Value of x ray examinations of the cervical spine

C A HELLER, P STANLEY, B LEWIS-JONES, R F HELLER

Abstract

The value of x ray examination of the cervical spine was studied. In one district general hospital it has been estimated that such examinations occupy one radiographer and one room for four hours a week. Eighty-five per cent of patients aged 60 or more who had been referred for an x ray examination of the neck in one year were reported as having cervical spondylosis, and there were no unexpected findings of infection or malignancy at any age.

The reports of patients referred for x ray examination of the cervical spine were compared with those of control patients who had originally attended for barium studies. There was no significant difference in the prevalence of cervical spondylosis between the two groups, although the severity of the disc changes was greater among cases than controls. There were no consistent relations between symptoms and changes seen on x ray films.

It is suggested that x ray examinations should be performed only when there is a clinical suspicion of malignancy or infection, after trauma, or when surgery may be indicated. There is little point in taking x ray films of the neck to diagnose cervical spondylosis.

Introduction

Requests for *x* ray examination of the cervical spine are common. The prevalence of cervical spondylosis in the normal population is high,[1 2] however, and the diagnostic value of such *x* ray films may therefore be limited.[1] This study was designed, firstly, to examine the frequency of requests for *x* ray examination of the cervical spine in a district general hospital; secondly, to compare the prevalence of changes of cervical spondylosis seen on *x* ray films in people referred for such examinations with that in control patients; thirdly, to assess the relation between symptoms and changes seen on *x* ray films; and, lastly, to see what action referring doctors planned to take as a result of the report of the *x* ray examination.

Methods

Information was obtained on all the *x* ray examinations of the neck performed at Ealing Hospital for the 12 months July 1979 to June 1980, including the age and sex of the patient, the source of the referral, and the report given. For comparison the same information was obtained for the months of January, June, and November in both 1977 and 1978 from the same hospital and in 1979 from another district general hospital in London.

Ealing Hospital, Southall, Middlesex UB1 3HW
C A HELLER, MB, FRCR, consultant radiologist
P STANLEY, DCRR, senior radiographer
B LEWIS-JONES, DCRRT, superintendent radiographer

St Thomas's Hospital Medical School, London SE1 7EH
R F HELLER, MRCP, FFCM, reader in community medicine

Correspondence to: R F Heller.

CASE/CONTROL STUDY

Patients referred for *x* ray examination of the cervical spine during the period November 1980 to April 1982 were eligible to be regarded as cases. Those who were referred after trauma or as part of an investigation of a generalised arthropathy or bone survey were excluded, as were Asian patients because of an apparent high incidence locally of bone tuberculosis, which meant that generalisations could not be made. Later checking showed that 10% of the eligible cases were not included in this study owing to the radiographer's failure to enrol them. Control patients were those attending the same *x* ray department for barium studies. It was thought that they would be representative of the population from which the cases came and that the extra radiation they would receive from taking part in the study would be small in relation to their other investigations.

Written consent for an anteroposterior and lateral *x* ray examination of the cervical spine was obtained from patients after they had received a written explanation of the extra radiation dose. Only four potential control patients refused to take part. We had planned to ask all non-Asian patients who were having barium studies to have additional *x* ray films taken of the cervical spine, although this was not always possible owing to time constraints, selection being based only on this criterion.

Each patient was asked to complete a symptom questionnaire, which included information on age, sex, race, place of referral, reason for referral, and whether the patient had ever been treated for neck trouble. All *x* ray films were read by one radiologist, who was unaware of whether the film was from a case or a control. The changes seen on *x* ray films were coded with a standard classification[3]; grade 3 or 4 disc abnormalities were called "severe disc changes," and grade 3 or 4 apophyseal abnormalities "severe joint changes." In addition, a diagnostic category was assigned to reflect usual reporting practice —this was "normal," "cervical spondylosis," or "other." To check that the sole radiologist was not biased 100 *x* ray films, selected to include those coded as "normal" and "cervical spondylosis" from both case and control patients, were also independently coded by four consultant radiologists.

For statistical analysis we computed the prevalence of "cervical spondylosis," "severe disc changes," and "severe joint changes" in various age-sex groups among cases and controls. The relation of changes seen on *x* ray films with different factors, such as age, sex, previous treatment for neck trouble, and being a case or control, was tested by entering this information for each patient as independent variables into a multiple logistic regression model with the presence or absence of the different changes seen on *x* ray films as the dependent variable in turn with the GLIM (generalised linear interactive modelling) package.

SYMPTOMS

A questionnaire was given to both case and control patients to inquire about pain in the arm or shoulder, "shoulder blade," neck, and back of the head and stiffness in the neck. Each of these symptoms had been reported more often by a series of patients who were receiving treatment for cervical spondylosis than by controls when the questionnaire was being piloted. The relation between the presence or absence of each symptom and the presence or absence of changes seen on *x* ray films was examined separately for case and control patients, again with a multiple regression model to allow for any independent effects of age and sex.

MANAGEMENT PLAN

To see what influence the report might have on the referring doctor's plan for management, after the studies had been done 97 consecutive reports on *x* ray films of the neck were sent to the referring general practitioners, accompanied by a short questionnaire asking what action was planned. No reminders were sent if the doctor did not reply.

Results

Altogether 1263 *x* ray examinations of the cervical spine were performed during the 12 months July 1979 to June 1980; 30% of these were due to referral from general practice, 27% from casualty, and the others mainly from other hospital outpatient clinics. Table I shows the strong relation of age to the report given; although 52% of all the reports were of cervical spondylosis, this varied from 17% in those under 40 to 85% in those aged 60 or more. Nearly 20% of the *x* ray films did not have a radiologist's report; these were mainly those from casualty departments. At each age a report of cervical spondylosis was less likely among patients referred from casualty departments than among those referred from other departments of the hospital or from general practice—for example, only 64% of those aged 60 or more from casualty departments had a report of cervical spondylosis compared with 87% of the others. In 1977 and 1978 the findings from the same hospital were closely similar, although the number of *x* ray examinations performed a month was lower, and they were similar in the other district general hospital. Five of the reports were of tuberculosis: one patient was initially sent for *x* ray examination from the orthopaedic clinic with a history of weight loss, acute pain in the neck, and localised area of tenderness on examination and four of the five films were follow up films on treatment. There were no reports of other infectious or neoplastic disease.

TABLE I—*Number of neck x ray films and reports given in one year. (Figures in brackets are the percentage of those with a report in each age group)*

Report on *x* ray films	Age (years)			All ages
	<40	40–59	≥60	
Normal	259 (77)	126 (32)	22 (9)	407 (41)
Cervical spondylosis	59 (17)	237 (61)	219 (85)	515 (52)
Other	20 (6)	26 (7)	17 (7)	63 (6)
No report	132	64	50	246
Total No of *x* ray films	470	453	308	1231*

*Age not known for 32 subjects.

CASE/CONTROL STUDY

The cases included nearly all those patients referred for neck *x* ray examinations during the 18 months (with the exception of Asians and patients referred after trauma or to investigate generalised arthropathy) and may be considered representative of patients presenting to a district general hospital. Control patients also came from the same population, and their selection was unbiased; being due only to the logistic requirements of a busy *x* ray department.

The prevalence of reports of cervical spondylosis was higher in cases in young men than in controls, but these differences were not seen in older men or in any age group in the women (table II). The severity of changes seen on *x* ray films was consistently greater in the cases than in the controls (table II). Nevertheless, over 60% of the controls aged 60 or more had severe disc changes. There was no difference in the prevalence of severe apophyseal joint changes between cases and controls. Among the cases, 27% of the men and 35% of the women had had treatment for neck trouble compared with 15% of men and 24% of women controls.

Table III shows the independent influence on changes on *x* ray films of age, sex, being a case rather than a control, and having had previous treatment. Age was a very strong predictor of all changes; men were more likely to have both an *x* ray report of cervical spondylosis and severe disc changes than women, as were those who had had treatment for neck trouble; and cases were more likely to have severe disc changes than controls. There were no reports among cases or controls of unexpected neoplasms or infections.

The four other radiologists were slightly more likely to report cervical spondylosis (on average in 57 of the 100 films compared with 50 by the study radiologist), with similar findings in both case and control films.

TABLE II—*Findings on x ray films in cases and controls*

Age (years)	No of *x* ray films		% Of cervical spondylosis		% Of severe disc changes		% Of severe joint changes	
	Cases	Controls	Cases	Controls	Cases	Controls	Cases	Controls
				Men				
<40	63	29	21	10	6	3		
40–59	98	64	65	58	41	39	1	8
≥60	93	54	90	89	88*	62	28	21
				Women				
<40	127	31	14	13	6	3		
40–59	166	98	58	56	39	29	7	5
≥60	106	89	85	88	79*	61	16	21

*The differences between proportions of cases and controls were significant: $p < 0.01$.

TABLE III—*Independent determinants of changes on x ray films among cases and controls*

Independent variable	Dependent variable		
	Cervical spondylosis	Severe disc change	Severe joint change
Age	398§	391§	128§
Male sex	6·0*	4·4*	1·5
Being a case	1·4	18·6‡	0·3
Having had previous treatment	8·5†	7·1†	0

Figures are χ^2_1 values for assessing the significance of the independent variables from the multiple logistic regression model.
*$p < 0.05$; †$p < 0.01$; ‡$p < 0.001$; §$p < 0.0001$.

SYMPTOMS

Although cases were more likely to report symptoms of pain in the arm, shoulder, "shoulder blade," neck, and back of the head and stiffness of the neck, there were few and inconsistent relations between these symptoms and the presence of changes on *x* ray films among the cases and among the controls. Women were more likely than men to report most of the symptoms.

MANAGEMENT PLAN

Replies were received from 71 of the 97 general practitioners who were asked about their planned action; in 33 patients the report had been of cervical spondylosis and in 36 it had been "normal" (a similar proportion of "normals" were in the group whose general practitioners did not reply). A report of cervical spondylosis was less likely to lead to reassurance and more likely to lead to a referral to the hospital orthopaedic department than when the report was "normal."

Discussion

Requests for *x* ray examination of the cervical spine are common. It is estimated that the number of films requested in Ealing Hospital is equivalent to the time of one radiographer and the use of one *x* ray room for four hours a week. (In the same hospital in 1982 there was an increase of 10% in the number of *x* ray examinations over that reported here for 1980.) The other district general hospital in London that was also surveyed gave similar numbers of films taken a year, and in an examination of practices in another hospital outside London the numbers were even higher (P West, personal communication). With increasing age the chance of having a report of cervical spondylosis increases so that 85% of those aged 60 or more had such a report. The consistently lower prevalence of reports of cervical spondylosis in those referred from casualty departments probably reflects a response to the inquiry about injury rather than the absence of changes of spondylosis on the *x* ray film. (This was confirmed when the study radiologist specially read 100 neck *x* ray films of patients referred from the casualty department. The prevalence of cervical spondylosis was higher than that originally reported and closely similar to the prevalence among those referred from other sources.)

There were no unexpected findings of malignancy or infection in any of the films in this series, which suggests that the request

for x ray films of the cervical spine "just in case" such a finding is present is probably unjustified. The observation from the case/control study of a high prevalence of reports of cervical spondylosis in control subjects, together with the poor correlation between symptoms and x ray findings, further indicates the limited value of x ray films of the neck. The fact that there was no difference between case and control patients does not seem to be due to biased reporting as the study radiologist was slightly less likely to report cervical spondylosis in films from both cases and controls compared with a panel of other radiologists. (The prevalence of cervical spondylosis reported here may in fact be a slight underestimate.) Although the severity of disc changes was greater in cases than controls, the clinical importance of this is not clear. As previously shown women had more symptoms than men,[4] although they were less likely to have changes on x ray films.[2]

Only anteroposterior and lateral x ray films were taken, in line with current practice. More detailed radiology may be indicated if symptoms are persistent and severe enough for surgery to be considered[5] or if there is a clinical suspicion of local infection or malignancy. In addition, x ray films may be indicated after trauma, and we did not consider the value of such films, although in view of the large numbers and the lack of positive findings in them the results of such a study may be useful.

In 1966 a clinical trial was reported that showed no benefit from physiotherapy compared with placebo among patients with diagnosed cervical spondylitis.[6] It seems that there is little value in diagnosing cervical spondylosis because it is unlikely to lead to a change in patient management that will affect the clinical course of the condition. Nevertheless, the information on the follow up questionnaire from referring general practitioners suggests that having a diagnosis of cervical spondylosis from an x ray examination may suggest different management—for example, referral to hospital (with further use of resources) in place of reassuring the patient. We did not attempt to assess the action that would have been taken if an x ray film had not been taken, which would be necessary to know whether a report of cervical spondylosis really did alter the management of the patient.

In view of the high prevalence of changes on x ray films in both those referred for examination of the neck and controls, the poor relation between symptoms and changes on films, and the inability to alter the clinical course of the condition there seems to be little to be gained by taking an x ray film of the neck when there is a clinical suspicion of cervical spondylosis. Since such examinations put a large load on the radiology services we suggest that they are requested too often and doctors should consider reducing the number of their requests. In the United States studies such as this into the costs and benefits of diagnostic procedures are common,[7] although none has been reported on x ray examination of the neck, and some x ray investigations have been found to be overrequested.[8]

In Britain a start has been made in, for example, evaluating preoperative chest x ray films[9] and skull x ray films after trauma.[10 11] Further studies of the use of diagnostic tests might be worth while, particularly in times of increasing costs and use of diagnostic facilities.[12]

We suggest that x ray examination of the neck should be performed if there is a clinical suspicion of infection or malignancy or after some instances of trauma. If the symptoms are severe enough for surgery to be considered more detailed x ray examinations may be indicated. In most cases, however, there seems little point in requesting films of the neck to find cervical spondylosis.

We are grateful to the North West Thames Regional Health Authority for financial support; to Dr N A Pandit, Dr A C Keet, Dr D A H Yates, and Dr J A Mathews for allowing us to test the questionnaire on their patients; to Dr N B Bowley, Dr R Eban, Dr L Kreel, and Dr C G Whiteside for serving on the film reading panel; to Dr B D Van Leuven of St Stephen's Hospital for allowing access to records; and particularly to the radiographers and clerical staff of Ealing Hospital x ray department.

References

1 Friedenberg ZB, Miller WT. Degenerative disc disease of the cervical spine. A comparative study of asymptomatic and symptomatic patients. *J Bone Joint Surg* 1963;**45A**:1171-8.
2 Lawrence JS, De Graaff R, Laine VAJ. Degenerative joint disease in random samples and occupational groups. In: Kellgren JH, Jeffrey MR, Ball J, eds. *The epidemiology of chronic rheumatism.* Vol I. Oxford: Blackwell, 1963:98-121.
3 Atlas of standard radiographs of arthritis. In: Kellgren JH, Jeffrey MR, Ball J, eds. *The epidemiology of chronic rheumatism.* Vol II. Oxford: Blackwell, 1963:14-7.
4 Westerling D, Jonsson BG. Pain from the neck-shoulder region and sick leave. *Scand J Soc Med* 1980;**8**:131-6.
5 Brunton FJ, Wilkinson JA, Wise KSH, Simonis RB. Cine radiography in cervical spondylosis as a means of determining the level for anterior fusion. *J Bone Joint Surgery (Br)* 1982;**64**:399-404.
6 British Association of Physical Medicine. Pain in the neck and arm: a multicentre trial of the effects of physiotherapy. *Br Med J* 1966;i:253-8.
7 McPhee SJ, Myers LP, Schroeder SA. The costs and risks of medical care. An annotated bibliography for clinicians and educators. *West J Med* 1982;**137**:145-61.
8 Abrams HL. The "overutilisation" of x rays. *N Engl J Med* 1979;**300**:1213-6.
9 Royal College of Radiologists. Preoperative chest radiology. *Lancet* 1979;ii:83-6.
10 Royal College of Radiologists. A study of the utilisation of skull radiography in 9 accident-and-emergency units in the UK. *Lancet* 1980;ii:1234-7.
11 Roberts CJ. Medical care as a risk-avoidance procedure: underwriting the cost of care in the UK. *Br Med J* 1982;**285**:751, 754-5.
12 Wrighton RJ, Oliver RM. Trends in radiological practice in the NHS. *Health Trends* 1980;**12**:21-4.

(*Accepted 22 July 1983*)

Who was Leber, what is Leber's hereditary optic atrophy, and how common is it?

Theodor Leber is one of the most distinguished figures in the history of German ophthalmology.[1] His career began as assistant to Albrecht von Graefe, one of the founders of modern ophthalmology. Leber subsequently became professor in Göttingen and then in Heidelberg. An earlier study in 1861 elucidated the details of the vasculature of the human eye. In 1891 he published the fruits of years of research into ocular inflammation. His professional life seems to have been a restless search after knowledge of the physiology of the normal eye, the pathology of disease processes, and the relation of these factors to the clinical features of eye disease. He died in 1917 aged 78. Leber's hereditary optic atrophy has an acute onset in early adult life, men being affected much more commonly than women.[2] Severe visual loss in one eye is followed by similar symptoms in the other eye within a week or so, and recovery is unusual. Inheritance is sex limited but not mendelian. It is not passed on by affected men. The cause is not known, though it has been suggested that affected people have a defect in the metabolism of cyanide. Some ophthalmologists advocate treatment with large doses of vitamin B_{12}, and systemic steroids are sometimes given when the patient presents with the clinical picture of acute optic neuritis. There is no proof, however, that any treatment is effective. It is very rare, although over 1000 cases have been reported. In 1871 Leber described 15 cases, nine from four families he had observed himself,[3] but this was not the first description of the condition.—W J DINNING, consultant ophthalmologist, London.

1 Wagenmann A. Theodor Leber (Nachruf). *Arch Ophthalmol* 1917;93 (insert between pages 274 and 275.)
2 Walsh FB, Hoyt WF. Hereditary optic atrophies. In: *Clinical neuro-ophthalmology.* Baltimore: Williams and Wilkins, 1969:909-15.
3 Leber T Uber hereditäre und congenital-angelegte Sehnervenleiden. *Arch Ophthalmol* 1871;**17**:249-91.