CINEMYELOGRAPHY

Frank P. Smith, M.D., Frederick R. Pitts, Jr., M.D.,* and
Stanley M. Rogoff, M.D.

Division of Neurological Surgery and Department of Radiology, University of
Rochester Medical Center, Rochester, New York

(Received for publication September 24, 1959)

The flow of contrast media (such as Pantopaque) in the subarachnoid space may
be recorded by cinefluorography, which is essentially a motion picture of the image
formed by roentgen rays on a fluoroscopic screen. This method of making motion
roentgen-ray studies appeared as early as 1896. Progress was made by Reynolds2
who carried out his experiments in the years 1921–25. The technique did not have
practical value until Janker1 perfected a 35 mm. recording apparatus. The next im-
portant advance came after World War II with the development of intensification of
the x-ray image,2 which has reduced the radiation needed to expose motion-picture
film by a factor of 25 or more. We have applied this technique to myelographic
studies and have termed it cinemyelography.

Our first efforts in cinemyelography were made in 1954 with conventional cine-
fluorographic equipment.1 Because of the relatively large exposure required by this
unit, operation of the roentgen-ray tube had to be limited to runs of 10 or 20 seconds,
so that it was difficult to follow the flow of Pantopaque for a significant distance
along the subarachnoid space. Shortly thereafter, an image-intensifier unit was ac-
quired, and longer examinations became possible.

The majority of our cinemyelograms have been made with the apparatus shown
in Fig. 1, consisting of a 5-inch Philips X-ray Image Intensifier fitted with a 35 mm.
Arriflex camera. The field of view is circular with a diameter of about 4.75 inches for
thin subjects positioned close to the intensifier. When the plane of interest is farther
removed from the intensifier, as in a thick subject, the area that can be studied at
any one time is proportionally smaller. However, since the intensifier and camera are
freely moveable and since the field can be watched continuously through the viewing
system, the advance of the contrast medium may be followed and recorded on the
film. Generous girth of the patient is not a serious barrier and lateral views are ob-
tainable with satisfactory clarity.

Experience with cinemyelography has indicated that its primary role is educa-
tional in nature, offering a motion picture to students, nurses and physicians, who
might otherwise not have opportunity to witness the fluoroscopic portion of a myelo-
gram. Other advantages of the technique are as follows:

1. The cinemyelogram provides a continuous film record which may reveal a fill-
ing defect overlooked in the intermittent fluoroscopy and spot films. This is especially
ture when large amounts of Pantopaque are used and when two or more people may
be vying for position over the usual fluoroscopic screen. Fig. 2 demonstrates a
secondary defect which was found in the cinemyelogram and not detected by the
routine fluoroscopy and spot films. Spinal surgery in this case revealed not only a

* Present address: 414 Tenney Building, Madison 3, Wisconsin.

1112
left lateral disc rupture at L4 but also a central disc rupture at L5. This latter disc problem was a definite rupture of soft cartilage through a tear in the posterior spinous ligament. Without removal, this L5 rupture would have provided a postoperative symptomatic problem.

2. The flow of contrast medium in the thoracic spine can be studied better with cinemyelography than with routine myelographic technique. Too often, in the routine thoracic myelogram, the successful recording of Pantopaque as it flows through the thoracic spine depends upon split-second timing in tipping the patient and shifting from fluoroscopy to spot films, all of which may be confounded by intermittent necessary adjustments of the footstool of the examiner. With cinemyelography, the recording camera may be set over the generally suspected level and a continuous record made as the patient is gradually tilted with the examining unit. It is possible to have a continuous recording made over several different regions of the thoracic spine and the films may be reviewed later, at leisure, for study of detail in the flow of the contrast substance.

3. Observations of anatomical and physiological significance are available in studying the continued record of contrast substance in the subarachnoid space, not only in relation to gross spinal movements but also with such episodes as coughing or straining, which provoke changes in intraspinal pressure. The intrathecal relationship with basic structural problems, such as spondylolisthesis, may be demonstrated by this form of continuous film. Thus, the technique may be used for gaining information on a diversity of conditions related to the spine and its neurological contents.

DISCUSSION

Fortunately, the development of the image intensifier has reduced the amount of roentgen ray necessary for adequate exposure of films and has decreased the hazard
to the patient. It is difficult to calibrate roentgen-ray exposure, but by measurement in presswood phantom at the tabletop, with scatter included, the dose rate in our patients has varied from 0.41 to 0.75 roentgen per second of filming. This is the dose on the skin nearest the roentgen-ray tube, and the depth dosage is considerably less. With the maximal time of study limited to 1½ minutes, cinemyelography in the lumbar region delivers approximately the same scattered gonadal dosage as might be received during an intensive gastrointestinal study consisting of fluoroscopy and films. However, because of any possible problem of radiation dosage to the gonads of the patient, lumbar cinemyelography has not been performed in patients under 40 years of age.

Another limiting factor of the technique described above is that our periscope viewing device allows observation of the flow of Pantopaque by one person, usually the roentgenologist, at the time of the study. Thus, the neurosurgeon sees very little until the film is developed, dried and projected, usually requiring an interval of 24 hours. However, spot films may be taken at any time during the examination, thus providing the same observation available with a routine myelogram. The delay in viewing the motion-picture film has not proved to be a significant handicap to date, since there is ordinarily an interval of at least a day or two between the time of the

Fig. 2. (A) Spot film, from routine myelogram, showing filling defect at L4, left side. (B) Cinemyelographic view: defect at L4. (C) Cinemyelographic view, showing defect at L5, which had not been suspected in the routine myelographic study.
spinal study and the performance of surgery. Recently, television monitor systems have become available to facilitate group viewing of the fluoroscopic image during the procedure.

TEACHING FILM

Representative studies by the above technique have been compiled and joined to form a teaching film which shows various types of filling defects in the cervical, thoracic and lumbar spinal regions. This film may be borrowed on request, * mentioning the specific date that the film is needed for showing.

SUMMARY

Fluoroscopy of contrast substance in the subarachnoid space may be recorded on motion-picture film by a technique termed cinemyelography. The advantages and limitations of the technique are presented above. A teaching film is available.*

REFERENCES


* Address: Frank P. Smith, M.D., 260 Crittenden Blvd., Rochester 20, New York, N. Y.