Pitfalls and Errors in Diagnostic Ultrasound

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I would give great praise to the physician whose mistakes are small, for perfect accuracy is seldom to be seen.

Hippocrates, On Ancient Medicine, IX

(tr. By Francis Adams)

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Introduction

- Radiology is now at the front end of all hospital activities
- Conservative estimate of over a billion radiological examinations done worldwide annually.
- To err is human - Errors are inevitable as radiologists / sonographers
- Error can be defined as “a commission or an omission with potentially negative consequences for the patient that would have been judged wrong by skilled and knowledgeable peers at the time it occurred, independent of whether there were any negative consequences.”

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Introduction

- The use of the term “error” is however often unsuitable; it is better to concentrate on term “discrepancies” between a report and a retrospective review of a film or outcome (RCR 2001).
- “Opinion” may be defined as “a conclusion arrived at after some weighing of evidence, but open to debate or suggestion”, and thus an expert’s opinion should not be expected to be incontrovertible [Robinson 1997].
- Radiology involves decision-making under conditions of uncertainty and therefore cannot always produce infallible interpretations or reports.

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Introduction

- Errors in judgement must occur in the practice of an art which consists largely in balancing probabilities. Sir William Osler (1849-1919), Aequanimitas, with Other Addresses, Teacher and Student.
- The interpretation of a radiologic study is not a binary process; the "answer" is not always normal or abnormal, cancer or not.
- Medical diagnostic errors represent a serious public health problem and pose a threat to patient safety
- Errors also has serious repercussions on the radiologists / sonographers since it attracts increasing litigations.
- Many errors are of little or no significance to the patient, and some significant errors remain undiscovered.

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Introduction

- Unlike physical examination, or findings at surgery or endoscopy, evidence of a radiologic examination remains available for subsequent scrutiny
- A 20-year literature review in 2001 suggested the level of error for clinically significant or major error in radiology is in the range 2-20% and varies depending on the radiological investigation (Goddard 2001).
- A recent review found a "real-time" error rate among radiologists in their day-to-day practices averages 3-5%

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- Some techniques are particularly vulnerable to errors:
- Chest X-rays and mammography are most vulnerable
- CT/MRI have increasing complexities
- Ultrasonography (US) is increasingly used in emergencies in the evaluation of trauma or non-traumatic acute abdominal conditions.
- Ultrasound has become a key in obstetric practise.
- Ultrasonography is a useful tool, when considered along with clinical features of patient

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Cause of errors in US – Multifactorial

Ultrasound is very operator dependent.

- Acquisition of images - Inadequate optimization of the images
- Processing of images and interpretation
- Poor technique and use of inappropriate probes
- Perception failure
- Lack of knowledge of the technical equipment and misjudgement
- Lack of attention to the clinical history and examination
- Lack of communication with the patient (who may be uncooperative)
- Lack of knowledge of the possible differential diagnosis

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Factors contributing to errors can be categorized as being

Person related –active errors:

- Cognitive error - wrong attribution
- Perceptual error – observational and satisfaction of search
- Ambiguity of report or use of words

System related- latent errors:

- Inadequate clinical information
- Poor quality equipment
- Excessive workload
- Poor working conditions
- Increasing case complexities

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Artefacts in US

- Artefacts are a significant source of error in ultrasonography
- Some artefacts could also be averted by appropriate settings
- Occur secondary to improper scanning technique
- Caused due to the physical limitations of the modality.
- Ability to recognize and remedy potentially correctable artefacts is important for image quality improvement and optimal patient care.
- Understanding artefacts will minimize any misinterpretation in the report, and in certain situations it helps in the diagnosis.

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Errors in US

- Emergency ultrasound imaging is especially vulnerable to errors.
- Errors in obstetrics are usually significant and can lead to claims
- Litigation associated with diagnostic ultrasound has become increasingly frequent.
- Obstetric ultrasound has always attracted more litigation than other aspects of diagnostic ultrasound.
- In the 1980s, ectopic pregnancy was the most common reason for litigation; today, litigation related to a missed foetal anomaly is the most frequent indication

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Examples of usually missed diagnosis

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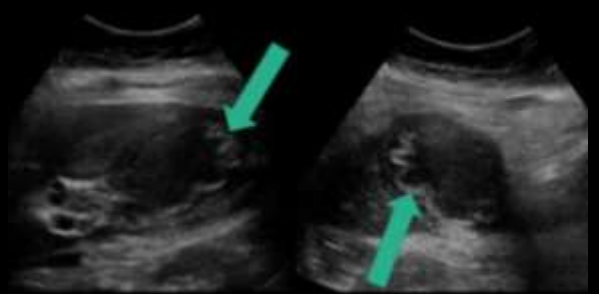
Gangrenous cholecystitis



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Gangrenous cholecystitis

- Striated appearance of wall
- Intraluminal membrane and debris
- Asymmetry of wall thickness
- Pericholecystic fluid collections

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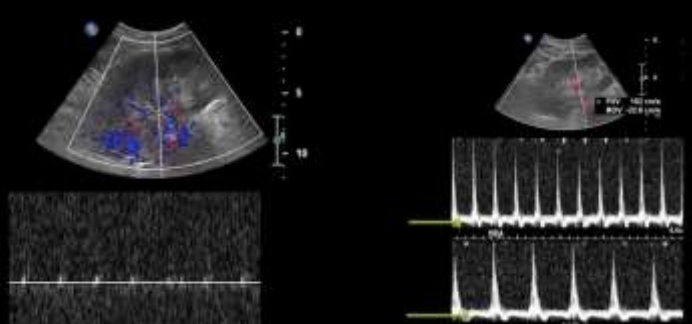
Renal vein thrombosis



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Ectopic pregnancy

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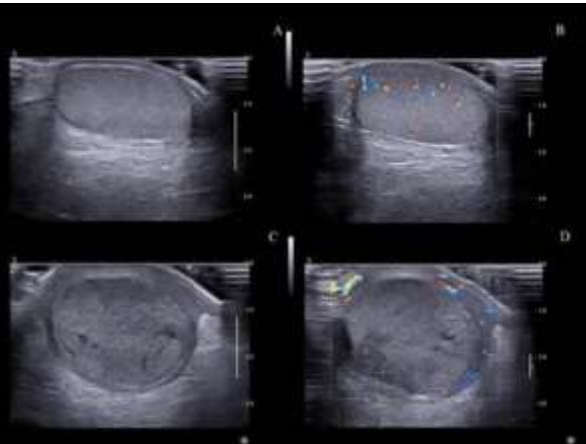
Testicular Torsion



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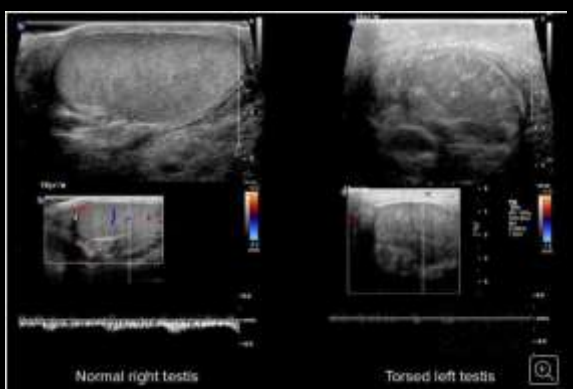
Testicular Torsion



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Managing discrepancies

- Implementation of a peer review process
- Medical education and training play key roles in ensuring that patients receive the best quality care.
- Reviewing previous studies to interpret new cases or consult with clinicians
- To hold and actively participate in meetings where cases involving radiological errors are discussed.
- New technology can be used to prevent errors
- Be open to ask second opinions or repeat / further imaging
- Greater openness with patients about harmful errors is recommended - Duty of Condour

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Feedback Level	Description
Level 1	Major Discrepancy (Immediate and significant clinical impact)
Level 2	Major Discrepancy (Probable clinical impact)
Level 3	Minor Discrepancy (Clinical impact unlikely)
Level 4	Minor Discrepancy (Either typographic or discrepancy of very doubtful significance)
Level 5	No Discrepancy
Level 6	Great Report (This report demonstrates skilful observation / interpretation by the radiologist)

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Limit errors

- Better working conditions
- Avoid disturbances while reporting and scanning
- Manage workload
- Appropriate support and training
- Open discussions with referring clinicians
- Strict vetting for appropriate imaging modalities and indications
- Make sure full and appropriate clinical information is available.
- Use of updated technology and machines

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