POLYTOMOGRAPHY IN OTOLARYNGOLOGY

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To the otologist conventional plain radiography of the temporal bone has in the past provided little detailed information. In an attempt to demonstrate individual areas of the temporal bone upwards of thirty specialized projections have been described.

Stereoscopic radiographs are of considerable value, but it is not easy to acquire the art of interpreting them, and they have not been very popular for this reason. The development of linear tomography provided a notable advance, but polytomography has greatly increased the scope of the method.

We owe a considerable debt to the French for developing this technique as well as a number of the special projections which are used.

What do we want to learn from skiagrams?

Radiology is of particular assistance in demonstrating: (1) Pneumatization, (2) Congenital abnormalities, (3) Fractures, (4) Foreign bodies, (5) Ossicular dislocation, (6) Presence of exudate in the air spaces, osteitis, decalcification and sequestration. (7) Opacities or bony erosions by cholesteatosis, including erosion of the ossicles. (8) Local and general bone disorders—(*a*) Otosclerosis, (*b*) Syphilis, (*c*) Paget's disease, (*d*) achondroplasia, (*e*) Engelmann's disease, etc. (9) Aneurysms. (10) Neoplasms—(*a*) Benign, Osteomas, haemangoimas, meningiomas, Glomus tumours and acoustic neuromas; (*b*) malignant of (i) external auditory meatus, (ii) middle ear, (iii) internal auditory meatus, (iv) invasion from adjacent organs, (v) metastases. In all these we wish to know especially the state of:

(1) The facial nerve.
(2) The ossicular chain.
(3) The labyrinthine windows.
(4) The semicircular canals, vestibule and cochlea.
(5) The internal auditory meatus.

What are the best radiographical techniques to demonstrate these details? In every case we need a lateral and an anteroposterior (Towne fronto-suboccipital, Chausee III or transorbital) or both. In many cases

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this is all we need. If more accurate details of certain areas are required the choice lies between (1) a series of special projections selected to display those points in two or three dimensions, (2) stereoscopic views, (3) linear tomography or (4) polytomography. With the last only two projections are usually required, because the combined effect is three-dimensional.

If the area of interest is small a succession of one millimetre cuts over a small range determined by the clinical condition and the result of plain radiography will usually provide all that is required. By following successive cuts on one film a good three-dimensional impression with anatomical relationship is obtained.

In all methods the best results can only be obtained by fine focus tubes, fine grain films, extreme accuracy in positioning and minimum magnification. The distance of the part to the film must be as short as possible.

It must be admitted that all the details of the bone are to be seen on a plain film, but it is not possible to unravel them when they have superimposed on them many other shadows.

For the practising otologist, for whom this is but one fraction of his work, the polytome gives a picture that can be understood moderately well after one or two years' experience. After studying the polytomographs it is often possible to go back to the plain films of the patient and discover many of the details that were previously confused.

It may be possible to see good detail in conventional radiographs when the skull bones are thin and the temporal bones light and well-pneumatized. But in most of the cases when details of the middle and inner ear structures would be of the greatest value the bones are dense and acellular and cause maximum scatter of the rays, giving a hopelessly hazy picture. It is in this type of case that the polytome really comes into its own.

With practice and experience the quality of the films has improved, but some of the skiagrams shown were taken before we had much experience of the machine.

At present the stapes, being only 200 μ thick, is very difficult to define, and the thin processes of the ossicles are also elusive. Severe and dense heaping up of otosclerotic bone shows if the cut coincides with it, but small foci cannot be seen. Tantalum wire shows well but steel is difficult to see.

To sum up, I would say that the use of the polytome is particularly justified in otology, where so many small but important structures are crowded closely together. It is perhaps of greatest value in congenital malformations, fractures, dislocation of the ossicles and neoplasms.

For those who would use it painstaking study is necessary if the full value of what it can show is to be realized.

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Illustrative Cases

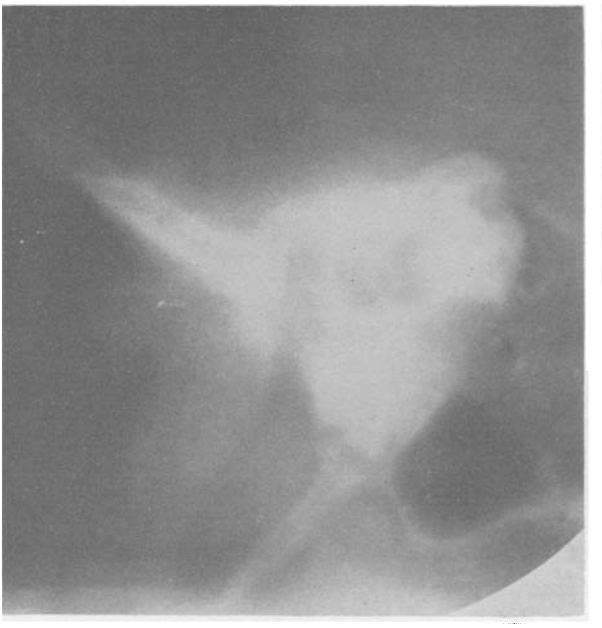


FIG. 1.

Polytomograph.

Case 1.—Elongated styloid process showing a synarthrosis at the attachment to the skull.



FIG. 2.

Plain submento-vertical projection.

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FIG. 3.
A.P. polytomograph.

Case 2.—Glomus tumour involving the left middle ear and extending along the lower part of the petrous bone opening into the internal auditory meatus. The vestibule and superior and lateral semicircular canals are also shown. The right petrous bone is normal.

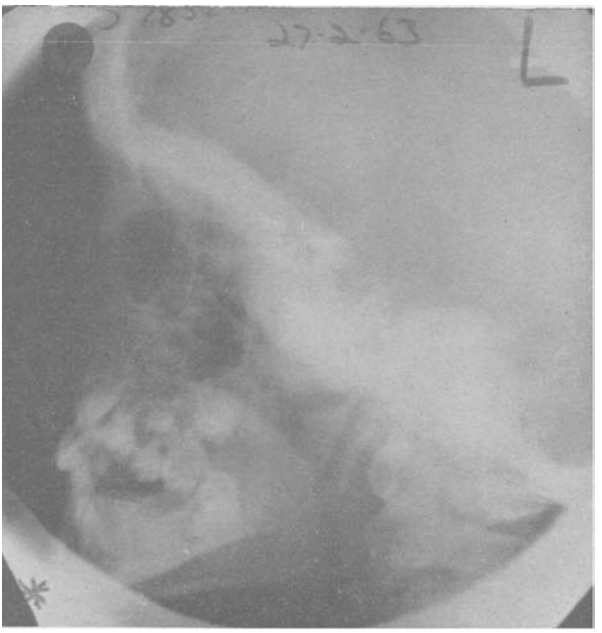


FIG. 4.
Plain lateral projection.

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FIG. 5.
A.P. polytomograph.

Case 3.—Girl aet. 7 years with Engelmann's disease. (Progressive diaphysial dysplasia). Plain lateral film shows extensive generalized bony sclerosis, but no detail is visible. Polytomograph shows the detail of bony encroachment on the external auditory meatus, middle ear and internal auditory meatus.

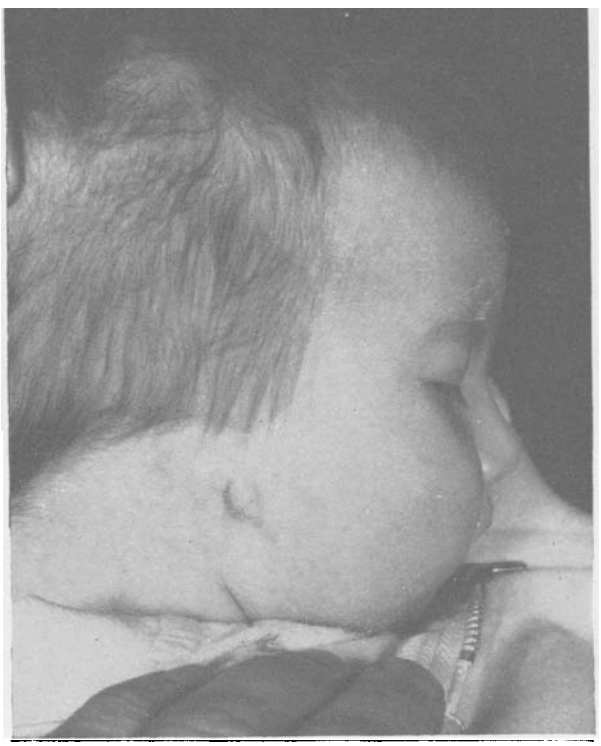


FIG. 6.
Photograph.

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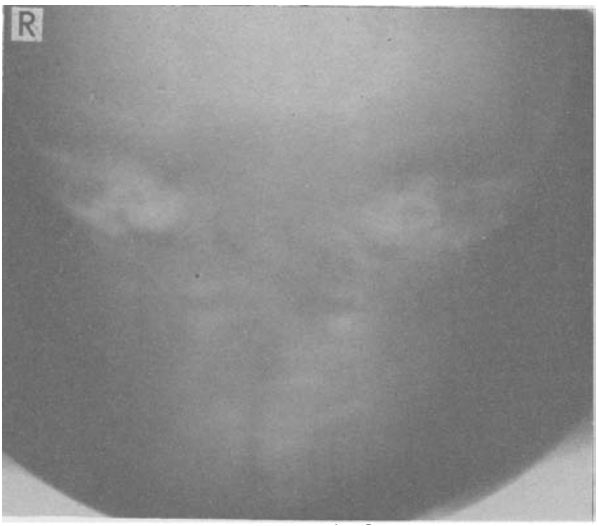


FIG. 7.

A.P. polytomograph.

Case 4.—Bilateral congenital malformation of the ear showing bony atresia of the external auditory meatus and deformity of the middle ear with enlargement of the left vestibule and lateral semicircular canal.



FIG. 8.

A.P. polytomograph.

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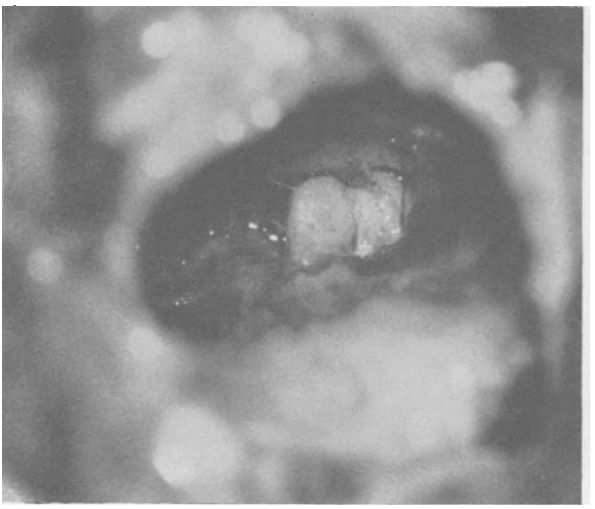


FIG. 9.
Photograph at operation.

Case 5.—Unilateral congenital meatal atresia with deformity and fusion of the malleus and incus.

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