Incidence and Causes of Chronic Renal Failure in Childhood

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Until now, dialysis and renal transplantation centres have been rather hesitant in taking children with terminal renal failure into their programme. In the 1970 report of the EDTA on regular dialysis treatment in Europe the age groups from 0 to 15 years comprise only 1.8% of all dialysis patients (Drukker et al, 1970).* It might seem, therefore, that children represent a negligible percentage of patients with terminal uraemia. Paediatric patients are considered unsuitable candidates by many people for dialysis treatment, not only because of the unsatisfactory results in the long run, but also for socioeconomic reasons. In addition, they present some special problems involving the cardiovascular system, nutrition, pubertal development and growth. Nevertheless, recent reports indicate that regular dialysis and transplantation are becoming practical and usually well tolerated procedures in childhood. For this reason, it becomes important to obtain exact figures on the incidence of chronic renal failure in childhood (Holliday & Potter, 1970; Meadow et al, 1970).

INCIDENCE

Only a few figures are available on the mortality rate from renal disease. For example, in the German Democratic Republic, an average of 3 children age 0-14 per million inhabitants per year were reported to die from all forms of renal disorders; almost a third of these were infants. As in other official mortality figures, acute and chronic forms of uraemia were not distinguished.

Figures from the Registrar General’s Reports in the United Kingdom (Meadow et al, 1970) suggest that 3.5 cases per million population per year die from chronic renal failure (CRF) during the first 15 years of life.

In 1969 we started a survey in the South Western part of Germany (Baden-Württemberg), to find the number of children with CRF who died during the

*but see the figures of Parsons et al (1971) in this volume. Page 3.
10-year period 1960 - 1969 or who were still alive at the moment of the survey. Twenty-two paediatric hospitals and units servicing most of the area’s population of 9 million took part. It was felt that by approaching small as well as large paediatric services in a closed geographic area the true incidence of CRF in childhood would best be reflected. Probably some paediatric patients in general or adult hospitals were missed by this survey. CRF was defined as a glomerular filtration rate of less than 30ml/min/1.73m² or a blood urea nitrogen of more than 25 mg/100 ml for more than 3 months. Per million inhabitants a mortality figure of almost 1.5 yearly was found for the first 16 years of life. In addition, half this number of children were still alive with CRF and in hospital care at the moment of the survey. No information was obtained regarding age and causes of CRF.

To get more insight into these factors, we started last year a more detailed survey on the incidence of CRF. This was done on the occasion of the 4th Meeting of the European Society for Paediatric Nephrology in Heidelberg. The members of this Society and some guests, most in charge of paediatric nephrology units, were asked for data on children with advanced CRF observed in their institutions from January 1965 to December 1969. The definition of advanced CRF was a glomerular filtration rate of less than 20ml/min/1.73m², a serum creatinine of more than 2 mg/100 ml or a blood urea nitrogen of more than 35 mg/100 ml, present for at least 6 months in children from 6 months to 16 years. This rather narrow definition was used to cover most patients with irreversible CRF who were likely to require dialysis treatment eventually. Until December 1970, 31 centres in 17 countries had taken part. The size of the population from which these figures are drawn is difficult to evaluate, because most institutions regarded themselves both as serving the local population as well as acting as a referral centre for renal disease in children. We estimated a total population of 80 million.

A total of 617 children were reported; 292 were dead and 325 alive on March 31, 1970. The mortality figure for CRF in children derived from these data is about 0.75 children per 1 million inhabitants per year.

The number of children with CRF reported in the European survey clearly

<p>| Table I. Advanced chronic renal failure in childhood ESPN survey, December 1970 |
|---------------------------------|-----|-----|-----|-----|</p>
<table>
<thead>
<tr>
<th>Age at death or at last examination (years)</th>
<th>0 - 5</th>
<th>5 - 10</th>
<th>10 - 16</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of dead patients</td>
<td>63</td>
<td>78</td>
<td>151</td>
<td>292</td>
</tr>
<tr>
<td>Number of patients alive in March 1970</td>
<td>58</td>
<td>118</td>
<td>149</td>
<td>325</td>
</tr>
</tbody>
</table>
increases with age (Table I). It must be stressed that infants below 6 months, ie an age group which, according to other reports, might have a peak incidence of CRF, were excluded, because at present they do not appear to be suitable recipients for renal transplants. Other experience allows us to assume that above the age of 15 years the frequency of terminal renal failure rises steeply: in the 1970 report of the European Dialysis and Transplant Association on regular dialysis treatment in Europe, the age group from 10 to 15 years comprised only 1.4% whereas that from 15 to 20 years 5.8% of all dialysed patients (Dukker et al, 1970).

CAUSES OF CRF IN CHILDHOOD

Three main aetiological groups of CRF, each with about an equal number of patients, were found in the survey of the European Society for Paediatric Nephrology (Table II):

1. Congenital kidney disorders, including cases of renal hypoplasia and cystic renal disease, Alport's syndrome, nephronophthisis and cystinosis;
2. Subacute and chronic glomerulonephritis, comprising also the nephropathy of anaphylactoid purpura;
3. Pyelonephritis, cases with or without malformations of the urinary tract, such as those associated with myelomeningocele, were not reported separately.

The group of congenital kidney disorders is revealed as the most important cause of CRF in children, while in adult mortality surveys it is responsible for only a small percentage of the cases of CRF. If the number of patients dead or alive are compared, it becomes apparent that glomerulonephritis in childhood more often has a fatal outcome than pyelonephritis or

<table>
<thead>
<tr>
<th>Table II. Diagnosis of children with chronic renal failure</th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>dead</td>
<td>alive</td>
</tr>
<tr>
<td>Congenital kidney disorders</td>
<td>84</td>
<td>110</td>
</tr>
<tr>
<td>Glomerulonephritis</td>
<td>108</td>
<td>75</td>
</tr>
<tr>
<td>Pyelonephritis</td>
<td>65</td>
<td>108</td>
</tr>
<tr>
<td>Vascular kidney disease</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>Systemic diseases</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Other disorders with known aetiology</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Unknown aetiology</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>292</td>
<td>325</td>
</tr>
</tbody>
</table>

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congenital kidney disorders. The preponderance of glomerulonephritis as a cause of death is also reflected in the reports on children entering a dialysis and transplantation programme. On the other hand, it can be predicted from our data that a relatively higher number of children with CRF caused by pyelonephritis will reach adult life.

According to this survey, other renal diseases are not important causes of advanced CRF in childhood. Patients with vascular kidney disease such as haemolytic-uraemic syndrome or renal venous thrombosis usually die or recover in less than 6 months after the beginning of hyperazotaemia and might, therefore, be under-represented in this survey.

Some regional differences in the frequency of certain aetiologies of CRF were also detected. Thus the percentage of congenital kidney disorders was higher in France than in other countries. Such differences might have epidemiological reasons; they could also be explained by a different diagnostic approach. For future surveys on the incidence and causes of CRF it might be preferable to include anatomical criteria for the diagnosis and to cover also the important but still neglected adolescent age group. It is suggested that close cooperation between adult and paediatric nephrologists is needed in the planning of special dialysis and transplantation centres for the younger age group. We believe that from the experience with adults, one such centre for children is needed for a population of 10 to 15 million inhabitants.

ACKNOWLEDGMENTS

The surveys reported in this paper were made possible through the cooperation of members of the European Society for Paediatric Nephrology and the directors of the children’s hospitals in Baden-Württemberg.

REFERENCES


OPEN DISCUSSION

MATTHEWS (Pittsburgh): How many children do you dialyse per week and how much heparin do you use in your paediatric dialysis?

SCHRÄER: May I answer your first question by showing a slide:

ADVANCED CHRONIC RENAL FAILURE IN CHILDHOOD
ESPN Survey, December 1970

<table>
<thead>
<tr>
<th>Method</th>
<th>No. of centres</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular peritoneal dialysis</td>
<td>13/31</td>
<td>30</td>
</tr>
<tr>
<td>Regular haemodialysis</td>
<td>15/31</td>
<td>74</td>
</tr>
<tr>
<td>Renal transplantation</td>
<td>8/31</td>
<td>15</td>
</tr>
</tbody>
</table>

This report from the European Society of Paediatric Nephrology shows that only a few patients were reported to have been dialysed either peritoneally or by regular haemodialysis. Renal transplantation had been done only in 15 patients. I cannot answer the question regarding heparin use: this was different in each centre.

MATTHEWS: In your view, what is the indication for haemodialysis? In other words, do you have any chemical parameters which would warrant the start of haemodialysis, or specifically at what serum creatinine levels do you start haemodialysis?

SCHRÄER: We believe that dialysis should be done if the child has normal psychomotor development. It was found that this parameter was the most important. We usually start dialysis treatment at creatinine levels between 10 and 20 mg/100 ml according to the clinical state of the patient. I think it is generally accepted that children usually develop clinical signs and symptoms at a much later stage of their disease than adults, if one compares the creatinine levels.

DUTZ (Chairman, Berlin, DDR): Are there any other comments or questions please? May I ask one question myself? Does the beginning of chronic dialysis depend on age, or does it depend upon the possibility of transplantation?

SCHRÄER: We think that regular dialysis treatment in childhood should only be considered if there is some possibility of a later transplantation. We don't think that regular dialysis should be done without facilities for transplantation, and therefore stress that dialysis and transplant centres for children should be at the same place.
C M KJELLSTRAND (Minnesota): We have dialysed 40 patients below the age of 15 years, the youngest being 3 weeks, who was dialysed for two months. I think I agree with your suggestion that dialysis should only be undertaken if you plan to do a transplant later on. The indications we have used for starting the patient on dialysis include, as you say, the creatinine level and also the clinical state of the patient. But we have more and more used another indication for starting haemodialysis and that is the presence of bone disease in the children. Of the 40 patients we have dialysed, 29 were transplanted later. Almost all patients grow after transplantation, but the cut-off is early — 14 for girls and 16 for boys. To wait for a creatinine level of 20 mg/100ml means that you might end up with very short patients, which might create quite a few psychological problems for these patients later on.

SCHÄRER: May I comment that growth failure in children with renal insufficiency is probably more often due to tubular insufficiency than to glomerular insufficiency.

SCHMIDT (Vienna): How high is the percentage of children with nephrotic syndrome who come to dialysis?

SCHÄRER: I can only say that in the experience we have had with Dr Schüler in Heidelberg, about half the patients entered the dialysis programme because of the nephrotic syndrome.

DUTZ: Allow me one final question. In the Charité, Professor Grossman is developing a special centre for children’s chronic dialysis alone. Do you think it is essential to have separate dialysis units for children?

SCHÄRER: May I refer this question to Dr Cameron, who coordinates adult and paediatric nephrologists, and who may be able to answer much better.

J S CAMERON (London): This is a very difficult question and the answer, I think, depends to some extent on local facilities and local talent in terms of the medical staff available. I think the ideal situation (and we have written about this — Meadow, R. et al (1970), Lancet, 11, 707) is that there should be a separate facility for the children which could share a large proportion of its staff and receive back-up from an adult nephrological unit in the same hospital. Although it has been done in several centres, I think it is very difficult to set up a completely separate childhood unit. If one looks at the separate units that exist — such as in Los Angeles and in Paris — one finds that in fact there is extremely close cooperation and some exchange of staff between the adult and the children’s unit. I think that the fact that these
children grow up to be adults indicates that we must do this as a cooperative venture.

N ALWALL (Lund): Thank you very much Dr. Schärer for a very interesting paper. I would like to say that this year for the first time we have a special session devoted to a symposium on kidney transplantation. Next year the possibility of devoting a corresponding space to paediatric nephrology has been discussed in the Council. We think it is very important to get a broader basis for our Association and especially for paediatric nephrology. I think you gave a very good introduction to this. Thank you very much.
PART III

TRANSPANTATION

i) CLINICAL RESULTS
Chairman: Professor P Michielsen

ii) IMMUNOLOGY
Chairman: Professor H Bucht

iii) STORAGE
Chairman: Dr W J Kolff