

## P-190 Comparing the Leeds Test Object TO.CTIQ phantom to the RMI Gammex IQ phantom

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This work is an ongoing assessment of the Leeds Test Object TO.CTIQ phantom. The purpose of this phantom is to cover as much routine level B QA within a single scan to help make CT surveys more efficient.

This phantom is therefore being assessed with two aims, firstly, do the features accurately assess the recommended parameters as per current guidance, and secondly, does phantom choice affect future survey results in terms of baseline comparisons. This assessment will compare the TO.CTIQ against an older RMI Gammex IQ phantom.

The features assessed in the Gammex are:

- Density of: PMMA, Air, Cortical bone (equivalent), Blood (equivalent)
- Resolution
- Slice thickness
- Low contrast detectability

Features in the LTO are:

- Contrast resolution of: Air, Delrin, LDPE, PTFE, and PMMA
- Line Spread Function
- Slice width
- Geometric distortion

To compare test objects both were taken to scanner surveys for a period of 6-8 months. Tests, particularly focusing on noise measurements, were carried out on both phantoms. As the 5 materials in the LTO are used to test contrast and noise, they have a much smaller diameter than the 4 materials in the Gammex. This means that Regions of Interest have to be much smaller and can give higher standard deviation as a result.

The slice profile in the LTO phantom requires a profile to be plotted and the FWHM to be found before calculating slice width. This is sometimes made more difficult by the fact some scanners do not have profile functions, or very limited functions, so images must be exported before an assessment is made. This is not always possible when there are no staff on site that use the equipment and know the correct/best way to get DICOM images off the scanner.

This is a work in progress and both phantoms will be continued to be assessed, where time allows, so conversion factors can be calculated, allowing either phantom to be used.

## Other

### P-191 Lymphoma - the great imitator

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**Aim/objective:** This poster provides a pictorial review of a selection of unusual presentations of Lymphoma on imaging. Our aim is to highlight the importance of considering Lymphoma in the differential diagnosis in a wide range of clinical presentations.

**Content/relevance:** Lymphoma can affect essentially all tissues in the human body producing a variety of imaging appearances. Like a number of other conditions, lymphoma is known as a “great imitator” and should be considered as a possible diagnosis in a wide range of clinical presentations. We retrospectively reviewed a selection of images demonstrating atypical presentations of Lymphoma. Lymphoma was definitively diagnosed on biopsy in all cases. In some patients, Lymphoma was considered in the differential diagnosis following imaging. However, in other cases the suggested diagnosis on imaging was a different diagnosis such as colonic cancer.

**Outcome:** Although the diagnosis of Lymphoma is usually suggested by widespread lymphadenopathy, we have showcased a selection of unusual presentations of Lymphoma occurring in the absence of significant lymphadenopathy. We have found that Lymphoma can manifest in many ways and can be seen to mimic different pathology. Lymphoma may present in a variety of different forms, therefore, it should be considered in the differential diagnosis of mass lesions.

**Discussion:** This pictorial review provides an insight into the varying presentations of Lymphoma and how it can imitate a wide variety of disease processes.

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#### **P-192 You want to scan what? No worries**

[Elizabeth Davies](#)

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As a CT applications specialist I am fortunate to experience different and unusual uses of CT scanning. This presentation is a pictorial review of my experience installing a 16 slice CT scanner in a University Veterinary Centre followed by assisting in the installation of the equine table. I will introduce the audience to this versatile scanner and its technology. Show how the equine table is used in conjunction with the scanner and look at some interesting cases that have been done so far at the centre. These will include CT images of rescued native wildlife, trauma cases, and canine portography.

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#### **P-193 Developing and validating a psychometric scale for AP pelvis image quality assessment**

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**Purpose:** To create and validate a psychometric scale for assessing image quality for antero-posterior (AP) pelvis radiographic images(digital).

**Methods:** The scale was created following a standard format(Bandura's theory for self-efficacy). An initial pool of items was generated (n=29)and presented to a focus group(radiologist & radiographers, n=7). These items were reviewed and modified accordingly. Next, a series of seven AP pelvis images were generated using a phantom across a range of image qualities. Image qualities was initially confirmed using signal to noise ratio(SNR ranged from 10.9 to 35.1). In order to validate the scale a sample of 151 radiographers (under-and postgraduates) were invited to score image quality on seven images(of known qualities).

**Results:** Using the scale participants aggregated mean scores increased with increasing SNR (62.8 to 111.9,r<sup>2</sup> =0.93). Cronbach's alpha revealed that the scale items were consistent in measuring the image quality across the 7 images( $\alpha$ =0.823 to 0.913;minimum  $\alpha$ ≥0.6). Factor analysis was conducted to examine how many factors can be extracted from the above set of items(ie. anatomical or technical). Redundant items were removed because they were either highly skewed(i.e.≤-1or≥1), introduce excessive amounts of error(i.e.SD≥1.5) or poorly correlated with other scale items (i.e. inter-item correlation cutoff point  $r$  ≥0.25) and resulted in a final 24 items scale.

**Conclusion:** This study presents the first development and validation of an image quality scale based on Bandura's theory. There was excellent correlation between the scale scores and the SNR and together with above stastical analysis the scale appears reliable and valid.

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#### **P-194 The evolution of X-ray diagnostics based on examples of the specific US Army hospitals in Kuwait and Multinational Division Central-South under Polish command in 2003-2004**

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**Background:** Wilhelm Roentgen discovered X-rays on 8th Nov 1895. In March 1896, Kaiser Wilhem Academy in Berlin was equipped with the first military radiological unit.During the Greco-Turk War in 1897, military radiological equipment was ready to be tested by the English and German teams. It was necessary to wait until the War-in-India (1897-1898) for the the military radiological unit to appear on the battlefield. In 1898 the practical use of radiology enabled to conduct examinations during the Sudan War, where the electric batteries were charged by means of cycling! During the Boer War (1899-1902) doctor H. Kutter used petrol engine that he had requisitioned from a mine on the Rand to power his X-ray equipment.

**Materials and methodology:** The many difficulties encountered by the radiologists at war, included the summer head that softened the emulsion on the X-ray plates, the sand that stuck to the plates, the lack of adequate darkrooms for developing and the frequent lack of running water for washing the plates (Fort Klapperkop Military Museum–Boer War).

Evaluating the following X-ray offices: Camp Wolf (Kuwait), Camp Lima (Iraq, near Karbala), Camp Babylon (Iraq, 85km/53miles south of Baghdad), it may be concluded that in the age of electronic image editing, the difficulties mentioned above belong to the past. The fundamental issue of diagnostics' rate is currently the X-ray unit.

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**Conclusions:** The nature of soldiers' injuries and their mass-frequency explains the rapid introduction of X-ray diagnostic Lodox-System (low-dose whole-body x-ray), which enables safer and more efficient medical evacuation.

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**P-195 A closed loop audit of adequacy in completion of radiology request forms in general surgery at a large tertiary teaching hospital**

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**Background:** It is well known that the usefulness of radiological investigation is reduced if sufficient clinical details and the clinical query are not provided (IRMER 2000). Issues around completion of request forms appear to persist regardless of the introduction of electronic submissions. Patient demographics and requestor details are automatically populated but insufficient clinical information to validate requests continues to delay patient management.

**Materials/methods:** Retrospective data was collected of the first 100 Computerised tomography (CT) and Ultrasound (US) requests during two periods, from August 2012 (period 1), then December 2012 (period 2). Data was collected from the electronic PACS system and clinical details appropriateness decided by a consultant radiologist. In-between the two periods a briefing session was given to educate junior requestors on completing requests.

**Results:** In periods 1 & 2 patient demographics (name, age, address and number) and requestor details (name of requestor and consultant) were completed at a rate of 100%. In period 1 only 81% were indicated compared with a rate of 96% in period 2 (re-audit). Rates of specifying a presenting complaint rose by 32.4% (71% to 94%). By re-audit 98% posed a clinical question, compared with 67%. There was a significant increase in all domains investigated ( $p=0.01$ ).

**Conclusion:** Educating requestors improved adequacy of clinical details in all domains; however did not meet national target (100%). As a consequence radiology briefings will be incorporated into future departmental inductions and consideration for individual entry fields for presenting complaint and clinical question.

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**P-196 Cardiothoracic ratio: The effect of increasing breast size on heart magnification**

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**Introduction:** The cardiothoracic ratio (CTR) was established in 1919 by Danzer, whose data was primarily taken from a male sample. Only historical evidence suggests the PA chest projection, from which it is derived, is best practice, applicable to all physiques. This study sought to confirm whether the PA chest radiograph is accurate at reflecting the CTR of large-chested women.

**Methodology:** The anatomical CTR of a phantom thorax was calculated. Samples of bra-sizes were translated into object-to-image-distances (OID) for PA chest radiographs. In total 15 OID distances were applied, and 30 radiographs produced. Data was collected by measuring CD and TD to produce the radiographic CTR (rCTR). The data was analysed.

**Results:** The results for the 180cm SID set-up were consistent in revealing that the PA projection was accurate at demonstrating the CTR regardless of the increasing OID. However, under the 150 cm SID condition, the data revealed the rCTR to decrease

**Conclusion:** This study reassures practitioners faced with increased OIDs caused by the presence of large-breasts that the PA chest projection accurately demonstrates CTR. It also reveals the numerical value of CTR can inaccurately suggest heart pathology due to the individual dimensions contribution to the ratio calculation, reaffirming CTR only as an indicator, not a diagnosis of cardiac pathology.

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**P-197 Lord Kelvin and the discovery of X-rays**

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**Objectives:** Lord Kelvin was the pre eminent scientist of his day. He is widely quoted as saying "X-Rays will turn out to be a hoax". In this presentation we will show that in fact Kelvin embraced the discovery readily and was instrumental in the early use of the X-Ray for Diagnostic purposes.

**Materials:** Reviewing published accounts and the Kelvin archives at The University of Glasgow show that Kelvin was initially sceptical about X-Rays. However having been sent a proof copy by Roentgen on 1st Jan 1896 documents

show that he was immediately impressed and promptly wrote to Roentgen congratulating him. By passing the paper on Kelvin encouraged others to replicate the experiments and records show that this led directly to the establishment of the first Diagnostic X-Ray department in the United Kingdom.

**Discussion:** While Kelvin is correctly quoted as being initially suspicious about X-Rays he can be shown to have been immediately won over on seeing Roentgen's publication. Records show that he encouraged early repetition of experiments with X-Rays within the few days between receiving the proofs and their general publication. This led to John Stevenson's experiments and his early use of X-Rays for medical purposes in Glasgow. He corresponded with Roentgen, was an early subject of "X-Ray photography" and he supported the awarding of the Nobel Prize to Roentgen. We conclude that while Kelvin had a healthy distrust of X-Rays his open mind quickly saw the value of the work and its potential application in medicine and industry.

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### **P-198 Health physicists are from Mars, patients are from Venus**

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**Aim:** To explore the psychology behind lay-people's understanding of radiation risk from medical imaging, in order to understand the difficulties of communicating that risk.

**Content:** Radiology departments often have a table of analogies for explaining radiation risk to patients. There has been little research into which of these analogies patients find most reassuring/alarming. This quantitative study asked students at the researcher's University, with no radiation training, to rank these analogies by perceived risk.

Also the study asked students to complete the phrase "nuclear \_\_\_\_\_", to gauge their associations with the word. Additionally, imaging modalities were ranked according to their perceived typical dose and this list deliberately included "nuclear medicine" and "RNI", to consider whether the name carried with it greater perceived risk.

**Relevance/impact:** To assist radiographers/referrers gaining informed consent from patients, without causing unnecessary anxiety.

**Outcomes:** Respondents over 25 were more likely to complete the "nuclear" phrase with "bomb", "war", or "weapon", than more neutral terms. The majority estimated Nuclear Medicine as more risky than RNI. Radiation from bananas and air travel were most frequently perceived as the least dangerous analogies.

**Discussion:** The public's fear of radiation is drip fed by news stories of nuclear disaster. Additionally popular fiction frequently uses 'mutation by radiation' as a plot device. Risk perception is largely an emotional response and scientific information has little effect on patients' decisions to consent. Their choice is more likely to be based on psychological factors such as trust in the individual medical professional and feeling empowered by choice.

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### **P-199 The role of imaging in the research and diagnosis of neurodevelopmental delays in children under 5 yrs old**

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**Aim:** To examine the use of imaging in research of neurodevelopmental delays, in particular Autism Spectrum Disorders (ASDs).

**Content:** A critical review of the literature exploring neuroimaging in neurodevelopmental research was undertaken. This included a summary of imaging modalities most widely applied, images and an outline of diagnostic models for ASD using imaging.

**Findings:** Levels of specialism vary nationally and internationally, which have implications on availability of techniques and modalities, eg. fMRI and diffusion-tensor imaging. However, although some significant anatomical findings have been identified, due to the heterogeneity of the condition, none of them have been adapted for diagnostic use based on imaging alone. It would appear that clinical observations and parental report have greater diagnostic weight.

**Implications for imaging:** Imaging remains a collaborative source of information along with clinical findings and observations. As technological advances continue to impact imaging, the role and significance of specialist modalities is likely to increase in terms of research and the potential diagnosis of ASDs.

**Discussion and recommendations:** Changes in diagnostic criteria for ASDs since publication of DSM-V in 2013, have indicated the significance and role of clinical observations. There is need for a reliable repository of data and images

so that existing images can be shared and interrogated to identify common neuroanatomical traits in neurodevelopmental disorders (if any) before subjecting the young (usually children less than 5 years old) to neuroimaging.

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**P-200 The effect of Adaptive Iterative Dose Reduction 3D (AIDR 3D) on radiation dose in a cardiac CT practice: Reducing dose, improving practice**

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**Background:** In 2010 NICE recommended the routine use of cardiac CT in patients presenting with chest pain and a low pre-test likelihood of coronary artery disease. This carries a significant implication for radiation exposure.

**Objective:** To determine if an update in software to AIDR 3D and changes in practice could improve clinical care by significantly reducing radiation dose in CT coronary angiography (CTA).

**Method:** A Toshiba 160 slice CT scanner was used pre and post AIDR 3D software. Data regarding 50 patients before and after the introduction of the new software was collected and analysed. This included radiation dose, BMI, heart rate and beta blocker administration.

**Results:** Initially patients received an average DLP of 270.3mGy\*cm (118-400) or an effective dose of 3.8 mSv (k-factor=0.014) if acquisition of each volume occurred with one beat and 620mGy\*cm (256-919) 8.7mSv if acquisition of each volume with 2 beats. This was reduced by two thirds to an average DLP of 97.3mGy\*cm (33-190) 1.4mSv post AIDR 3D for 1 beat acquisition and 418mGy\*cm (177-833) 5.9mSv for two beat acquisition. There were consistently lower levels of radiation exposure in low BMI patients who were beta blocked to single beat acquisition.

**Conclusion:** ADIR 3D significantly reduces the radiation dose for CTA. Very low dose is possible with Toshiba's 160 slice CT scanner in low BMI patients beta blocked so as to allow acquisition of each of the two volumes in 1 heart beat. All patients are now beta blocked to a heart rate of 60bpm.

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**P-201 The role of multi detector computed tomography in the evaluation of the effects of Kawasaki disease upon the heart and coronary arteries: A comparison with invasive coronary angiography**

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**Aim:** To compare multi detector computed tomography (MDCT) and invasive coronary angiography (ICA) in the evaluation of the effects of Kawasaki Disease (KD) upon the heart and coronary arteries in paediatric patients.

**Methodology:** A review of current literature was carried out using appropriate terms. Additionally, references from appropriate articles were reviewed. Where possible, sources greater than five years old were excluded ensuring relevance and currency. Journals written in English worldwide were considered.

**Findings:** Dual source CT can result in less ED. MDCT is more cost effective than ICA in management of KD. MDCT is more patient friendly and carries less risk.

**Discussion:** MDCT continues to advance and develop while development of ICA is stagnant. It appears to be a matter of time before MDCT overtakes ICA as the standard for imaging in this field. MDCT is also useful in general angiography with those who can comprehend arrested respiration.

**Conclusion:** MDCT has the potential to be a valuable future resource. It appears to have significantly advanced to the point where it could replace angiography as the gold standard. It costs less, reduces ED, lowers risk and has greater patient acceptability. However large clinical trials of current generation scanners would need to take place before this occurs.

DS-MDCT provides additional functionality. The 264 and 320 detector row scanners currently being used in research could be instrumental in future paediatric cardiac imaging. However ICA remains a valuable imaging tool which can be used in cases where MDCT is inconclusive.

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**P-202 Contribution of fetal MRI in diagnosis of congenital lung lesions in clinical practice**

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**Hypothesis:** MRI has complementary function to US in the diagnosis of congenital lung lesion. Its performance in diagnosis of CLL is improving over time.

**Objectives:** To determine whether MRI is useful in diagnosis of different CLL in comparison to that of US and that its performance is improving over time.

**Methodology:** Retrospectively available data for all patients referred for MRI for suspected fetal lung malformations in the period between 2000-2013 have been reviewed. 167 fetus was recruited from which 85 had a complete data set available. Performance of MRI over the first part of this period is compared to the second part.

**Findings:** MRI diagnosis was accurate in 53.85% of cases, an incomplete diagnosis was reported in 14.26 % and and in- accurate diagnosis in 10.26% of foetuses. In the first part of the period MRI confirmed US finding in 76.9% , changed diagnosis in 17.9% and added information in 5.13% of cases. Whereas it confirmed US diagnosis in 36.59%, added information in 48.78% and changed diagnosis in 14.63 % of cases in the second part of the period. Congenital diaphragmatic hernia (CDH) was the most frequently diagnosed anomaly followed by bronchopulmonary sequestration (BPS) and congenital cystic adenomatous malformation (CCAM). Congenital tumour, bronchogenic cyst and emphysema are very rare.

**Conclusion:** MRI diagnostic accuracy has increased over time adding extra important details to help in patient counselling and enabling patients to make informed decision. Furthermore these details are helpful in the management strategy.

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### P-203 Congenitally absent piriformis muscle, a case report

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**Content:** We report a rare case of a congenitally absent left piriformis muscle that was discovered as an incidental finding on MRI scan in a 46 year old man with lower back pain. Anomalies of the piriformis muscle have been reported in the literature especially in relation to piriformis syndrome but to the best of our knowledge an absent piriformis muscle has not yet been reported.

**Relevance/impact:** Congenital muscle malformations can present in many forms and can be associated with symptoms and syndromes. However, the absence of a muscle or muscles can be an incidental finding as this report shows. This case report highlights how radiological imaging and in this case MRI scanning can not only provide information about the symptoms being investigated but can lead to other unexpected findings which may be useful in other clinical situations, for example in the planning of future intramuscular injections and surgical procedures in the anatomical area being investigated.

**Outcomes:** Subsequent assessment and investigation indicated the cause of the patients pain was degenerative disc disease and not associated with the absent piriformis muscle.

**Discussion:** The gluteal region is a common site for intramuscular injections; it is therefore important to be aware of any muscle anomaly as nerve damage in this region can lead to severe complications including impotence in the male patients. We highlight the importance of preparing patients for the possibility of incidental radiological findings which may have clinical significance.

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### P-204 An investigation into the use of unenhanced computed tomography kidney, ureter and bladder (CTKUB) examinations in diagnosing suspected acute renal colic at a NHS hospital in the United Kingdom

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**Aim:** To investigate the diagnostic yield of unenhanced CTKUB examinations that result in positive, alternative and normal findings.

**Method:** A retrospective audit of all unenhanced CTKUB examinations (n=463) was conducted from the 1st March 2013 to 31st October 2013. Cases were identified using the study description 'CTKUB'. The data was downloaded from the radiological database into an excel spreadsheet and then categorised into patient age, gender, clinical findings and diagnostic yield:

1. Positive if calculi was detected
2. Alternative/incidental if any other pathology was detected
3. Normal if no calculi or pathology was detected

**Result:** Results were then analysed using microsoft excel and SPSS software.

Diagnostic yield was 54% (n=250) positive, 24% (n=109) alternative and 22% (n=104) normal. The Royal College of Radiologists (2010) indicated CTKUB should detect calculi in 44-62% of patient with an alternative diagnosis in a further 6-18%. Of the positive results 69% (n=173) were male and 31% (n=77) were female. Chi square test indicated a significant correlation ( $p=0.001$ ) between gender and the presence of calculi. The Mann Whitney U test showed no correlation ( $p=0.697$ ) between patient age and the presence of stone.

**Conclusion:** CTKUB is superior at detecting calculi related to acute renal colic with a sensitivity of 97-98% and specificity of 96-100%. Although it is a relatively low dose examination (10mSv each), the dose is still significant. Therefore, their use should be monitored regularly to ensure examinations have a reasonable diagnostic yield and are not being used as screening tools for inappropriate, non-specific abdominal pain. Alternative modalities like plain X-ray should be considered where appropriate for example, follow-up after treatment.

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## P-205 Imaging of hepatocellular carcinoma: A review of imaging techniques and appearances

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**Key learning objectives:** To review the differential diagnosis of hepatocellular carcinoma (HCC) in patients with known liver cirrhosis. To illustrate with examples the typical multi-modality imaging features and highlight its radiological appearance.

**Description:** HCC is the most common type of primary liver cancer worldwide and in the UK, cirrhosis is the biggest risk factor and present in up to 95% of cases. Whilst elevated Alpha-fetoprotein (AFP) levels can potentially confirm diagnosis, this is not an unequivocal sign of HCC and elevated levels may be caused by other conditions, eg. intrahepatic cholangiocarcinoma. In the context of cirrhosis, HCC diagnosis can be made on observation of the 'HCC radiologic hallmark'; this refers to positive contrast enhancement during the arterial phase of dynamic imaging studies and negative enhancement (washout) seen on the portal venous phase. The radiologist can therefore be instrumental in making an accurate diagnosis in these cases. This exhibit will address the specific radiological features on 4-phase scanning using contrast-enhanced MDCT and contrast-enhanced MRI. The clinical symptoms and biological chemical findings will also be discussed in relation to EASL-EORTC guidelines and Map of Medicine.

**Conclusion:** Both contrast-enhanced MDCT and contrast-enhanced MRI are sufficiently sensitive to detect the 'HCC radiologic hallmark', necessary to non-invasively confirm HCC diagnosis. Both modalities are also capable of reproducing images in a variety of planes, which is useful for treatment planning. Although contrast-enhanced MRI has a better safety profile and superior tissue contrast, patient outcomes are unlikely to be detrimentally affected should contrast-enhanced MDCT be used instead.

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