

as infection with cytomegalovirus, toxoplasmosis, streptococcal pharyngitis, infectious hepatitis, and adenovirus pharyngotonsillitis (the main differential diagnoses).

The shift in age distribution of anginose IMN in our community cannot be attributed to socioeconomic conditions as these have been constantly improving in our urban community over the past 20 years; nor can it be related to the emergence of new diagnostic tests because the changing pattern was observed before such tests were available in our medical centre.

Interestingly, Sumaya *et al* prospectively evaluated children with documented IMD induced by Epstein-Barr virus between 1976 and 1982⁶ and concluded that 'an unexpected finding was the large number of young children less than 4 years old with this disease.' They found that 45% of their patients under 4 years old had exudative tonsillopharyngitis. They also found, as we did, that the incidence in

boys was more than twice that in girls. The similarity of their data, from the United States, to ours implies that the increase in the occurrence of clinical IMN in early childhood may be a worldwide rather than a local phenomenon.

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Referral to a regional centre improves outcome in extremely low birthweight infants

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SUMMARY Referral of extremely low birthweight infants (< 1001 g) from district hospitals in a geographically defined area to a specialist regional centre significantly improved their chances of survival.

Referral of preterm infants or of their mothers antenatally to a regional unit has been widely accepted as improving outcome, though there is little evidence to support this belief. Reports of improved survival either compare results before and after the introduction of a transfer programme, with the problem of historical controls, or contrast the outcome of infants transferred to a regional unit with that of those left behind, though such groups are not comparable.¹ This study compares the 28 day mortality of extremely low birthweight infants in eight geographically defined areas with the rate of referral from their district hospitals to a regional perinatal centre.

Methods

Mersey regional neonatal intensive care unit is in Liverpool Maternity Hospital and with the obstetric units provides a regional perinatal referral service for Mersey region and north Wales. For the purpose of this study I divided the region into eight areas corresponding to district or area health authorities. These areas were Clwyd, Gwynedd, West Cheshire, (Chester, Warrington, Halton), East Cheshire (Crewe and Macclesfield), St Helens, Liverpool, Sefton (North and South), and Wirral.

The data for the study were obtained from forms LHS 27/1 for each district for the years 1980-3 inclusive and the admissions records of the regional neonatal intensive care unit. Form LHS 27/1 is completed by each district health authority yearly and returned to the regional health authority and to the statistics department of the Department of Health and Social Security in Blackpool or, in the case of Wales, the Welsh Office in Cardiff. Information reported on the form includes the number of

Table Referral rates of extremely low birthweight [ELBW] infants from different health districts in relation to their birth rates and mortality of low birthweight [LBW] and ELBW infants

Area	Corrected mortality of LBW infants	Corrected rate of LBW infants	Mortality of ELBW infants	Rate of ELBW infants	Referral of ELBW infants (%)
West Cheshire	28	53	375	1.87	83
East Cheshire	35	69	862	2.92	0
Clwyd	38	58	681	2.40	38
Gwynedd	57	56	600	1.81	65
St Helens	45	72	696	3.73	38
Sefton	38	60	741	1.92	4
Wirral	37	60	625	2.61	56
Liverpool	39	70	613	3.38	99

notifications of births to mothers normally resident in the district concerned adjusted by any notifications of births to mothers transferred in or out of the area, together with the place of birth. Births are also recorded on the form in birthweight groups for infants of 2500 g or less, with the age of death of those dying in the first month notified as day 0, 1–7 days, and 7–28 days. The records of the regional intensive care unit yielded the number of extremely low birthweight infants admitted and the mothers' place of residence. Both in utero and postnatal transfers were included.

From these data I derived the following variables for each area: corrected rate of low birthweight (1001–2500 g) infants per 1000 live births, corrected neonatal mortality of low birthweight infants per 1000 live births, rate of extremely low birthweight infants per 1000 live births, neonatal mortality of extremely low birthweight infants per 1000, referral rate of extremely low birthweight infants to the regional centre, and distance of the principal district hospital in each area from the regional centre. The Table shows these figures for each of the eight areas. Correlations between variables for the areas were sought with Spearman's rank correlation test.

Results

Altogether 201 extremely low birthweight infants were referred over the four years, and the referral rate varied between 0% and 99%. Mortality at 28 days ranged from 375 to 862/1000. A significant correlation between referral rate and lower mortality was observed ($r=0.92$, $p<0.01$). The 28 day mortality for extremely low birthweight infants would obviously be affected by the number of infants registered as liveborn in a given area; this varied between 1.8 and 3.7/1000. It has been suspected that some hospitals do not register very small infants who are likely to die, particularly when intensive care is not readily available. To investigate

this possibility the rate of extremely low birthweight infants was compared with the corrected rate of low birthweight infants for each area: there was a strong correlation between the two ($r=0.96$, $p<0.01$).

There was no significant correlation between the rate of low birthweight infants and mortality of these infants or between the rate of extremely low birthweight infants and mortality in the eight areas. The distance in miles of the main hospital in each area from Liverpool did not correlate with referral rate.

Discussion

Advances in neonatal intensive care have undoubtedly contributed to improvements in the survival of extremely low birthweight infants. Crude comparisons between the populations treated in referral centres and district hospitals have, however, suggested that such gains are minimal and that little benefit exists in referring very tiny infants.² In this study I looked at the effect of transfer on the smallest infants, among whom any effect would be most obvious. Each area had the same opportunity to refer infants, and during the time of the study the regional unit was rarely unable to accept any referral. The rate of referral did not correlate with the distance from the regional unit but presumably depended on the policy of the individual district hospitals. Failure to register extremely low birthweight infants as live births would have a serious effect on a study such as this. The wide variation in rates of extremely low birthweight infants (1.8–3.4/1000) might indicate that this was happening. The rate for each area, however, correlated well with the corrected rate of low birthweight infants, suggesting that non-registration of these infants was unlikely and that the variation in rates was real reflecting socioeconomic conditions rather than attitudes to resuscitation at birth. The neonatal mortality in both extremely low birthweight and low birthweight

babies did not correlate significantly with their respective rates of occurrence, suggesting that even in areas of socioeconomic deprivation with high rates of low birthweight babies outcome may be independent of this. Extremely low birthweight infants form a high risk population but represent only about 4:1000 of all infants born. Though this study shows that such tiny infants do best when referred to a regional centre, the effect of referral

may not be as pronounced in larger infants, and further studies are necessary to clarify the issue.

References

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Blood cultures in neonates with percutaneous central venous catheters

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SUMMARY We compared the results of 74 pairs of blood cultures obtained simultaneously every two weeks from a peripheral vein and a percutaneously inserted central venous catheter in 38 newborns. Three babies (7.9%) had bacteraemia. In two of these the central catheter was colonised 48 hours beforehand.

In most of the reported cases of sepsis related to the use of central venous catheters the diagnosis was based on the natural history or on a positive result of a blood culture obtained either from a peripheral vein or through the catheter. We considered that by obtaining simultaneous blood cultures from a peripheral vein and the catheter, it might be possible to identify catheter colonisation before peripherally drawn blood samples yielded a positive culture.

Patients and methods

Thirty eight neonates, including 27 who weighed less than 1.25 kg, with percutaneously inserted silastic central venous catheters were studied. Clinical data are summarised in Table 1. Catheters were inserted

using the peripheral veins of the extremities and scalp exclusively.¹ The infusion included FreAmine III (American McGaw, American Hospital Supply Corporation) and 10% Intralipid (Cutter Laboratories). All infusions and administration sets were changed daily by the nurses under sterile conditions.

The 1 ml blood samples were drawn simultaneously, one from a peripheral vein and the other through the central catheter, at two weekly intervals for as long as the catheters were in place. Each blood specimen was cultured on aerobic and anaerobic culture media. Aerobic culture medium consisted of 10 ml tryptic soy agar broth and the anaerobic culture medium of 10 ml brain heart infusion broth. Blood cultures were inspected daily for seven days.

Results

The mean (SD) duration that catheters were in place was 34.5 (20.6) days, with a range of 14-95 days. Seventy four sets of blood cultures were obtained routinely. In addition, eight sets of blood cultures were drawn because of clinical suspicion of infection, but all yielded negative results. Results of the routine cultures are shown in Table 2. Three of the 38 patients had positive blood cultures, an incidence of bacteraemia of 7.9%. These three cases are described in more detail below. In the first two patients the catheter was colonised before a positive culture was obtained from peripheral blood.

Case 1. A patient with a birth weight of 2880 g was receiving assisted ventilation for the management of

Table 1 *Clinical characteristics of the 38 infants studied. Values are mean (SD) [range]*

Birth weight (g)	1228 (705)	[620-2930]
Gestational age (weeks)	29.2 (4.4)	[25-42]
Postnatal age (days)	19.6 (15.7)	[1-81]
Weight when catheter put in place (g)	1515 (790)	[650-3320]