Neonatal Outcome and Epidural Hyperthermia (NOEH): an interim analysis of secondary outcomes

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Introduction

- The two major causes of intrapartum hyperthermia are epidural hyperthermia and intrapartum infection (Figure 1).[1]
- Intrapartum hyperthermia (all cause) is associated with neonatal brain injury and intrapartum infection is associated with cerebral palsy.[2,3]
- Epidural hyperthermia is associated with adverse maternal and neonatal outcomes, including sepsis evaluation, antibiotic administration and operative delivery, but it is not known if it is associated with neonatal brain injury.[1,2]

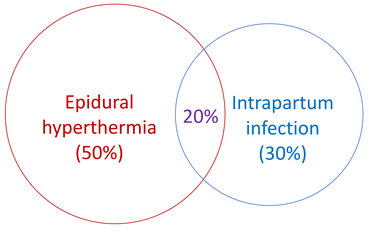


Figure 1: Aetiology of intrapartum hyperthermia.[1]

Aims

- NOEH is an ongoing retrospective cohort study whose primary aim is to investigate the relationship between epidural analgesia, intrapartum hyperthermia and neonatal brain injury.
- Here we present a first interim analysis of secondary maternal and neonatal outcomes.

Methods

- Data were extracted from all intrapartum deliveries at Imperial College Healthcare NHS Trust between August 2017 and July 2020 (Figure 2).

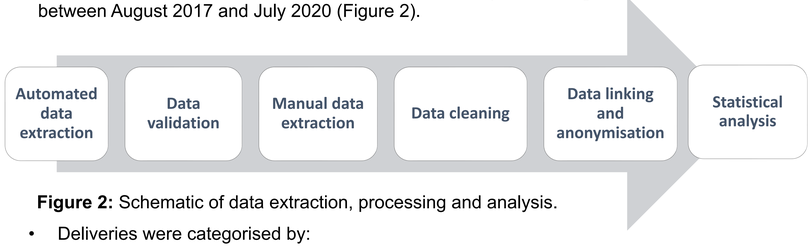
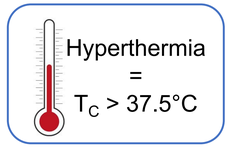


Figure 2: Schematic of data extraction, processing and analysis.

- Deliveries were categorised by:
  1. Mode of labour analgesia (epidural vs no epidural)
  2. Max intrapartum temperature (hyperthermia vs no hyperthermia).
- Between-group comparisons were conducted with Chi-Squared or Kruskal-Wallis tests. Post-hoc analysis was conducted with Bonferroni and Dunn's methodology.
- * indicates difference to the "no epidural, no hyperthermia" group ($p < 0.05$).
- Definitions:
  1. Maternal sepsis evaluation = intrapartum blood culture.
  2. Operative delivery = instrumental vaginal delivery or caesarean section.
  3. Neonatal sepsis evaluation = blood or CSF culture in the 1st 72h of life.
  4. Cord acidosis = pH < 7.0 or BE < -15.9.



Results

Table 1: Maternal and neonatal clinical data.

	No epidural, no hyperthermia	No epidural, hyperthermia	Epidural, no hyperthermia	Epidural, hyperthermia
Maternal	*(n = 11,585)*	*(n = 307)*	*(n = 7,253)*	*(n = 1,345)*
Age (yrs)	32 (28-35)	32 (27-36)	32 (28-36)	31 (27-35)*
BMI (kg/m²)	24.1 (21.5-27.7)	24.4 (22.1-28.3)	24.3 (21.7-28.1)	24.8 (22.2-28.4)*
Caucasian	3,971 (34)	89 (29)	2,746 (38)*	481 (36)
≥37 weeks	1,0775 (93)	295 (96)	6,725 (93)	1,284 (95)*
Nulliparous	5,545 (48)	219 (71)*	5,013 (69)*	1,109 (82)*
Time (min)	145 (60-307)	500 (245-812)*	476 (273-744)*	705 (440-942)*
Neonatal	*(n = 11, 675)*	*(n = 325)*	*(n = 7,529)*	*(n = 1,422)*
Sex (male)	5,926 (51)	169 (52)	3,871 (51)	763 (54)
Weight (g)	3310 (3000-3630)	3400 (3000-3718)*	3280 (2950-3605)*	3400 (3080-3710)*

Data are median (IQR) or n (%). Time = duration of active labour.

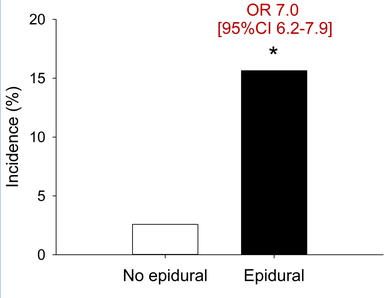


Figure 3: The incidence of intrapartum hyperthermia with and without epidural analgesia.

Table 2: Median (IQR) maternal and neonatal duration of hospital stay (days).

	Maternal	Neonatal
No epidural, no hyperthermia	1.7 (1.1-2.6)	0.8 (0.4-1.6)
No epidural, hyperthermia	3.6 (2.4-5.6)*	1.9 (1.0-3.8)*
Epidural, no hyperthermia	3.0 (2.1-4.2)*	1.2 (0.6-2.3)*
Epidural, hyperthermia	4.4 (3.2-6.2)*	2.3 (1.3-4.2)*

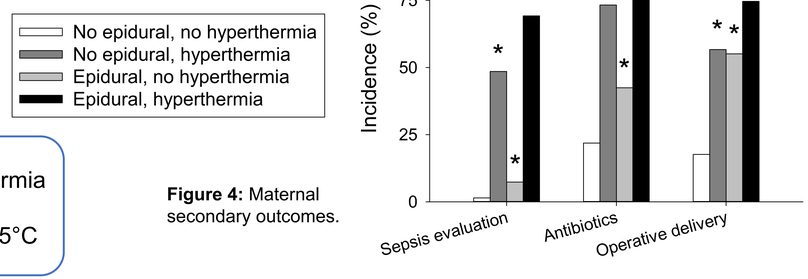


Figure 4: Maternal secondary outcomes.

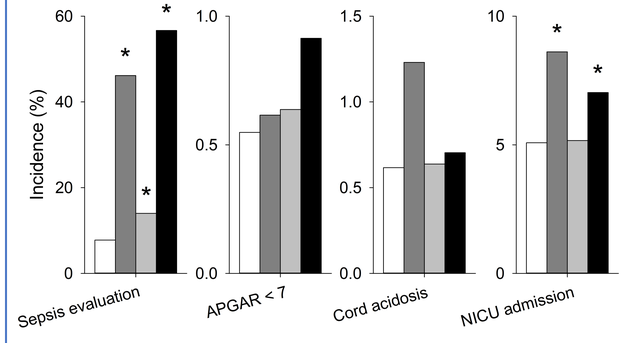


Figure 5: Neonatal secondary outcomes.

Table 3: Maternal and neonatal outcomes.

Outcome	No epidural, hyperthermia	Epidural, no hyperthermia	Epidural, hyperthermia
Maternal			
Sepsis evaluation	63 [48-83]*	5 [4-6]*	151 [124-182]*
Antibiotics	9.8 [7.6-12.7]*	2.6 [2.5-2.8]*	27.7 [23.3-32.9]*
Operative delivery	6.1 [4.9-7.7]*	5.7 [5.4-6.1]*	13.7 [12.0-15.7]*
Neonatal			
Sepsis evaluation	10.2 [8.1-12.8]*	1.9 [1.8-2.1]*	15.5 [13.7-17.6]*
APGAR < 7	1.1 [0.3-4.6]	1.2 [0.8-1.7]	1.7 [0.9-3.0]
Cord acidosis	2.0 [0.7-5.5]	1.0 [0.7-1.5]	1.4 [0.6-2.2]
NICU admission	1.8 [1.2-2.6]*	1.0 [0.9-1.2]	1.4 [1.1-1.8]*

Values are OR [95% CI] relative to the no epidural, no hyperthermia group.

Discussion

- This interim analysis confirms the previously observed associations of epidural hyperthermia with sepsis evaluation, antibiotic administration and operative delivery.[1]
- The association of epidural hyperthermia with NICU admission is novel, but currently there is insufficient data to assess the plausibility of a causal link.
- Further data is awaited to explore the relationship of epidural hyperthermia with neonatal brain injury.

Future Research

- Extract neonatal neurodevelopmental outcomes at 2 years old.
- Recruit further study centres to contribute data.

References

1. Mullington CJ, Malhotra S. *Hyperthermia and epidural analgesia in obstetrics.* BJA Education 2021; **21:** 26-31.
2. Morton S, Kua J, Mullington CJ. *Epidural analgesia, intrapartum hyperthermia, and neonatal brain injury: a systematic review and meta-analysis.* BJA 2021; **126:** 500-15.
3. Wu YW, Colford JM. *Chorioamnionitis as a risk factor for cerebral palsy: A meta-analysis.* JAMA 2000; **284**: 1417–1424.