CLINICAL PRACTICE

Sedation of children undergoing MRI — a risky business!

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On its own magnetic resonance imaging (MRI) poses little risk to children, but sedation or general anaesthesia used to facilitate the examination increases the risk of adverse events. Conscious sedation may guarantee adult patient compliance in difficult cases; however a deeper level of sedation is required for children aged 6 months - 7 years. Children older than this often comply with instructions to remain still. Infants may go to sleep with a feed.

Following sedation disasters various guidelines were issued on safe sedation practices.[1] The Radiological Society of South Africa noted, in the local guidelines,[2] that a deeper level of sedation is often required in children. 'Conscious sedation' is defined as a therapeutically induced state of depressed consciousness (allowing a procedure to be performed) while the patient independently maintains his or her airway and ventilation. It differs from 'deeper sedation' required for paediatric MRI patients which produces depressed consciousness such that the patient is not easily roused by noise but leads to inability to maintain a patent airway independently.[1,2] Deep sedation can be achieved using an oral hypnotic (chloral hydrate/Vallergan); this may have to be topped up with an intravenous tranquilliser (e.g. midazolam) or an opioid (pethidine/fentanyl).

MRI hardware is unique in the following ways:

- The patient lies over 1 m inside the gantry housing the electromagnetic coils of the scanner. This limits access to the patient's head and airway.
- The patient must be stationary for 5 minutes at a time, which on average is the time it takes for each sequence. Any movement during acquisition degrades the image and the whole sequence must be repeated.
- The hardware is noisy when in operation.
- MRI creates a powerful magnetic field within which monitoring equipment must function. The latter must not degrade the image by interference and not cause injuries from induced currents or missile effect. The monitoring equipment must be highly specialised for this environment.

General anaesthesia is an alternative to sedation for paediatric MRI patients. It is costly in terms of manpower, equipment, drugs and recovery time. However it minimises adverse events in high-risk patients and invariably results in excellent MRI images. A comparison beween sedation and general anaesthesia is shown on Table I.

Adverse events[3] related to sedation include:

- respiratory events (hypoxaemia, upper airway obstruction, pulmonary aspiration and respiratory arrest)
- over-sedation which requires prolonged monitoring and may require admission to hospital
- inadequate sedation which results in abandonment of the procedure owing to suboptimal quality images
- adverse reaction to medications, e.g. nausea, vomiting or paradoxical reactions.

These adverse events can be avoided if stringent guidelines are followed including strict patient selection criteria, continuous monitoring during the examination, and a maximum limit on drug dosage set.[1]

Minimum requirements for safe sedation practice

Sedation is used in some European[4] and Canadian[5] centres but there are guidelines and strict protocols for this. A trained nurse sedationist assesses fitness for sedation according to set criteria and administers all sedatives. The sedationist is then responsible for monitoring the sedated patient throughout the

Table I. A comparison of how sedation and general anaesthesia meet the requirement for scanning

	Sedation	General anaesthesia
Reliability	Unpredictable, with 5% MRI failure rate[3,4]	Few MRI failures
Rapidity of turnover	Variable onset of action — slower	Quick onset of action — faster
Safety	Less safe, but safer with guidelines[4]	Safer — no data to support this
Cost	Cheaper	Expensive
Availability	Trained sedationists are more available	Less available, can batch cases
Impact on waiting lists	Decreases waiting time	Relative increased waiting period

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The authors have all been involved in facilitating MRI examinations of children at the GSH MRI suite and wish to raise awareness of our colleagues of inherent risks involved in MRI examination of children.

procedure until recovery. Monitoring includes continuous pulse oximetry. Electrocardiography and blood pressure measurement are used at the discretion of the sedationist. Full resuscitation equipment is available for use if necessary. Criteria for discharge include normal vital signs and ability to maintain an airway independently. This practice does not differ from local guidelines on safe sedation technique.[2]

Trained nurse sedationists, supervised by appropriately trained radiologists, can provide a safe and effective service in understaffed anaesthetic departments. This has been proven in a number of studies, with success rates of 92 - 95% and a low incidence of adverse events.[4,5] A nurse sedationist needs appropriate training and stringent guidelines. The candidate should preferably have ICU or recovery room experience. Continuing education, preferably by the anaesthesia department, should be provided to ensure quality of practice. Sedationists should be aware of their right to refuse to perform 'risky' sedations as they and not the referring clinician are ultimately responsible for risk assessment.[2]

The minimum requirements for safe practice in children are currently unattainable at our off-site MRI facility. This is the reason for the recent decision by the departments of radiology and anaesthesia at Red Cross Children's Hospital to change our practice from sedation to general anaesthesia.

Conclusion

Sedation may be a useful alternative to the expensive multidisciplinary team needed for general anaesthesia, but it is a risky business. Centres practising sedation should be aware of the inherent risk and have an adequate setup.

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4. Sury MRJ, Hatch D, Deeley T, Dicks-Mireaux C, Chong WK. Development of a nurse-led sedation service for paediatric MRI. *Lancet* 1999; **353:** 1667-1671.
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