

TITLE:

**‘FEED AND WRAP’ OR SEDATE AND IMMOBILISE FOR NEONATAL BRAIN
MRI?**

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Word count: 529 words

Successful neonatal brain Magnetic Resonance Imaging (MRI) relies on having a settled infant within the scanner to permit acquisition of the necessary sequences and good quality interpretable images. Unsettledness may lead to incomplete or unsuccessful scans, and costly rescheduling of scans with concomitant parental anxiety and inconvenience. Significant motion artefact may confound or preclude interpretation, leading to diagnostic errors.[1] Use of premedication to assist neonatal MRI is controversial: routine sedation may be used safely and effectively in neonates,[2] though some report successful imaging without sedation.[3] It is unclear how widely routine sedation premedication is practised.

In November 2013, on joining the MARBLE research study,[4] our centre (Norwich) electively introduced routine use of chloral hydrate sedation along with a body splint-immobilising device for neonatal MRI. We aimed to: i) review our local experience with MRI quality and success in epochs before and after introducing sedation and vacuum immobilisation; ii) determine current UK practices regarding use of sedation for neonatal brain MRI.

We retrospectively reviewed brain MRI reports of term/near-term neonates treated in Norwich for neonatal encephalopathy. Scans done on intubated neonates, elsewhere, or after the neonatal period were excluded. In epoch 1 (September 2010-September 2013) standard practice was 'feed and wrap', i.e. pre-feed and swaddle the infant, and scans were at 1.5 Tesla. In epoch 2 (October 2013-January 2015), routine chloral hydrate sedation (50 mg/kg dose) was used along with the Med-Vac™ infant immobiliser (CFI Medical, MI, USA) for MARBLE study recruits scanned at 3 Tesla (Figure 1). Sedated babies underwent continuous clinical monitoring during MRI. Two reviewers (TI and PC) independently reviewed MRI scans for technical quality by grading local radiology reports after devising a simple scoring system: 0=no

movement artefact mentioned; 1=minor movement artefact, not apparently limiting scan interpretation; 2=significant movement artefact affecting most/all sequences and precluding full interpretation or requiring a rescheduled scan. Inter-rater agreement of scan gradings was calculated and disagreements were resolved by consensus.

Median (range) postnatal age at first MRI was 9 (5-23) days in epoch 1 (n=48 neonates) and 9 (5-17) days in epoch 2 (n=23 neonates). Median scan duration was 55 minutes (range: 41-90 minutes) in epoch 2, some 10-15 minutes longer than in epoch 1 due to the extra research spectroscopy acquisition. No baby had any clinical instability associated with chloral sedation. Table 1 shows scan gradings. Cohen's κ for grading agreement was 0.65. Five babies (10%) in epoch 1 required seven repeat scans between them due to prior artefacted scans, while none in epoch 2 needed a repeat.

Table 1 *MRI scan quality in two epochs graded using a simple scoring system*

Scan movement artefact grade	Epoch 1: 'Feed and wrap' (n=48)	Epoch 2: Routine Sedation & Med-Vac™ (n=23)
0 = No artefact	23 (48.0)	23 (100)
1 = Minor artefact	7 (14.5)	0 (0)
2 = Major artefact	18 (37.5)	0 (0)

Data are n (%)

In February 2015 we telephone surveyed all UK tertiary NICUs to ask their sedation practices for neonatal brain MRI. Responses were obtained from 53/53 units:

16 (30%) routinely used sedation; 31 (59%) sometimes used, ie when 'feed and wrap' failed; and 6 (11%) never used. Of units using sedation, 42 (89.0%) used chloral hydrate, 2 (4.5%) used morphine, 2 (4.5%) used buccal midazolam, and 1 (2.0%) used clonidine.

In our centre, routine chloral sedation combined with Med-Vac immobilisation safely achieved a 100% success rate for completed MRI with good quality images and has proved far superior to the 'feed and wrap' method. For us this combination has allowed successful research MRI participation.

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Author contributions: PC conceived the idea for this study and devised the grading system. RG, PM, GJ, PL and ST facilitated 3T MRI set up and data acquisition; KF, and CS assisted with clinical monitoring and data acquisition. TI did the telephone survey. TI and PC graded MRI reports and analysed the data. PC and TI wrote the first manuscript draft. All authors contributed to manuscript revision and approve the final version. PC is guarantor.

Parental consent: Written parental consent was provided for publication of Figure 1.

Competing interests/ Conflict of interest statement: There are no competing interests and no conflict of interests to declare in relation to this work.

Ethics approval: Not required. The review of clinical MRI radiology reports was a service evaluation/audit and neither this nor the telephone survey of current practices required formal REC review under current UK NRES guidance.

Acknowledgements: We thank our neonatology medical and nursing colleagues, our radiology colleagues, and the radiography staff of the MRI department. We are

grateful to Simon Dove, Head of Medical Illustration, and to the parents for permitting us to use the clinical photograph.

Figure 1: *A sedated infant still asleep post MRI within the Med-Vac immobiliser*

