

MEDICAL PRACTICE

Contemporary Themes

Radiography of injured arms and legs in eight accident and emergency units in England and Wales

ROYAL COLLEGE OF RADIOLOGISTS WORKING PARTY

Abstract

The use of radiography of the arms and legs (extremity radiography) in 32 936 patients attending eight accident and emergency units was studied. Although extremity radiography was satisfactory in terms of cost per bony injury detected (£40), considerable differences between centres in the predicted and actual yields of bony injury were observed.

Guidelines for selection of patients for extremity radiography would reduce variability in its use and improve the quality of present practice.

Introduction

Some radiologists regard the current use of radiography of the arms and legs (extremity radiography) in patients attending accident and

emergency units with acute musculoskeletal injuries as over zealous. They believe that heavy workloads, fears of medical litigation, patients' expectations, and the absence of guidelines for objective selection of patients may exert pressure on an often inexperienced doctor to refer more patients for radiography than is necessary. As extremity radiography is the definitive examination to confirm the presence or absence of a fracture or dislocation, however, many of those who attend accident and emergency units with injured arms and legs probably have clinical signs and symptoms that are sufficiently severe to justify its use.

During 1982-3 the Royal College of Radiologists Working Party on the Effective Use of Diagnostic Radiology undertook a multi-centre audit of extremity radiography in the management of 32 936 patients attending eight accident and emergency units throughout England and Wales. Results of earlier audits of preoperative chest radiology in elective non-cardiopulmonary surgery, skull radiology in the management of head injury, and abdominal radiology in the initial management of the acute abdomen have already been published.^{1,8}

This paper presents preliminary data from the study. It describes the current use of extremity radiography, relates information about outcome to the clinical examination, and shows how these characteristics differ between hospitals in England and Wales. The data obtained will be used to investigate the factors that determine clinical prediction and to explore whether guidelines for the selection of patients for extremity radiography might be as useful as those proposed for preoperative chest and skull radiology.^{1,2,5-7,9-11}

Methods

The audit was intended to reflect the use of extremity radiography by accident and emergency units in England and Wales. Eight centres were considered to be the maximum number that could be controlled properly using the resources available at the central research headquarters. Of these eight, four were teaching centres, five were in high density urban areas, and three were in low density urban areas. The study was carried out over four

Members of the Royal College of Radiologists Working Party on the Effective Use of Diagnostic Radiology in January 1985 were: Dr M E Abrams, Department of Health and Social Security; Professor E Rhys Davies, Bristol Royal Infirmary; Mr W P Ennis, University of Wales College of Medicine, Cardiff; Professor K T Evans (convener), University Hospital of Wales, Cardiff; Dr P M Hacking, Royal Victoria Infirmary, Newcastle upon Tyne; Dr A E Hugh, North Staffordshire Royal Infirmary, Stoke on Trent; Dr J W Laws, King's College Hospital, London; Dr M R McNulty, Royal United Hospital, Bath; Professor C J Roberts, University of Wales College of Medicine, Cardiff; Dr G R Sutherland, Stobhill General Hospital, Glasgow.

Under the guidance of the working party the following took part: Dr L A Williams, Dr M Prescott, Cardiff Royal Infirmary; Dr S Field, Mr E P Abson, Kent and Canterbury Hospital; Dr J E Williams, Dr A Barker, St George's Hospital, London; Dr I P Maddison, Dr S Tachakra, Central Middlesex Hospital, London; Dr E Roebuck, Dr S H Dave, University Hospital, Nottingham; Dr P M Hacking, Mr A K Maitra, Royal Victoria Infirmary, Newcastle upon Tyne; Dr R M Paxton, Mr I P Stewart, Plymouth General Hospital; Dr B Clay, Mr M C T Morrison, Princess Margaret Hospital, Swindon.

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weeks in each centre between November 1982 and December 1983. The months of February and August were avoided to allow new staff to settle down before helping with the study.

Specially designed wallets were used at each centre to collect the information (figure). Instructions for recording information on the wallets were distributed to medical staff in the units, radiologists, radiographers, and clerical staff and were also posted up in appropriate working areas as reminders for those actively participating. On an agreed starting date wallets were issued to each examination and treatment room. When up to three of the extremity radiographs listed were requested for one patient the examining doctor filled in the usual x ray request form and placed it inside the wallet. For each site to be radiographed the doctor noted the presence or absence of 10 signs and symptoms before predicting the probable radiological outcome. The time since the injury and any previous attendance at an accident and emergency unit were also noted on the front of the wallet.

ROYAL COLLEGE OF RADIOLOGISTS—RADIOLOGY OF EXTREMITIES IN ACCIDENT AND EMERGENCY SERVICES

EXTREMITY X-RAY REQUEST WALLET

A. Please indicate the presence or absence of each of the following clinical signs and symptoms as they apply to each extremity area to be x-rayed.

Specify x-rays requested using the codes opposite			
Gross signs (bony deformity or crepitation)	Yes/No	Yes/No	Yes/No
Pain at rest	Yes/No	Yes/No	Yes/No
Pain with weight bearing or movement	Yes/No	Yes/No	Yes/No
Generalised tenderness	Yes/No	Yes/No	Yes/No
Bony point tenderness	Yes/No	Yes/No	Yes/No
Limitation of movement	Yes/No	Yes/No	Yes/No
Swelling	Yes/No	Yes/No	Yes/No
Bruising	Yes/No	Yes/No	Yes/No
Abnormal distal vascular or tendon functions	Yes/No	Yes/No	Yes/No
Impaired sensation	Yes/No	Yes/No	Yes/No
Previous attendance with the same injury	Yes/No	Yes/No	Yes/No

EXTREMITY — CODES

Upper limb

Shoulder joint	SJ
Humerus	HU
Elbow	EL
Radius+Ulna	RU
Wrist	WR
Hand	HA
Finger(s)	F(S)

Lower limb

Hip joint	HJ
Femur	FE
Knee	KN
Patella	PA
Tibia+ Fibula	TF
Ankle	AN
Foot	FO
Toe(s)	T(S)

B. Clinical examination/previous findings suggest that the above x-ray examination(s) will confirm the following:

1. Fracture
2. Joint dislocation
3. Other bone or joint pathology
4. Foreign body in soft tissue
5. No abnormality
6. Diagnosis not fitting any of the above categories please specify

C. How long since injury/condition occurred?

1. Less than 12 hours
2. 13-24 hours
3. 1-2 days
4. 3-7 days
5. More than 1 week

Wallet used by staff to collect information on extremity radiography in each patient.

On receipt of a request for extremity radiography the radiographer recorded the patient's name and age, date of examination, and departmental reference number on the reverse of the wallet, which was then filed in the department of radiology. When the films became available for reporting the findings were recorded on the wallet according to an eight point classification, which had been agreed by all participating radiologists. Any history of

extremity radiography for the same injury was also recorded. Completed wallets were checked by a research assistant and sent to the study headquarters in Cardiff. Information from each wallet was transferred to a coding sheet before analysis by computer. Data on doubtful cases were returned to the centre in question for further checking.

Results

During the study 32 936 new patients attended the eight units. A total of 10 199 extremity radiographs were requested for 8868 new and 237 existing patients, and 2414 bony injuries were identified radiologically, of which 2311 (96%) were fractures and 103 (4%) dislocations. Ninety nine medical staff in accident and emergency departments, 62 radiologists, and 194 radiographers participated in the study. Table I shows the outcome of extremity radiography in each centre. The yield of bony injuries ranged from 21.3% among patients referred for radiography at their first attendance in centre 1 to 34.7% in centre 2. Children aged up to 15 comprised 28% of the sample (ratio of boys to girls 1.5:1), and 10% of the sample were aged 65 or more. The proportion of new attenders arriving within 48 hours of injury ranged from 83% in centre 7 to 91% in centre 5.

Table II shows, for each injured site, the number of extremity radiographs reported; the ratio of bony injuries referred for radiography at first attendance (including patients who attended at night and were recalled for radiography the next day) to those not referred; the yield of bony injuries reported by the radiologist; and the proportion of extremity radiographs thought likely to show bony injury by the requesting doctor on the basis of the clinical examination. The ankle was the most frequently radiographed site (15%), then the finger (14%), foot (13%), wrist (12%), and hand (11%). Examinations of the toe (3%), humerus (1%), and femur (1%) were requested least. Only 10 patients out of 2404 (0.4%) with bony injuries were not selected for radiography at their first attendance (table II). Further analysis showed that one of 50 fractures of the scaphoid and one of 84 fractures of the femoral neck were not referred for radiography at the first visit.

Table II shows a wide variation in yield of bony injury according to site. The yield was particularly high for toes (41%), wrist (40%), shoulder (40%), and humerus (37%). Even the knee, the site with the lowest incidence of bony injury, had a yield of 7%. The results indicate the difficulty of identifying bony injury by clinical examination alone. Doctors predicted a 50.3% incidence of bony injuries among patients referred for extremity radiography on first attendance; the actual yield was 25.3%. The ratio of predicted to actual yield was particularly high for the knee (3.7:1), ankle (2.9:1), foot (2.7:1), and elbow (2.4:1). The last column in table II emphasises the importance of extremity radiography as a final arbiter of bony injury. For all sites combined 21.3% of bony injuries occurred in patients who were referred for radiography but were not expected to have bony injury on the basis of clinical examination. The proportion of such injuries reported but not expected was high for the knee (44%), ankle (39%), and toe (30%). In contrast, only 6% of bony injuries found on radiographs of the radius and ulna were not predicted clinically.

Table III shows large differences between centres in the observed and predicted yields of bony injury. For all examinations of the arm the observed yield ranged from 27% to 45%; the proportion expected to show bony injuries from 42% to 81%; and the proportion of bony injuries identified radiologically but not expected on the basis of clinical examination alone from 7% to 28%. For radiographs of the leg the observed yield varied less (14% to 22%) but the proportion expected to show bony injury ranged from 25% to 68% and the proportion of bony injuries not expected on the basis of clinical examination from 14% to 44%.

Discussion

A previous study showed that skull radiography accounted for 10% of all requests by accident and emergency departments for radiography and yielded two fractures for every 100 examinations.³ In contrast, we found that extremity radiography accounted for 58% of all such requests and yielded 25 bony injuries for every 100 examinations. Some regard a knowledge of the presence of bony injury of the finger or toe as of little clinical importance, but even when these sites were excluded the overall yield was still high at 24.2%. In the United Kingdom at present we estimate that about 3.5 million extremity radiographs are obtained yearly at a cost to the National Health Service of some £35 million.¹² Our study shows that these will identify 875 000 bony injuries at a cost of £40 for each case detected. This takes no account of the clinical and social value (for example, earlier return to work) of the 2.7 million negative findings.

TABLE I—Numbers of medical staff participating, workload, and outcome of extremity radiography in eight accident and emergency units

	Centre No								Total
	1	2	3	4	5	6	7	8	
Medical staff	16	8	13	21	9	12	10	10	99
Consultants	2	1	2	4	1	2	1	1	
Registrars	1	2	1	2	1	2	1	2	
Senior house officers	13	5	8	7	4	6	8	6	
General practitioners and others			2	8	3	2		1	
Reporting radiologists	7	11	9	5	4	7	12	7	62
Consultants	3	4	6	4	4	3	4	2	
Other grades	4	7	3	1		4	8	5	
Radiographers	34	24	15	20	25	20	36	20	194
Patients attending unit for first time during study	5340	3596	4267	2900	2693	8279	3027	2834	32936
Outcome of first referral examinations (%):									
Fracture or dislocation or both	21.3	34.7	23.5	26.1	30.5	23.9	22.2	22.8	25.3
Foreign body	1.4	1.4	1.1	0.5	1.1	2.2	0.4	1.3	1.4
Other condition	4.1	5.8	5.2	7.8	2.7	3.1	5.5	5.9	4.7

TABLE II—Numbers of extremity radiographs and predicted and observed yields of bony injury for each examination site

Site examined	No (%) of extremity radiographs reported	Bony injuries referred/not referred for extremity radiography at first attendance	Predicted yield of bony injuries (%)	Observed yield of bony injuries (%)	% Of observed bony injuries that were not clinically expected
Shoulder joint	545 (6)	217/0	56	40	15
Humerus	91 (1)	34/0	66	37	9
Elbow	568 (6)	124/0	52	22	19
Radius and ulna	379 (4)	136/0	63	36	6
Wrist	1151 (12)	463/2	63	40	16
Hand	1068 (11)	293/1	57	28	15
Fingers	1296 (14)	366/2	52	28	29
Hip joint	292 (3)	100/1	51	35	16
Femur	92 (1)	20/0	41	22	11
Knee	805 (8)	54/0	26	7	44
Tibia and fibula	291 (3)	59/1	44	21	24
Ankle	1439 (15)	198/1	41	14	39
Foot	1236 (13)	223/2	48	18	24
Toes	283 (3)	117/0	59	41	30
Total	9536 (100)	2404/10	50.3	25.3	21.3

TABLE III—Clinical expectations compared with radiological outcome of extremity radiography at patient's first attendance

	Centres								Total
	1	2	3	4	5	6	7	8	
Radiographs of the arm:									
No reported	890	677	651	423	372	1378	343	364	5098
Predicted yield of bony injuries (%)	53	56	46	57	81	64	42	54	57.1
Observed yield of bony injuries (%)	28	45	30	34	44	28	27	28	32.1
% Of observed bony injuries that were not clinically expected	15	23	25	16	7	14	28	20	17.8
Radiographs of the leg:									
No reported	776	566	611	401	362	1048	332	342	4438
Predicted yield of bony injuries (%)	40	38	25	32	68	58	29	38	42.5
Observed yield of bony injuries (%)	14	22	17	17	17	18	17	18	17.5
% Of observed bony injuries that were not clinically expected	35	29	44	31	14	19	37	30	28.8

Only 10 of the 2414 patients with bony injury identified in this study did not undergo radiography at their first attendance. This figure is encouraging in view of the obvious difficulties of detecting bony injury on clinical examination alone. For example, of 1439 patients referred for radiography of the ankle, 595 were thought to have a bony injury on the basis of a clinical examination, but only 120 of these were confirmed by radiography. A further 79 bony injuries of the ankle were found in patients referred for extremity radiography but not thought to have bony injury on the basis of clinical examination alone.

The high yield of bony injuries among those referred for radiography and the very low incidence of fractures among patients not referred for radiography at the first visit to accident and emergency departments is at present necessarily achieved by fairly liberal use of extremity radiography. The results of this study suggest that present practice is satisfactory in terms of cost per benefit achieved compared with the cost of detecting a skull fracture (£1100¹³). The cost of detecting a bony injury is only £40.

Unlike with preoperative chest radiology¹ and skull radiology³ we found no evidence that extremity radiography was being substantially overused and little justification for developing guidelines intended to limit its use in the United Kingdom, as Brand and his colleagues have proposed in the United States.¹⁴

The differences in clinical practice between centres were striking and need further consideration. For example, in centre 5 the proportion of patients with bony injuries of the arms referred for extremity radiography but not expected to have such injury on the basis of the clinical examination alone was a quarter of that in centre 7, yet the overall yield of bony injuries of the arm in centre 5 was almost double that in centre 7 (table III). Although some variation in conditions of patients presenting between centres is likely, we would not expect this to account for the substantial differences in yield evident in table III; nor can these differences be explained by the few patients with bony injuries (10 in all) not referred for radiography at the first visit.

The differences in observed and predicted yields within and

between centres probably imply a variability between doctors in their perception of what constitutes clinical suspicion of bony injury and the extent to which they believe an extremity radiograph might help to resolve this. If this variability could be reduced the quality of present practice would be further improved. We believe that this could be achieved by developing guidelines for selection of patients for extremity radiography similar to those already proposed for preoperative chest radiology and skull radiology.^{1 5 6 9-11}

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For Debate . . .

Is there a place for placebo controlled trials of antiepileptic drugs?

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Abstract

In many patients who develop epilepsy the disease is short lived and the overall number of seizures small. The role of anticonvulsant drugs in such patients is uncertain. If treatment is merely suppressive and the disease self limiting then treatment may not be necessary in some patients. If, on the other hand, early treatment prevents the subsequent evolution to chronic epilepsy then it is imperative. To resolve this issue it is essential to undertake placebo controlled trials, in which a group of patients with newly diagnosed epilepsy is given active treatment and compared with a similar group given placebo alone.

This article is based on a paper given in May 1984 at a meeting of the British branch of the International League Against Epilepsy and on a debate held in April 1984 during a combined meeting of the neurosciences departments of the Charing Cross, Westminster, and Central Middlesex hospitals attended by members of the Association of British Neurologists.

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Introduction

For over 125 years effective antiepileptic drugs have been available. Bromides were introduced into clinical practice in 1857, phenobarbitone in 1912, and phenytoin in 1938, well before the modern idea of clinical trials was conceived. There is no doubt that these and other drugs in current use suppress seizures. This has been objectively shown in animal and laboratory work and confirmed by extensive clinical experience. As epileptic seizures can have serious social and psychological consequences and cause injury and occasionally death, withholding effective treatment to give placebo appears to have little justification. On the other hand, there is equally no doubt that antiepileptic drugs are toxic, having side effects that are potentially serious and occasionally life threatening. Notwithstanding their pharmacological efficacy the unnecessary use of these drugs is therefore unjustifiable.

In three particular clinical circumstances the need for treatment with antiepileptic drugs is uncertain: in patients with newly diagnosed disease who have had only a few seizures; in patients receiving long term treatment who are free of seizures; and in patients with continuing epilepsy that is seemingly unresponsive to treatment. Particularly important issues arise in the first group. Ethical principles that apply generally to clinical trials will apply in this case; the issues are different in studies in which placebo is added to a regimen on one or more antiepileptic drugs that patients are already taking.

The natural history of epilepsy

Questions about the role of treatment are best raised in the context of the natural history of the disease—that is, its course while untreated. Because effective drug treatment has been available for so long there is almost no statistical information on the course of