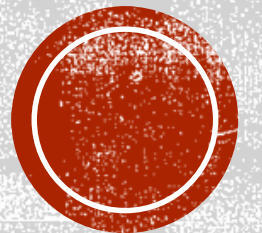


MRI SAFETY

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- Radiographer by profession
- Started working in MRI between 2005 – 2011
- Manager for Medical Imaging Department
- 2017 Manager for Radiotherapy Department
- 2019 Service Manager for Allied Healthcare professions
- My main responsibility is quality management systems, service innovation.



There have been many developments in paediatric MR examinations in recent years, which have led to a dramatic increase in the number and types of referrals.



MRI examinations of children require a particular set of Knowledge and Skills in order to successfully obtain diagnostic images with minimal distress to the patients and their family.



Paediatric MR imaging can be considered one of MRI subspecialties.



In our facility we routinely scan patients from the early foetal stages right up to 18 years.

**KNOWLEDGE,
SKILLS AND
COMPETENCE**



MRI RADIOGRAPHER COMPETENCE PROFILE

- The competence profile included 43 competences grouped under 7 key activities
 - Image Acquisition (IA) - 20 competences
 - Education (E)- 6 competences
 - Quality Assurance (QA) - 5 competences
 - **Safety and Risk Management (SRM) - 2 competences**
 - Service Unit Management (SUM) - 4 competences
 - Facility Management (FM) - 5 competences
 - Research (RES) - 1 competence

The full profile can be viewed on EPOS B-0149 (control no 6863)



KEY ACTIVITY—SAFETY AND RISK MANAGEMENT

- Safety and Risk Management relates to the overall safe care of the patient and/or their guardians, public and other workers. It involves the collection of data about the patient and procedure.
- The radiographer participates in the determination of the most appropriate action plan that results in enhanced safety to patient and others.
- The radiographer shares participation in the monitoring of MR and related devices, evaluation of clinical protocols to ensure the on-going protection of patients, and persons from the deleterious effects of physical agents and development of risk assessment tools (e.g safety screening forms, patient experience surveys).



2 MAIN COMPETENCES

- Assumes responsibility for risk assessment and the provision for the physical and psychological needs of patients before, during and after the scan.
- Assumes responsibility for the application of standard safety operating procedures in maintaining a working environment safe from hazards that could arise from chemical, physical and biological agents.



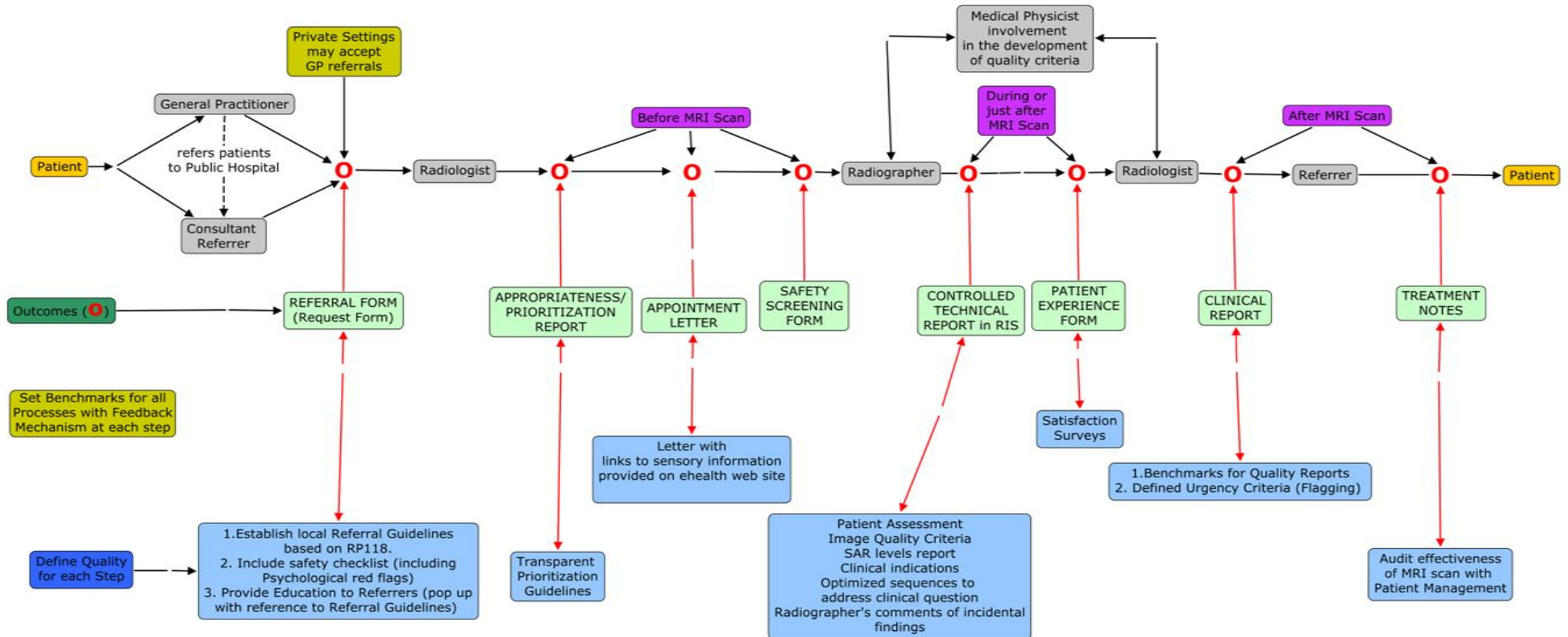
IS MRI SAFE?

- Literature is filled with MRI related incidents some of them ending with catastrophic events – Deaths, Burns, Explosions, etc.
- Therefore I consider MRI as one of the most dangerous equipment in hospital.
- Generally operated by radiographers together with radiologists, medical physicists and biomedical engineers.



HOW SHOULD MRI SAFETY BE MANAGED?

MR Care Pathway





Educate all MR personnel



Implement zoning - Zone 1, 2, 3 and 4



Have a continuous education policy, at least once a year



Once patient is in zone 4, scanning radiographer has final say



Effective communication essential

**FIRST THINGS
FIRST –
EDUCATION,
MANAGEMENT**





Accompanying family more common in pediatric population



Implement one person only rule



Safety screening for the accompanying adult



Compulsory gowning



Implement policy for smooth workflow - ?MRSO



Contrast adverse reaction policy



No family accompanying sedated patients



Switch to macrocyclic contrast agents

**IMPLEMENT
POLICY
TOWARDS
SAFETY**





Screen for Foreign bodies, biological implants or medical devices



Adopt an effective screening program to protect patients, family members, and staff when entering the MR environment in the presence of ferromagnetic devices.



an understanding of the risk factors for these implants and devices

FOREIGN BODIES AND IMPLANTS





All patients to wear gowns that has been checked by radiographers



All patients to leave personal belongings in safety boxes in Zone 2



All staff to leave personal belongings (keys, pagers, coins) away



All equipment entering Zone 4 must be checked by Radiographer

PROJECTILES





temperament, stress, pain, and illness play an important role in patient compliance, creating difficulties in establishing definitive age limits for identifying which children will require these procedures.



Encouraging children to co-operate for an MRI examination and identifying those who cannot are arguably the most significant challenges in pediatric MRI.



Sedation or anesthetic is commonly required for younger children or those with significant behavioral problems.

A WORD OR TWO ABOUT BEHAVIOUR





Skills how to talk to children and adolescents



Use of distraction and relaxation techniques



taking the time to help the child to feel safe and secure in the environment is important.



young children can pick up on their parents' anxiety or the technologist's impatience through nonverbal clues.



They may not understand these feelings and can interpret them as anger or fear of the examination.

COMMUNICATION SKILLS – VERBAL / NONVERBAL

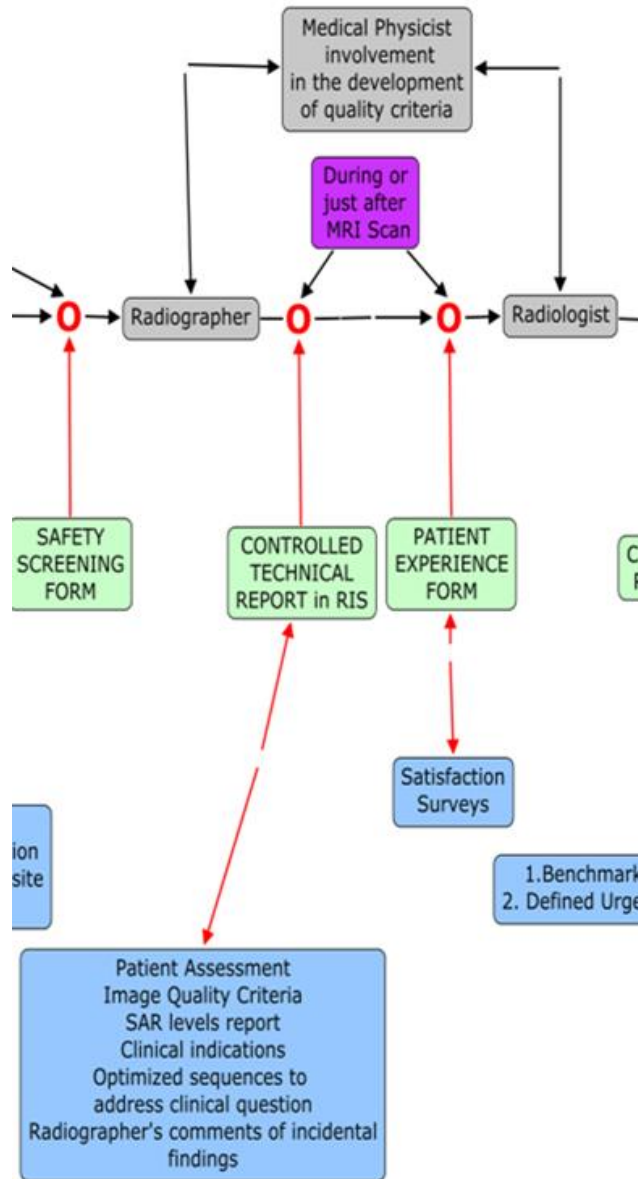


Engage with Parents	Involve a team approach	Explain in simple terms	Keep contact, even handshakes, touch, hugs
Engage with Child	Get down to their level	Use simple language	Use names, Eye contact
Frame the experience	Help them verbalize the experience	Involve play	Smile
Empower child	Offer choices	Praise good behaviour	Be positive

COMMUNICATION



DURING MRI SCAN



- Controlled Technical report done by radiographer to include:
- Patient assessment -
- Image quality Criteria (self assessment)
- SAR levels
- Modified sequence to address incidental findings.
- Infection control.
- Type of sedation.





MRI of children poses a number of specific safety issues with patient heating being the primary concern.



Neonates and infants in particular have immature thermoregulation mechanisms, and higher core body temperatures making them particularly sensitive to RF heating effects.



These mechanisms are further affected by sedation and anesthesia, or when babies are swaddled for imaging.



have a greater surface area to weight ratio than adults.

SAFETY ISSUES





RF heating and burns are frequent



Burns most common cause of MR safety related incidents



SAR – heat deposition by RF (local, global)



Heating burns in leads, implants



Heating burns – body as a loop

RF HEATING





Important to input the right weight of patient



Proper positioning and use insulation pads



Avoid creating any loops



Re-emphasis through-out the scan

RF HEATING - SAFETY





Monitoring Equipment must be MRI compatible



Avoid looping of any sensor wires. Eddy currents may create burns



Use MRI compatible ECG electrodes



MRI compatible anaesthesia equipment



Ensure proper ventilation



All MRI Rooms must be equipped with central hospital Oxygen, Suction, Air

SEDATION





Preparation – Identify child. If Neonate – feed and swaddle? If older – Play therapy?



use a range of resources to assist children to comply with the procedure, such as brochures, MRI toys and storybooks, discussions with parents.



Mock MRI scan – helps MRI team to identify those children who are able to comply with MRI scan requirements such as breathing, keeping still for long scans.



Mock MRI scans – Helps MRI team to familiarize them with environment, sounds and equipment.

TECHNIQUE FOR SCANNING WITHOUT SEDATION





Limiting the use of IV contrast in pediatric examinations can often mean the difference between a successful awake scan and a rebook for sedation.



Where contrast is necessary, it is often helpful to separate the procedures of IV placement and the MR exam by either placing the cannula before the examination or offering a break between the pre and post contrast scans.

INTRAVENOUS CONTRAST



Nephrogenic
Systemic
Fibrosis

MR Safety
issues: Contrast
adverse reaction

Nausea,
vomiting, more
serious adverse
events

Allergies more
common in
children

Accumulation of
Gadolinium in
body

Switch to macro-
cyclic contrast
agents

CONTRAST MEDIA





Acoustic Noise

< 99 dB

3T > 1.5 T

Liquid Helium

Possibility of FIRE



3T IMAGING - CHALLENGES

- The increased field strength leads to greater RF deposition, resulting in increased heating (SAR).
- B1-field inhomogeneities, chemical shift, motion artifacts and susceptibility artifacts are more pronounced at higher field strengths.
- Prolonged T1 relaxation at higher field strengths creates challenges in image contrast, particularly in the neonatal brain.

CONCLUSION

- Develop an MRI Pathway with quality criteria at each step
- Have policies and standard operating procedures in place
- There is no 'one size fits all' approach to imaging children and pediatric MRI requires dedicated specialist knowledge, flexibility, and expert input from the technologist.
- An awareness of the challenges in pediatric MRI and experience in pediatric imaging techniques is vital to successful examination.

