

## Middle Articles

### Rationalizing Requests for X-ray Films in Neurology

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The demands on diagnostic radiology are growing all the time. It has been estimated that this growth is of the order of 8% annually in the United States and that the consumption of x-ray film doubles every 13 years. The time taken to examine patients with a number of conditions, some common, which are consistently or almost consistently negative radiologically could be put to better use by allowing more time for the elaborate radiological examinations. Moreover, whenever time and money can be saved, more time can be devoted to the major procedures, which are becoming more complicated and time-consuming.

We have set out to evaluate the requests for radiological examinations in patients attending the outpatient department of a specialist neurological hospital. The present custom is that a minimum of four x-ray projections are necessary for the routine examination of the skull of a patient suspected of a cerebral lesion. Also at least four projections are necessary for the examination of the cervical spine and a fifth through the open mouth if there is a history of trauma.

The first part of this study is retrospective, and concerns patients seen with a diagnosis of migraine or headache, pain in the neck or cervical spondylosis, Parkinsonism, and vertigo or Ménière's disease. All these patients attended initially in 1964 and the present analysis was carried out in 1966 (Table I). Patients presenting with epilepsy which began at the age of 15 years or over and with no physical signs, and patients with dementia but no other physical signs, were also studied.

TABLE I.—Retrospective Study

Diseases	No. of Case Notes Examined	No. of Cases X-rayed	No. Neg. X-rays	Comments
Migraine ..	100	Skull 59 Sinuses 5 Cerv. spine 7	59 4 5	None admitted
Headache ..	100	Skull 75	75	
Parkinsonism	50	Skull 9	9	Final diagnoses of tension, depression, migraine, etc. 8 other patients were admitted—x-ray pictures of skull all normal
Neck pain	60	Skull 9 Cerv. spine 37	9 15	2/3 over 40 years of age. 22 some degree of spondylosis
Vertigo ..	100	Skull 57 Int. auditory meatus 16 Sinuses 38	57 16 29	Final diagnosis of Ménière's disease in 8, vestibular neuritis 18, basilar ischaemia 11 anaemia 11, etc.

#### Prospective Study

Two hundred consecutive patients who attended the outpatients department, who had no physical signs, and in whom

the radiological examination of the skull was (with the agreement of the physician) confined to a lateral view, were followed up for one year. These patients had diverse neurological symptoms ranging from headaches or giddiness to attacks of unconsciousness. Table II sets out the diagnoses.

TABLE II.—Table of Diagnoses

Epilepsy, idiopathic	44
Epilepsy, onset at age 15 or over, ? cause	40
"Headache" or migraine	64
Syncope	22
Anxiety, depression	12
Vertigo ? cause	12
Miscellaneous, restless legs, memory deterioration, etc.	6

Most of these patients were referred back under the care of their general practitioner (Table III). Nine were subsequently admitted, and Table IV shows the diagnoses reached and the radiological investigations carried out.

TABLE III.—Prospective Study of 200 Cases

Discharged to care of general practitioner	151
Still attending outpatient department	32
Did not attend again though they had further appointments	8
Admitted to hospital	9

TABLE IV.—Patients Admitted to Hospital

Case No.	Sex	Age	Diagnosis	Radiological Investigations
1	M	37	Migrainous neuralgia	Carotid arteriogram normal. Skull normal
2	M	21	Tension headaches	Skull normal
3	M	60	Brain stem ischaemia	Skull normal
4	M	55	Nephritis, hypertension, uraemia	Died elsewhere. Skull normal
5	M	54	Epilepsy late onset	Chest showed cancer of bronchus. Gamma scan showed right frontal lesion. Skull normal
6	F	57	Transient cerebral ischaemic attacks	A.E.G. cerebral atrophy. X-rays skull normal
7	F	45	Amnesic episodes. ? epileptic	Skull calcification basal ganglia. A.E.G. normal
8	M	46	Depressive illness	Skull normal
9	F	63	Vertebrobasilar insufficiency	Skull normal

It can be seen that in both studies the x-ray pictures of the skull were normal in all the patients without physical signs. The finding of cervical spondylosis in 22 out of 37 cases who presented with neck pain and who had an x-ray examination performed is not surprising when one notes that two-thirds of them were over 40 years of age. The only other abnormal x-ray findings were mild opacities of the sinuses in 9 of the 38 patients who presented with vertigo and who had sinus x-ray films taken.

#### Epilepsy

The records of 200 consecutive patients presenting with epilepsy at the age of 15 or over in 1964 were studied. Those

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with physical signs when they were first seen were excluded from the analysis. Of 161 patients x-rayed, 158 had skull x-ray films taken—156 were normal and in 2 there was evidence of an old linear fracture of the skull. Fourteen patients were subsequently admitted to hospital. In one patient physical signs developed eight months later; he was admitted and a further x-ray examination of the skull showed evidence of raised intracranial pressure. An astrocytoma was found. One other patient had a meningioma.

In order to have at least a five-year follow-up, the records of 100 consecutive patients presenting with epilepsy at age 15 and over without physical signs in 1960–61 were then studied. Of these 100 patients, 83 had had the skull x-rayed and all films were normal apart from an old linear fracture in one patient. One patient showed hyperostosis frontalis interna, which we regard as of no clinical significance. Forty-four remained well or suffered only from an occasional epileptic seizure in the subsequent five years. Two patients were lost to the follow-up and 27 required subsequent admission, six of whom proved to have intracranial masses. One patient had a meningioma, one had a cerebral abscess, three had a glioma, one of whom died, and one had an oligodendroglioma. Two were lost to the follow-up. The x-ray films of the skull were consistently normal in all six patients and isotope encephalography (gamma scan), angiography, and air encephalography were used to indicate the diagnoses before operation (Table V).

TABLE V

Age at Onset	No. of Patients in Age Group	No. of Patients with Definite Diagnosis	Comments
15–20	25		
21–30	29	1	Onset 24. One year after septicaemia. 3 years later meningitis → cerebral abscess
31–30	14	3	(a) Onset 37. Signs 5 years later. Oligodendroglioma. (b) Onset 31. Signs 16 years later. Glioma grade III. (c) Onset 35. No signs. Focal E.E.G. abnormality. Glioma grade III
41–50	18	1	Onset 44. No signs but focal symptoms and E.E.G. abnormality. Signs 5 years later. Meningioma
51–60	7	1	Onset 56. Signs 4 months later. Glioma grade III
Over 60	5		
Not stated	2		

### Dementia

The notes of 50 patients presenting with intellectual impairment and/or failing memory were studied. Again those with other physical signs were excluded. They were first seen during 1959–64. Thirty-three of the 50 patients were admitted subsequently and all had an x-ray examination of the skull. Twenty-six also had an air encephalogram, ventriculogram, or angiogram. As a result of these investigations an abnormality was found in 24. The diagnosis of senile or pre-senile dementia was made in 31 patients and of cerebral

arteriosclerosis in 14, including the majority of those not admitted to hospital. One patient had a meningioma, the plain x-ray film of the skull still being normal; one suffered from general paralysis of the insane and one from carcinoma. Another patient had a nutritional encephalopathy and one patient had post-traumatic dementia.

### Discussion and Conclusion

The retrospective study gives ample evidence that the great majority of plain x-ray films taken for these conditions, migraine or headache, pain in the neck, Parkinsonism, vertigo or Ménière's disease, and epilepsy, in the absence of physical signs, do not contribute materially to the diagnosis. It is, of course, accepted that they serve to exclude gross disease, by demonstrating a calcified lesion, changes of raised intracranial pressure or decalcification, and abnormal vascular channels, and in some way give an added reassurance to the patient. It is our contention, however, that a single lateral film will serve this purpose, and where indicated this could be followed up by full views at the discretion of the radiologist. It goes without saying that the physician can at all times request full or further views.

Our hope is that by highlighting the facts as they are we have helped to indicate the use of plain x-ray films of the skull and cervical spine as a preliminary examination in those cases where the appearance of raised intracranial pressure or other neurological signs demand further investigations by means of contrast studies. (We accept that patients without physical signs may pose an even more difficult diagnostic problem to be unravelled than those with physical signs.) In the absence of such signs a lateral film of the skull or cervical spine would suffice. In cases suspected of harbouring a cerebral mass, or presenting with neurological syndromes which can be associated with carcinoma of the bronchus, a chest x-ray film should be taken, and it may indeed be the most useful radiological procedure in reaching a diagnosis.

Two-thirds of the cases presenting with dementia (where the problem is slightly different, in that the intellectual impairment is a physical sign) were subsequently admitted to hospital, and plain x-ray examination of the skull was only a preliminary to contrast radiological studies and more intensive laboratory examinations. It is obvious that the saving in time and effort to patient, doctor, and hospital department in delaying or avoiding such unrewarding examinations can be put to other use. The application of the same critical evaluation to other investigation procedures, both in radiology and elsewhere, should help in bringing about a degree of sensible economy.

We wish to thank all our colleagues who have allowed us to examine the case notes of patients under their care, and who co-operated in the prospective study. We also wish to record our appreciation of the help of Mrs. Ashe in conducting the follow-up.