Minimising the Use of Anaesthesia / Sedation in Paediatric Imaging and Radiotherapy: The Role of Play Therapy and Patient Education.

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Imaging is being increasingly used in paediatrics to aid diagnosis and monitor treatment (Kilbaugh et al., 2010). Magnetic Resonance Imaging (MRI) in particular is the modality of choice for neurological concerns and is becoming more widely used for thoracic and abdominal imaging (Edwards and Arthurs, 2011). Due to the difficulties of gaining children's compliance and co-operation in both Computerised Tomography (CT) and MRI, clinicians have often resorted to sedation and general anaesthesia (Anastos, 2007, Bates et al., 2010, Netzke-Doyle, 2010, Hartman et al., 2009, Hansen, 2009, Raschle et al., 2009, Edwards and Arthurs, 2011, de Bie et al., 2010, Khan et al., 2007, Haeberli et al., 2008, Filin et al., 2009, Kilbaugh et al., 2010, Lawson, 2008, Pressdee et al., 1997). Sedation has been referred to as

> "Necessary in infants and very young children"… [and that] … "Those between 4 and 8 years of age are difficult to manage … an alternate method of gaining trust and co-operation of these young children would be invaluable"
> (Pressdee et al. 1991).

Similar issues are faced in radiotherapy. During the planning stage, immobilisation devices such as head gear and masks need to be custom made and fitted. This process alone can be intimidating for children but treatment has its' own hurdles. Parents are unable to accompany children during treatment as it would expose them to radiation. For children who suffer separation anxiety, parental absence is challenging and exacerbated in a strange environment (Scott et al., 2002). If such difficulties can be overcome, a child's compliance means numerous general anaesthetics (GA) are avoided over the course of radiotherapy treatment (Filin et al., 2009, Haeberli et al., 2008). An urgency for treatment can limit the amount of time available to educate and prepare a child adequately for a non-GA procedure (Edwards and Arthurs, 2011). Also, if an investigation is beyond the child's emotional and cognitive capacity to cope, anaesthesia would be the preferred treatment (Filin et al., 2009).

However avoiding GA where appropriate has significant advantages:

- All GAs entail risk (Netzke-Doyle, 2010) and… "It is almost always safer to perform the required study without sedation" (Khan et al., 2007, p.30).
- Nurses have reported that with repeated sedations, increased dosages are necessary over time (Bates et al., 2010). Avoiding repeated sedation minimises development of drug tolerances in children.
- Parents experience psychological distress with the induction of GA upon their child. In avoiding anaesthesia there is evidence of increased parental satisfaction with the health service (Hansen, 2009, Khan et al., 2007, Haeberli et al., 2008).
- Hospitals benefit from a decrease in costs (Edwards and Arthurs, 2011). The University Children's Hospital of Zurich introduced a psycho-educational program to assist children in undergoing radiotherapy treatment without GA and decreased costs by 36% (Haeberli et al., 2008).

For these reasons avoiding unnecessary sedation/anaesthesia of children is best practice.

KEY FACTORS IN PAEDIATRIC PROGRAMS

Various approaches have been used in imaging and radiotherapy to avoid unnecessary GA or sedation in children. Across such interventions there are some key factors to consider:

AGE:

The use of non-pharmacological strategies in radiotherapy has challenged the notion that children under 5 require sedation/anaesthesia. Scott et al. (2002) used play preparation with 2 - 5 year olds over a 5 year period, resulting in 52/60 or 82.5% of patients required no sedation at all. Haeberli et al. (2008) implemented a psycho-educational program and consequently nearly two thirds of children under the age of 5 years co-operated without GA. Filin et al. (2009) looked exclusively at patients aged 3.5 - 6 years and using a multidisciplinary approach to prepare children resulted in only 5/52 children needing sedation.

In many hospitals it has been routine to sedate or anaesthetise children under the age of 6 for MRI (Kilbaugh et al., 2010, Smart, 1997, Raschle et al., 2009, Edwards and Arthurs, 2011, Lawson, 2008). However, the feed and sleep method implemented at Queensland's Mater Private MRI Unit had an overall success rate of 89% for children under the age of 40 weeks. Both the alert and the relaxed patients had good quality diagnostic images (Hansen, 2009), suggesting infants need not be asleep for the scan to be viable.

Simulation training in a mock scanner used with children under 7 (who were generally sedated) resulted in them obtaining 53/60 structural scans and 23/36 functional scans of diagnostic quality (de Bie et al., 2010).

> "It has been shown that play therapy, simulation and behavioural approaches… are successful methods to reduce anxiety, reduce overall movement and to allow MRI without sedation in children as young as 3 years of age"
> (Raschle et al. 2009).

With the use of play preparation and distraction techniques in CT and MRI, a reduction in sedation rates was achieved. This was statistically effective in all individual age ranges under 7, with an overall reduction in sedation by 36.4% in CT and by 44.9% in MRI (Khan et al., 2007). One manufacturer designed the *"Ambient Experience",* a CT scanner with lighting and projections. Introducing this child friendly scanner saw a reduction in sedation rates by 16% in children under 18 months and 28% in children under 4 years of age (Anastos, 2007). Despite reluctance to attempt scans or radiotherapy without GA in young children, evidence suggests this can be successfully achieved with the right approach.

DEVELOPMENT:

Within the paediatric population requiring MRI, there is a prevalence of developmental disability and autism (Kilbaugh et al., 2010). Studies have often excluded these patients on the assumption that they will be unable to comply with scanning requirements (de Bie et al., 2010). It is possible that their exclusion increased the success rate of studied interventions.

Children with developmental disabilities have three times the risk of complications such as hypoxia when sedated (Kilbaugh et al., 2010). Given the greater likelihood of them experiencing adverse effects, it is important they be included in interventions aimed at avoiding sedation or GA. Nordalh et al. (2008) concluded that children with developmental delays and autism could obtain high quality MRIs through the use of sleep or video viewing (Netzke-Doyle, 2010). An attribute of successful programs is interventions specifically tailored to children's individual needs (Filin et al., 2009, Haeberli et al., 2008). An emphasis on developmentally appropriate interventions allows for the inclusion of all children based on their own capacity. This approach circumnavigates protocols that make sweeping exclusions based on age or disability. In turn assessment of individual patients becomes essential and requires professionals with child development qualifications to determine suitable candidates for non-GA trials (Bates et al., 2010).

PREPARATION & EDUCATION:

Preparing and educating children about their healthcare is a key element in non- pharmacological interventions (Anastos, 2007, de Bie et al., 2010, Edwards and Arthurs, 2011, Filin et al., 2009, Haeberli et al., 2008, Khan et al., 2007, Pressdee et al., 1997, Raschle et al., 2009). This process typically involved:

- Photo booklets or diaries;
- Medical play with models and toys;
- Role play and games for skill development and practising stillness;
- Simulation with mock scanner;
- Familiarisation through a visit to scanning/treatment areas;
- Discussion that included parents.

Procedure education is integral to most programs but the use of a photo diary alone was found to have no significant affect in reducing stress or anxiety in paediatric patients, nor did it improve parental satisfaction (Hartman et al., 2009). Specifically tailored education is more effective and who delivers it is pertinent. Studies used "specially trained nurses" (Haeberli et al., 2008) or ensured the delivery of child development training, so clinicians could acquire tools to educate children in a manner appropriate to their age (Filin et al. 2009). Centres with access to a play therapist (aka play specialist or child life specialist) utilised this professional and their specific child development training

to effectively implement procedural education (de Bie et al., 2010, Khan et al., 2007, Pressdee et al., 1997).

> "Retrospective studies have shown that adequate play specialist input prior to MR scanning can lead to very low failure rates in children aged 4 – 8 years"
> (Edwards and Arthurs 2011).

The use of play therapists is highly recommended, particularly where clinicians do not have access to a mock scanner (Raschle et al., 2009). Radiographers do not have the time or necessary understanding of child development to be able to prepare individual children for treatment. The play specialist has the necessary skills to do this in a way, that not only gains a child's co-operation but also enables them to develop new coping skills and strategies (Pressdee et al., 1997).

DISTRACTION:
After patients have been assessed, educated and prepared they are ready to attempt treatment without GA. At this stage developmentally appropriate distraction techniques are used. Methods include:

- Feed and sleep in infants (Hansen, 2009)
- Watching a DVD during scanning (Netzke-Doyle, 2010, Raschle et al., 2009, Edwards and Arthurs, 2011, Khan et al., 2007)
- Relaxation audio CD (Filin et al., 2009, Smart, 1997)
- Lighting displays (Anastos, 2007, Khan et al., 2007, Edwards and Arthurs, 2011)
- Audiovisual cues for instructions during a scan (Anastos, 2007)

ELEMENTS OF SUCCESS ACROSS STUDIES

Consistent themes emerged in studies reporting success in reducing sedation and GA rates.

Child Friendly Physical Environments:
Patients' surroundings affect mood and comfort (Raschle et al., 2009). Children are particularly susceptible to strange environments and are less responsive to standard clinical settings (Edwards and Arthurs, 2011). Paediatric friendly waiting areas impact positively upon children's stress and anxiety levels (Hartman et al., 2009). The Ambient Experience built upon this notion and allows environments to be tailor made. Individuals can select their desired images and projections for the scanner (Anastos, 2007). In the absence of child friendly surroundings, allowing children to bring familiar items such as a toy, music, or DVD has a positive effect (Filin et al., 2009).

Parental Participation:
Involving family members in procedure education can facilitate the child's active participation in the process (Raschle et al., 2009). The child's preparation process often inadvertently educates parents about the impending procedure. Given that children take their cues from parents, it's beneficial for the parent to be relaxed and prepared (Filin et al., 2009). Parental presence reduces stress in children (Hartman et al., 2009) and therefore having them accompany a child to the scanner is advocated. Where parents are active participants in their child's education on radiotherapy, parents show an increased ability to intervene and assist their child during the planned procedure (Haeberli et al., 2008, Filin et al., 2009). Including parents in children's learning of non-pharmacological stress reduction techniques, means that parents are able to facilitate these strategies in other settings as required (Smart, 1997).

Child Empowerment:
A sense of helplessness and lack of control is the pervasive experience of children in hospitals. Anxiety and pain increase when the patient feels a lack of control (Smart, 1997). By promoting and teaching children non-pharmacological strategies we help them regain a locus of control. Interventions aimed at avoiding sedation, strive to make children active participants in their healthcare and to minimise trauma (Filin et al., 2009). Eliminating fears, anxieties, and dealing with a child's misconceptions about treatment, as early as possible, is recommended (Raschle et al., 2009, Scott et al., 2002). This again highlights the importance of an individualised preparation program.

Cultural Change:
For sedation to be used only as absolutely necessary the faculty involved must adopt a policy and practice that reflects this value (Edwards and Arthurs, 2011). During a study by Kahn et al. (2007) the radiology department publicly displayed their goal to reduce sedation and updated the associated figures quarterly. An unexpected benefit in "the ambient experience" study was an increase in moral and job satisfaction among the CT nursing and radiography staff (Anastos, 2007).

GAPS AND LIMITATIONS IN STUDIES:

Length of scans
Across studies the length of children's scans varied greatly. Raschle et al. (2009) set a maximum imaging time of 45 - 60 minutes with a maximum of 5 -7 minute sections. Infants using feed and sleep techniques had 15 minutes scans and this could have contributed to the success rate (Hansen, 2009). Concerns that scanning times are longer in awake versus sedated children have been opposed by Bates et al. (2010) who concluded that MRI scanning time was not significantly different between the two groups for diagnostic images to be obtained.

Quality of scans
When children are not sedated it is feared that image quality will be compromised. Bates et al. (2010) compared scans of awake versus sedated children and found that while motion artefact was increased, the images were adequate for diagnosis. De Bie et al. (2010) made similar comparisons in their study and results confirmed no age related differences with respect to the quality of structural MRI scans.

Focus of investigation
Different parts of the body require different lengths of scanning time. Many studies focused on brain scans (Netzke-Doyle, 2010) which are relatively short and do not require children to breath hold or follow instructions during the scan. Limiting investigations to short scans could have contributed to the success of such studies.

Cannulation
The use of intravenous Gadolinium (or contrast) is common place in MRI investigations. However, the mention of cannulation procedures in the reviewed studies is limited. In a study of non-sedated paediatric patients by Bates et al (2010) only 11/100 required the use of contrast. It was not disclosed how children were prepared for this procedure or how they coped. It is possible the children already had IV's or central lines in place. Given how distressing needle procedures can be for children, the issue cannot be discounted as a cause for potential failure of a non-sedated scan (Edwards and Arthurs, 2011).

CONCLUSION

While there are potential limitations or difficulties associated with the non-sedated scanning of children, the benefits are extensive. Studies on reducing sedation and anaesthesia in paediatric radiology and radiotherapy have demonstrated it is possible to: eliminate risks associated with GA and sedation, eliminate recovery time for patients, increase patient and family satisfaction, decrease costs for hospitals, increase staff satisfaction and morale, avoid drug tolerances in children, minimise radiation exposure over time due to increased patient co-operation and fewer repeat scans as a result of non compliance. Given such evidence it is imperative that services reflect upon their current practice and seek to make changes towards a best practice of minimising paediatric anaesthesia in imaging and radiotherapy (Scott et al., 2002). The definition of a "successful scan" needs to shift from a crystal clear image, to a high-quality diagnostic study where the emotional needs of children and parents are still "in the picture".

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