Impact of perinatal asphyxia on parental mental health and bonding with the infant: a questionnaire survey of Swiss parents

Antje Horsch, Ingo Jacobs, Leah Gilbert, Céline Favrod, Juliane Schneider, Mathilde Morisod Harari, Myriam Bickle Graz, on behalf of the Asphyxia and Cooling Register Group

ABSTRACT

Objective To compare current mental health symptoms and infant bonding in parents whose infants survived perinatal asphyxia in the last 2 years with control parents and to investigate which sociodemographic, obstetric and neonatal variables correlated with parental mental health and infant bonding in the asphyxia group.

Design Cross-sectional questionnaire survey of parents whose children were registered in the Swiss national Asphyxia and Cooling register and of control parents (Post-traumatic Diagnostic Scale, Hospital Anxiety and Depression Scale, Mother-to-Infant Bonding Scale).

Results The response rate for the asphyxia group was 46.5%. Compared with controls, mothers and fathers in the asphyxia group had a higher frequency of post-traumatic stress disorder (PTSD) symptoms (p<0.001). More mothers (n=28, 56%) had a symptom diagnosis of either full or partial PTSD than controls (n=54, 39%) (p=0.032). Similarly, more fathers (n=31, 51%) had a symptom diagnosis of either partial or full PTSD than controls (n=19, 33%) (p=0.034). Mothers reported poorer bonding with the infant (p=0.043) than controls. Having a trauma in the past was linked to more psychological distress in mothers (r=0.31 (95% CI 0.04 to 0.54)) and fathers (r=0.35 (95% CI 0.05 to 0.59)). For mothers, previous pregnancy was linked to poorer bonding (r=0.41 (95% CI 0.13 to 0.63)). In fathers, therapeutic hypothermia of the infant was related to less frequent PTSD symptoms (r=−0.37 (95% CI −0.61 to −0.06)) and past psychological difficulties (r=0.37 (95% CI 0.07 to 0.60)) to more psychological distress. A lower Apgar score was linked to poorer bonding (r=−0.38 (95% CI −0.64 to −0.05)).

Conclusions Parents of infants hospitalised for perinatal asphyxia are more at risk of developing PTSD than control parents.

INTRODUCTION

Perinatal asphyxia is a life-threatening event affecting 2/1000 infants, which qualifies as a psychologically traumatic stressor for parents.1 When associated with hypoxic ischaemic encephalopathy (HIE), it may lead to disabling brain injuries or death.2–4 Current treatment of HIE requires immediate transfer to a specialised neonatal unit and therapeutic hypothermia in order to reduce the risk of brain lesions and neurodevelopmental disabilities.5

Parents of infants admitted to a neonatal intensive care unit report more stress,6 more adjustment difficulties and need for support during the first year after delivery7 8 compared to parents of healthy infants. They may experience post-traumatic stress disorder (PTSD),9–11 anxiety and depression following the birth.12

Although two qualitative studies described the experiences of becoming a parent after perinatal asphyxia13 14 and another showed that fathers may be traumatised,15 PTSD symptoms or psychological distress have
not been measured in parents of these children. PTSD consists of four symptom clusters (re-experiencing, avoidance, hyperarousal, and dissociative symptoms) and is diagnosable from 1-month post-trauma. Assessing postnatal PTSD and psychological distress is important for the well-being of parents and PTSD may significantly interfere with infant bonding, leading to severe and long-term consequences for the development of the baby. The current study aimed to compare current symptoms of PTSD, psychological distress and infant bonding in parents who had an infant with perinatal asphyxia in the last 2 years with control parents. It was predicted that parents of the asphyxia group would report more PTSD and psychological distress symptoms and poorer infant bonding than controls. Another objective was to investigate which sociodemographic, psychological, obstetric and neonatal variables were correlated with mental health symptoms and infant bonding in both groups.

METHODS

Study design and sample

This cross-sectional Swiss national cohort study (questionnaire survey of Swiss parents) included infants surviving perinatal asphyxia (asphyxia group) born in 2012 and 2013 (i.e., up to 2 years after birth), registered in the national Asphyxia and Cooling register of the Swiss Neonatal Network and Follow-up Group. Infants are anonymously entered in the register if they have a gestational age of more than 35 weeks and fulfill criteria for therapeutic hypothermia (low Apgar score, need for ventilatory support or abnormal blood gases during the first hour of life, clinical signs of encephalopathy during the first 6 hours of life). The questionnaires were sent out to the participating hospitals in May 2014, who then sent them on to the asphyxia group parents. Parents were sent an invitation letter, a participant information sheet and the questionnaires in French, German or English, with a prestamped envelope, by their local referring hospitals.

The control group was recruited during the same time period. Parents of the control group were recruited via flyers in public places, on Swiss internet forums for parents and on a website of the University of Lausanne. They were eligible if they had given birth in 2012 or 2013 to a full-term infant that they judged to be healthy (i.e., up to 2 years after birth). When accessing the online questionnaire, participants first read the information sheet; informed consent was implied when they completed the anonymous questionnaire in French, German or English.

This study was approved by the cantonal ethical review board (Vaud) and by the Swiss Federal Commission for Privacy Protection in Medical Research.

MEASURES

Parental PTSD was measured using the 17-item Post-traumatic Diagnostic Scale (PDS). It provides both a diagnosis according to DSM-IV criteria and a measure of PTSD symptom severity, as well as symptom cluster severity (re-experiencing, avoidance and hyperarousal) and has been widely used in postnatal populations. Participants rated how often they experienced each of the symptoms in the past month, using a 4-point frequency scale ranging from 0 (not at all or only one time) to 3 (5 times per week or almost always). A partial PTSD symptoms diagnosis was defined as meeting the criteria for two of the three PTSD symptom clusters. The PDS has good psychometric properties.

General psychological distress of parents in the past week was assessed with the Hospital Anxiety and Depression Scale (HADS), a 14-item questionnaire. Each item is scored from 0 to 3, with higher scores indicating greater psychological distress. The HADS has good psychometric properties, with a Cronbach’s alpha of 0.81 in the current study.

The Mother-to-Infant Bonding Scale (MIBS) consists of eight adjectives that describe feelings towards their baby (loving, resentful, neutral or felt nothing, joyful, dislike, protective, disappointed and aggressive) and measures infant bonding. Each adjective is followed by a 4-point scale ranging from 0 (very much) to 3 (not at all). The scoring is reversed. Possible scores range between 20 and 42, with high scores indicating problem- atic bonding.

Parents also completed a demographic questionnaire (age, marital status, migrant status, educational background for mothers, occupation for fathers, previous pregnancy for mothers) with two items assessing whether they had experienced past or current psychological difficulties (In the past, have you already experienced emotional or psychological difficulties? (yes/no). If yes, can you please briefly describe this? Do you currently experience emotional or psychological difficulties? (yes/no). If yes, can you please briefly describe this?) and whether they had experienced a past traumatic event (Have you already experienced a traumatic or particularly stressful situation? (yes/no). If yes, can you please briefly describe this?)

Parental socioeconomic status was determined using the Largo score, a 6-point scale, with recorded mother’s education (1 = university and 6 = special or no schooling) and father’s occupation (1 = leading position and 6 = unskilled labour). Parents also reported demographic details related to their infant (gender, gestational age, birth weight, current age of infant). Neonatal variables were obtained from the national asphyxia register: Apgar score (at 1, 5 and 10 min), umbilical cord pH, number of days when full sucking was achieved, whether infant was resuscitated >10 min, Sarnat stage, whether therapeutic hypothermia had occurred, whether the neurological examination at discharge had been normal and whether any seizure had occurred.
STATISTICAL ANALYSES

Data were analysed using IBM SPSS V.22. Descriptive statistics were calculated for each scale. Mothers and fathers of the asphyxia and control group were compared separately regarding sociodemographic characteristics using χ² tests, independent samples t-tests and Mann-Whitney U-tests. Responders and non-responders within the asphyxia group were compared regarding obstetric and neonatal variables using χ² tests and independent samples t-tests. To compare the asphyxia and control groups regarding the central tendencies of the non-normally distributed mental health and bonding outcomes (PDS total score and symptom clusters, HADS, MIBS), rank based Mann-Whitney U-tests were performed. The effect size for the Mann-Whitney statistic was estimated as r = z/√N. The limits of the 95% CI of the effect size estimate r obtained for the Mann-Whitney statistic were calculated with Exploratory Software for Confidence Intervals (ESCI). Established guidelines for the interpretation of r suggest that a large effect is 0.50, a medium-sized effect is 0.30 and a small effect is 0.10.

The χ² tests were performed to compare PTSD cluster symptoms between groups. The effect sizes of frequencies analysed with a χ² test were expressed as the differences of the two independent proportions and the corresponding 95% CI was calculated using ESCI. To compare groups regarding PTSD diagnosis (none, partial, full), a Kendall rank correlation analysis was carried out. Bivariate correlation analyses (Pearson’s and point-biserial correlations) between sociodemographic, obstetric and neonatal variables and mental health or infant bonding were carried out. Prior to assessing the correlation, the non-normally distributed variables (PDS, HADS, MIBS, Largo, gestational age and Apgar score) were rank-based inverse normal transformed within each gender using Blom’s formula. Given that the non-independence of mothers’ and fathers’ scores may lead to biased estimates, mothers and fathers were analysed separately. Within each gender, correlations with 95% CI were calculated. The 95% CI for correlations and effect size estimates r were calculated using the ESCI.

RESULTS

Sample characteristics

For the asphyxia group, parents of 114 registered infants were contacted and 95 parents (52 mothers and 43 fathers) of 53 infants (46.5%) responded. The control group was composed of 134 mothers and 58 fathers. Missing data per variable ranged from 0 to 7 (mothers) and 0 to 13 (fathers). Missing data were not replaced. The comparison of responders and non-responders according to infant neonatal variables listed in tables 1 and 2 resulted in no significant differences (see online supplementary table S1). Regarding demographic variables, three significant differences between asphyxia and control mothers were found (see table 1): asphyxia group mothers had a higher Largo score, p=0.011 and reported a lower frequency of previous pregnancies (p<0.001) compared with controls. Furthermore, the current age of the infant was higher for the asphyxia group (18 vs 14 months) (p<0.001). For fathers, corresponding significant differences were found for Largo score, (p=0.002) and current age of the infant (18 vs 14 months, p<0.001).

Mental health symptoms and infant bonding: group comparisons

Mothers in the asphyxia group reported a higher frequency of total PTSD symptoms than controls, p_{1-tailed}<0.001 (see table 3). This difference was due to a higher frequency of re-experiencing symptoms in asphyxia group mothers compared with controls, p_{1-tailed}<0.001. Consistent with the latter finding, mothers in the asphyxia group were also more likely to have at least one re-experiencing symptom than controls, χ²(1)=25.21; p<0.001 (difference in proportions: 41.7%, 90% CI 29.3% to 51.0%). Fourteen mothers (28%) in the asphyxia group met the criteria for partial PTSD diagnosis compared with 30 (22%) in the control group. An additional 14 mothers (28%) met the criteria for full PTSD diagnosis compared with 22 (16%) in the control group. When comparing both groups, asphyxia mothers were more likely to receive a partial or full PTSD symptom diagnosis (Kendalls’ τ=0.16, p=0.032). Asphyxia group mothers also reported poorer bonding with the infant compared with controls, p_{1-tailed}<0.001 (difference in proportions: 37.2%, 90% CI 20.5% to 51.1%). Criteria for partial PTSD were met by n=10 (24%) in the asphyxia group and n=13 (22%) in the control group. Criteria for a full PTSD symptom diagnosis were met by n=11 (27%) fathers of the asphyxia group and n=6 (10%) of the control group. When comparing both groups, asphyxia fathers were more likely to receive a partial or full PTSD symptom diagnosis (Kendall’s τ=0.20, p=0.034). No significant group differences for the HADS total score were found. The difference for total PTSD symptoms between asphyxia and control group was also found in fathers, p_{1-tailed}=0.038 (see table 3). Fathers in the asphyxia group reported a higher frequency of re-experiencing symptoms compared with controls, p_{1-tailed}<0.001 and were significantly more likely to report at least one re-experiencing symptom compared with controls, χ²(1)=13.16, p<0.001 (difference in proportions: 37.2%, 90% CI 20.5% to 51.1%). Criteria for partial PTSD were met by n=10 (24%) in the asphyxia group and n=13 (22%) in the control group. Criteria for a full PTSD symptom diagnosis were met by n=11 (27%) fathers of the asphyxia group and n=6 (10%) of the control group. When comparing both groups, asphyxia fathers were more likely to receive a partial or full PTSD symptom diagnosis (Kendall’s τ=0.31 (95% CI 0.04 to 0.54)) and having a previous pregnancy was linked to poorer bonding (r=0.41 (95% CI 0.13 to 0.63)) (see online supplementary table S2). In fathers of the asphyxia group, therapeutic hypothermia of the infant was related to less frequent PTSD symptoms (r=−0.37 (95%-CI −0.61 to −0.06)). Past psychological difficulties (r=0.37 (95% CI 0.07 to 0.60)) and past trauma (r=0.35 (95% CI 0.05 to 0.59)) were positively correlated with general psychological distress, and a lower Apgar score...
Table 1  Sample characteristics for mothers and fathers of the asphyxia and control groups

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mothers</th>
<th>Fathers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Asphyxia (n=52)</td>
<td>Control (n=134)</td>
</tr>
<tr>
<td></td>
<td>Control (n=134)</td>
<td>Asphyxia (n=43)</td>
</tr>
<tr>
<td></td>
<td>t, U or $\chi^2$ p Value</td>
<td>t, U or $\chi^2$ p Value</td>
</tr>
<tr>
<td>Parents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>32.02±4.74</td>
<td>32.44±4.27</td>
</tr>
<tr>
<td>Largo score</td>
<td>2 (1–5)</td>
<td>1 (1–5)</td>
</tr>
<tr>
<td>Marital status (with partner)</td>
<td>48 (92%)</td>
<td>126 (94%)</td>
</tr>
<tr>
<td>Migrant status (yes)</td>
<td>16 (31%)</td>
<td>33 (25%)</td>
</tr>
<tr>
<td>Previous pregnancy (yes)</td>
<td>21 (42%)</td>
<td>100 (76%)</td>
</tr>
<tr>
<td>History of psychological difficulties (yes)</td>
<td>19 (37%)</td>
<td>46 (34%)</td>
</tr>
<tr>
<td>Past trauma (yes)</td>
<td>27 (52%)</td>
<td>50 (37%)</td>
</tr>
<tr>
<td>Infants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gestational age (weeks)</td>
<td>40 (35–42)</td>
<td>40 (35–42)</td>
</tr>
<tr>
<td>Birth weight (g)</td>
<td>3381.25±408.11</td>
<td>3396.53±506.19</td>
</tr>
<tr>
<td>Age at survey (months)</td>
<td>18.16±7.46</td>
<td>14.13±7.04</td>
</tr>
<tr>
<td>Gender (female)</td>
<td>21 (40%)</td>
<td>75 (56%)</td>
</tr>
</tbody>
</table>

Values are expressed as mean±standard deviation, median (range) or n (%). Due to missing data, effective sample sizes ranged from n=182 to 186 (mothers) and from n=88 to 101 (fathers).
was linked to poorer bonding ($r = -0.38$ (95% CI $-0.64$ to $-0.05$)) (see online supplementary table S3).

**DISCUSSION**

This cross-sectional questionnaire-based Swiss national cohort study comparing parents of infants surviving perinatal asphyxia with those of healthy infants found more frequent PTSD (and particularly re-experiencing) symptoms and more frequent partial or full PTSD symptom diagnosis in asphyxia parents compared with control parents. Furthermore, poorer bonding with the infant in mothers of infants born with asphyxia compared with controls was found. Results need to be considered with caution, as mothers in the asphyxia group had a lower socioeconomic status, a lower frequency of previous pregnancies and slightly older infants compared with controls. Compared with control fathers, fathers in the asphyxia group had a lower socioeconomic status and older infants.

These results show for the first time that parents of infants with perinatal asphyxia experience elevated symptoms of PTSD, and particularly re-experiencing symptoms and more frequent partial or full PTSD symptom diagnosis in asphyxia parents compared with control parents. Furthermore, poorer bonding with the infant in mothers of infants born with asphyxia compared with controls was found. Results need to be considered with caution, as mothers in the asphyxia group had a lower socioeconomic status, a lower frequency of previous pregnancies and slightly older infants compared with controls. Compared with control fathers, fathers in the asphyxia group had a lower socioeconomic status and older infants.

This novel result may be explained by the fact that a lower Apgar score would have indicated a more severe life threat for the infant and fathers might have unintentionally found it harder to develop a bond with their infant for fear of losing it. However, this remains to be explored in future studies.

Strengths of the study are the inclusion of a national cohort, the comparison with a control group and the use of standardised questionnaires. The effect sizes of the significant correlations were all moderate and are thus of potential clinical relevance. The relatively low response rate (47%) is comparable with other studies of high-risk populations and regarded as fair, particularly given the tendency of traumatised parents to avoid reminders of the childbirth or hospital stay. Limitations of the study include the cross-sectional, retrospective design of the study, thus not allowing for causal conclusions, the risk of a reporting bias and potential problems with multiple testing. The small sample size related to the low prevalence of perinatal asphyxia limited the statistical power, despite it being a national cohort study. The MIBS has so far not been validated for the use with fathers, for whom a bonding questionnaire remains to be developed. Caution needs to be taken in interpreting the results, given that both groups differed on sociodemographic characteristics. Further limitations are the recruitment of the anonymous control group via flyers in public places, not allowing us to check for health problems of their infants and relying on the self-report of the parents. Finally, the temporal nature of the associations, and the potential impact of events between birth and the parental...
Table 3  Range and median questionnaire scores, Mann-Whitney-U-test coefficients and effect size estimates r for mothers and fathers in the asphyxia group and control group

<table>
<thead>
<tr>
<th></th>
<th>Asphyxia</th>
<th>Control</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>Md</td>
<td>Range</td>
</tr>
<tr>
<td>Mothers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PDS total score</td>
<td>8.80</td>
<td>7.19</td>
<td>6.00</td>
<td>0–37</td>
</tr>
<tr>
<td>PDS re-experiencing</td>
<td>3.29</td>
<td>2.81</td>
<td>3.00</td>
<td>0–12</td>
</tr>
<tr>
<td>PDS avoidance/numbing</td>
<td>2.52</td>
<td>2.86</td>
<td>1.50</td>
<td>0–12</td>
</tr>
<tr>
<td>PDS hyperarousal</td>
<td>2.88</td>
<td>2.95</td>
<td>2.00</td>
<td>0–13</td>
</tr>
<tr>
<td>HADS total score</td>
<td>9.38</td>
<td>5.88</td>
<td>9.00</td>
<td>0–25</td>
</tr>
<tr>
<td>MIBS total score</td>
<td>3.38</td>
<td>3.65</td>
<td>2.00</td>
<td>0–13</td>
</tr>
<tr>
<td>Fathers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PDS total score</td>
<td>8.82</td>
<td>10.61</td>
<td>7.00</td>
<td>0–45</td>
</tr>
<tr>
<td>PDS re-experiencing</td>
<td>2.93</td>
<td>3.56</td>
<td>2.00</td>
<td>0–15</td>
</tr>
<tr>
<td>PDS avoidance/numbing</td>
<td>2.71</td>
<td>3.76</td>
<td>1.00</td>
<td>0–18</td>
</tr>
<tr>
<td>PDS hyperarousal</td>
<td>3.27</td>
<td>3.91</td>
<td>2.00</td>
<td>0–14</td>
</tr>
<tr>
<td>HADS total score</td>
<td>8.57</td>
<td>5.74</td>
<td>7.00</td>
<td>0–27</td>
</tr>
<tr>
<td>MIBS total score</td>
<td>2.09</td>
<td>2.79</td>
<td>1.00</td>
<td>0–11</td>
</tr>
</tbody>
</table>

r = z/√N; 95% CI=lower and upper level of the 95% CI. The total sample sizes ranged from n=179 to 186 (mothers) and from n=89 to 101 (fathers).
*p<0.05.
**p<0.001 (1-tailed).
HADS, Hospital Anxiety and Depression Scale; M, mean; Md, median; MIBS, Mother-to-Infant Bonding Scale; PDS, Post-traumatic Diagnostic Scale; U, Mann Whitney test statistic; z, z test (a positive z-score denotes higher scale scores in the asphyxia group).
responses, which we did not ask for in either group, may have potentially influenced the study outcomes. We also did not ask parents in either group about infant health issues or events since birth, which may have potentially influenced the study outcomes. Future studies with a larger cohort, a prospective design and a control group matched on important sociodemographic variables are needed. Furthermore, investigating the effects of PTSD and bonding on infant outcomes would be of interest.

CONCLUSION
This study showed for the first time more frequent PTSD (and particularly re-experiencing) symptoms and more partial or full PTSD diagnosis in asphyxia group parents compared with the control group. Furthermore, we found that a history of past trauma puts parents at increased risk of general psychological distress after perinatal asphyxia.

Acknowledgements
We would like to thank the following units for collaborating in the Asphyxia and Cooling Register Group: Lausanne: Anita Truttmann, Jean-Francois Tolsa; St. Gallen: Irene Hoigne, John Micalef; Aarau: Philipp Meyer, Gabriel Konetszy; Bern: Karin Daetwyler, Bene Wagner; Luzern: Martin Stocker, Thomas Berger; University Hospital Zürich: Dirk Bassler, Cornelia Hagmann; University Children's Hospital Zürich: Barbara Brottschi, Vera Bernet; Basel: Sven Wellmann, Sven Schulze; Chur: Walter Baer, Brigitta Scharrer; Geneva: Ricardo E. Pfister; Central manager: Mark Adams.

Contributors
AH had primary responsibility for the study design, data acquisition, analysis and writing of the manuscript and approved the final manuscript as submitted. MBG was involved in the study design, data acquisition and writing of the manuscript and approved the final manuscript as submitted. U was responsible for the statistical expertise, performed all final statistical analyses, contributed to the writing of the manuscript and approved the final manuscript as submitted. CF and LG contributed to the data analysis, critically reviewed and revised the manuscript and approved the final manuscript submitted. JS and MMH contributed to the interpretation of data, critically reviewed and revised the manuscript and approved the final manuscript as submitted.

Competing interests
None declared.

Patient consent
Obtained.

Ethics approval
This study was approved by the cantonal ethical review board (Vaud) and by the Swiss Federal Commission for Privacy Protection in Medical Research.

Provenance and peer review
Not commissioned; externally peer reviewed.

Data sharing statement
The datasets analysed during the current study are available from the corresponding author on reasonable request.

Open Access
This is an Open Access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/

© Article author(s) (or their employer(s)) unless otherwise stated in the text of the article) 2017. All rights reserved. No commercial use is permitted unless otherwise expressly granted.

REFERENCES