

Review

It's Time for Small "PAUSE"- Pitfall Analyses of Ultrasonographic Examinations: A Thought to Ponder for Clinicians

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Abstract

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In this era of technology, lots of emphasis is given to imaging technology as ultrasonography, which is increasingly becoming popular as a diagnostic modality in almost all fields of medicine, without realizing its inherent errors. Errors in radiology are uncomfortably common with the adjudged rate of 3-5% as studies revealed and much higher rates have been reported in many targeted studies (Lee et al., 2013). Ultrasonography is a useful tool, when considered along with the clinical features of patient. A majority of errors in radiology can affect the subsequent diagnosis and treatment of a patient. In case of an abnormality, not explained clinically, a second opinion from another radiologist or a discussion between clinician and radiologist may help to eliminate errors in diagnosis. In this article, we demonstrate the common sources of diagnostic possible errors and pitfalls in ultrasound based diagnosis through a literature search involving the incidence of events, the ways they can be categorized to aid understanding, and contributing factors, both human and system-based errors. Possible approach to minimize errors is contemplated to ensure better patient management and treatment outcomes.

Keywords: Medical errors, diagnostic tool, radiology, ultrasonography

INTRODUCTION

A wise professor once told his students that, we treat human beings and not reports. However, no longer this practice is followed in current medical practice. Many asymptomatic patients with no relevant clinical findings are treated for only ultrasonographic abnormality. This is to highlight the fact that ultrasonographic findings have many inherent flaws like human error, machine error changing the echogenicity of the tissue, tissue error, etc. We recommend asymptomatic patients with normal clinical findings and only ultrasound reported abnormality should at least have two ultrasonographic reports from a different person as a rule and a thorough work up to initiate treatment.

In situations where ultrasonographic reports correlate with patient's symptoms or clinical findings, a single report may be enough to initiate treatment.

Radiology differs from other medical specialties by

depending entirely on visual perception and on the identification of specific characteristics on a radiograph. The technician and radiologist can both perform their jobs in a more efficient and focused manner if they have adequate information. Ultrasonography has become a chief diagnostic tool for an immense increase spectrum of clinical conditions or as the first procedure employed in the evaluation of trauma or non-traumatic acute abdominal conditions (Feldman et al., 2009).

DISCUSSION

The main reason for analyzing medical errors is to foresee as well as try to avert them. It was recently estimated that one billion radiologic examinations are performed worldwide annually, most of which are inter-

preted by radiologists (Bruno et al., 2015). Most professional bodies would agree that all imaging procedures should include an expert radiologist's opinion, given by means of a written report (Standards for the reporting and interpretation of imaging investigations (2006). This activity constitutes much of the daily work of practicing radiologists.

Medical diagnostic errors represent a serious public health problem and pose a threat to patient safety because they are an indication of poor patient care. Error is inevitable in medicine and common in radiological diagnosis. Radiology is one of the specialties most liable to claim of medical negligence. An error is a deviation from the expected norm, regardless of whether it results in any harm. Errors may be categorized in a wide range of ways and there are methods in place that facilitate error identification so that steps can be introduced to minimize their occurrence. Factors contributing to errors can be categorized as being system-related (latent errors) or person-related (active errors). The latter is human cognitive errors and are thus more likely to be preventable but also more likely to have an adverse outcome than technical errors (Romano and Pinto, 2012).

The cause of error in radiology is multifactorial. They can arise during acquisition of images, processing, and interpretation, poor technique, 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), use of inappropriate probes, inadequate optimization of the images, failure of perception, lack of knowledge of the possible differential diagnosis, over-estimation of one's own skill, failure to suggest further ultrasound examinations or other imaging techniques (such as Computed Tomography or Magnetic Resonance Imaging) (Pinto, 2010; Pinto et al., 2012).

Diagnostic errors in radiology could also be an intuitive error or intellectual errors. Although the exact estimate of intuitive errors in making a diagnosis is not known, it has been calculated to be in the 60-70% range (Martensson et al., 2009).

Emergency imaging techniques are especially vulnerable to errors, more than any other diagnostic imaging technique: acquisition of accurate ultrasonographic images depends on the operator. The correct choice of ultrasound transducers, ultrasound frequency, and ultrasonographical skills are essential in reducing errors during the acquisition. In Obstetrics and Gynaecology imaging, most of the problems relating to the acquisition of correct images of the pelvic organs may be overcome with the use of transvaginal scanning. Ultrasound image processing depends on a number of physical factors of ultrasound itself and its interactions with body structures (Ong, 2004).

Artifacts are a significant source of error in ultrasonography. Image artifacts are often encountered in clinical imaging modalities such as ultrasound and will be an explanation for confusion for the sonographer. Some artifacts could also be avertable and arise secondary to improper scanning technique and by adopting an appropriate scanning technique, some artifacts can be circumvented. Other artifacts are caused due to the physical limitations of the modality.

Ultrasonographic artifacts arise secondary to errors inherent to the ultrasound beam characteristics, the presence of multiple echo ways, impetus errors, and attenuation errors. The ability to recognize and remedy potentially correctable ultrasonographic artifacts is important for image quality improvement and optimal patient care (Feldman et al., 2009).

An important determinant of error in emergency ultrasonographic depends on the technical ability of the operator. A precise ultrasonographic examination is directly associated with operator ability, training, and experience. The sonographer's responsibilities comprise the highest possible benefit of the diagnostic capability of ultrasonography, the knowledge of what to look for, and the competence to interpret the ultrasonographic findings based on the understanding of the physiology and pathological changes of the examined organs. Modern ultrasound equipment is certainly adequate for generating images and results of anomalies like meningocele, myelomeningocele or a congenital heart defect. However, such diagnoses can only be made if considerable operator skill is associated with knowledge and experience.

The earliest lawsuit associated with diagnostic ultrasound occurred in 1974 and related to Obstetrics and Gynaecology measurements. Before 1974, pictures were therefore tough to interpret that ultrasound was thought of very little worth with the exception of obstetrical measure information and for characterizing masses as cysts. Litigation associated with diagnostic ultrasound has become increasingly frequent as pictures became easier to interpret, expectations inherent to the capacity of diagnostic ultrasound to facilitate diagnoses of subtle fetal anomalies became higher, and sonographic equipment has become more widespread. Obstetric ultrasound has always attracted more litigation than other aspects of diagnostic ultrasound. There has been a change in the main target of litigation over time: in the 1980s, ectopic pregnancy was the most common reason for litigation; today, litigation related to a missed fetal anomaly is the most frequent indication (Sanders, 2003).

In musculoskeletal ultrasonography also multiple factors affect the correct performance and interpretation of ultrasound such as the quality of the ultrasound machine, the choice of an appropriate transducer or correct machine settings, the correct scanning technique including proper positioning of the transducer or use of

a ultrasound standoff pad where necessary knowledge or the capabilities and limitations of the modality in clinical knowledge and typical artefacts, knowledge of musculoskeletal anatomy and functioning (Małgorzata and Artur, 2017).

David A Jamadar has also highlighted the fact that there are many pitfalls in musculoskeletal ultrasonography due to misinterpretation of normal anatomic structures as well as misinterpretation of pathologic condition. Knowledge of such pitfalls will improve accuracy in the sonographic diagnosis of the musculoskeletal disorders (David et al., 2010).

Types of a lawsuit in ultrasound (including the ultrasound performed on an emergency basis) involve the following groups: missed diagnoses, misinterpreted sonograms, invented lesions, delay in communicating information to a clinician, failure to perform sonography, fraud cases, procedure-related cases, and sonographer-related suits (Sanders, 2003).

Errors in emergency ultrasound are often reduced by improving knowledge as well as in the system.

An important goal of error analysis is by creating a system for reducing or preventing the prevalence of errors and minimizing the degree of damage.

The science of measuring diagnostic errors is underdeveloped (Newman-Toker et al., 2009) and the implementation of a peer review process in diagnostic radiology is one method of responding to this need. Medical education and training play key roles in ensuring that patients receive the best quality care. Peer review is very important in the discovery of errors. Some departments have integrated systems of peer review into their daily clinical workflow by providing previous interpretations with every new study and including a checkbox for the interpreting radiologists to indicate whether they agree with the previous interpretations and, if not, a text box to indicate why they disagree. When reviewing previous studies to interpret new cases or consult with clinicians, errors may be discovered such as discrepancies in the interpretation of the images themselves or in additional or revised clinical information. Radiologists have been encouraged to hold and actively participate in meetings where cases involving radiological errors are discussed. New technology can be used to prevent errors. For example, natural language processing and voice recognition software can be trained to detect errors or discrepancies within reports automatically, before the report is verified or signed off by radiologists (Pinto et al., 2012). In addition, greater openness with patients about harmful errors is recommended. Many ethicists and professional organizations endorse such disclosure of harmful errors to patients (Gallagher et al., 2007; Disclosure: What works now and what can work even better, 2004; Code of Medical Ethics, 2005).

CONCLUSION

It is important to understand that ultrasonography alone can lead to misdiagnosis of a case, if other, clinical features of patient do not correlate with the ultrasound findings. In such cases, it is important to repeat the scan with other radiologist to minimize inter-observer misinterpretation or a discussion between clinician and radiologist can lead to the better understanding of the case and images leading to more accurate diagnoses.

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