
Autosomal dominant polycystic kidney disease
Systemic lupus erythematosus
Hereditary nephritis

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of recipients and donors. *Nephrol Dial Transplant* 1999; 14: 2621–2624

15. The Living Non-Related Renal Transplant Study Group. Commercially motivated renal transplantation: results in 540 patients transplanted in India. *Clin Transplant* 1997; 11: 536–544

#### **II.4 Immunogenetic work-up of the donor**

See section I.6.1: Immunogenetic work-up of the recipient (and donor).

See paragraph III.1.1: Cross-matching donor/recipient: ABO blood group matching.

See paragraph III.1.2: Cross-matching donor/recipient: HLA matching and mismatching.