Survival rates in cystic fibrosis

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SUMMARY Life tables were calculated for 273 British children with cystic fibrosis for the period 1974–9. There was a marked improvement in survival rates in the meconium ileus group compared with the 1969–73 data, but there was little improvement in patients presenting later with other symptoms.

Cystic fibrosis (CF) is the most common lethal inherited disease that affects white populations. Several studies have used actuarial life table analysis, and it has been noted that survival rates have improved markedly in the last 20–30 years.^{1 2 3} We compared recent survival rates with those in our earlier life tables.^{1 4 5} We also examined whether mortality rates were greater among girls and patients with meconium ileus (MI).

Patients and methods

We studied the 273 patients attending the CF clinic at this hospital between 1 January 1974 and 31 December 1979. These patients had typical symptoms of CF such as recurrent pulmonary infection, failure to thrive, nasal polyps, rectal prolapse, and MI, together with at least two sweat sodium concentrations greater than 60 mmol (mEq)/l on samples weighing 100 mg or more. An exception was made for babies with MI who died before having a sweat test. They were included in the analysis if the pathological findings at necropsy were consistent with CF. Surgical admission records and necropsy records for the period of study were examined to ensure that no such patients were omitted.

Data obtained by reviewing the patients' medical

records were recorded on punched cards for computer analysis. Life tables were constructed and survival curves plotted with the Survival procedure of the Statistical Package for the Social Sciences (Northwestern University, Evanston, Illinois, USA). Analysis was not performed beyond 16 years as patients were routinely transferred to adult clinics at this age. As CF is a genetic disorder patients were entered into the survival analysis at birth (earlier studies have shown little difference in CF survival rates between patients entered at birth or at presentation).⁴ Statistical comparisons between survival curves were made using the non-parametric test developed by Desu⁶ to compare the survival of the groups over the whole period of study.

Results

MI patients had a greater perinatal mortality rate: their first year mortality rate was 6.5% compared with 0% in the non-MI children. Inspection of the survival curves showed that children between 10 and 13 years of age who presented with MI also had a slightly greater mortality rate than the non-MI patients. Statistical analysis by the Desu rank sum test showed that survival to 16 years was significantly worse in MI patients than in non-MI patients ($\chi^2 = 4.98$, $P < 0.05$) (Table). If the 8 patients who died in the first year from surgical complications before referral to the CF centre for out-patient care are excluded from the analysis, however, the survival rates are not significantly different ($\chi^2 = 0.19$, $P > 0.05$). Survival rates for girls were not significantly different from those for boys up to 16 years of age (Table). Inspection of the curves showed that the girls had a slightly lower cumulative survival rate after 8 years of age but the difference was small.

Table Median survival rates and cumulative survival to 16 years of age in 273 children with cystic fibrosis, according to presentation and gender

Group	No	Median survival (yr)	Proportion surviving to age 16 years (%)	SE of proportion surviving to age 16 years (%)	P*
Meconium ileus	65	16+	53	13	<0.05
Non-meconium ileus	208	16+	73	5	
Boy	158	16+	77	6	NS
Girl	115	16+	61	8	
All patients	273	16+	70	5	

*By Desu rank sum test.
NS = not significant.

Figure Survival curves of children with cystic fibrosis entered at birth (a) meconium ileus patients (b) non-meconium ileus patients.

The survival curves for the current 1974-9 series were plotted in comparison with the results from the earlier reported series.¹⁻⁵ MI patients were shown separately because of their worse survival rates in this and earlier studies (Figure (a)). It was apparent that survival rates in the MI series had improved appreciably, although it was not possible to evaluate this change statistically because the raw data from the earlier studies has not been preserved. Much of the improvement in the MI group was due to better survival in the first year. There was little change in survival rates in the non-MI patients (Figure (b)) compared with the last series from 1969-73.¹

Discussion

The survival rate in MI patients improved considerably in 1974-9 compared with 1969-73. This was mainly related to a reduced first year mortality rate that may be attributed to improved neonatal

care and the more frequent use of parenteral nutrition. It was disappointing that survival rates were not improved in the majority of CF patients, who do not present with MI. This may represent increasing severity of infection with *Pseudomonas aeruginosa*—an important pathogen in CF for which there is no effective long term treatment.

There was no significant difference in survival rates between boys and girls with CF before the age of 16 years, although an earlier study showed a greater decline of pulmonary function after puberty in girls than in boys.⁷ Several studies have shown worse survival rates for girls than for boys when the life tables have extended to adult life, and particularly good survival rates have been described for Canadian boys.⁸ It is possible that an important difference in survival rates in our boys and girls was concealed by ending the analysis at 16 years.

These data show that during the period 1969-79 presentation with MI became much less of a disadvantage to the survival of our CF patients. Between 1974 and 1979, however, survival in non-MI patients did not improve compared with the period 1969-73, but the survival rates were similar to those reported by centres in Australia, Canada, and the USA.³⁻⁸

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