Reducing extravasation injury in radiology

SOCIETY OF RADIOGRAPHERS

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Learning outcomes...

- extravasation of radiological contrast
- training and educating radiographers to recognise extravasation
- undertaking audit of practice and driving improvement
- improving practice and training

Know your audience

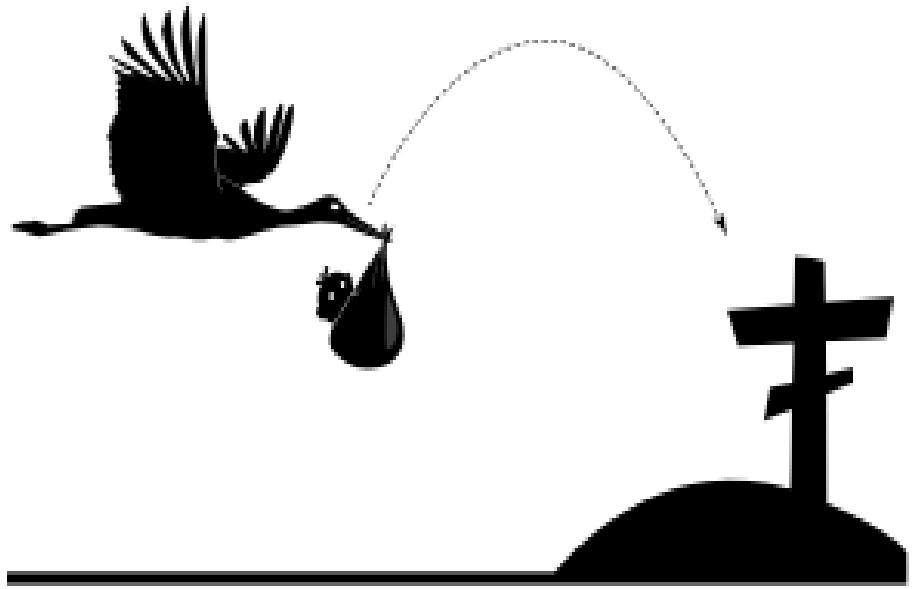
What will you learn?

- Context
  - Patients
  - Techniques
  - Workforce
  - Location
  - Demand
  - Technology

- Governance
  - Guidance
    - Education and training
  - Standards
  - Audit
- Litigation
- Future?

https://www.safetysigns4less.co.uk/Safety-Signs/Hazard-Specific-Signs/Chemical-Signs/Radiation-Controlled-Area-Portrait?utm_source=google&utm_medium=product_feed_or_listings&pl=STD&ccv=Y&sku=6A027AN-S&gad=1&gclid=Cj0KCQjw1OmoBhDXARIsAAAYGSF-WE1V32mS9pB2BwXtCueRrhvXaWKH3Ei14wm3QujY-dswlWv4JjsaAhtSEALw_wcB

Intravenous medicines in radiology

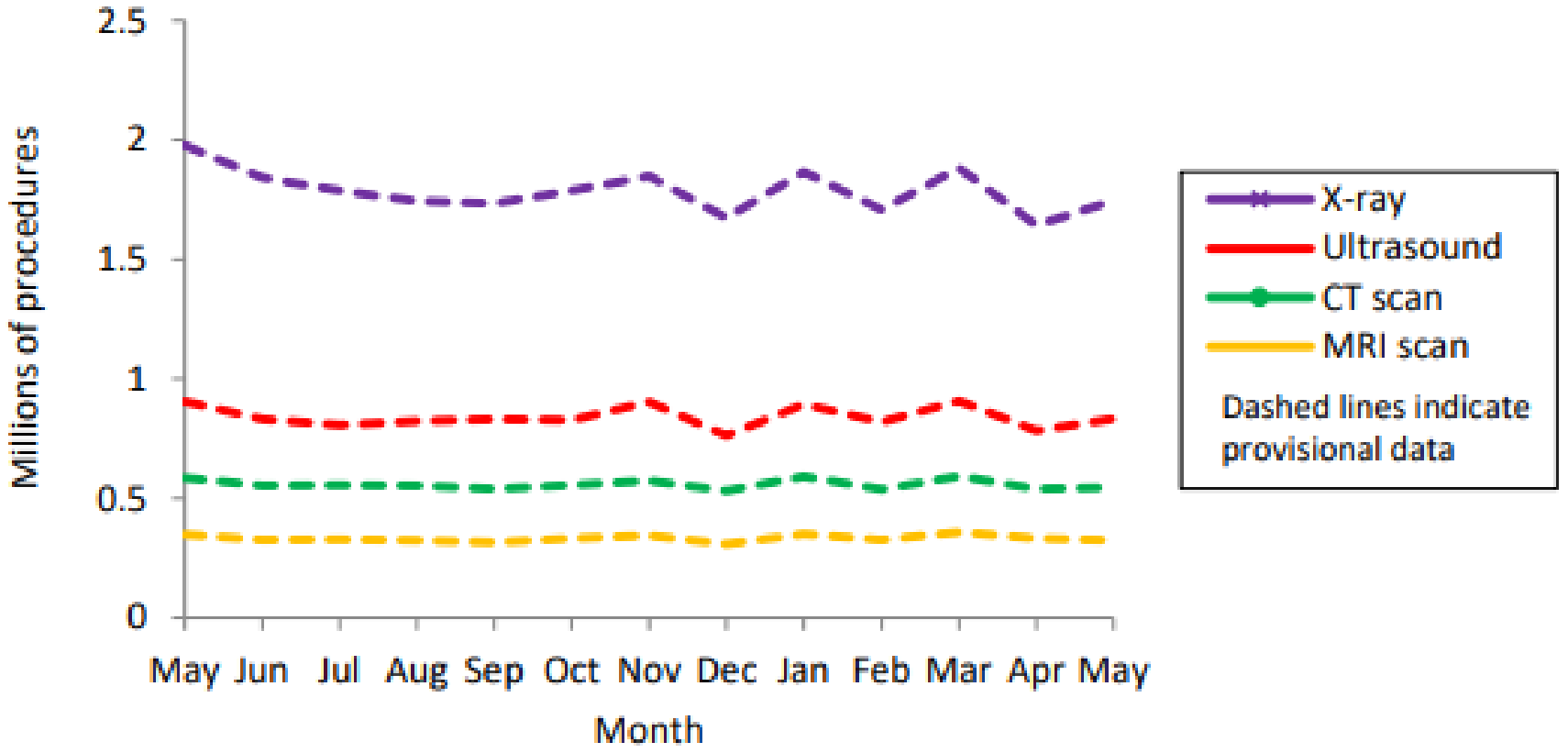


- **Contrast media**
  - Used in imaging techniques
  - enhance the differences between body tissues
- **Ideal:**
  - achieve very high tissue concentration
  - Minimal adverse effects.
- **Iodine-based**
  - Enhance X-ray, CT and fluoroscopic images
- **Gadolinium-based**
  - MRI enhancement
- **Gas-filled microbubbles**
  - Enhance US images

- **Radioisotopes**
  - Nuclear medicine
- **Saline**

Context

Graph 1: NHS imaging activity in England, May 2022 to May 2023



https://www.england.nhs.uk/statistics/wp-content/uploads/sites/2/2023/09/Statistical-Release-21st-September-2023-PDF-420KB.pdf

Contrast media management

- Cannula gauge
- Cannula position
- Rate
- Volume
- Strength
- Contraindications
  - Allergy
  - Acute kidney injury
- Complications
  - Extravasation
  - Patient interaction/communication
- Scanning protocol
- Radiation dose optimisation

https://www.nist.gov/news-events/news/2019/03/new-x-ray-measurement-approach-could-improve-ct-scanners

Contrast media development

https://www.youtube.com/watch?app=desktop&v=F8igOh4COQQ

https://www.itnonline.com/article/contrast-mediacontrast-agent-market

Administration - CT

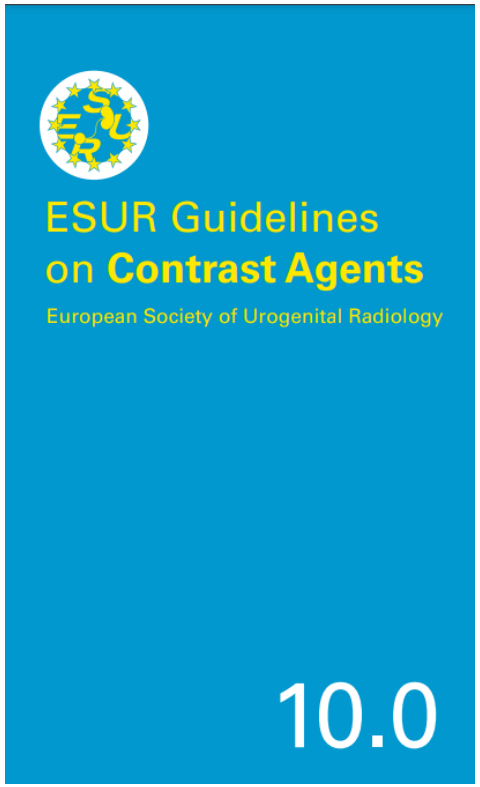
- Single or multi-use dosage systems
- Standard or weight-based volumes
- Viscous material
- +/- saline chaser
- Pressure monitor
- Initiated in scan control room

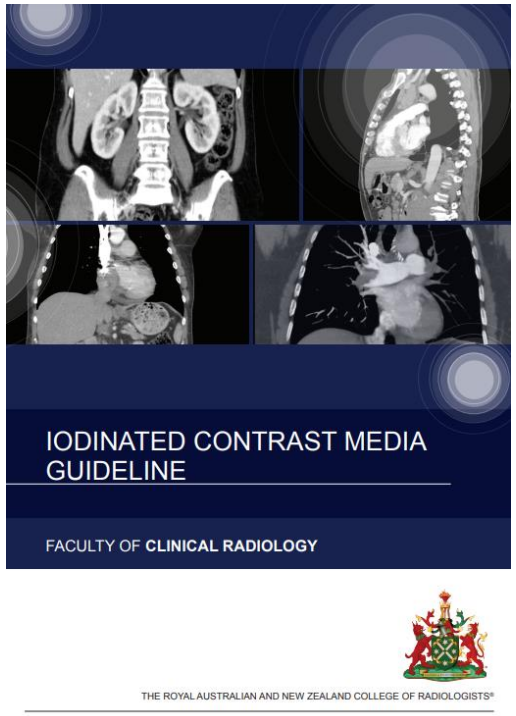
https://www.bracco.com/en-dk/product/ct-expres

https://www.medicalexpo.com/prod/shenzhen-seacrown-electromechanical/product-129203-956374.html

https://healthcare-in-europe.com/en/radbook/injectors/2075-optivantage-multi-use.html

Prevention and recognition of extravasation





C.1. CONTRAST MEDIUM EXTRAVASATION

Type of injuries	• Most injuries are minor. • Severe injuries include skin ulceration, soft-tissue necrosis, and compartment syndrome.
RISK FACTORS	
Technique-related	• Use of a power injector. • Less optimal injection sites including lower limb and small distal veins. • Large volume of contrast medium. • High-osmolar contrast media. • High-viscosity contrast media.
Patient-related	• Inability to communicate. • Fragile or damaged veins. • Arterial insufficiency. • Compromised lymphatic and/or venous drainage. • Obesity.
To reduce the risk	• Intravenous technique should always be meticulous using an appropriate sized plastic cannula placed in a suitable vein to handle the flow rate used during the injection. • Consider use of cannulas with sideholes. • Test injection with normal saline. • Use non-ionic iodine-based contrast medium.

Management	• Documenting the extravasation with a plain radiograph, CT scan or MR scan of the affected region may be helpful.
	• Conservative management is adequate in most cases.
	  • Limb elevation
	  • Ice packs
	  • Careful monitoring.
	• If a serious injury is suspected, seek the advice of a surgeon.

Risk factors

(Roditi et al., 2022)

Technique	Patient
• Less optimal injection sites including lower limb and small distal veins	• Inability of patient to communicate
• Large volume of contrast medium	• Fragile or damaged veins
• High osmolarity contrast media	• Compromised lymphatic and/or venous drainage
• Viscous contrast media	• Obesity

Contrast media extravasation (CMEX)

- is a complication where there is leakage of intravenously administered contrast agents (either iodine or gadolinium-based), into the surrounding soft tissues

- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9038843/#:~:text=Roditi%20G%2C%20Khan,35175378%3B%20PMCID%3A%20PMC9038843

Case

Contrast media extravasation (CMEX)

- Reassure patient
- Raise limb
- Use a cold compress
- Monitor (+/- imaging)
- Alert medical practitioner
- Record on incident register and patient record
- Provide patient information for escalation
- Ensure access to plastic surgery is available

Case courtesy of Luu Hanh, Radiopaedia.org, rID: 87245

Contrast Extravasation CTSIG Audit

Thea Buchan – CT Superintendent ULCH

Colette Keohane – Deputy CT Superintendent UCH

Introduction

- Contrast agents are frequently used for CT examinations
- A known risk is extravasation which can have serious implications for our patients
- Radiographers who perform contrast enhanced scans are responsible for evaluating the intravenous access, verifying the catheter size, monitoring the flow rate and adjusting to prevent adverse events
- CT departments are often challenged regarding the number of datix submitted for extravasation

Scope

- The intention of the audit was to look at multiple centres and compare extravasation data
- How do we compare to published extravasation rates?
- Is there a gap in rates between centres?

Our data and how we compare

7 centres submitted data

Data was transposed into our audit template if not submitted in this format

Our data

Centre	1	2	3	4	5	6	7
No. of Extravasation (Recorded via datix)	55	18	18	27	44	31	72
Inserted by radiology	43%	39%	28%	67%	14%	29%	
Angiogram/triggered	64%	39%	56%	41%	43%	45%	54%
Injection observed in room	24%		44%	59%	59%	55%	93%
Percentage of total number of contrast enhanced scans performed	0.13%	0.20%	0.22%	0.09%	0.32%	0.18%	0.50%

Our data – Risk factors

Centre	1	2	3	4	5	6	7
Patient Age	23-91 years			21 – 87 years	28-98 years	Range 23 – 89 years	21-94 years
	Average 62			Average 62	Average 72	Average Age: 65yrs	
							Average 70
Gender	70% female			70% female	55% female	65% female	Female 70%
	30% male			30% male	45% male	32% male	Male 29%
							Unknown 1%
Patient Type	49% inpatients	61% inpatients	72% inpatients	33% inpatients/ED	86% inpatients	77% inpatients	59% IP
						23% outpatients	38% OP
							3% Unknown

Our data

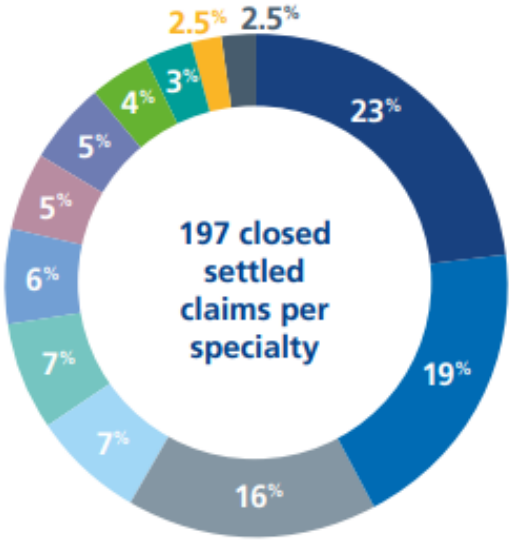
Average extravasation rate	0.23%
Range	0.09% - 0.50%

Recommendations and next steps

- The average extravasation rate falls below that of the published literature
- There are some centres which are reporting extravasation rates above 0.26% However we would need a more complete data set to look at these
- Extravasation data matches well with demographics of patients known to be at higher risk – How can we manage these risks?
- The CTSIG should continue to collect data on extravasation rates as an annual audit
- The CTSIG can look at CPD for members aimed at maintaining and improving extravasation rates

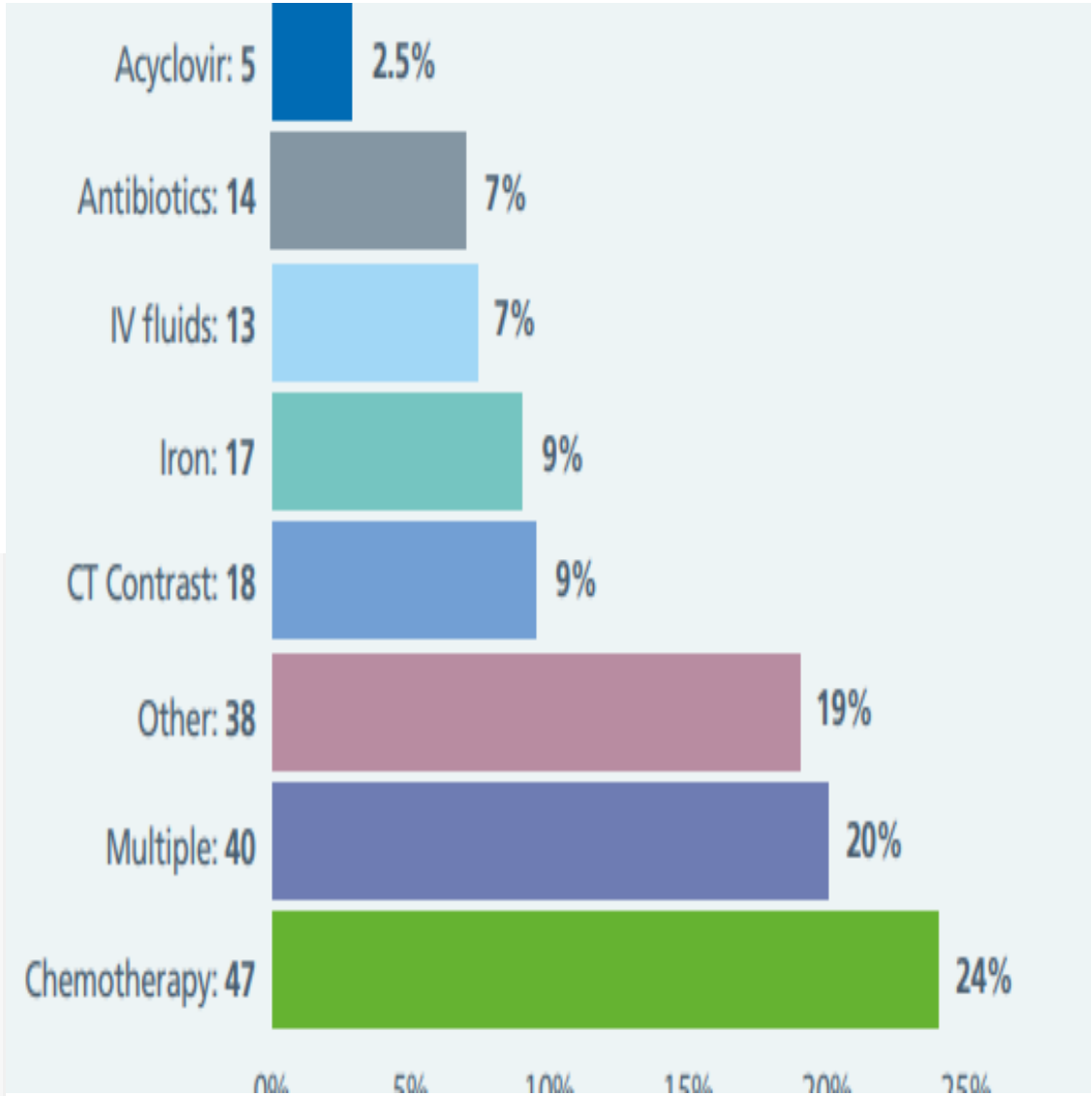
Further questions

- Current policy
- Training
- Location: acute/community facility
- Radiographers: specialist/rotational
- Cannula: department insertion/ward insertion
- Technique: triggered scan, flow rate etc.
- Observed injection
- At-risk patient?
- Grade of injury

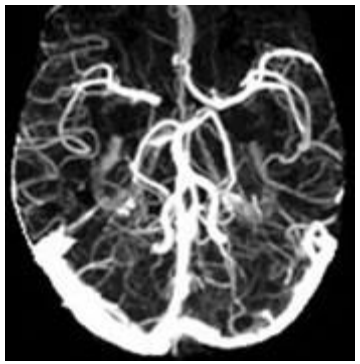


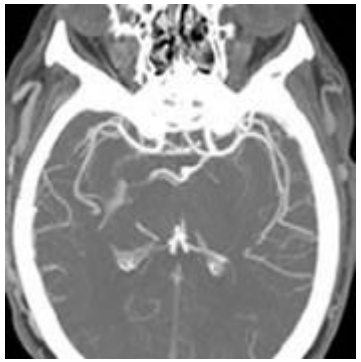
Paediatrics	45 (23%)	Anaesthesia	10 (5%)
Oncology	38 (19%)	Radiology	10 (5%)
Other	32 (16%)	Intensive care medicine	7 (4%)

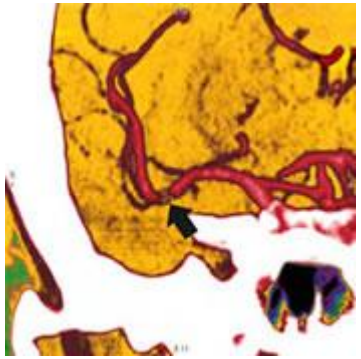
Radiology litigation



Future work







https://www.urmc.rochester.edu/imaging/specialties/procedures/ct-angiogram.aspx