Estimation of neonatal body fat percentage by skinfold measurement is a reasonable alternative to PEAPOD to predict neonatal morbidity

Sarah Banting[1], Kirsten Dane[2], Stephen Tong[1,2], Lisa Hui[1,2], Anna Middleton[1,2], Susan Walker[1,2], Teresa MacDonald[1,2]
[1]Department of Obstetrics and Gynaecology, University of Melbourne, Melbourne, Australia; [2]Mercy Perinatal, Mercy Hospital for Women, Melbourne, Australia.

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BACKGROUND

- Fetal growth restriction (FGR) is associated with neonatal morbidity, including hypothermia, and mortality[1] [5]
- Small for gestational age (SGA; <10th centile), a common proxy for FGR, commonly flags neonates who require additional surveillance[2], however:
  - SGA neonates may not be growth restricted;
  - neonates with birthweight ≥10th centile may have also been subject to FGR, and may be missed [3]
- Low PEA POD body fat percentage (BF%) predicts neonatal morbidity due to FGR better than classification as SGA[4], but PEAPOD devices are not widely available
- PEA POD air displacement plethysmography is the gold standard to estimate neonatal BF%, but it is possible to estimate BF% by measuring neonatal skinfolds

AIM

To compare BF% estimated by skinfold measurements to PEA POD BF% and birthweight centiles in their prediction of hypothermia – a key neonatal morbidity measure of reduced nutritional reserve while in utero.

METHODS

- 149 neonates had customised birthweight centiles calculated, and BF% prospectively estimated by both:
  i. triceps and subscapular skinfolds and sex-specific equations[6];
  ii. PEA POD air displacement plethysmography (with PEA POD BF% converted to sex-specific centiles)
- Neonatal medical record review determined if hypothermia (T <36.5°C) occurred
- The abilities of birthweight centiles, skinfold BF% and PEA POD BF% centiles to predict hypothermia were assessed by comparison of area under the Receiver Operating Characteristic (ROC) curve, and of sensitivity, positive predictive value (PPV) and negative predictive value (NPV) at fixed 92.5% specificity

RESULTS

- 42/149 (28.1%) neonates had hypothermia
- When background characteristics of hypothermia cases were compared to controls, there were no significant differences identified between the groups
- Infant birthweight centile, skinfold BF% and PEA POD BF% centile were all significantly associated with neonatal hypothermia on ROC curve analysis (Table 1)
- There was considerable overlap between the 3 predictors, with skinfold BF% demonstrating the highest area under the curve and significance values
- At 92.5% specificity for hypothermia, PEA POD BF% centile and skinfold BF% each performed with superior 26.1% sensitivity to that of (11.9%) of birthweight <10th centile (Table 1)

IMPLICATIONS

- Estimation of neonatal BF% using skinfold measurements performed just as well as PEA POD BF% in predicting neonatal hypothermia (Table 1)
- Both methods of BF% estimation were superior to classification as SGA (birthweight <10th centile)
- *If BF% better predicts not just hypothermia, but other neonatal morbidities associated with FGR, such as hypoglycaemia, than birthweight centile, then estimation of BF% may better flag which neonates require invasive blood sugar testing.*

Table 1. Predictive performances of birthweight, skinfold and PEA POD BF% for neonatal hypothermia (All data presented with 95% Confidence Intervals)

	Birthweight <10th centile	Skinfold BF%	PEA POD centile
Area under the ROC curve	0.61 (0.52 – 0.71) p = 0.03	0.66 (0.55 – 0.76) p = 0.003	0.62 (0.51 – 0.73) p = 0.02
Specificity	92.5% (85.8% - 96.7%)	92.5% (85.8% - 96.7%)	92.5% (85.8% - 96.7%)
Sensitivity	11.9% (4.0% - 25.6%)	26.2% (13.9% - 42.0%)	26.2% (13.9% - 42.0%)
PPV	38.5% (17.8% - 64.3%)	57.9% (37.3% - 76.1%)	57.9% (37.3% - 76.1%)
NPV	72.8% (70.3% - 75.2%)	76.2% (72.6% - 79.4%)	76.2% (72.6% - 79.4%)

CONCLUSIONS

Neonatal BF% better predicts neonatal hypothermia than birthweight centile. Estimation of neonatal BF% by skinfold measurement could be a reasonable and cost effective alternative to use of a PEA POD device, which is not currently widely available.

REFERENCES
1. Figueras, An integrated approach to fetal growth restriction. *Best Pract Res Clin Obstet Gynaecol* 2017.
2. PSANZ/Stillbirth CRE Position Statement: Detection and Management of Fetal Growth Restriction in Singleton Pregnancies 2019.
3. Gordijn, Consensus definition of fetal growth restriction: a Delphi procedure. *Ultrasound Obstet Gynecol* 2016
4. Carberry Is body fat percentage a better measure of undernutrition in newborns than birth weight percentiles? *Pediatr Res* 2013,
5. Malhotra Neonatal Morbidities of Fetal Growth Restriction: Pathophysiology and Impact. *Front Endocrinol (Lausanne)* 2019.
6. Slaughter Skinfold Equations for Estimation of Body Fatness in Children and Youth. *Hum Biol* 1988, 60:709-723.

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