Obstetric complications and mild to moderate intellectual disability

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Background
Mild to moderate intellectual disability affects 2.5% of the general population and is associated with an increased risk of several psychiatric disorders. Most cases are of unknown aetiology although genetic factors have an important role.

Aims
To investigate the role of obstetric and neonatal complications in the aetiology of mild to moderate intellectual disability.

Method
Obstetric and neonatal complications recorded at the time of pregnancy and delivery were compared between participants with mild to moderate intellectual disability, age-matched siblings and unrelated controls using logistic regression.

Results
Admission to a special care baby unit and not being breast-fed on discharge were more common in people with mild to moderate intellectual disability. Not being breastfed on discharge was also more common in those with intellectual disability than unaffected siblings. Foetal distress was more common among controls than among those with mild to moderate intellectual disability.

Conclusions
Admission to a special care baby unit and not being breast-fed on discharge may be related to the aetiology of intellectual disability, although the direction of this association is unclear.

Declaration of interest
None. Funding detailed in Acknowledgements.

Mild to moderate intellectual disability has a prevalence of 2.5% in England.[1] It is defined broadly as impaired intelligence, requiring an IQ of 40–69,[2] and is linked to poverty and social exclusion.[1] The majority of cases are thought to be of idiopathic aetiology; however, genetic and environmental factors are understood to have a role.[3] Genetic factors may act directly on the developing brain, or indirectly, for example by predisposing to environmental adversity such as obstetric and delivery complications.[4] Higher rates of such complications occur in people who develop intellectual disability compared with controls.[5,6] Sibling studies of individuals with mild to moderate intellectual disability may offer a better understanding of the relative contributions of genetic and environmental factors; yet – with the single exception of individuals with autism[7] – to the best of our knowledge no study has compared obstetric complications between individuals with intellectual disabilities and their unaffected siblings. We aimed to compare obstetric and delivery complications between individuals with mild to moderate intellectual disability, age-matched siblings and unrelated controls to explore the aetiological factors relating to the development of intellectual impairments.

Method

Sample

Participants aged 13–22 years who were receiving additional learning support for presumed cognitive difficulties (estimated IQ 50–80) were recruited through the Scottish public educational system as part of a larger longitudinal study examining the mental health needs of individuals in receipt of special education support (the disability group). The recruitment method has been described elsewhere.[8] Individuals with a history of brain trauma, Down syndrome or other syndromal disorder, major sensory impairment, absence of speech or major cerebral palsy were excluded. Schools sent out explanatory letters to relevant families who subsequently contacted the research team to participate. Written informed consent was obtained from all participants and their

parents. There were two control groups: the first comprised typically developing siblings of the participants within 5 years of their age (the siblings group), and the second was an unrelated control group, not receiving special educational support and selected from participants' social contacts and from volunteers within their communities (the control group). The study was approved by the Lothian research ethics committee, the Lothian Health Primary Care Division management committee and the privacy advisory committee of National Health Service (NHS) National Services Scotland.

Age-appropriate neuropsychological tests were administered: the Wechsler Intelligence Scale for Children III – Revised (WAIS–III–R) or the Wechsler Adult Intelligence Scale (WAIS).[9,10] The degree of intellectual disability was rated using the ICD–10 criteria for mental retardation;[2] all participants in the intellectual disability group had IQ scores of less than 70 and all siblings and unrelated controls had IQ scores over 70.

Assessment of obstetric complications

Participants and their mothers were asked to give consent for examination of their obstetric histories from health service records. For the period 1980–94 inclusively, obstetric histories were taken from Scottish Morbidity Record (SMR 2) data collected nationally at the time of pregnancy and confinement by the Information and Statistics Division of the NHS in Scotland. The linkage involved probability matching,[11] gathering records belonging to the same individual with 98–99% accuracy, avoiding maternal interviews and subsequent response bias.[12]

Obstetric and neonatal data

The SMR 2 included medical information about the mother and features of the pregnancy, birth and puerperium. Information was documented on an antenatal record sheet by the relevant obstetrician and on a structured delivery record by either a midwife or an obstetrician. Unique entries existed for each

admission during the obstetric and post-delivery periods. In addition to the mandatory fields, other complications were recorded using four-digit ICD–9 codes.[13] Information on rhesus incompatibility and maternal smoking was not completed routinely. Neonatal data (SMR 11) were collected in a similar manner to the SMR 2 data and included neonatal information such as Apgar scores, birth weights, gestational age, details of admissions to a special care baby unit and feeding choices on discharge. Additional information including pre-eclampsia, threatened abortion, rhesus incompatibility and rubella infection could be obtained using the four-digit ICD–9 codes.

Data analysis

The analysed data fields were those recorded in the majority of participants with few missing values and those most commonly reported in other studies. Lewis–Murray Scale items reflecting antepartum and intrapartum conditions were assessed.[14] Additionally, 'failure to breastfeed' has been implicated in the literature on intellectual development and for the completeness of data recording in this sample was included. Duplicate entries existed between SMR 2 and SMR 11 for factors, including gestational age, Apgar scores and birth weight; in these instances the obstetric record (SMR 2) was used. 'Duration of pregnancy – calculated gestational age', a specific data-set in SMR 2, was used for statistical analysis.

Statistical procedures

Individual demographic characteristics were compared between the intellectual disability group, the siblings group and the control group. Logistic regression was used to compare the odds of specific obstetric and delivery complications between the three groups, controlling for demographic characteristics such as gender, socio-economic status and gestation. Additional factors were also controlled for when relevant.

Results

Of the families of 501 individuals who initially agreed to take part, 42 were excluded owing to the clear identification of causes for their child's intellectual disability. Sixty-five withdrew or made no further contact. Letters requesting access to the individuals' Scottish Morbidity Records (birth, obstetric and neonatal records) were sent to the remaining 394 families; 269 consented. Obstetric records were linked to 232 participants. Of these, 114 had IQ measurements and 49 scored less than 70 on the age-appropriate test (WISC–III–R or WAIS). The parent study found that not all young people receiving special educational support had IQs suggestive of intellectual disability.[8] Eight siblings were matched to seven individuals with intellectual disability. A further 13 siblings whose affected relatives had declined to participate or did not gain birth record linkage were included.

Record linkage

Linkage to birth records was achieved in 86% of the sample. The main reason for failure to identify records was birth outside Scotland. Record linkage with birth records occurred for 49 participants with disability, 21 siblings and 20 controls. The SMR 2 data were linked to birth records in 49 participants with disability, 20 siblings and 20 controls, and SMR 11 data were linked to birth records in 49 participants with disability, 16 siblings and 19 controls.

Demographic characteristics

Males constituted approximately half of the disability and siblings groups but only a quarter of the control group, as recruitment of female volunteers was less difficult. Importantly, there was no significant difference in the mean ages (or birth years) between groups, thus avoiding any potential effect of improved obstetric knowledge and techniques over the birth period of the cohorts (Table 1).[15] Parental manual employment was significantly more common in the intellectual disability group and siblings than in controls.[16] Siblings were not matched individually to participants with disability, hence minor and statistically insignificant differences in parental occupation were found between the two.

IQ scores

The IQ scores ranged from 40 to 69 (mean=59.8, s.d.=7.3) in the disability group to 77–119 (mean=96.3, s.d.=12.7) in the siblings group and 79–143 (mean=109.8, s.d.=17.5) in the control group. All pairwise group differences in IQ were significant.

General findings

Differences were found in the prevalence of several obstetric and delivery complications. Complications that were present in at least 5% of individuals receiving special educational support or demonstrated a significant association with the population who did not receive special educational support are shown in Table 2 (full details are provided in online Table DS1). Many obstetric and neonatal complications demonstrated a gradation of effect, appearing strongest in the cohort with intellectual disability and more marked among siblings than healthy controls.

Maternal factors

Mothers tended to be older among the disability and siblings groups than among controls. More controls were first-born but none was born into a sibship of four or more. These results did not differ significantly between groups.

Complications of pregnancy and delivery

There was no significant difference in any complication of pregnancy between the groups, although twice the number of mothers of participants in the disability and siblings groups had had hospital admissions prior to delivery compared with the control group. Foetal distress was significantly more common among the control group than the disability group ($P=0.03$). Any induction of labour, and particularly artificial rupture of membranes, was more common among the disability group than controls, but did not reach statistical significance.

Table 1 Descriptive statistics for the three study groups

	Disability group (n=49) n (%)	Siblings group (n=21) n (%)	Control group (n=20) n (%)
Male gender	25 (51)	10 (48)	5 (25)
Child's age (year of birth)			
12–15 (1990–4)	16 (33)	5 (24)	9 (45)
16–19 (1985–9)	31 (63)	15 (72)	10 (50)
20–23 (1980–4)	2 (4)	1 (5)	1 (5)
Parental manual occupation	40 (82)[a]	15 (71)[a]	4 (20)

a. Disability–control and sibling–control difference significant at the 1% level, $P<0.01$.

Table 2 Obstetric and neonatal complications: logistic regression correcting for gender and parental employment status and calculated gestational age between groups

	Disability group (n=49) n (%)	Siblings group (n=21) n (%)	Control group (n=20) n (%)	Disability group v. control group		
				P	OR	95% CI
Complications of delivery						
Early or threatened labour	4 (8)	3 (14)	0 (0)	0.99	2E+008	NC
Foetal distress	13 (26)	10 (48)	10 (50)	0.03	0.76	0.59–0.98
Any induction of labour	12 (24)	4 (19)	1 (5)	0.60	14.90	0.90–246.80
ARM	11 (22)	3 (14)	1 (5)	0.06	14.70	0.87–249.78
Oxytocics	7 (14)	1 (5)	0 (0)	0.99	8E+009	NC
Prostaglandins	5 (10)	1 (5)	0 (0)	0.99	1E+009	NC
Umbilical cord complications	3 (6)	1 (5)	3 (15)	0.11	0.09	0.00–1.80
Abnormal presentation[a]	5 (10)	0 (0)	3 (15)	0.70	0.65	0.08–5.57
Planned C-section	4 (8)	2 (10)	3 (15)	0.53	0.45	0.04–5.28
Emergency C-section	6 (12)	0 (0)	1 (5)	0.34	3.32	0.28–40.12
Instrumental delivery	16 (33)	3 (14)	6 (30)	0.63	1.47	0.30–7.19
Neonatal complications						
Gestation <37 weeks[b]	8 (16.3)	3 (14.3)	0 (0.0)	0.99	2E+009	NC
Gestation >42 weeks[b]	10 (20.4)	4 (19.0)	5 (25.0)	0.34	0.50	0.09–2.25
OFC <32 cm	4 (8.2)	4 (19.0)	0 (0.0)	0.99	2E+008	NC
Crown–heel <48 cm	5 (10.2)	3 (14.3)	0 (0.0)	0.99	3E+008	NC
Crown–heel >55 cm	1 (2.0)	1 (4.8)	7 (35.0)	0.03	0.03	0.00–0.65
Winter birth[c]	12 (24.5)	2 (9.5)	3 (15.0)	0.83	1.24	0.19–8.25
Apgar score ⩾7[d]	4 (8.2)	1 (4.8)	0 (0.0)	0.99	5E+008	NC
Any resuscitation	12 (24.5)	3 (14.3)	3 (15.0)	0.24	3.46	0.43–27.76
Jaundice	4 (8.2)	1 (4.8)	1 (5.0)	0.72	1.78	0.08–40.95
SCBU admission	13 (24.5)	5 (23.8)	1 (5.0)	0.02	19.50	1.53–248.35
Breastfed on discharge	7 (14.3)	9 (42.9)	14 (70.0)	<0.01	0.09	0.02–0.48

ARM, artificial rupture of membranes; C-section, Caesarean section; NC, not calculable; OFC, occipitofrontal circumference; SCBU, special care baby unit.
a. Any non-vertex presentation.
b. Gestation was corrected for gender and parental employment status only.
c. Birth between December and February.
d. Apgar scores measured at 5 min.

Neonatal complications

Calculated gestational age showed a trend towards prematurity in the disability and siblings groups. More controls were postmature. Birth weight and length suggested that those with disabilities were shorter and lighter than controls, who were significantly more likely to have a crown-to-heel length greater than 55 cm when compared with the disability or sibling group (OR=27.92, 95% CI 1.38–565.5). Both these results ceased to be significant at the 5% level after correcting for maternal height.

Admission to a special care baby unit was significantly associated with later special educational support. Breastfeeding on discharge was proportionately more common among controls than among the disability and siblings groups. Both controls and siblings (OR=0.20, 95% CI 0.06–0.67) were significantly more likely to be breastfed than the disability group. When special care baby unit admission was included in the logistic regression model, controls (OR=0.16, 95% CI 0.03–0.94) and siblings (OR=0.17, 95% CI 0.05–0.66) remained significantly more likely to be breastfed than the disability group. When comparing admission and breastfeeding directly, chi-squared tests revealed no significant association (disability group P=0.17, siblings P=0.34, controls P=0.30). All other indicators of hypoxia around the time of birth (long labour, emergency Caesarean section, placental abruption, cord prolapse, signs of asphyxia and any resuscitation) showed no statistically significant difference between the groups.

Discussion

Not being breastfed on discharge and admission to a special care baby unit were significantly more common in individuals with intellectual disabilities than in controls. Not being breastfed was also more common in people with intellectual disabilities than in unaffected siblings, suggesting that this finding is not confounded by maternal factors such as socio-economic status. In controls, the detection of foetal distress was more common than in people with intellectual disabilities, which may reflect greater surveillance by health service staff, increased maternal reporting, or possibly relate to features of the foetus that render it unable to express distress owing to factors that contribute to a later diagnosis of intellectual disability.

Comparison with other studies

Breastfeeding may reduce the risk of infection, improve nutrition,[17] and confer advantage in cognitive development[18–21] and subsequent educational attainment,[22,23] for example through direct nutritional advantage[24] and by enhancing the bonding between mother and child.[25] Most studies have controlled for maternal education; however, when maternal intelligence has been specifically assessed, some studies maintain that breastfeeding is beneficial,[26,27] whereas two recent large-scale investigations found no association between breastfeeding and intelligence.[28,29] Alternatively, reduced infant competence may be associated both with an initial inability to breastfeed and later learning difficulties. More severe neurodevelopmental impairments have been found in children diagnosed with cerebral palsy who had feeding difficulties in the first 4 weeks of life.[30] Impaired gross and fine muscle functioning in infants who were small for gestational age has been associated with not being breastfed at 3 months.[31] Mothers in our study were also significantly more likely to breastfeed the healthy siblings, suggesting that infants with impaired intellect may have had physical difficulties limiting their abilities to attach in order to breastfeed, rather than the mothers

choosing not to breastfeed. Attitudes to breastfeeding have changed with health promotion over the years. In this study there was no significant difference in the years of birth between the groups, preventing the influence of these factors. Complications occurring during delivery or in the neonatal period, such as admission to a special care baby unit, may also affect a mother's confidence and opportunities to breastfeed.[32] In this study, special care baby unit admission was not significantly associated with breastfeeding, suggesting that each may be an independent risk factor or indicator for the development of intellectual disabilities.

The reporting of foetal distress was strongly associated with not receiving later special educational support. Although it may be a more sensitive indicator of delivery complications, it seems unlikely that foetal distress is less common in people with later learning difficulties; however, foetuses predisposed to intellectual disabilities may be less able to express foetal distress in response to adverse intrauterine conditions. The association may be more plausibly explained by detection or reporting differences. Foetal distress is poorly defined,[33,34] but can be diagnosed by decelerations in foetal heart rate, presence of meconium and excessive foetal movement, often prompting administration of oxygen and specialist involvement. Most diagnoses of foetal distress are associated with the birth of healthy babies,[35] suggesting that the recognition and management of suspected foetal distress may reduce the risk of later learning difficulties.

Strengths and limitations

This is the only study of which we are aware to compare obstetric and delivery complications in individuals with intellectual disabilities with their unaffected siblings and controls. The cohort was identified through the educational rather than the healthcare system and is likely to be more representative of learning difficulties within the general population than those in mental healthcare settings. Selection bias has to be considered, as families proactively contacted the researchers to participate after an initial explanatory letter. All individuals with intellectual disabilities required special educational support; however, their adaptive functioning was not formally assessed and so they did not fulfil criteria for a formal diagnosis of intellectual disability.

The prospective rating of obstetric complications from SMR data has obvious advantages as this information was collected before the functional outcome was known and is therefore unlikely to be subject to differential bias, in contrast with maternal recall.[12] Few studies have addressed obstetric and delivery complications in intellectual disabilities using structured records. However, the sample size was small, especially when siblings were matched to cases, therefore conditional logistic regression was not used as it could only be applied to a small proportion of the entire sample. It was also not possible to gender-match controls and siblings to cases, reflecting a known excess of males in the learning-disabled population, because it was difficult to recruit teenage boys as volunteers for a project of this kind. Addressing this limitation in future studies would be important as it potentially limits the extent to which our results can be generalised to females. Finally, in this study we cannot exclude the effects of other obstetric and delivery complications on intellectual disabilities, owing to their limited prevalence in the general population. Further clear associations with intellectual disabilities will require larger cohorts.

Future research

Larger prospective studies to further assess the effects of specific obstetric and neonatal complications on intellectual development are needed. These studies should, where possible, take into account the role of maternal IQ and consider whether the increased rates of obstetric and delivery complications reported in disorders such as schizophrenia are independent of effects on general intelligence.

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First received 8 Nov 2007, final revision 28 Jul 2008, accepted 1 Sep 2008

Acknowledgements

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EXTRA CONTENT ONLINE

extra

Suspending disbelief: do we unfairly distrust our patients?

Su Mahadevan

As a medical student on the first day of my psychiatry attachment, I was sent to interview an in-patient with schizophrenia. I listened, innocent and enthralled, as he informed me in extensive detail how his employers had bugged his house, spiked his drinks, and recruited his neighbours to spy on him. 'But that's outrageous!' I exclaimed earnestly, 'They can't be allowed to do that. Why don't you tell the police?'

Some years on, I am pleased to say that my ability to spot the floridly psychotic and delusional patient has improved. But two recent experiences have made me question whether psychiatrists sometimes go too far in the opposite direction. A young man with personality disorder known to psychiatric services presented to accident and emergency shortly after a relationship breakdown, claiming he was unable to move his left arm and leg. On hearing of his history, psychiatric opinion sought by the acute stroke team attributed his symptoms firmly to conversion disorder, deeming further investigations both unhelpful and unnecessary. Three days later, magnetic resonance imaging revealed a large right middle cerebral artery infarct. Within a week of this experience, it came to light that an elderly patient with advanced dementia and behavioural problems, who for months had been ignored as he repeatedly talked about his carers abusing him, had in fact been describing a real situation. Discussion with experienced psychiatrists revealed that such occurrences are by no means unique or isolated.

In practice, it is easy to dismiss any unusual or improbable claim a mentally ill patient makes as untrue. Being confronted by a daily barrage of unreality – ranging from the psychotic patient with frankly bizarre delusions, to the manipulative patient intending to deceive – psychiatrists perhaps more than any other specialists are at risk of developing blanket cynicism and distrust. Elyn Saks, an American professor of law and psychiatry who herself suffered from schizophrenia, describes in her autobiographical account (*The Center Cannot Hold: My Journey Through Madness*; Virago, 2007) how her own subarachnoid haemorrhage was missed by experienced doctors, based on the unspoken assumption that anything a patient with a psychiatric history said was untrue. Is this attitude just another form of stigmatisation of people with mental illness?

Clearly we cannot believe everything we hear. But perhaps we should be more amenable to keeping an open mind, guarding against our own prejudices, and to investigating further in cases of uncertainty. This approach not only reduces the risk of missing a real physical or social problem, but also helps us to develop open and supportive relationships with vulnerable patients. For few things destroy trust and hope more effectively than being disbelieved when we really are telling the truth.