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Proteinuria and Renal Function in Kidney Transplant Donors 10–18 Years after Donor Uninephrectomy

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ABSTRACT

Ten to eighteen years after donor uninephrectomy (UN) the compensatory increase in renal function is maintained. Albuminuria was slightly increased in a few donors compared to the controls. We found no evidence for donor uninephrectomy to carry a risk for progressive renal failure. Further studies 2-3 decades after UN will provide additional insight in how UN affects the development of proteinuria and renal function.

INTRODUCTION

Experimental studies in rats and other species have revealed structural and hemodynamic changes in the remaining kidney after nephrectomy. Proteinuria, hypertension and progressive renal insufficiency may develop after varying degrees of renal ablation. Micropuncture studies have shown that the adaptive increase of glomerular flow and pressure is depending on arteriolar vasodilatation leading to increase of these variables in the glomerular capillaries. These events have been linked to the progressive glomerular damage in the remaining kidney. These changes are virtually abolished in the rat if the protein content of the food is reduced from normal 24% to 6%. Based on these findings the hypothesis has been brought forward that uninephrectomy (UN) in adult man could eventually result in progressive renal damage in the remaing kidney (4). This alarming perspective has caused considerable concern to us with our large living donor transplantation program in Göteborg. Donor nephrectomy has been considered to carry little risk both on long and short term and early follow-up studies have also confirmed this low risk as reported both by us and others (1, 2, 3, 5, 6, 9). This situation prompted us to carry out an investigation of our early kidney donors with more than 10 years of follow-up time after nephrectomy.

SUBJECTS

The donor group consisted of 64 donors who were nephrectomized between 1965-1973. Ten donors have died 5 - 15 years after UN while 16 are alive but not

yet fully examined. GFR was studied in 38 donors 10 - 18 years after nephrectomy and from 33 of these we received 3 consecutive 24 h samples of urine. The mean age at examination was 57 years (33 - 78). 21 were men and 17 were women. Reference values for the urinary analyses were obtained from a control group of 14 healthy 55-year old men.

METHODS

All donors were examined with plasma-^{51}Cr EDTA-clearance to assess the glomerular filtration rate (GFR). Every donor received instructions to collect three consecutive 24 h urine samples the days before arrival to the hospital. No preservatives were used in the collection bottles. The samples were stored at -18^{o} C. pH was not examined in the samples. The 24 h urinary total protein was determined with the biuret method after precipitation with Tsuchiya's reagent. The 24 h urinary albumin excretion was determined with quantitative immunoelectrophoresis according to Laurell. The 24 h urinary β2-microglobulin was determined with radioimmunoassay, Phadebas^{R} Pharmacia Diagnostics. Urinary creatinine excretion was also determined in all samples to assess the reliability of the urinary collections.

RESULTS

A total protein excretion of more than 0.5 g/24 h was found in four donors. No donor had proteinuria exceeding 1.3 g/24 h (Fig. 1).

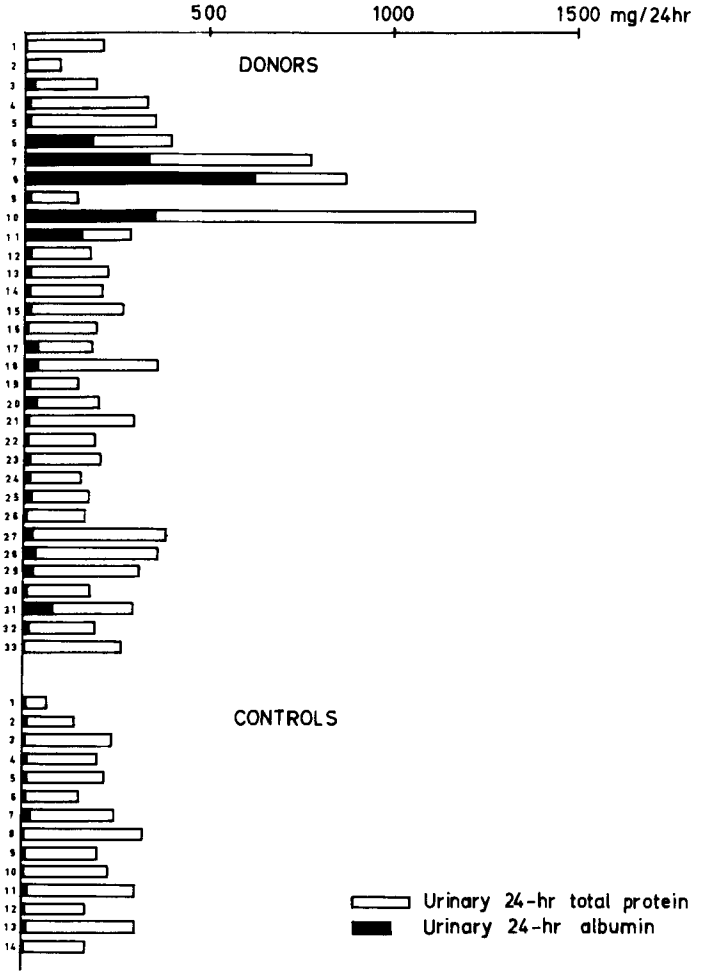
Mean values and ranges for the urinary 24 h excretion of total protein, albumin and β2-microglobulin in the donors and controls are presented in the table below.

	Donors (n=33)	Controls (n=14)	Significance
Total protein (mg/24 h)	306 (92-1217)	212 (65-326)	N. S.
Albumin (mg/24 h)	66 (5-620)	11 (7-23)	$p<0.01$
β2-microglobulin (ug/24 h)	1040 (49-28400)	157 (61-420)	N.S.

Only the albumin excretion was significantly increased in the donor group.

The distribution of the individual values for total urinary protein and albumin is given in Fig. 1. The donors with increased proteinuria had a higher proportion of albumin. This is in accordance with an increased glomerular leakage of albumin.

Fig. 1



The proteinuria was further evaluated according to Peterson, Evrin and Berggård studying the ratio between 24 h urinary albumin and β2 microglobulin (10). Compared to their refererence values we found two donors with tubular proteinuria and three donors with glomerular proteinuria. The distribution of the ratios is given in Fig. 2.

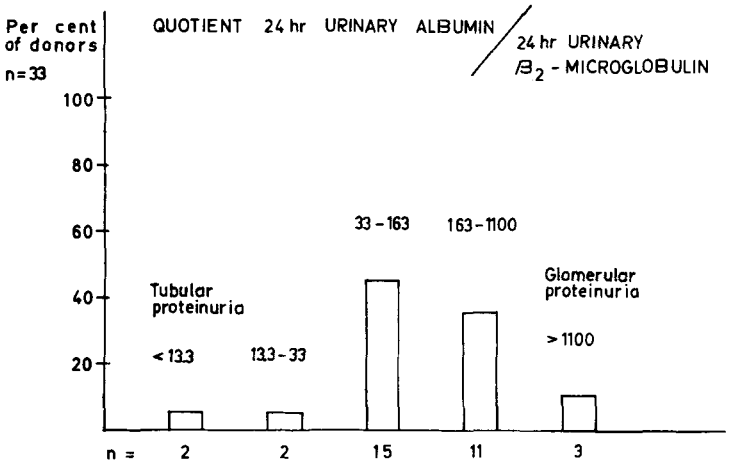


Fig. 2

The GFR in 48 donors varied between 38-104 ml/min/1.73 m^2. Fig. 3 illustrates the relation between GFR and age at follow-up. The area between the two lines in the diagram is the normal range of GFR for subjects with two kidneys at different ages (7).

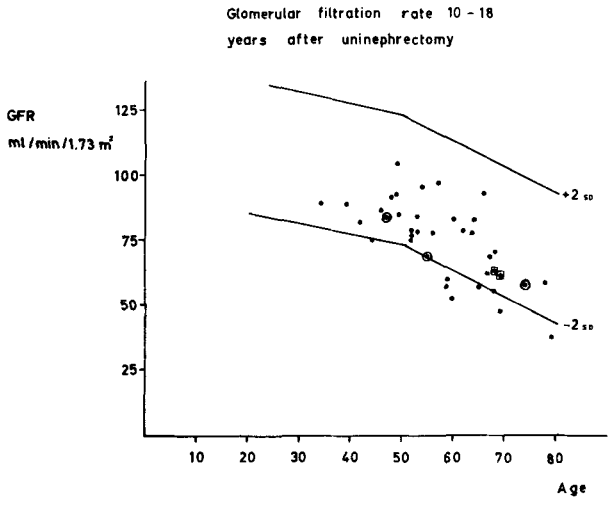


Fig. 3. Glomerular filtration rate in 38 donors 10 - 18 years after donor uninephrectomy.

● Donors with glomerular proteinuria ■ Donors with tubular proteinuria

The GFR in all but seven donors fell within the normal range, and in five donors with glomerular or tubular proteinuria it was not different from that in remaining donors.

In Fig. 4 the follow-up GFR is expressed as per cent of the pre-UN value. The donors have been arbitrarily separated into those with 24 h excretion of albumin of more or less than 30 mg/24 h and 24 h β2microglobulin excretion of more or less than 200 ug. The GFR was not significantly different between the groups.

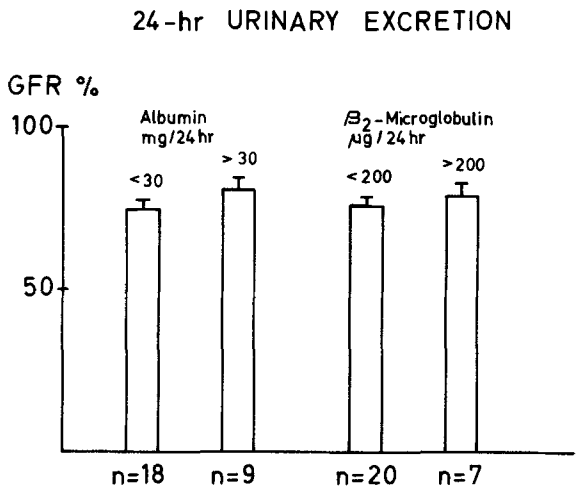


Fig. 4

DISCUSSION

Renal function is well maintained 10 - 18 years after UN and only seven donors were found to have a slightly decreased GFR compared to reference values for normal subjects with two kidneys( ). The two donors with tubular proteinuria were both treated for moderate hypertension but were otherwise prefectly healthy and a study of their case records gave no explanation for the proteinuria.

The moderate albuminuria in the donor group is difficult to evaluate. It seems to be limited to five or six donors who also have moderate proteinuria. There was no relation between the increased albuminuria and well defined diseases e.g. diabetes mellitus, hypertension or urinary tract infections. Finally there was no correlation between the albumin excretion and the GFR. Further studies 2 - 3 decades after donor-UN will provide additional insight in how the nephrectomy affects the development of proteinuria (8). In this study donor-UN has not been shown to carry a risk for progressive renal failure.

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