THE ENTRANCE OF PANTOPAQUE INTO THE VENOUS SYSTEM DURING MYELOGRAPHY

By LIEUTENANT COLONEL CHARLES L. HINKEL
Medical Corps, Army of the United States

MYELOGRAPHY, using opaque oil, has become an important and accurate diagnostic procedure. A valuable contribution was made when pantopaque was introduced for this purpose.10,11

Pantopaque (ethyl iodocephylundecylate) contains 30.5 per cent iodine and because of its admirable physical and chemical properties (which will not be discussed here) has proved highly satisfactory for diagnostic purposes and, in our experience, has given rise to no complications in the patients on whom it was used.

The control material was not, however, designed or intended for intravenous use.

It is the purpose of this paper to report a case in which 3 cc. of pantopaque inadvertently entered the venous system of a patient without serious consequences. To my knowledge, this is a unique occurrence. The spot roentgenogram (Fig. 1) is of considerable interest as a curiosity.

CASE REPORT

The patient, soldier, aged twenty-five, was admitted to Walter Reed General Hospital because of persistent pain in the lower part of the back. The pain was not very severe, remained in the midline, and was relieved by restriction of activity. There were no significant neurological or orthopedic findings except limited mobility in the presence of pain. There were no significant laboratory findings. Anteroposterior, lateral and oblique roentgenograms of the lumbosacral spine revealed no abnormalities.

Clinically, the diagnosis was not clear cut, and it was decided to make a myelogram to rule out intradural or intervertebral disc disease before final disposition of the patient.

On July 13, 1943, the following procedure was carried out in the roentgenoscopic room of the Roentgen Department.

The patient was placed on the table in prone position with the head of the table elevated 30 degrees, and a pillow was placed under the pelvis.

3:00 P.M.—A needle was inserted at the lumbar interspace and clear spinal fluid withdrawn from the needle.

3:01 P.M.—3 cc of pantopaque (1 amp. was injected without unusual manifestation. The needle was covered with sterile drapes and allowed to remain in place. The head end of the table was kept elevated 30 degrees. The pillow was removed from beneath the pelvis and lower abdomen. The patient lay prone upon the roentgenoscopic table. The room was darkened and the table brought to the horizontal position. The fluorescent screen was swung in position and a film placed in the spot film cassette.

3:05 P.M.—The roentgenoscopist (the author), who was fully “dark adapted,” saw the pool of pantopaque about the needle point at the level of the fourth and fifth lumbar vertebrae. No abnormalities were seen.

3:06 P.M.—In order to demonstrate that the oil was lying free in the subarachnoid space, the patient was asked to cough.* As the patient coughed, I saw a marked and bizarre change in the pantopaque column. It appeared to extend in all directions like a star-burst. The original subarachnoidal oil column shrank rapidly and branching, slender finger-like columns of oil were seen extending to the right, the left, caudal and cephalad from it. Within fifteen seconds no oil could be seen in the subarachnoid space and a broad oil column was seen forming to the right of the lumbar spine. It was at once realized that the oil had entered the venous system.

3:06½ P.M.—A spot roentgenogram was taken using a stationary grid (Fig. 1).

The patient coughed and complained of “tightness in his chest,” but continued to breathe and cooperate well.

Other spot roentgenograms were taken rapidly as the cassettes could be slipped in and out of the tunnel. None of these showed opaque oil.

* This is a simple but helpful maneuver which I have used in this examination many times. When the oil is in the subarachnoid space, the column splashes and migrates cephalad. When it has been injected subdurally it does not move quickly or far.
entrance of Pantopaque into Venous System

8 P.M.—Roentgenoscopy of the entire spine, skull, chest, heart and abdomen revealed no opaque oil.

10:09 P.M.—Without further aspiration, the needle was removed, the patient transferred to a stretcher, and roentgenograms were taken of spine, abdomen and chest. At this time the patient was feeling better, but showed a rapid pulse (100) and appeared pale and weak.

The films were developed immediately but showed no opaque oil or evidence of cardiac or pulmonary abnormality. No opacity was seen in the renal or bladder regions.

Chest and abdominal roentgenograms taken four hours later (7:00 P.M.) were also negative. Chest roentgenograms taken daily for a week, and weekly for two months after the episode showed no abnormalities, and no change since the original roentgenogram.

A twenty-four hour urine specimen July 13-14, 1943, showed 66.65 mg. of iodine in 1 cc. (method of White and Rolfe). 

For the next two days the patient was kept in bed and showed a low grade elevation of temperature to 99.4°F. He developed a leukocytosis up to 13,000 with 6 per cent eosinophils. This subsided by the third day and he was allowed to be up. He had no complaints which could be attributed to the procedure.

Two weeks later the same method revealed merely a “trace” of iodine in the urine.

The feces were not tested for iodine.

COMMENT

Other opaque substances have been inadvertently introduced into veins. This is not uncommon in retrograde pyelography (pylevenous backflow). It has occurred several times with lipiodol in the course of cisterna chyliography. Pantopaque is not intended for intravenous use and no report is known of its entrance into the venous system. No other case is known in which any opaque substance has entered the venous system during or as the result of myelography. The incident is therefore viewed as a curiosity rather than a complication to be anticipated or feared.

Strain has slowly administered 8 cc. of pantopaque intravenously to dogs weighing 15-20 kg. without serious results. Rapid injection resulted in a fatality. When the oil was emulsified, dogs tolerated as much as 20 cc. intravenously.

The manner in which pantopaque is broken down, hydrolyzed, and excreted is not understood and is still being studied. We have evidence in this case that a measurable amount of iodine was excreted in the urine in the first twenty-four hours. A “trace” was found in the urine two weeks later.

DISCUSSION

Certain deductions appear to be justified and are made in order to offer at least a possible explanation of this unusual incident.
1. The needle must have entered the subarachnoid space since clear (not bloody) spinal fluid was withdrawn.

2. The pantopaque was deposited in the neural canal; it was seen there by the roentgenoscopist, and appeared to be in the subarachnoid space.

3. The oil did not immediately enter the veins. It was seen roentgenoscopically within the spine four minutes after injection.

Instantly following the cough the oil was observed to leave the canal by means of multiple curvilinear pathways (veins). The exit of the oil was so rapid that in fifteen seconds the initial collection had disappeared from the spine; in thirty seconds it was shown in the inferior vena cava, and in several tributary veins (Fig. 1); and in one minute it had completely disappeared.

4. From the above it appears that the cough was the precipitating factor. It has been shown that coughing, sneezing, and straining cause a tremendous rise in the cerebrospinal fluid pressure. This pressure is many times that in the abdominal veins (patient lying prone) and we may assume that the oil was forced into one or more veins by the cough.

To explain the entrance into the veins one must postulate a defect in the venous wall.

(a) This was possibly caused by the initial insertion of the needle at 3:00 P.M. The absence of blood in the spinal fluid is difficult to explain in this case.

(b) Possibly the wall of the vein was torn or perforated by contact with the needle point in the act of coughing at 3:06 P.M. This hypothesis is better suited to the facts and timetable.

(c) Abnormal vessels in the cord or meninges might offer an explanation. Large vessels are found in meningioma, particularly the meningothelial type; hemangioma; venous angioma (racemose type). The presence of the opaque oil in the inferior vena cava is not surprising, as all the complicated veins and plexuses in this region drain either directly or indirectly into the cava.*

**SUBSEQUENT STUDY**

A spinal puncture was not done to study the fluid for blood or iodine following the above incident.

Because the suggestion of vascular tumor was made by the roentgenologist, a second myelogram was made (July 30, 1944). The needle was inserted at the second lumbar interspace and the examination was carried out without mishap. Roentgenoscopy and roentgenography revealed no variation from the normal.

**SUMMARY**

During the course of a myelographic examination, 3 cc. of pantopaque entered the venous system and rapidly ascended the inferior vena cava.

There was no objective evidence of oil embolus, and the toxic manifestations of the iodinated substance were very slight.

This is a unique occurrence, the actual mechanism and cause for which remains undetermined.

**REFERENCES**


*Anatomy of the Veins in the Lower Lumbar Region.*

The spinal medulla and meninges contain a network of veins which is largest in caliber in the lumbar region. This network drains into the intervertebral veins and into the internal vertebral venous plexuses.

There are two of these rich venous plexuses within the neural canal: (1) the posterior internal plexus which receives the lower vertebral veins from the bodies; (2) the anterior internal plexus which receives blood from the medulla and meninges.

Both internal plexuses which lie between the dura and the bone are linked by "venous rings," the retia venosa vertebrarum. Both plexuses communicate by means of large channels with the intervertebral veins which emerge (along with the nerves) through the intervertebral foramina and empty into the lumbar and lateral sacral veins.

The lumbar veins, usually four pairs, empty directly into the inferior vena cava (above), and to the right of the fifth lumbar vertebral column.

The lateral sacral veins (bilateral) follow the anterior surface of the sacrum to the lumbo sacral level where they empty into the hypogastric veins, which in turn flow into the common iliac, the aorta, and the inferior caval veins. The common iliacs are short, connecting the sacral veins only to the level of the fifth lumbar body where they fuse to form the inferior vena cava to the right of the aorta.

Due to the low venous pressure, the numerous by-passes and multiple communicating channels, the blood flow may be in any direction depending upon pressure changes (Batson).


12. STRAIN, W. H. Personal communication and unpublished material.

