The effect of introducing guidelines for cervical spine radiographs in the accident and emergency department

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Abstract

Objective—To assess the effect of guidelines for x ray requests on requests for cervical spine x rays.

Setting—Accident and emergency (A&E) department of tertiary referral centre.

Methods—Guidelines for all x ray requests were introduced in the (A&E) department of the Royal Infirmary of Edinburgh in February 1992. The effect of the guidelines on requests for cervical spine x rays was assessed by retrospective review of all such x rays taken over two 30 d periods, before and after the introduction of the guidelines. Junior staff had been in post for 3 months during both periods assessed. Films were reviewed for quality by a consultant radiologist.

Results—Guidelines reduced the number of inappropriate requests significantly; however, 26% of requests were still unnecessary. The standard of radiography improved but 49% of x rays remained inadequate, usually because the C7/T1 level was not demonstrated on the lateral view. The A&E doctors correctly interpreted the radiographs in 95% of examinations.

Conclusions—Guidelines reduce inappropriate x ray requests. Further improvements can be expected with continued education.

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Key terms: cervical spine radiographs; accident and emergency department; guidelines.

A large number of radiographs are taken in accident and emergency (A&E) departments, involving considerable time, cost, and radiation exposure. The radiographs taken in our department are subsequently reported by a radiologist. The appropriateness of requests and the quality of the films produced has been questioned.^{1 2} In an attempt to address these problems, guidelines for all radiological requests were produced jointly by the A&E and Radiological consultants at the Royal Infirmary of Edinburgh and implemented in February 1992.³ The guidelines took into account the recommendations of the Royal College of Radiologists.⁴

The aim of the guidelines was to assist the A&E doctors in their requests for radiographs rather than to lay down inflexible rules, and to specify for the radiographers the appropriate views to perform.

Indications for cervical spine radiographs include: patients in coma following head injury⁵; patients with neurological signs or symptoms of root or cord injury; patients with pain or symptoms referable to the neck following trauma or suspicion of cervical spine injury.

Patients with neck pain but no history of trauma do not normally need an x ray. An adequate cervical spine series consists of antero-posterior (AP) and lateral views of the cervical spine and an open mouth view of the odontoid peg.⁶ The C7/T1 interspace must be clearly visible on the lateral view. This may require the doctor to pull the patient's arms during the radiograph or to request a "swimmers" view.

We assessed: (1) the effect of guidelines on the number of examinations; (2) the appropriateness of requests; (3) the adequacy of the radiographic examination; (4) the A&E doctors' film interpretation.

Methods

We retrospectively reviewed all cervical spine radiographs taken over two 30 day periods. A preguideline group in November 1991 was compared with a postguideline group in May 1992. Junior staff had been in post for three months during both periods assessed. The records for all patients were reviewed to establish the indication for the examination, and the A&E doctors' interpretation.

The films were reviewed for adequacy and formally rereported by a consultant radiologist (IB).

Results

There was a significant reduction in the number of cervical spine radiographs performed in the A&E department following the introduction of guidelines.

In November 1991 (before the guidelines), 196 cervical spine x rays were requested out of a total of 3800 x rays (5.1%). In May 1992, after the introduction of the guidelines, 103 cervical spine radiographs were requested out of a total of 3520 (2.9%). The reduction is highly statistically significant (P < 0.001 by the Yates χ^2 test) (table 1).

Table 1 Number of cervical spine x ray requests

	No of C spine x rays requested (total No x rays)	% of total x rays
November 1991	196 (3800)	5.1
May 1992	103 (3520)	2.9
		P < 0.001

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Table 2 Indications for x ray

	Coma after head injury	Neurological signs	Neck symptoms	No indication
Nov 1991	14 (7%)	13 (7%)	102 (52%)	75 (38%)
May 1992	12 (11%)	4 (4%)	65 (63%)	27(26%)
				P < 0.05

Case mix comparability was ensured by taking a 10% sample of all patients presenting to the A&E department in the two months. This was performed by looking at the first, 15th, and 30th day of each month. In November 1991, 23 of the total of 640 patients (3.5%) presenting in the three days had possible neck symptoms. In May 1992, 25 out of the total 702 patients (3.56%) had possible neck symptoms. There is thus close case mix comparability.

The commonest indication for requesting cervical spine x rays was neck pain or symptoms referable to the neck following trauma, accounting for 52% of the preguideline group and 63% of the postguideline group. Several patients had more than one indication.

In the preguideline group 75 patients (38%) had no indication for cervical spine radiograph, that is, they did not meet any of the guideline indications and had a full range of pain free neck movement with no neurological abnormality.⁷

In the postguideline group 27 patients (26%) had no indication for x ray. This fall in unnecessary requests of 12% is statistically significant (P < 0.05) (table 2).

Over 70% of the radiographs taken in the two periods were located. Of the 30% not located there were similar numbers of films missing from both November (28%) and May (34%). The radiographs were assessed in the following ways: (1) Had all three views been taken? (2) Was each of the three views complete? (3) Had each x ray been labelled with the correct name, date, and side marker? For the radiographs to be adequate, all the criteria had to be met.

Before guidelines were introduced, two (1.4%) of the examinations fulfilled all the criteria for adequacy. This low figure is because in 82 cases (57%) only a lateral radiograph was taken, in 58 cases (41%) lateral and AP views were taken, but in only three cases (2%) were all three views taken. Following guidelines, 35 (50.7%) were considered adequate (P << 0.001) (table 3).

The standard of x rays taken in the post-guideline group was reviewed in more detail. Every patient had a lateral view, 78% an odontoid peg view, and 87% an antero-posterior view. Sixty nine per cent of the lateral views were adequate. Failure to show C7/T1 occurred in 31% of lateral views. The C6/7 interspace was not visible in 20%. The odontoid peg view was adequate in 87% of

Table 4 Adequacy of x rays in May 1992 (after introduction of guidelines)

	Performed	Adequate
Lateral	69 (100%)	48 (69%)
Odontoid peg	54 (78%)	47 (87%)
AP	60 (87%)	59 (98%)

cases. Teeth obscuring the peg was the most common cause of inadequacy. Ninety eight per cent of the AP views were acceptable. In all cases, x rays were labelled correctly (table 4).

All radiographs were reported by a consultant radiologist (IB) and compared with the A&E doctors' interpretation. In both pre-and postguideline groups, the junior doctors showed over 95% accuracy in interpretation. Seven radiographs were interpreted incorrectly by the A&E doctors. In four cases, a normal x ray was thought to show an avulsion fracture of a vertebral body. Three abnormal films were reported as "normal" by the A&E doctors. The abnormalities were: (1) widened distance between the posterior arches of C1 and C2 suggesting possible ligamentous injury; (2) malalignment between C2 and C3 consistent with rotary subluxation; further views were normal; (3) a vertical lucency in the superior articular facet/pedicle of C3.

Discussion

The introduction of joint guidelines has been effective in reducing inappropriate requests for cervical spine x rays by 12%. The close case mix comparability provides strong evidence that the reduction in x ray requests was a result of the guidelines. However, 26% of requests are still unnecessary. In our department this means 300 unnecessary requests per year. The large number of inappropriate requests may reflect junior doctors' anxiety over missing neck injuries. However, a normal radiograph could give the doctor a false sense of security. A previous study has shown that in 17% of patients with spinal cord injury, there was no plain film evidence of trauma.⁸ The importance of careful clinical examination in conjunction with appropriate radiography cannot be overstressed.⁹⁻¹¹

The effectiveness of guidelines in reducing unnecessary requests has cost implications. A series of three cervical spine views costs approximately £10.00. The reduction in cervical spine x ray requests resulted in an annual saving to this department of over £11 000. The reduction in x ray requests also reduces radiation exposure, and time spent in the A&E department.

Although guidelines resulted in improved radiographic quality, 49% of x rays were still inadequate, mostly because the C7/T1 interspace is not shown.¹²

The 95% accuracy in A&E doctors' radiographic interpretation could be misleading.¹³ As the incidence of abnormal films was very low (<2%) we cannot conclude that junior doctors would show 95% accuracy in detecting plain film abnormalities. A previous study showed that A&E senior house officers failed

Table 3 Standard of x rays

	Adequate	Inadequate
November 1991	2 (1.4%)	141 (98.6%)
May 1992	35 (50.7%)	34 (49.3%)
	P << 0.001	

to recognise 78% of radiologically demonstrable injuries of the cervical spine.¹⁴

Following this study, we are considering further methods to reduce inappropriate requests and to improve the standard of films as described below.¹⁵

We plan to hold monthly meetings in the A&E department led by a consultant radiologist (IB) at which x ray errors are discussed. This is an ideal platform at which to reinforce the guidelines, both with regard to indications for performing radiographs and to obtaining adequate films. It is important to stress the requirement for obtaining adequate views, and this is the joint responsibility of both radiographer and clinician.

All radiographs requested and performed in the A&E department are subsequently reported by a radiologist, and the reports matched with the record sheet. In future we intend to routinely incorporate into the report comments as to the appropriateness of the request and the adequacy of the films produced.

With continued education and the application of such guidelines we anticipate further improvements in the use and value of standard radiography in the A&E department.

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