

Hal Gray was a true polymath. In 1982 Peter Wardman (Joint Executive of The Gray with Barry Michael in 1999) wrote: "Gray must have been the first scientist to have a thorough appreciation of current activity in all 4 sectors of radiation research: physics, chemistry, biology and medicine".

His studies in tumour hypoxia, taken forward by his colleagues at the Lab, are his most important legacy.

### D8.3 Exploring the equilateral: Why are medical images rectangular?

Michael Jackson

Royal Hospital for Children and Young People, Edinburgh

Radiological images are almost exclusively constructed and viewed in a rectangular format - a seemingly obvious and banal statement to imaging professionals. However, the origins of rectangular image format and the constraints it imposes upon how we view the body requires consideration to fully understand the past and present of medical imaging, and to help shape its future in the best interest of patients. This paper draws upon early precursors of digital image capture including tapestry and the reticolato grid used by early pioneers of linear perspective, together with more recent rectangular framing devices (such as cinematic aspect ratio) to demonstrate why a well-rounded approach to imaging individuals will be required in the era of Artificial Intelligence.

### D8.4 Neuroradiology and philology as presented in *The Doctor is sick* of 1960 by Anthony Burgess

Adrian Thomas

Canterbury Christ Church University

The relationship between a patient and radiography is developed in *The Doctor is Sick* written by Anthony Burgess (1917-1993) in 1960. Edwin Spindrifft, the central character, is investigated in the neurosurgical department of a London hospital for a suspected brain tumour. Edwin is a linguist and there is much discussion of words and their origins in the book. The book is semi-autobiographical since Burgess himself collapsed whilst teaching history. The character of Doctor Eddie Railton, who looks after Edwin in the novel, is based on Sir Roger Bannister (1929-2018) the London neurologist who looked after Burgess and arranged for the investigations. The relationship of the patient to the image of the patient, and to how the image is obtained is a complex one. The description by Burgess of being on the receiving end of medical imaging is a fascinating account by a writer of the first order. Maintaining the correct balance between efficiently obtaining a diagnostic result from a complex radiological study and the patient not becoming simply a passive object is not an easy one, either then or now. The themes of the relationship between image and reality are even more relevant now than in 1960, as the virtual and the real become progressively less distinct and will be discussed.

Burgess, A. (1960) *The Doctor is Sick*. Heinemann: London. Thomas, A.M.K. (2022) *The Invisible Light*. Boca Raton: CRC Press (in press)



## Proffered papers: Paediatrics and Head & Neck

### E5.1 The role of the radiographer in a children's hospital during the COVID-19 pandemic

Clare Simcock

Great Ormond Street Hospital for Children NHS Foundation Trust

**Background:** The impact of the COVID-19 pandemic is far reaching, and radiographers have played a vital role in the diagnosis of this new virus. Fortunately, most children don't become seriously unwell with COVID-19. Despite increased rates of infections in children, hospitalisation rates remain very low at 1-5 in 100,000. [1]. However, a very rare and new condition associated with COVID-19 infection has been identified called Paediatric Multisystem Inflammatory Syndrome (PIMS-TS). This has led to a new referral pathway for imaging of these patients and required adaptation to current clinical practice.

**Purpose:** This poster aims to describe this new syndrome and its associated symptoms. Children with paediatric multisystem inflammatory syndrome temporally associated with COVID-19, develop a significant systemic inflammatory response. This rare syndrome shares common features with other paediatric inflammatory conditions including Kawasaki disease, staphylococcal and streptococcal toxic shock syndromes, bacterial sepsis and macrophage

activation syndromes. It can also present with unusual abdominal symptoms with excessive inflammatory markers. Early recognition by paediatricians and specialist referral including to critical care is essential [1]

**Summary:** This poster will describe the clinical pathway for these patients and the diagnosis, imaging and management of this newly emerging syndrome. This poster will demonstrate imaging findings associated with a number of cases who presented at our institution and their associated clinical outcomes.

[1] 2021 RCPCH Guidance: Paediatric multisystem inflammatory syndrome temporally associated with COVID-19 <https://www.rcpch.ac.uk/resources/paediatric-multisystem-inflammatory-syndrome-temporally-associated-covid-19-pims-guidance> (Accessed 12.12.21)

---

## E5.2 Don't get your bowels in a twist

*Nida Mushtaq; Elliot Elwood; Josephine Bretherton*

Chelsea and Westminster Hospital NHS Foundation Trust

**Background:** Acute intestinal obstruction is a common paediatric surgical emergency and should be considered in any child presenting with vomiting, abdominal pain, and abdominal distension. Many causes of bowel obstruction arise from congenital anomalies and two or more anomalies can be present. In these rare cases, recognition of the underlying cause of obstruction can be particularly challenging on imaging [1,2]. We describe an interesting case of a 19-month-old-boy who presented acutely with non-bilious vomiting and symptoms of bowel obstruction. CT imaging was performed after an abdominal x-ray and ultrasound did not narrow the diagnosis. Interpretation was particularly challenging, and a dilated tubular structure seen in the left upper quadrant was felt to represent an inflamed appendix with an associated bowel obstruction. A background of a rotational bowel anomaly was also thought to be present given the SMA/SMV orientation and left-sided large bowel loops [3]. Intraoperatively this patient was found to have Meckel's diverticulitis which was seen as the dilated tubular structure on CT and resulted in acute bowel obstruction. These findings were seen on a background of intestinal malrotation.

**Purpose:** This case turned out to be an excellent learning case and highlighted some key learning points which were particularly useful regarding image interpretation on the background of rotational bowel anomalies. The poster will feature key CT images which correlate with the intra-operative findings.

1. Applegate KE, Anderson JM, Klatte EC. Intestinal malrotation in children: a problem-solving approach to the upper gastrointestinal series. *Radiographics* 2006; 26: 1485–1500 2. Pickhardt PJ, Bhalla S. Intestinal malrotation in adolescents and adults: spectrum of clinical and imaging features. *AJR Am J Roentgenol* 2002; 179: 1429–35 3. Joshi A, Kale K, Patil SB, Sankhe A. Isolated hindgut malrotation: a rare variant of intestinal malrotation. *IJSS* 2016; 2: 1.

---

## E5.3 Imaging and management of traumatic scalp artery pseudoaneurysms

*John Asquith; Mary Jones; James Davies*

University Hospital of North Midlands

**Background:** Pseudoaneurysms of the scalp arteries are rare. However, a pseudoaneurysm should be suspected in a scalp swelling that persists, particularly if following head injury. Superficial temporal artery pseudoaneurysms are more common than occipital. Investigation can be made by various imaging modalities and ultrasound can often be diagnostic without the need for ionising radiation or invasive angiography. A range of treatment options for scalp pseudoaneurysm have been described, which include direct pressure, surgical excision, thrombin injection and embolization. Due to the extensive collateral supply over the scalp surgical ligation is often the mainstay of treatment.

**Purpose:** We illustrate the imaging of scalp pseudoaneurysms. We consider and discuss different treatment options.

**Summary:** We present the imaging of occipital and temporal pseudoaneurysms and discuss the different management options, which include interventional radiology. Occipital artery pseudoaneurysms are relatively rare.

---

## E5.4 Radiological imaging of children with Osteogenesis Imperfecta at Great Ormond Street Hospital

*Jessica Eaton; Alistair Calder*

Great Ormond Street Hospital for Children NHS Foundation Trust

The term Osteogenesis imperfecta (OI) describes a group of genetic disorders characterized by bone fragility; In 85-95% of cases, the disorder is caused by heterozygous mutations in genes encoding type I collagen chains (Marini, 2020). Also known as "brittle bone disease", OI is characterized by varying degrees of bone fragility, deformity, low bone mass density and connective tissue problems. Approximately 300 children under 16 in England have severe, atypical or complex OI (DeVile et al, 2019). At Great Ormond Street Hospital (GOSH), the OI service is one of four

highly specialised services in England and provides care for approximately 100 of these children. The Trust provides a multidisciplinary care model, including highly specialised input from pharmacology, physiotherapy and imaging. This comprises of a weekly multidisciplinary clinic, an outreach service and an inpatient service for drug treatment and therapy interventions. This poster aims to showcase the radiographic techniques used at GOSH to monitor children with OI. It will outline imaging techniques used, the rationale behind them and how this method harnesses the clinical expertise of the Radiology team to provide an evidence-based, high-quality imaging service for children with OI. Learning outcomes include, how to safely image children with "brittle bones" and the importance of a multi- imaging modality approach. Most importantly, we aim to highlight that this multidisciplinary approach is essential for successful diagnosis and management of the condition.

### E5.5 Referred otalgia - pearls and pitfalls for the general radiologist

*Richard Chayto; Alan Eccles; Jack Looker; Nick Hollings; Ben Rock*

Royal Cornwall Hospitals NHS Trust

**Background:** Pain referred to the ear, known as referred (or secondary) otalgia, is a common presentation to the ENT surgeon. Its mechanism is complex, due to the confluence of multiple sensory pathways that include the cranial nerves V, VII, IX, X and cervical nerves C2 and C3, resulting in uncertainty of the central nervous system to pinpoint the exact location of the abnormality.

Referred otalgia is a 'red flag' symptom for ENT surgeons, necessitating a thorough clinical history and examination, which includes review of the ear, oral cavity, teeth, temporomandibular joint, neck/cervical spine and fiberoptic nasendoscopy of the upper aerodigestive tract. It is common for the site of pathology to be clinically occult, especially if pathology lies at the skull base, postcricoid, submucosal or parapharyngeal spaces for example. Therefore, imaging plays a vital role in the diagnostic workup of referred otalgia.

It should be noted that the diagnostic yield of referred otalgia imaging for significant pathology is low (except in patients with past history of head and neck cancer). <sup>1</sup>Nevertheless imaging remains central to the referred otalgia diagnostic pathway to minimise risk of missing head and neck malignancy.

**Purpose:** To review the sensory pathways that supply the ear, to explore the regions of the head and neck that also share sensory innervation, and to demonstrate the important pathologies causing referred otalgia.

**Summary:** The poster will present a pictorial review of the relevant anatomy and important pathologies relevant to referred otalgia imaging, aimed at both general and head & neck radiologists.

1. Ainsworth, E., Pai, I., Kathirgamanathan, M. and Connor, S.E.J. (2020) Diagnostic Yield and Therapeutic Impact of Face and Neck Imaging in Patients Referred with Otalgia without Clinically Overt Disease. *American Journal of Neuroradiology*, 41(11), 2126-2131.



## Proffered papers: Imaging technology

### F6.1 Cardiac sorting in routine 4DCT data

*Mark Wrobel<sup>1</sup>; Lauren Pearson<sup>1</sup>; Alan McWilliam<sup>1</sup>; Mark Gooding<sup>2</sup>; Corinne Faivre-Finn<sup>3</sup>; Marcel van Herk<sup>1</sup>*

<sup>1</sup>University of Manchester; <sup>2</sup>Miranda Medical; <sup>3</sup>Christie NHS Trust

**Background:** 4DCT scans of lung cancer patients are used for radiotherapy planning. Respiratory motion is currently well defined. However, the heart is blurred due to cardiac motion leading to poor definition of substructures to be spared in the future. This leads to potential excess damage of such structures during radiotherapy. This project aims to correct standard 4DCT for cardiac motion and improve image quality.

**Method:** DICOM data from ten radiotherapy 4DCT scans (Phillips Brilliance Big Bore) was registered on the heart to compensate respiratory motion. Next, we find and merge slices acquired in different cardiac phases. The mean area of all slices as function of time shows pulsation of blood vessels in the neck. Fourier transform was performed to detect the heartbeat frequency and exact frequency and phase found by fitting a trial function to the data. Finally, the 4DCT scans slices were sorted based on the parameters and merged to obtain cardiac sorted scans.

**Results:** The heart can be seen at different points in the cardiac cycle in Fig.1. The beating heart outside diastole is shown in the left image causing blurriness and doubling of calcifications. Conversely, the right image shows the same slice location in diastole: the heart's vessels, chambers, calcifications and edge are sharp and well defined.