

Routine Abdominal and Pelvic Ultrasound Examinations: An Audit Comparing Radiographers and Radiologists

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Abstract

An audit of 202 routine abdominal and pelvic ultrasound examinations was carried out to evaluate the clinical performance and interpretation of these scans by radiographers and compare them with radiologists, and to investigate the extended role of radiographers in performing these scans. Each scan was first performed by a radiographer and then repeated by the radiologist. The findings were subsequently compared and any discrepancy resolved by re-scanning the patient with or without the involvement of an independent radiologist, or by follow-up of the patient by other imaging studies. In 158 (78.2%) scans, there was complete agreement between the radiographer's and radiologist's findings. In 44 scans (21.8%), there was incomplete agreement – there were 108 abnormal findings in these scans with incomplete agreement/discrepancy in 53 abnormalities. Overall, the accuracy of radiographers was 92.0% and radiologists was 91.7%; however, the accuracy rates were 94.0% and 96.4%, respectively, when minor abnormal findings without significant influence on the patient's clinical outcome were excluded.

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Introduction

Since its introduction into clinical practice in the early 1970s, ultrasound (US) has become firmly established as an extremely valuable imaging modality and widely used to the extent that abdominal US is the second most commonly performed imaging study (after chest radiography).¹ Our department has also experienced a steady and significant increase in demand for US services over recent years; the number of US examinations performed annually has increased from 16,734 in 1997 to 20,845 in 2000 (Fig. 1).

US scanning practice varies considerably from one institution to another, ranging from the radiologist performing the whole examination without the aid of a radiographer to that of a trained radiographer scanning (according to a set protocol) without supervision or checking by the radiologist and simply recording representative images and findings for subsequent reporting by the radiologist. Studies have shown that trained radiographers performing and reporting routine obstetric ultrasound scans can achieve good sensitivity and specificity in the detection of fetal anomalies in the United Kingdom.² With increasing

workload in US imaging in most radiology departments, “skill mix” and the “extended role of the radiographer” have become topical issues in radiology, creating much interest and discussion.³

To ensure such a scheme operates effectively, there has to be appropriate quality control of the extended role of trained radiographers in US imaging. One method is to audit the recall rate of patients (who have been scanned initially only by a radiographer) for a second evaluation by a radiologist.⁴ Another method is to review retrospectively provisional reports of radiographers performing the scan and compare them with the radiologists' subsequent interpretation of the images (which were taken by the radiographers) and their final reports.⁵ However, both of these types of audit were limited in that the radiologist was dependent on the images taken by the radiographer. Hence, any abnormal finding/s missed by the radiographer might subsequently also be missed by the reviewing radiologist.

Our audit, therefore, is a prospective study comparing directly the accuracy of radiographers with radiologists in routine abdominal and pelvic US scans and investigating

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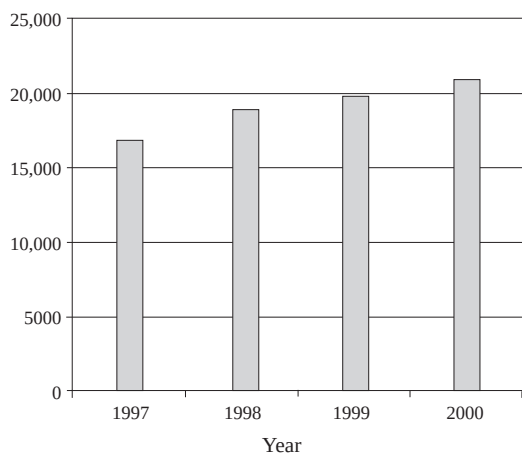


Fig. 1. Number of ultrasound examinations performed in the Department of Diagnostic Radiology, Singapore General Hospital, in the years 1997 to 2000. Source: Radiology Information System (RADNET), Department of Diagnostic Radiology, Singapore General Hospital.

the possibility of an extended role of radiographers in performing these scans.

Materials and Methods

Over a 9-month period, 200 patients who attended the Ultrasound Section of the Department of Diagnostic Radiology, Singapore General Hospital for routine general abdominal and/or pelvic US scans were randomly selected to be included in our study. After registering at the Ultrasound Section counter, the patients were then scanned in any one of the 4 US examination rooms (in no particular order) depending on room availability (for example, the first patient who registered may be scanned in room 4, the second in room 1, the third in room 2, and so on). Two rooms were staffed by radiographers participating in the study. Only patients listed for routine general abdominal and/or pelvic scans were included in our study; special and more complex US scans (colour doppler imaging, trans-rectal/trans-vaginal/trans-cranial scans, scans of small parts – breast, testes, thyroid) were excluded. All the subjects included in the study were outpatients with ages ranging between 17 and 88 years (average age, 51.4 years) and they comprised 96 males and 104 females. A total of 202 scans were performed—162 general upper abdominal scans, 35 renal scans and 5 trans-abdominal pelvic scans.

Four specialist radiologists, with a minimum 3 years post-specialist qualification [FRCR (UK) or equivalent in Diagnostic Radiology and with special interest in US imaging] and 3 radiographers (with a minimum of 2 years of dedicated ultrasound imaging experience; all 3 were qualified with Advanced Diploma in Sonography, Nanyang Polytechnic, Singapore) were involved in the audit exercise. Only two US scanners were used in the study – Acuson Sequoia and Acuson 128 XP (both of ACUSON Corp,

Mountain View CA, USA).

Each scan was first performed by the radiographer (according to a set protocol) who acquired the hard-copy images and recorded her findings on a worksheet. The patient was then scanned immediately afterwards by the attending radiologist without prior knowledge of the radiographer's scan results, and the findings recorded. Both the radiologist and radiographer had access only to the clinical information on the radiological request form and any accompanying previous scan/s before commencing examination of the patient.

The findings by the radiologist and radiographer were then correlated and compared. If there was complete agreement of the findings, the patient was allowed to leave. If, however, there was any discrepancy between the two reports, the patient was then re-scanned immediately by the radiologist together with the radiographer and the discrepancy confirmed or excluded; the patient was then allowed to leave. In cases where the discrepancy could not be resolved, the patient was then scanned by an independent operator (another radiologist with special interest in US) and/or followed up by other definitive investigation or further imaging.

Results and Discussion

A total of 202 abdominal and pelvic US scans were performed on the 200 patients in our study. Forty-eight scans had normal findings with no abnormality detected by both the radiologist and radiographer. There were 110 examinations with 170 abnormalities detected and agreement between the operators in their findings of these abnormalities. This resulted in 158 scans out of 202 with complete agreement between radiologists and radiographers.

In the remaining 44 scans, there were 108 abnormalities detected with agreement between the operators in 55 abnormalities and discrepancy in 53 abnormalities (Table I). This results in an overall agreement between radiologists and radiographers of 83.7% ($\{48 + 170 + 55\} / \{48 + 170 + 108\}$). All 53 abnormalities missed or not reported by either the radiologist or radiographer on initial scanning were reproducible and confirmed on re-scanning of the patient by the operators together – 26 were initially detected by radiologists but missed or not reported by radiographers, and 27 vice versa. This gives an overall accuracy for radiologists of 91.7% ($\{48 + 170 + 55 + \text{abnormalities detected by radiologists but missed or not reported by radiographers [26]}\} / \{48 + 170 + 55 + 53\}$), and accuracy for radiographers of 92.0%.

These 53 abnormalities were subsequently reviewed individually and analysed further; about half of them could be considered as minor findings with no clinical significance

TABLE I: ABNORMALITIES MISSED OR NOT REPORTED BY EITHER RADIOLOGIST OR RADIOGRAPHER IN ULTRASOUND SCANS WHERE THERE WAS INCOMPLETE AGREEMENT BETWEEN THE OPERATORS

Pathology	Missed / not reported by radiologists (total of 27 abnormalities)	Missed / not reported by radiographers (total of 26 abnormalities)
Liver		
Cysts	2	3
Haemangiomas	1	-
Calcified granulomas*	1*	2*
Fatty changes	-	3
Cirrhosis	-	4
Gallbladder		
Calculi	3	2
Polyps*	7*	2*
Re-canalisation of umbilical vein	2	-
Kidneys		
Cysts (<1 cm size)*	6*	3*
Cysts (>1 cm size)	2	4
Angiomyolipoma*	2*	1*
Polycystic	1	-
Splenomegaly	-	1
Abdominal ascites	-	1

* Figures with asterisks denote minor findings with no clinical significance or had no influence on the patient's subsequent management or outcome.

or had no influence on the patient's subsequent management or outcome – sub-centimetre renal cysts and angiomyolipomas, calcified liver granulomas and tiny gallbladder polyps (<5 mm size). Exclusion of these minor findings (marked by * in Table I) from the study resulted in only 29 abnormalities not detected initially by the radiologist/radiographer—18 abnormal findings detected initially by radiologists but missed or not reported by radiographers and 11 abnormalities, vice versa. This resulted in a revised accuracy rate of 96.4% for radiologists and 94.0% for radiographers.

The results of our audit (83.7% agreement between radiographers and radiologists with accuracy rates of 96.4% for radiologists and 94.0% for radiographers) carried out in a local institution in Singapore with an extremely heavy US workload (>20,000 scans performed annually) demonstrate adequately the satisfactory high level of agreement between radiographers trained in US and radiologists in the performance of routine abdominal and pelvic US scans. Our audit also shows the excellent accuracy rate of both groups of operators which compare favourably with studies performed in overseas centres. A study carried out by Weston et al⁶ compared US scans done by a standard service (that is, scans performed by radiographers and

reported by radiologists) with those performed and reported by an independent auditing radiologist. Their study involved a smaller group of 100 patients (as compared with our group of 200 patients) but their results were very similar, with an agreement rate between the 2 groups of operators of 82.9% and accuracy rate of 89.7% for the standard service and 93.2% for the auditing radiologist. Leslie et al⁷ compared US scans performed by radiographers directly with those performed by radiologists on a prospective double-blind basis; their agreement rate was 94.0% with accuracy rates of 96% for radiographers and 97% for radiologists.

The current practice in our department is that radiologists check on all patients immediately after radiographers have performed the initial scans and acquired the hard-copy images according to a set protocol; the radiologists then report all radiographer-performed US scans. Given the high level of agreement between radiologists and radiographers and the excellent accuracy level as have been shown in various studies, a new work routine has been contemplated in some centres whereby radiographers performing US scans who detect no abnormality or straightforward abnormalities (such as gallstones or renal cysts) will be able to issue their own report.⁷ Considering the current interest and debate on the extended role of radiographers in radiology departments and given the results obtained from our audit exercise and similar studies overseas, such concepts would certainly be worth exploring.

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