

ASSOCIATION BETWEEN RISING HAEMOGLOBIN CONCENTRATION AND RENAL CYST FORMATION IN PATIENTS ON LONG TERM REGULAR HAEMODIALYSIS TREATMENT

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Summary

Seventeen of 20 (85%) patients on RDT for six to 13 years were found to have acquired renal cysts. There was a significant positive association between Hb and duration of RDT. The extent of cyst was positively and significantly correlated with the latest Hb and years on dialysis. There was also a significant positive correlation between size of cysts and the latest Hb. However, cyst size and years on dialysis only approached statistical significance. There was no correlation between kidney size and latest Hb.

Complications in patients with acquired renal cysts appear to resemble those of familial polycystic disease with the added risk of neoplasia.

Introduction

Recently we made the observation that our patients on regular dialysis treatment (RDT) for more than 10 years, were no longer seriously anaemic.

In 1980 [1], the development of renal cysts in glomerulonephritic RDT patients was described. We therefore investigated whether there might be an association between the rising haemoglobin (Hb) concentration and the formation of renal cysts.

Patients and methods

In 1981, we studied all surviving patients who had been on RDT for six or more years. There were 14 men and six women, (mean age 44.8 years). Eight had been on RDT for 10 to 13 years (mean 11 years) and 12 for six to nine years (mean seven years). The aetiology of their renal disease was:

Glomerulonephritis	9	Hypertensive nephrosclerosis	2
Chronic pyelonephritis	2	Gouty nephropathy	1
Hypervitaminosis D	1	Aetiology undetermined	4
Lipodystrophy and glomerulonephritis	1		

These patients had undergone standard haemodialysis three times weekly for five to seven hours, using 1m² disposable or non-disposable plate dialysers which were re-used with their blood lines up to six times [2]. All but three of the patients had been on home dialysis.

Haemoglobin concentrations were determined at approximately six-monthly intervals using standard laboratory methods. First values included in this survey were those observed six months after commencing RDT.

Plasma erythropoietin concentrations were determined blindly (OHBG) using a mouse liver cell assay method [3].

Twenty-four hour urine volumes were measured in all the patients who were passing urine.

Kidney size, cyst size and extent of cysts were measured by two radiologists (DAG and CAMcC) who were not aware of the patient's haemoglobin levels or number of years on dialysis. 'Aloka' real time ultrasound and 'Diasonograph' B scanners were used for measurement of kidney size, cyst size and extent of cyst formation. Results were expressed as follows:

Kidney size The longitudinal and antero-posterior dimensions of the kidneys were estimated using the caliper system of the ultrasound equipment, renal size being expressed as the product of these two measurements.

<i>Size of cysts</i>	0 = No cysts	
	1 = <1cm	maximum diameter
	2 = 1 – 2.5cm	maximum diameter
	3 = >2.5cm	maximum diameter

<i>Extent of cysts</i>	0 = No cysts	
	1 = <25%	kidney mass replaced by cysts
	2 = 25–50%	kidney mass replaced by cysts
	3 = >50%	kidney mass replaced by cysts

Five patients were excluded from statistical analysis for the following reasons:

- Two patients had unilateral hydronephrosis.
- In two patients one of their kidneys could not be visualised.
- The fifth patient had had a unilateral nephrectomy because of haematuria, cystic changes and gross enlargement.

Results

Hb concentrations Time spent on RDT was found to have a close positive correlation with Hb concentration as shown in Figure 1 ($r = +0.58$ $p < 0.005$ two-tail).

Erythropoietin concentration Figure 2 shows significant negative correlation between plasma erythropoietin level and latest Hb concentration ($r = -0.58$ $p < 0.01$ two-tail).

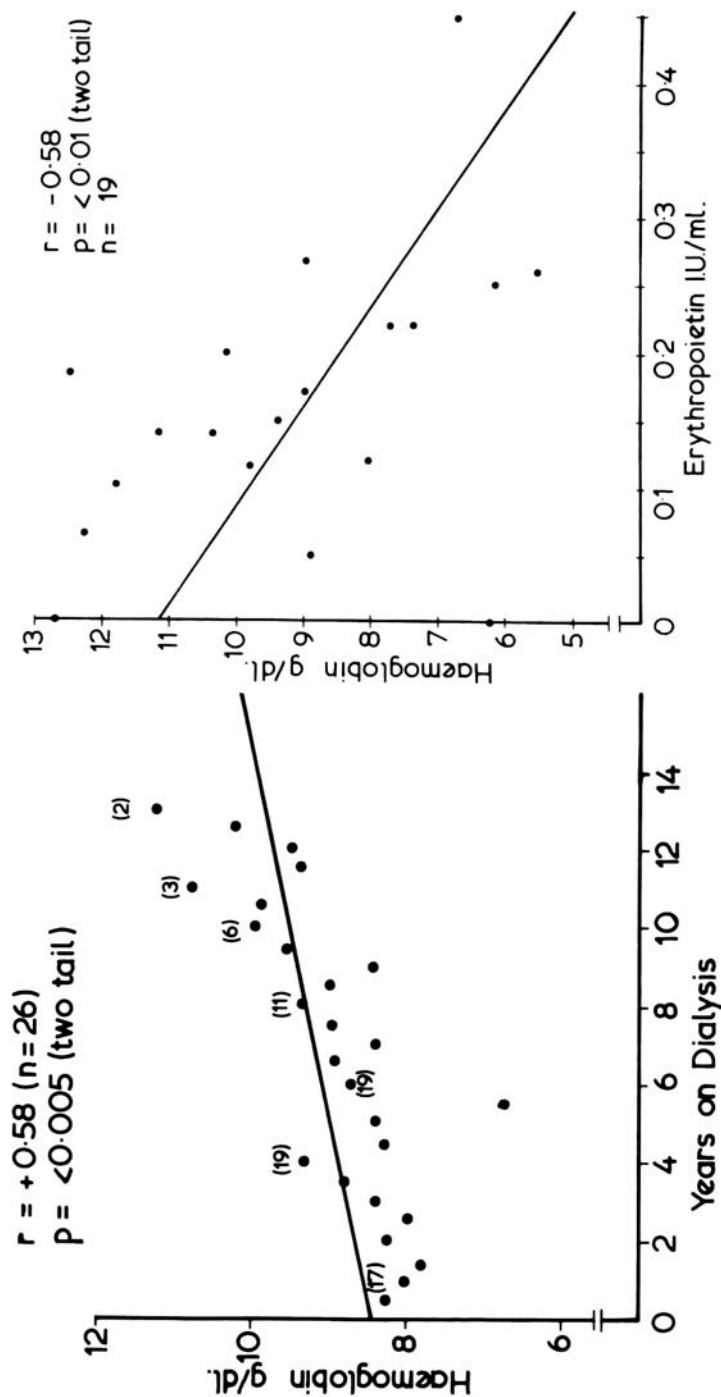


Figure 1. Six monthly Hb values in 20 patients for six to 13 years on RDT. The first value was taken six months after commencement of RDT. Figures in brackets denote number of estimations

Figure 2. Significant negative correlation of erythropoietin concentration with the latest Hb concentration in 19 patients on RDT

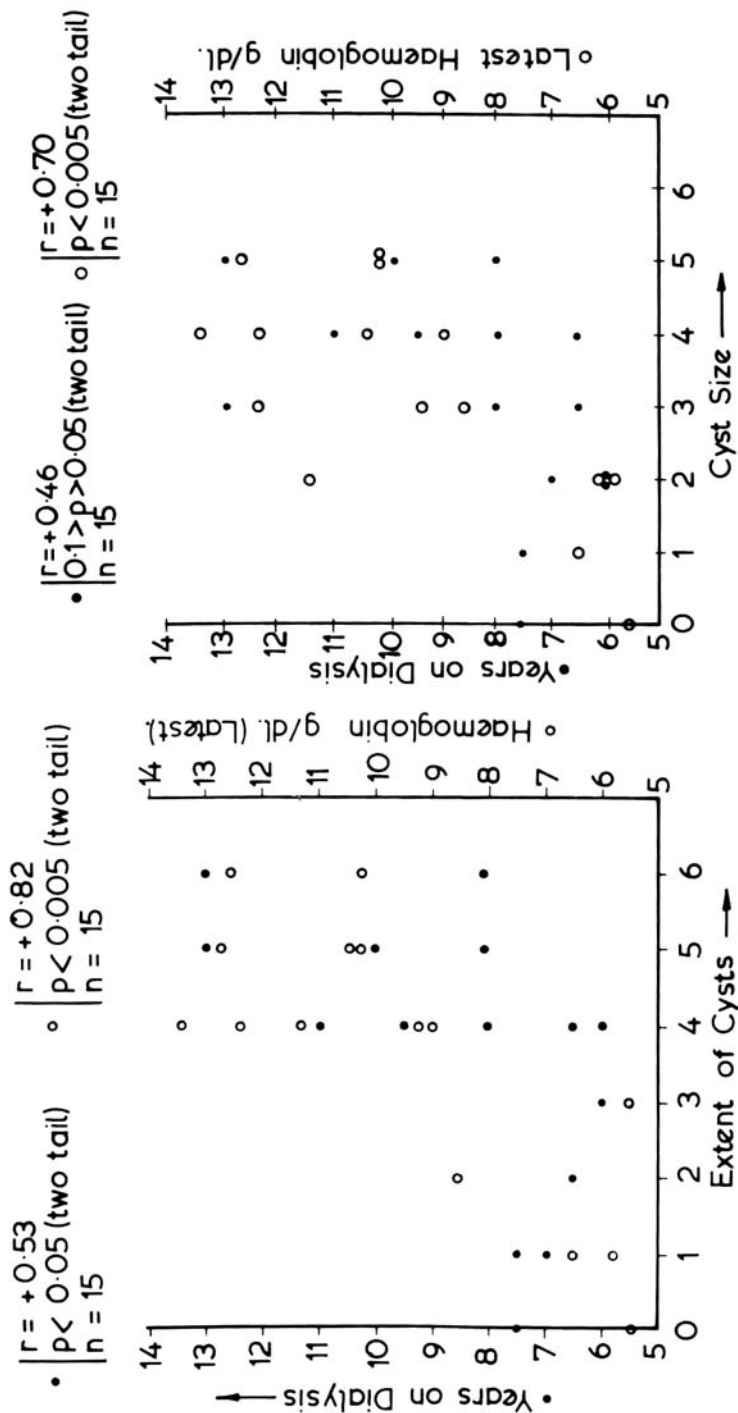


Figure 3. Extent of renal cysts correlated to years on RDT and the latest Hb concentration. The extent of cysts is the total sum of cysts in both the kidneys which was measurable only in 15 patients

Figure 4. Size of renal cysts correlated to years on RDT and the latest Hb concentration. The size of renal cysts is the total sum of cysts in both the kidneys which was measurable only in 15 patients

Kidney size Though some of the kidneys were markedly enlarged and clinically palpable, there was no overall correlation between the latest Hb concentration and kidney size ($r = +0.26$ $p > 0.2$ two-tail).

Extent of renal cysts Figure 3 shows a significant positive correlation between extent of cysts and the most recent Hb ($r = +0.82$ $p < 0.005$ two-tail), and also between extent of cysts and years spent on RDT ($r = +0.53$ $p < 0.05$ two-tail). Eighty-five per cent of patients (17 out of 20) had renal cysts.

Size of renal cysts Figure 4 shows a significant positive correlation between size of cysts and the most recent Hb ($r = +0.70$ $p < 0.005$ two-tail). An association approaching significance level between the size of cysts and years spent on RDT is also shown in Figure 4 ($r = +0.46$ $0.1 > p > 0.05$ two-tail).

Twenty-four hour urine volume Twelve of the patients were anuric, four passed less than 100ml daily, three less than 500ml and only one patient passed 1100ml daily. There was no significant correlation between 24 hour urine volume, the latest Hb concentration or plasma erythropoietin values.

Discussion

In RDT patients, kidney parenchyma is usually reduced during the first three years of RDT but after four years, kidney volume appears to increase again, probably due to acquired cystic disease of the kidney [1].

A 79 per cent incidence of renal cyst formation in patients on RDT for four years or longer has been previously reported [1]. The mean age of these 29 patients was 40 years and the prevalence of cysts was not age-dependent.

In our 20 patients (mean age 44.8 years) who had been on RDT for six to 13 years (mean 8.6 years) the cyst detection rate as 85 per cent.

It is well-known that patients with primary polycystic kidney disease are less anaemic than other renal insufficiency patients with a corresponding degree of renal failure.

The number and size of acquired cysts in chronic renal failure can ultimately mimic familial polycystic disease. One of our patients with well-documented crescentic glomerulonephritis was so misdiagnosed by the surgeons when he needed nephrectomy for uncontrollable haemorrhage from his huge cystic kidney after 10 years of RDT.

Presumably the rise of the Hb in long-term RDT patients occurs in response to erythropoietin release, resulting from renal anoxia induced by cyst formation. Whatever the mechanism, its occurrence is obviously beneficial to the patient, balanced only by the risks of renal infection, haemorrhage or renal adenocarcinoma [1,4].

A feedback mechanism is the likely cause of negative correlation between haemoglobin and plasma erythropoietin levels.

Whether renal cyst formation is due to accumulation of a metabolic product or heparin, or leaching of a chemical form from the polyvinyl chloride tubing of the extracorporeal circuit remains to be determined. This question might

have a bearing on the pathogenesis and possible prevention of cyst formation in familiar polycystic disease.

References

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