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MIMER III AND ROTATING CHAIR

by

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The precision in projection required in neuroradiology was emphasized already by LYSHOLM, and resulted in his design in 1925 of the precision instrument for skull radiography. When rapid serial cerebral angiography was introduced in the ninteen-fifties, the need for new equipment became apparent, and this led to the construction of the Mimer (FREDZELL & LINDGREN). This unit was based on the same radiographic principles of projection as the Lysholm unit but offered greater flexibility for direction of the central beam towards a stationary film, and the object table could in addition be replaced by a biplane cut-film changer (SJÖGREN & FREDZELL).

Developments in image intensification and transmission have created new possibilities for the application of fluoroscopy in connection with encephalography and myelography. There is also a trend towards increasing use of tomography in such examinations. This tendency has hitherto been restrained by the lack of an easily manoeuvrable unit, especially for use in encephalography. Tomography should in our opinion not be considered as a separate examination but should rather be used as a complementary radiographic technique comparable to the selection of high or low kilovoltage. It therefore should be possible to apply

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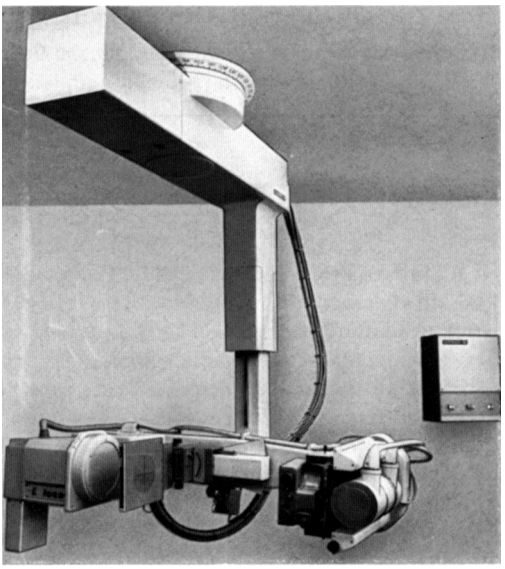

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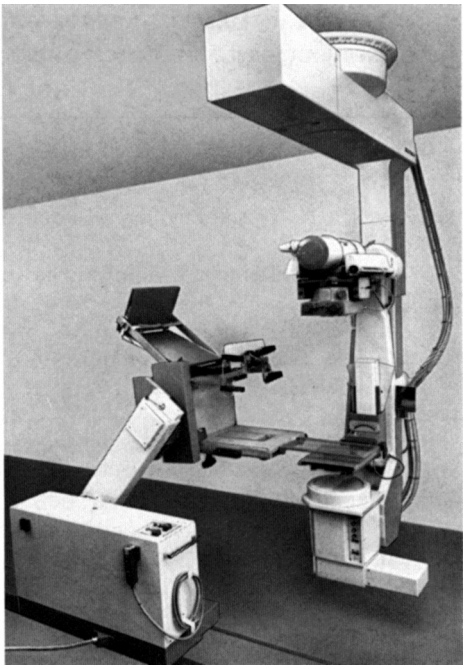

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Fig. 1. Mimer III. a) Adjusted for examination with horizontal beam. b) Rotating chair adjusted for examination of patient in supine position with vertical beam.

tomography as well as fluoroscopy with as little effort and time lag as an alteration of kilovoltage.

It has for technical reasons been considered desirable to have access to an entity of equipment in which the roentgen tube, cassette holder, image intensifier and device for tomography are permanently in position for use. This is achieved by the design of a U-arm which carries the tube at one end and the cassette holder and the image intensifier at the other. By means of suitably constructed supporting arms the central ray can be adjusted in any direction in relation to the object to be examined, which can be placed at the centre of rotation. The location of the object at the centre of rotation was recommended by DULAC (1956) especially for radiography of the ear, and was applied in the Princeps.

Gravity plays a role in the distribution of contrast medium and the patient must be placed in a certain position since the region to be examined is given and cannot be altered. To achieve the predetermined positioning it is usually sufficient to rotate the patient about his long axis. However, when symmetrical filling must be maintained in encephalography and ventriculography, rotation

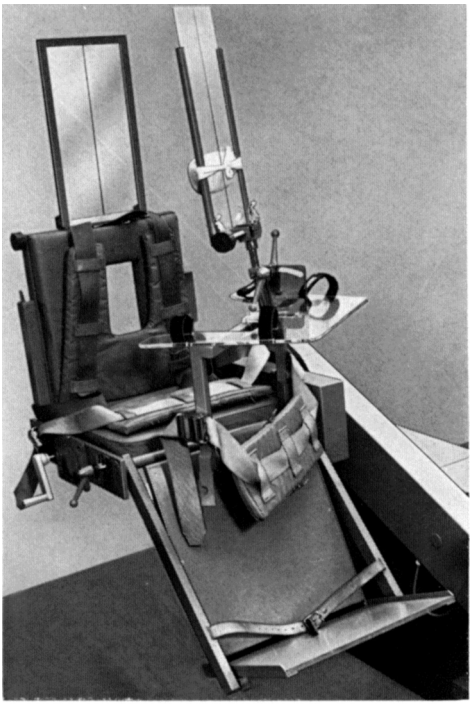

Fig. 2. Rotating chair-table (RCT-2) with supports and strappings used in encephalography and ventriculography.

about a transverse axis is preferable. This is the situation in ventriculography of the posterior fossa and when bilateral filling of the temporal horn is required. Devices for rotation of the patient have been designed with these purposes in mind (POTTS & TAVERAS 1964, POTTS 1965). Problems of a similar kind are encountered in myelography when considerable tilts around the horizontal transverse axis may be required. The demands for equipment to support the patient during the above-mentioned neuroradiologic procedures are thus similar enough to justify the construction of a rotational unit equally suitable for all these purposes. In the development of a new roentgen stand, according to the requirements mentioned, it is necessary to consider the demands on the rotating support of the patient, and vice versa. It has therefore been considered logical to arrange for a parallel construction of both units.

Technical description of Mimer III and the rotating chair-table

Mimer III. The pattern of movement of the roentgen tube introduced in 1959 with the first Mimer stand is maintained in Mimer III (Fig. 1). The roentgen tube is suspended in two arms, one of which, the tube arm, rotates about

Fig. 3. Patient positioned for TV fluoroscopy and air-filling of posterior fossa during encephalography.

a horizontal axis and the other, the vertical arm, about a vertical axis. In this system of movement the central ray can be directed from any point on the surface of a sphere to its centre, which coincides with the intersection of the two axes. In Mimer III, the radius of the sphere is 80 cm. The tube arm is extended and carries a cassette holder and an image intensifier tube. The vertical arm is suspended from the ceiling and consists of two telescopic members which allow a vertical adjustment of 56 cm.

The cassette holder, which has a circular opening for TV fluoroscopy, and the image intensifier tube are not directly attached to the extended tube arm but via a third arm which can be tilted $\pm 20°$ in relation to the tube arm. This tilt is activated by a motor, which also controls a corresponding travel of the tube in order to achieve correct linear tomographic travel of the focal spot and cassette, or the image intensifier. Tomography may thus be performed with any directioning of the central ray. Three tomographic angles have been chosen, namely 10°, 15° and 30°. The exposure times are then 0.8, 1.3 and 3.0 seconds.

Tomographic fluoroscopy is provided since the image intensifier tube follows the cassette. Certain TV monitoring accessories, i.e. an image storage unit, are however necessary to make this kind of fluoroscopy useful. The position of the tomographic layer is indicated by a light pointer. All tomograms are magnified exactly 40 % and therefore offer the most accurate means of measuring the correct size of any detail.

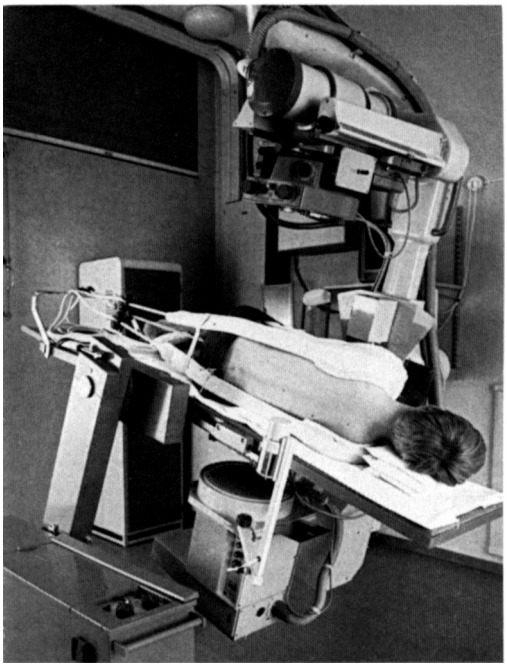

Fig. 4. Mimer II and rotating chair-table adjusted for use in gas myelography.

Different holders, including Lysholm multiline-focussed grids, are available for each cassette size. The holder permits the cassette to be rotated ± 90° and tilted ± 40°. The focus-film distance can be varied between 80 and 110 cm, according to the location of the cassette holder along the tube arm. A small object/film distance may thus be obtained, and annoying interference by the patient's neck or shoulder is avoided. By tilting the cassette holder it is possible to obtain tomographic layers oblique to the central ray and at an angle that corresponds to the tilt of the cassette. This is sometimes the only way to obtain the required location of the layer in the case of a given tomographic travel. An example is a frontal cut parallel to the optic chiasm.

An alternative to Mimer III is offered by Mimer II. The arm system responsible for the travel of the roentgen tube, cassette and image intensifier are in Mimer II suspended in a heavy cantilever which travels vertically along a column attached to floor and wall. The ceiling is left bare but the unit requires more floor space than Mimer III. The two units are identical in function.

The rotating chair (RCT-2) (Fig. 2) consists of a seat which can be converted to a flat table top, and a rotating lever, the position of which determines

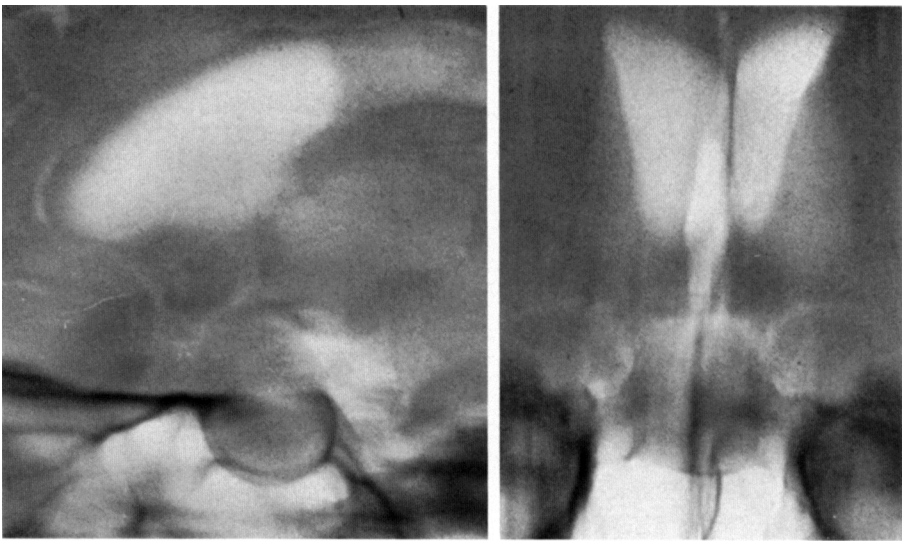

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Fig. 5. Suprasellar extension of intrasellar tumour depicted by tomography.

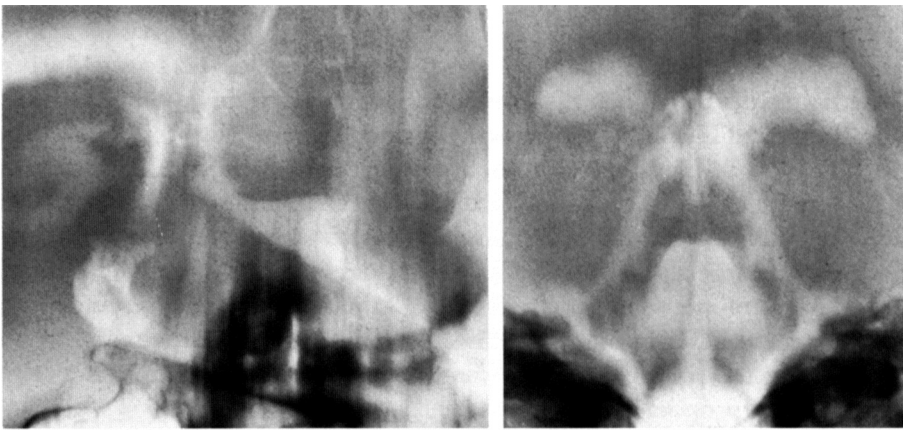

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Fig. 6. Tomographic examination of posterior fossa with encephalography.

the height (50 to 100 cm) above the floor level of the seat. There is also a base unit, which among other items contains a motor and gears for vertical adjustments parallel with the floor, by rotation of the lever, and for the free rotation of the seat. The chair-table is adjustable longitudinally by the travel of the base

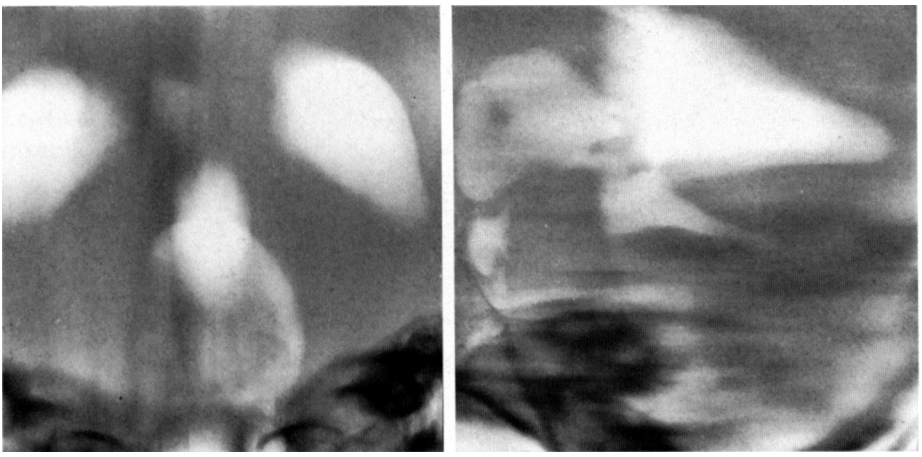

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Fig. 7. Ventriculography in a case of tumour of the fourth ventricle.

on a track countersunk into the floor, and transversely by the travel of the seat in relation to the rotating lever.

Forehead and neck supports are provided for the head, and the patient may be strapped to the seat. A hole in the back of the chair is provided for lumbar puncture (Fig. 3). The patient remains fastened to the chair in a sitting position during all phases of encephalography and ventriculography; a complete somersault may be accomplished. The speed of rotation of the patient may be continuously selected between 2°/second and 24°/second, i.e. one complete revolution in 15 seconds.

The back of the chair for encephalography may be replaced with a larger one, non-obstructive to radiation, which is used during myelography after the chair has been converted to a flat table top (Fig. 4). The patient is suspended head down in a harness in which he may be turned into supine or prone position from the originally lateral recumbent position. Linear tomography on a recumbent patient can be used all along the body with a travel parallel to the spine, and from the head to the lumbar area with a travel transverse to the spine.

The Mimer units in clinical practice

Mimer II and the rotating chair have for nearly two years been in daily use in the department of neuroradiology. Mimer II is identical to Mimer III in its clinical application, and our experiences, which are based upon over one thousand examinations, should therefore be valid for both units. Furthermore, we have

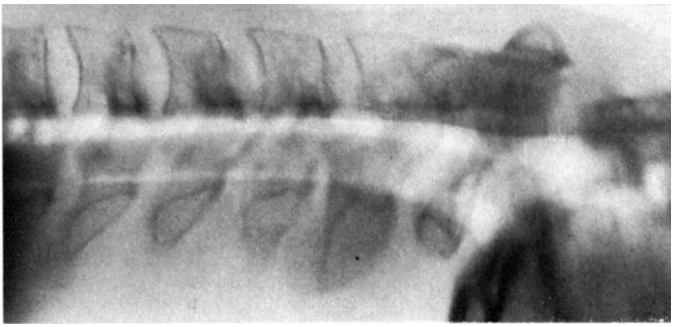

Fig. 8. Gas myelography. Tomography with horizontal beam direction.

had several years of experience of corresponding examinations carried out with the Lysholm skull-table, as well as with Mimer I. The examination routine in encephalography performed with Mimer II is basically the same as earlier, i.e. mainly identical with that described by LINDGREN (1949), with modifications introduced according to new possibilities.

One advantage with instant fluoroscopy is that it makes the initial and most critical phase of encephalography in the sitting position less time-consuming. This is because it affords immediate information about the absence or presence of tonsillar herniation and about the degree of filling of the ventricular system and the subarachnoidal cisterns. The examination may therefore progress without delay. Should a posterior fossa lesion be considered improbable, the examination may be carried out immediately in the supine and prone positions. The patient is so well strapped in the chair that the lumbar puncture needle can be left in situ. The rigid and reliable fixation of the patient, combined with the movability of the unit increases the security since the head end can be instantly lowered in case of imminent herniation or fall in blood pressure.

The rotating chair does not restrict the patient to an examination in sitting, prone, or supine, positions. He may be placed in any intermediate position to obtain optimal filling of any part of the ventricular system, or of the subarachnoid cisterns. This fact, combined with the possibility of performing tomographic studies during all stages of the examination, has permitted more information to be procured about previously less discernible structures (Fig. 5).

The design of the equipment is such that it does not always leave the patient within easy reach but this has been no problem either for the radiologist or for the anaesthetist when the examination has been performed under general anaesthesia. On the contrary, examinations of patients under general

anaesthesia are preferably performed with the Mimer because of the high security offered. Some minor disadvantages are that with the patient in horizontal position the areas below the cervical spine cannot be fluoroscoped with a horizontal beam direction. The vertical adjustment of Mimer II should preferably have been larger, e.g. in order to facilitate radiography in lateral projection with the head down. The total time required for an encephalographic examination has not been shorter than with earlier equipments, mainly because of the frequent use of tomography (Fig. 6).

The rotating chair has been found to be a labour-saving aid in the management of the patient during ventriculography, especially for achieving and maintaining filling of the ventricular system of the posterior fossa (Fig. 7). Gas myelography has been successfully carried out both by the suboccipital and lumbar routes according to the techniques described by LINDGREN (1939) and WESTBERG (1966) (Fig. 8).

Daily work with Mimer II has shown the unit to be of value also outside of neuroradiologic work. Instant fluoroscopy may be used at most skeletal and joint examinations as a control that optimal projection has been obtained, e.g. during arthrography. Examinations, including tomography, in the erect position may afford additional information concerning the spine, hip joints and knee joints. Mimer II is also a linear tomograph which fulfils the clinical demands for all kinds of tomography where the exposure time is of subordinate importance. The excellent results obtained with Mimer II have convinced the authors that the characteristic principles of this unit should not be confined to neuroradiology but should be extended to other fields of diagnostic roentgenology.

SUMMARY

The roentgendiagnostic unit Mimer III and the rotating chair-table RCT-2 are described. These offer great flexibility in the choice of beam direction and positioning of the patient as well as ready accessibility of TV fluoroscopy and linear tomography.

ZUSAMMENFASSUNG

Die Röntgendiagnostik-Einheit Mimer III mit Rotationsstuhl-Tisch RCT-2 wird beschrieben. Sie erbietet grosse Variationsmöglichkeiten in der Wahl der Strahlenrichtung und Lage des Patienten sowie unmittelbaren leichten Zugang für Fernsehdurchleuchtung und lineare Tomographie.

RÉSUMÉ

Description de l'appareil de radiodiagnostic Mimer III et du fauteuil-table rotatif RCT-2. Ils offrent une grande maniabilité pour le choix de la direction du rayonnement et de la mise en place du malade, ainsi que la possibilité immédiate d'utiliser la radioscopie télévisée et la tomographie linéaire.

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