

PART VI

TRANSPLANTATION

Chairmen: Dr J Traeger and Dr Bergström

The Prevalence of Theoretically Available Cadaveric Kidney-Donors at the Copenhagen Kommunehospital

M FRIEDBERG, N A LARSEN and S LARSEN
Kommunehospital, Copenhagen, Denmark

With the present rate of progress in cadaveric kidney transplantation a shortage of available kidneys may well prove a limiting factor to transplantation programmes. In order to determine the number of theoretically available donors of cadaveric kidneys at the Copenhagen Kommunehospital, a retrospective survey of the 1400 patients who died during 1968 was carried out. Excluding patients dying from accidents, there still were 45 available donors with 90 acceptable kidneys. This is a minimum number, since those dying from accidents are usually a major source of cadaveric kidneys.

MATERIAL AND CRITERIA FOR EXCLUSION OF DONORS

The Copenhagen Kommunehospital is a municipal, urban hospital with 884 beds and about 20,000 admissions per year. The hospital has no departments of neurosurgery, thoracic surgery, or paediatrics. During 1968 exactly 1400 patients died in the hospital; 1185 of these (85 per cent) had an autopsy performed, and the kidneys and their vessels were examined both macroscopically and by light microscopy. The rest – 215 patients – either had no autopsy performed or were transferred to the Institute of Forensic Medicine for autopsy. In neither case could systematic information concerning the state of their kidneys be obtained. Therefore these patients were excluded from the survey although the group comprised all patients dying from accidents and suicide.

Our criteria for exclusion of donors (Table I) are nearly similar to those defined by Calne (1967) although of necessity the limitations have been made more definite. Patients younger than eleven years or older than 70 years were excluded. So was everybody suffering from cancer, except those with primary intracranial tumours. Septicaemia or proven bacteraemia, active tuberculosis, and systemic disease also caused exclusion. In order to rule out renal disease, we required that the kidneys should be of normal size and appearance, there should be no history of previous renal disease,

normal serum creatinine concentration, no proteinuria, no abnormal urinary sediment, and no hypertension. For terminal hypotension an arbitrary limit of one hour was decided on.

Table I. Criteria for exclusion of potential cadaveric kidney-donors

1. AGE below 11 or above 70 years
2. CANCER (except primary intracranial tumours)
3. SEPTICAEMIA or proven bacteraemia
4. TUBERCULOSIS (active)
5. SYSTEMIC DISEASE
6. RENAL DISEASE
7. ARTERIAL HYPERTENSION
8. TERMINAL HYPOTENSION for more than one hour

The primary evaluation of the material was based on the autopsy findings. In those not excluded by this screening procedure, a further and more thorough evaluation based on the case reports and the laboratory investigations, was carried out. Because of the predominance of relatively old patients special care was taken to determine if changes in renal histology due to physiological aging were so severe as to exclude the donors selected by patho-anatomical and clinical criteria.

Changes due to physiological aging of the patients were defined as: (a) Atherosclerosis of small and medium-sized arteries, (b) glomerular fibrosis and hyalinisation, (c) tubular atrophy, (d) interstitial fibrosis with lymphocyte and plasma cell infiltration, and (e) medullary interstitial fibrosis. The degree of change was graded as absent, slight, moderate, or severe. To ensure a uniform evaluation the histological specimens from the kidneys of the 45 potential donors were all examined by our senior pathologist.

RESULTS

The end result was 45 acceptable donors. Their age and sex are given in Table II. Two thirds of the donors were in the 61 - 70 years age group, and

Table II. Age and sex of 45 potential cadaveric kidney-donors

Sex	Age (years)				Total
	11-40	41-50	51-60	61-70	
M	0	1	6	19	26
F	0	4	3	12	19
Total	0	5	9	31	45

only five were younger than 50 years. Table III shows the primary causes of death. Half of the 45 donors died from cardio-pulmonary diseases, with myocardial infarction as the single disease responsible for the greatest

Table III. Primary causes of death of 45 potential cadaveric kidney-donors

	Number of donors
Myocardial infarction	11
Other cardio-pulmonary disease	12
Cerebro-vascular accident	7
Primary intracranial tumour	5
Other neurological disease	2
Hepatic insufficiency	6
Other	2

number of donors. Other cardio-pulmonary diseases were myocardial insufficiency (4), pulmonary embolism (3), chronic cor pulmonale (2), rheumatic valvular disease (2), and a previously operated atrial septal defect (1). In accordance with the primary causes of death, 35 of the donors died in medical wards and six in the department of neurology, while only two came from surgical wards and two from the intensive-care unit of the department of anaesthesiology (Table IV).

Table IV. Distribution of the 45 potential cadaveric kidney-donors among the departments of the hospital

	Number of donors
Surgical departments (296 beds)	2
Medical departments (315 beds)	35
Neurological department (80 beds)	6
Anaesthetic department (12 beds)	2
Other departments (181 beds)	0
<hr/> Total	<hr/> 45

In order to estimate the risk of accepting donors with undiagnosed renal disease, cancer, or active tuberculosis, we re-examined the case histories, laboratory investigations, and autopsy findings of those of the 1185 patients in whom these diseases had been found during life or at autopsy.

There were 62 cases of renal disease. Four of them were unsuspected at the time of death. However, three had macroscopic changes that would have been visible on removal of the kidneys. The fourth, a 52-year-old woman, developed an acute tubular necrosis during the last few hours before her death. Her kidneys were of normal size and appearance at the autopsy, but microscopy revealed the tubular lesions.

None of the 216 patients with cancer would have been acceptable. Only three patients neither had a definite diagnosis nor were suspected of suffering from cancer, and these were excluded for other reasons.

Only two of the thirteen patients with tuberculosis had signs of active

tuberculosis. In both the diagnosis had been made before the patients died.

With most of the donors in the 61-70 years age group there was a certain risk of encountering severe changes in the kidneys due to accelerated physiological ageing. However, only one donor had moderate changes due to ageing, while 28 had slight changes and 21 had no visible changes at all (Table V).

Table V. Degree of physiological changes in the kidneys due to ageing correlated to age of donors

Renal changes	Age (years)			Total
	41-50	51-60	61-70	
None	3	4	14	21
Slight	2	5	16	23
Moderate	0	0	1	1
Total	5	9	31	45

DISCUSSION

The 45 potential donors selected according to our criteria from a total of 1400 patients dying in the hospital in 1968, amount to 3.2 per cent. As patients dying from accidents were excluded from the investigation, this must be regarded as the minimum number of theoretically available donors. Furthermore our criteria for exclusion have probably been too rigid. Successful transplantation of cadaveric kidneys from donors older than 70 years (Calne, 1969) and donors with terminal hypotension for up to twelve hours (Brunius et al, 1968) have been reported. On the other hand many ethical and practical problems (e. g. death criteria, consent from next of kin, 24-hour tissue typing service, and co-operation between different departments) will limit the number of available kidneys.

Although our retrospective study was founded on the autopsy findings, the results could be correlated with the case histories, clinical findings, and laboratory results. Thus 99.7 per cent of the patients excluded would still have been excluded even if autopsy findings had not been available and we had had to rely on what was known about the patients when they died. Although the majority of the donors were 61 - 70 years old, changes in the kidneys due to ageing were only slight. The criteria for exclusion seem to offer a reasonable protection against donors suffering from renal disease, cancer or active tuberculosis.

The investigation has shown that even with all patients dying from accidents excluded and with rigid criteria for selection of donors, a hospital with about 1400 deaths per year should be able to provide a sufficient number of cadaveric kidneys for a transplantation unit.

ACKNOWLEDGEMENTS

The authors thank the department of pathology and the clinical departments of Copenhagen Kommunehospital for permission to use their files and case reports. The authors are especially indebted to Dr P. Christoffersen, senior pathologist, for his evaluation of the renal histology of the potential cadaveric kidney-donors.

The study has been supported by King Christian the Tenth's Foundation.

REFERENCES

- Brunius, U., Bergentz, S. E., Ekman, H., Gelin, L. E. and Westberg, G. (1968) *Scandinavian Journal of Urology and Nephrology*, 2, 15
Calne, R. Y. (1967) *Renal Transplantation*. Edward Arnold Ltd., London
Calne, R. Y. (1969) *British Medical Journal*, 2, 565