Letters

Intracranial lesion localisation: a simple method using CT scanning

Sir: A marking system has been developed by the author in the Department of Neurological Surgery, Sheffield to help achieve better localisation of intracranial lesions on CT scans. The method is simple, economical and not time consuming. It has been used successfully over the past nine months and has proved itself of value in the positioning of exploratory burr holes and also of osteoplastic flaps. It is of particular help in locating high convexity lesions. Localisation of lesions seen on CT scans is assisted by the bony landmarks towards the base of the skull while the ventricles at a higher level provide the required landmarks. However, above the ventricular level it is always difficult to define the relationship of the lesion to a particular point on the scalp. The difficulties are compounded by the fact that the patients are scanned with varying degrees of neck flexion.

The marking system we have used consists of a special bandage, replacing the usual circumferential band which is applied to the head during CT scanning, a radio-opaque marker and a lateral skull radiograph. Bandage “A” is 15 cm wide and 55 cm long with two broad bands of elastic attached to one end, so that it will adapt to skulls of differing circumference. A narrow “Velcro” tape (1 cm wide) has been sewn along the external surface of both edges of the bandage. Bandage “B” is similar to “A” but is shorter and incorporates a radio-opaque grid made of monofilaments impregnated with barium sulphate. These monofilaments, which have been extracted from “Ray-Tec” surgical swabs, are stitched to the bandage at 1 cm intervals in the horizontal plane and at 2 cm intervals in the vertical plane (fig A).

The marking method depends on the ability to identify the inclination of the CT cut in relation to the orbito-meatal line. This inclination is of course indicated by the gantry light of the scanner, while the actual cut lies 5 cm rostral to it. Bandage “A” is wrapped securely round the patient’s head before the head is placed within the scanner gantry; it is essential to be sure that the edge of the bandage lies parallel to the line of the scan cut. The scanning routine proceeds as usual until the lesion is demonstrated. The scanner is then stopped and the head is moved out 5 cm, so that the line of the gantry light now corre-

![Fig](a) The circumferential head bandage (A). The marking bandage (B) and marker (C); (b) External marker stuck to the outside of the circumferential head bandage (A); (c) CT showing the intracranial lesion and the marker on the surface of the skull; (d) Lateral skull radiograph showing the grid marks and the marker.
sponds to the level of the lesion. A radiopaque marker (made of fine catheter, 1-5 cm long) is then taped with “Microspore” to the outside of the bandage in the vertical plane, centred on the gantry light (fig B). The head is replaced 5 cm deeper and the cut is repeated with the marker. This allows one to see the intracranial lesion and the vertical marker on the surface of the skull (fig C). The patient is then moved to another room with bandage “A” and the marker undisturbed, whereupon the second bandage “B” is secured to the underlying bandage “A” with the aid of “Velcro” strips. The grid marks are arranged to lie on the same side as the lesion. A radiograph is then obtained in the lateral projection with the film placed on the side of the lesion (fig D) to avoid magnification. The horizontal lines of the grid marks, being parallel to the edges of both bandages “A” and “B” indicate the plane of the scan. The information provided by the skull radiograph can be transferred to the patient’s scalp either by measuring from a recognisable landmark or, when the patient is anaesthetised, by placing the film against the patient’s head.

The difficulty of localisation of small intracranial lesions on CT has been widely recognised by neurosurgeons and radiologists. Experience may minimise the errors but the precise localisation of high convexity lesions still poses a considerable challenge. Review of the world literature shows that there have been various attempts made to solve this problem.\(^1\)\(^\text{ }\)\(^2\) Of these attempts, those using simple techniques have proved insufficiently accurate.\(^3\)\(^\text{ }\)\(^4\) Furthermore, the methods which required fixed external skull markers produced scan artefacts.\(^1\)\(^\text{ }\)\(^3\)\(^\text{ }\)\(^4\) Computer assisted systems, although highly effective, require the help of an expert radiologist to perform, and the information gained can only be transferred to the patient using a number of fairly complicated measurements.\(^5\)\(^\text{ }\)\(^6\) It seems that all the previously published methods are time consuming and on occasions may be rejected for that reason. The method here described works well in this department, but we shall have to await confirmation of its value, if and when it is taken up elsewhere. The main source of error in the method arises from the fact that one may not place the marker on bandage “A” to overlie the centre of the lesion in the antero-posterior plane. This problem can be overcome by observing the marker-lesion relationship on the scan and adjusting the projection on to the scalp accordingly. Localisation in the rostral-caudal plane is guaranteed by the gantry light and the placing of the markers thereon. Because of this potential inaccuracy, we do not recommend this method for precise stereotactic localisation but the technique has proved itself of value for the purpose of biopsy and planning of osteoplastic flaps. We have also found it helpful in indicating tumour-bearing territory to the radiotherapists. The method of localisation adds less than five minutes to the scanning time and takes on average only twelve minutes to complete. Construction of the bandage is easy and cheap.

I am grateful to Mr AA Jefferson for his kind help and advice in the preparation of this letter.

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References

Chiari (type 1) malformation and syringomyelia in a patient with Noonan's syndrome

SIR: Noonan's syndrome is an inherited disorder affecting both males and females. The genetic mechanism is uncertain. Cases have been described in which the inheritance is autosomal dominant,\(^1\) recessive or multifactorial, and in some cases relatives have shown only isolated features.\(^2\) The syndrome is named after Jacqueline Noonan who performed a large survey of children with congenital heart disease\(^3\) and described a group of patients with valvular pulmonary stenosis who were short, mentally retarded and showed considerable physical resemblance. Such patients have been described as resembling the Turner phenotype with respect to short stature, webbed neck and cubitus valgus. However, patients with Noonan's syndrome have normal chromosomes, mental retardation and different systemic abnormalities.\(^4\) The facial features of Noonan's syndrome are hypertelorism, antimongoloid slant of the eyes, small mandible, low set ears and a relatively short neck. Deformities of the sternum and vertebral abnormalities are common and include scoliosis and spina bifida occulta. Other deformities which have been described\(^5\) are hepatosplenomegaly, ocular abnormalities, cardiovascular lesions in addition to pulmonary stenosis, undescended testes, delayed puberty, and a case of hypopituitarism.

Neurological defects have rarely been reported. We describe a patient with Noonan's syndrome who had a type I Chiari malformation and a syrinx. These malformations have not previously been reported in this syndrome.

Mr AH is a 33-year-old caucasian male with features of Noonan's syndrome. He is mentally retarded with a verbal IQ of 68 on the Wechsler Adult Intelligence Scale, and is registered as partially sighted. He has five siblings who are between 1-6 metres and 1-7 metres in height but no family members have obvious features of this syndrome. He was initially referred to hospital as a teenager with symptomatic pulmonary stenosis, and in 1964 he underwent pulmonary valvotomy and infundibular resection. This resulted in symptomatic relief though cardiac catheterisation ten years later showed residual stenosis of the pulmonary valve ring. In 1981 he presented to the Department of Neurology with a two year history of discomfort in his neck, difficulty in performing fine movements with his left hand and a stiff left leg which impaired his mobility. On examination he was 1.5 metres in height with characteristic facies, short neck, pectus excavatum and cubitus valgus (fig). Body hair was reduced and his testes were undescended. There were no signs of cardiac failure, but an ejection systolic murmur was heard, maximal in the second left interspace. The liver was palpable.