Plain abdominal radiographs: can we interpret them?

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ABSTRACT

INTRODUCTION Plain abdominal radiographs commonly form a part of medical assessments. Most of these films are interpreted by the clinicians who order them. Interpretation of these films plays an important diagnostic role and, therefore, influences the decision for admission and subsequent management of these patients. The aim of this study was to find out how well doctors in different specialties and grades interpreted plain abdominal radiographs.

MATERIALS AND METHODS A total of 76 doctors from the Departments of Accident & Emergency, Medicine, Surgery and Radiology (17, 32, 23 and 4, respectively) participated in the study which involved giving a diagnosis for each of 14 plain abdominal radiographs (5 'normal' and 9 'abnormal'). They were also asked the upper limit of normal dimensions of small bowel and large bowel. One point was awarded for correctly identifying whether a radiograph was normal/abnormal, 1 point for the correct diagnosis and 1 point for the correct bowel dimensions, giving a total score of 30.

RESULTS Mean scores out of 30 for specialties were as follows: Accident & Emergency 13.1 (range, 2–22), Medicine 11.2 (range, 2–23), Surgery 15.0 (range, 8–24) and Radiology 17.0 (range, 14–20; $P = 0.241$). Mean scores out of 30 for different grades of doctors were as follows: pre-registration house officers 10.8 (range, 4–20), senior house officers 13.0 (range, 2–22), registrars/staff grades 13.8 (range, 2–23) and consultants 17.3 (range, 12–24; $P = 0.028$). Fifteen out of 76 (19.7%) doctors correctly identified the upper limit of normal dimension of small bowel; 24 out of 76 (31.6%) correctly identified the upper limit of normal dimension of large bowel.

DISCUSSION The level of seniority positively correlated with skills of plain abdominal radiograph interpretation. A large number of doctors were unable to give the correct upper limit of normal dimensions for small and large bowel.

CONCLUSIONS All doctors could benefit from further training in the interpretation of plain abdominal radiographs. This could perhaps take place as formal teaching sessions and be included in induction programmes. Until then, plain abdominal films should ideally be reported by radiologists where there are clinical uncertainties; important management decisions made by junior doctors based on these films should at least be confirmed with a registrar, if not a consultant.

KEYWORDS

Radiography – Abdominal – Clinical competence – Medical staff

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About 2700 plain abdominal radiographs are ordered per annum in our hospital. However, due to a shortage of radiologists, only out-patient radiographs are formally reported by radiologists. Under the *Ionising Radiation (Medical Exposure) Regulations 2000*, it is a legal requirement for a clinician who requests a radiograph to record its evaluation, detailing diagnostic findings or therapeutic indications.¹ Although plain abdominal radiographs are not routinely ordered during investigation of patients with abdominal pathology, they still form a significant fraction of radiological investigations requested in the accident &

emergency department. The interpretation of these plain abdominal films could affect management plans for the patients. There is always the concern that missed significant abnormalities may be dangerous.² On the other hand, 'overdiagnosing' a radiograph, which shows a variant of normal, may lead to over-investigation and inappropriate referrals and admissions.

To our knowledge, there has been no study exclusively investigating the ability of doctors of different grades and specialties to interpret plain abdominal radiographs. In view of the fact that teaching on the interpretation of these plain

Table 1 Numbers of participants according to specialty and grade and comparison of scores between different grades (range in parentheses)

	A&E	MED	SURG	RADIO	Total	Mean score
PRHO	0	10	8	0	18	10.8 (4–20)
SHO	12	12	5	0	29	13.0 (2–22)
Registrar/SG	4	8	4	1	17	13.8 (2–23)
Consultant	1	2	6	3	12	17.3 (12–24)
Total	17	32	23	4	76	

abdominal films is fairly limited at medical school, we conducted a study on the ability of clinicians to interpret them.

Materials and Methods

All doctors from the specialties of medicine (MED), surgery (SURG), accident & emergency (A&E) and radiology (RADIO) were invited to participate in the study over a 2-month period. A total of 76 doctors of various grades were assessed out of a possible 91 as shown in Table 1; 15 doctors did not participate due to unavailability. Fourteen plain abdominal radiographs were selected, of which 5 were 'normal' and 9 were 'abnormal'. These were selected by a consultant radiologist and the abnormalities reflected a variety of surgical conditions including small bowel obstruction, large bowel obstruction, caecal volvulus, sigmoid volvulus, pancreatic calcification and thickened bowel wall.

Participants were told that the radiographs were not necessarily abnormal prior to interpreting the films. This was done on a standard X-ray box in a quiet environment on a one-to-one basis. Patient details were obscured to prevent any participant from recognising the film and all films were shown in the same order. Participants had to state if the film

was normal or abnormal, and to provide a diagnosis if they thought it abnormal. To prevent participants from 'learning' as they viewed each subsequent radiograph and applying it during the assessment, they were not allowed to go back to a previous radiograph to change their answer. No clinical information was provided as each radiograph had characteristic features which allowed the diagnosis to be made. Participants were also asked the upper limits of normal dimensions of small bowel and large bowel in centimetres.

At the end of each assessment, no answers were revealed to any participant to prevent bias. One point was awarded for correctly identifying whether a film was normal/abnormal, 1 point for the correct diagnosis and 1 point for the correct bowel dimension, giving a total score of 30. There was no time limit for each assessment.

To determine whether there was a statistically significant difference between scores obtained by different grades of doctors and also between different specialties, a general linear model was fitted using GenStat (v. 6.1). 'Total score' was the dependent variable and factors 'grade' (4 levels) and 'specialty' (4 levels) were predictive variables. By fitting 'grade' and 'specialty' simultaneously, it was possible to adjust for the fact that grades were unevenly distributed among specialties and *vice versa*.

Table 2 Comparison of scores between different grades and specialties

	A&E	MED	SURG	RADIO
PRHO	–	10.2 (4–18)	11.5 (8–20)	–
SHO	13.2 (5–20)	11.8 (2–20)	15.6 (8–22)	–
Registrar/SG	13.0 (2–22)	11.4 (6–15)	17.8 (15–23)	20
Mean score between specialties	13.1 (2–22)	11.2 (2–23)	15.0 (8–24)	17.0 (14–20)

Range in parentheses.

The mean score between specialties includes consultants.

Results

Mean scores between specialties

The results are shown in Table 2 and it would appear that the mean average score was best for RADIO, followed by SURG, A&E and MED. However, the table is unbalanced, and after adjustment for imbalance in grades, the rank order is SURG, RADIO, A&E and MED. This result is, however, not statistically significant ($P = 0.241$).

Mean scores between grades

The results are shown in Tables 1 and 2 and indicate a statistically significant difference between the grades of doctors with a positive correlation between seniority and score ($P = 0.028$). Taking consultant as the reference level, the estimated effect of being a registrar/staff grade was to lower the score by 2.4 points (SE = 1.9; $P = 0.21$), for a SHO was to lower the score by 2.90 (SE = 1.86; $P = 0.12$) and for a house officer to lower the score by 5.7 (SE = 1.9; $P = 0.004$).

As the number of consultants from the chosen specialties who participated in the study was small, we did not compare the results for different specialties for this grade.

Small bowel and large bowel dimensions

Fifteen (19.7%) and 24 (31.6%) doctors correctly identified the upper limit of normal dimensions of small bowel and large bowel, respectively. Four (5.3%) gave the same figure for both small and large bowel. The answers ranged from 1.5 cm to 10 cm for small bowel, and 4 cm to 15 cm for large bowel.

Discussion

Recognising a grossly abnormal plain abdominal radiograph is not difficult but it is far more difficult to recognise normal films which raise clinical suspicion merely due to unusual bowel gas patterns. Plain chest radiographs feature strongly in teaching sessions for medical students and junior doctors. However, the interpretation of plain abdominal radiograph is not commonly taught to the same standard. This explains why most doctors find interpreting them difficult.⁵ Yet, plain abdominal films are commonly requested during the investigation of patients in the accident & emergency department. Most of these films are interpreted by the doctors who ordered them as they are seldom reported by radiologists during on-call hours. Clinical decisions are, therefore, made based on their interpretation of these films in light of the clinical presentation.

The study re-assuringly shows a statistically significant difference between different grades of doctors, implying that experience does contribute to plain radiograph interpretation skills. Surprisingly, there was little difference in

the mean score between senior house officers and registrars/staff grades (43.4% versus 45.9%) contrary to what one would expect. This could be due to senior house officers increasing their knowledge whilst studying for membership examinations. In analysing the answers, the authors noticed that a large number of doctors had difficulty differentiating between small bowel and large bowel. Many did not know what the normal dimensions of bowel were, with only 19.7% and 31.6% of doctors giving the correct answer for small bowel and large bowel, respectively. Of participants, 5.3% gave the same answers for both small bowel and large bowel. This finding is especially worrying as it could mean that some patients with obvious bowel obstruction remain undiagnosed and untreated.

The mean scores were highest for doctors from the departments of radiology followed by surgery which could reflect the greater experience and exposure to plain abdominal radiographs compared to doctors from the departments of accident & emergency and medicine. However, this result was not statistically significant and could be due to the small number of participants from the radiology department in the study, of whom 75% were consultants. Also, the mean scores for the different specialties was likely to be skewed negatively by the inclusion of pre-registration house officer scores for medicine and surgery as this group of junior doctors scored the lowest. The uneven distribution of numbers and grades within each specialty makes it difficult to improve the design of the study for comparison purposes.

To decrease the time between medical decision-making by the doctor who orders the plain abdominal radiograph and the formal radiological report, teleradiology or full-time, on-site coverage by a radiologist have been proposed.⁴ However, it is unlikely to be a reality in most hospitals in the UK in the near future. Having radiologists to report radiographs 24 hours a day may prevent misinterpretation but is unlikely to be cost effective.²

Conclusions

From the results of this study, all doctors could benefit from further training in the interpretation of plain abdominal radiographs. Indeed, these should be featured more prominently than CT and MRI interpretation during X-ray meetings as doctors are required to be able to interpret them during on-call hours when on-site consultant cover is not necessarily available. X-ray teaching programmes of different levels of intensity should be scheduled as part of induction programmes for doctors of all grades on first joining the firm. This will ensure all doctors gain the interpretive skills they require.

Clearly, consultants are better at interpreting plain abdominal films than all other grades of doctors. Hence,

important management decisions made by junior doctors based on these films in light of the clinical presentation should at least be confirmed with a registrar if not a consultant. However, if there is doubt, a radiologist should always be consulted.

Acknowledgements

We wish to thank Professor Stephen Senn, Department of Statistical Sciences, University College London for his assistance with the statistical analyses of the results. Also, we wish to thank all doctors who kindly participated in this study.

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doi 10.1308/003588406X83096

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