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Original Research

Neonatal mortality amongst Scottish preterm singleton births (2001–2010): record linkage of maternity data and neonatal mortality data

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ABSTRACT

Objectives: To provide a contemporary estimate of singleton neonatal mortality based on birthweight and gestational age at delivery from 2001 to 2010, and to compare this with a similar data set from 1985 to 1994.
Study design: Record linkage of maternity data and neonatal mortality data. Population: All singleton preterm deliveries from 24 to 36 weeks inclusive between 2001 and 2010.
Setting: Scotland, UK.
Methods: NHS National Services Scotland uses a standardized maternity discharge record to collect details of maternities in Scotland. These delivery records were linked to the infant death files from the National Records of Scotland. Main outcome measure: Neonatal death.
Results: Between 2001 and 2010 there were 525,997 liveborn singleton deliveries of which 31,280 were preterm (5.95%). In this preterm group the neonatal mortality rate was 18.2/1000, a significant reduction from 41.3/1000 in 1985–1994 ($P < 0.001$). The neonatal mortality rate fell with advancing gestation from 451/1000 at 24 weeks to 2.74/1000 at 36 weeks.
Conclusions: This is the largest recent study to use both birthweight and gestational age at delivery to consider neonatal mortality. These data will aid the management and prognostic guidance of preterm delivery.

Introduction

Preterm birth is the leading cause of neonatal death worldwide,[1] and is also associated with long term disability.[2] The neonatal mortality rate is described as the number of deaths in the first 28 days of life per 1000 live births. Reliable data regarding neonatal mortality rates can be used to provide prognostic guidance for both the mother and obstetrician in the context of preterm delivery. In addition, neonatal mortality information is useful to neonatologists considering the appropriate level of medical intervention after delivery of a preterm baby.

A number of studies have examined neonatal mortality at different gestational ages or at different neonatal weight independently[3] but the largest study to look at these both

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together is now 20 years old: 1985–1994.[4] Over this time there have been advances in both obstetric and neonatal practice, and an updated analysis will be of value to guide current clinical practice. We used the comprehensive population based records held by NHS National Services Scotland (NSS) in order to reliably estimate neonatal mortality for each gestational age and infant weight sub category.

Methods

Information services within the non-departmental public body – *National Services Scotland*, use the Scottish Morbidity Record 02 (SMR02) maternity discharge record to routinely collect details of maternities. These were linked to the infant death files using a unique patient identifier (Community Health Index) number and the date of delivery. The completeness of coverage of births on SMR02 over the period of 2001–2010 by comparison with National Records of Scotland birth records is 98%.[20] NSS Information Services regularly assess the accuracy of the data by comparing a national sample of records with the clinical case notes, most recently for 2008/9.[21]

We identified all liveborn preterm singleton deliveries in Scotland (24–36 completed weeks of gestation) over a period of 10 years. Menstrual dates and ultrasound examination was accepted as the best possible estimate of gestational age. National guidelines for our study population advise ultrasound assessment to be used in preference to menstrual dates when estimating gestational age.[5,6] Birthweight as recorded on the delivery date was categorized into 250 g strata and the neonatal mortality rate was calculated for each gestational age/foetal weight group. Categories with less than ten live births were omitted (as indicated by numbers in italics) in order to exclude small numbers at the extremes of foetal weight.

Results

Between 2001 and 2010 there were 525,997 liveborn singleton deliveries, of which 31,280 were preterm (5.9%) (Table 1). The total number of deliveries has therefore fallen by 16% since the 1985–1994 study, but the proportion of preterm deliveries has increased from the previous figure of 5.4% ($P < 0.001$) Table 2. The mean age of the women was 29 years as compared to 27 in the previous cohort ($P < 0.001$).[4]

This decrease in the number of deliveries is reflected by population data that indicate the number of women living in Scotland between the ages of 15–44 has decreased from 1,121,019 in 1985 to 1,058,338 in 2010.[7] The general fertility rate (i.e. the number of live births per 1000 women between the ages of 15–44) for this population has also decreased over time. The mean general fertility rate between 1985 and 1994 was 58.4 compared to 52.7 between 2001 and 2010.[8] Age categorized data demonstrate a fall in the fertility rate of women under the age of 30 and an increase in those aged 30 years and older.[9]

The overall neonatal mortality rate within the preterm group was 18.2 per 1000.

This compares with a neonatal mortality rate of 41.3 per 1000 in the previous study ($P < 0.001$).[4] As with the previous study, neonatal mortality in the recent group fell with increasing gestation (Table 3).

Of the preterm deliveries, 50.5% were spontaneous vertex deliveries, 40.5% caesarean section, 7.1% were instrumental deliveries, and 1.8% were breech; there has been a statistically significant increase in the caesarean section rate from 33% in the previous study ($P < 0.001$).[4]

Neonatal deaths due to foetal abnormality increased from 3% at 24 weeks to 68% at 36 weeks (Table 4). This is similar to the previous study.[4]

17,808 of the 31,280 preterm deliveries were due to spontaneous preterm labour and 13,396 women were delivered for obstetrical reasons. The remaining 76 records were excluded, as delivery method was unassigned. There was no significant difference between the likelihood of neonatal death in the iatrogenic deliveries compared to the non-iatrogenic deliveries (P-value = 0.530). The iatrogenic deliveries being those that were indicated on obstetric reasons and the non-iatrogenic deliveries being spontaneous, non-indicated deliveries. This is contrary to the findings of the previous study where the neonatal mortality was higher in the iatrogenically delivered group as compared to the spontaneous labour group.[4]

Discussion

Main findings

Neonatal mortality for any given preterm weight at a specific gestational age can be estimated by using the information in Table 3. These data can be used to predict neonatal outcome after a preterm delivery and estimate the risk of delivering a foetus.

Strengths and limitations

The data in Table 3 are drawn from a large database, and a robust methodology has been used to establish their accuracy. They should be generalized to other populations with caution, however, given that there are differences in overall preterm delivery rates worldwide, with a range 5–18%.[1]

The quality of neonatal care also varies widely such that even within Europe neonatal mortality rates are 2.0 per 1000 births at 28 weeks in the Slovak Republic and Finland, and 4.9 in Latvia and France.[3] Caesarean section rates also vary across different European countries, with rates of 14% reported in the Netherlands and 38% in Italy.[3]

Estimating the risk of delivering a foetus preterm is partly limited by the accuracy of neonatal weight prediction from an obstetric ultrasound scan: accuracy is compromised by large intra- and interobserver variability[10] and is not uncommonly ±10 to 15%.[11]

We were unable to calculate an adjusted neonatal mortality rate that excluded lethal foetal abnormalities, as abnormality data were unavailable for some preterm weight and gestational age strata. Using data from the Scottish Stillbirth and Neonatal Database, Table 4 outlines the percentage contribution of congenital abnormalities to