ARACHNOIDITIS FOLLOWING THE USE OF IODIZED OIL.

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It is the purpose of this paper to present clinical and experimental data which suggested to us that pantopaque [ethyl-10-(P-iodophenyl) undecylate] and other iodized oils may contribute to severe and disabling arachnoiditis. Peacher and Robertson, in their excellent report of 300 cases, concluded that "No gross pathological changes were evident in cases where the subarachnoid space has been exposed at varying periods following [pantopaque] spinogram". Encystment and nerve-root irritation were not observed by them and meningeal response was "minimal and transient". In one of our cases, encystment of pantopaque did occur, and the localized nature of the reaction about the drug indicated that the pantopaque was the cause of this reaction.

EXPERIMENTAL DATA

Twelve dogs were used for these experiments. Three cubic centimeters of pantopaque was injected into the cisterna cerebellomedullaris of one group of these animals. The head was held in a dependent position immediately after injection. The dogs were sacrificed from six days to eight weeks after insertion of pantopaque, and roentgenograms of the head were made just before each animal was sacrificed. These x-rays showed pantopaque scattered about the cisternae basales (Fig. 1). Gross and microscopic studies were made of the brains, and attention was focused especially upon the meninges about the cisternae basales.

There was a meningeal reaction in all the dogs in this group which varied in intensity.

FIG. 1
Roentgenogram of head of dog showing pantopaque in cisternae basales.

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Brains of dogs showing difference in degree of reaction in different animals. Pantopaque had been inserted into the cisternae basales of both of these animals nineteen days previously; antemortem x-rays showed that it was still present. Note the globules of oil over the base (O).

Photomicrograph (×175) showing chemical meningitis. This dog had been sacrificed nineteen days after insertion of pantopaque into the subarachnoid space. Brain stem, B. S.; meninges, M.; inflammatory reaction, I. R.
(Fig. 2), but tended to become more pronounced as time passed. Thus the degree of reaction on microscopic examination was much less in animals sacrificed six days after insertion of the material than in those sacrificed several weeks later. After two weeks in some there was a severe cellular reaction in the meninges about the base of the brain similar to that seen in bacterial meningitis (Fig. 3). This included the presence of round cells, polymorphonuclear cells, macrophage infiltration, and deposition of fibrin. No ventriculitis was evident. Several of these animals which had been docile before insertion became irritable thereafter and remained irritable.

There was little or no reaction to pantopaque inserted into the peritoneal cavity, pleural cavity, or on the conjunctiva. This may be due in part to the fact that the pleural and peritoneal cavities of dogs are relatively resistant. Pantopaque was probably eliminated from the conjunctiva immediately by tearing.

CLINICAL DATA

CASE 1. N. K., a male, thirty-seven years old, began to experience pain in the low back and in the right lower extremity while he was lifting a heavy object in October 1947. Pain had been aggravated by stooping, bending, and lifting, and there had been some radiation to the right thigh. He had been hospitalized in several institutions for this complaint. On March 18 and 20, 1948, myelograms had been made for which pantopaque was used. These were regarded as normal (Figs. 4-A and 4-B). At that time his temperature and pulse had been normal. Records were scanty, but there was no indication that an attempt had been made to remove the pantopaque from the subarachnoid space. No cerebrospinal-fluid studies made before insertion of pantopaque were available. Nine days after myelography the patient had been rehospitalized, complaining of severe pain in the low back and in both lower extremities. On this readmission his temperature was 101.5, pulse 90. Again no attempt was made to remove the pantopaque and a diagnosis of psychoneurosis was made. In July 1949, he had been studied in the orthopaedic department of another institution; the report stated that "x-rays of the lumbar sacral region showed evidence of pantopaque oil in the spinal canal". Neurological findings were reportedly within normal limits. He was seen again at the same institution in July 1950, complaining of pain in the chest, low back, and right lower extremity. Roentgenograms of the lumbo-sacral spine again showed pantopaque within the spinal canal.

On August 19, 1950, one of the authors was asked to see this patient. He complained of low-back and bilateral sciatic pain. There had been recent weakness of the lower extremities, loss of libido, and incontinence of bowel and bladder. Examination at this time revealed hypo-algesia which included all lumbar and sacral segments. The ankle jerks and knee jerks were absent. There was some limitation of back motion. Straight-leg raising was limited bilaterally. A pantopaque myelogram had been made the preceding day (Figs. 4-C and 4-D), which showed a complete obstruction to the flow of pantopaque below the fourth lumbar level and revealed the presence of two immovable collections of pantopaque at the lumbo-sacral level. Above this level the contrast medium flowed freely without abnormality. Following this procedure the newly injected oil was removed. The two immovable collections remained fixed (Fig. 4-E).

On August 23, 1950, a laminectomy was done. There was no spinal fluid below the fourth lumbar level. The cauda equina appeared as a ropelike mass of nerve roots and connective tissue without any cleavage lines. In the center of this adhesive mass was found a cyst, measuring approximately one-half inch in diameter, which contained an oily material resembling pantopaque. It corresponded in size and position to the immovable collection of pantopaque noted on the roentgenograms. Futile attempts at lysis of adhesions were abandoned. No herniation of the intervertebral disc at the fourth or fifth interspace was noted.

The patient's postoperative course was uneventful. He received a course of deep roentgen therapy (1,000 r) to the cauda equina, and seemed to gain some benefit therefrom.

CASE 2. M. H., a female, twenty-nine years old, had first noted pain in the low back and right lower extremity in 1940. In 1949 she had been operated upon for a herniated disc; six months later a fusion had been done by the same surgeon. She had experienced bilateral lower-extremity pain since liptidol myelography preceding her first operation. These myelograms reportedly showed no abnormalities. She also had experienced some neck and shoulder pain which dated from the time of her myelograms.

On July 14, 1951, this patient was first seen by one of the authors. The pain in the low back and lower extremities had progressed. On examination she showed limitation of anterior bending. There was well defined hypo-algesia over the distribution of the first sacral segments bilaterally, more marked on the left than on the right. There was less marked hypo-algesia of all sacral and lower lumbar segments, with a vague sensory level at the second lumbar segment. Weakness of dorsiflexion of the left foot was evident. Knee jerks and ankle jerks were within physiological limits. A roentgenogram (Fig. 5-A) of the lumbo-sacral spine revealed disseminated globules of radiopaque material scattered about the subarachnoid space throughout the lumbar and sacral levels. Craft fragments were also present. The patient was discharged, but was re-
hospitализирован через девять месяцев. Миелиограммы, сделанные в это время, показали полное отсутствие в нижней части 12-го поясничного позвонка (рис. 5-Б и 5-С). Было обнаружено отсутствие аномалии в кровотоке в этой области.

В феврале 1952 г. выполнена ламинэктомия. Это показало наличие острой арахнидома в области поясничной области. Из нижней части 12-го поясничного позвонка медиальная часть спинного мозга была заполнена массой, которая состояла из соединительной ткани, в которой была введена масса, проникающая до трех миллиметров в диаметре. Эта масса состояла из жирной и скопленной маслянистой липидол. После ламинэктомии, пациенту была проведена заароктоге гамма (1000 р) в область крестцового пространства. Ее боль продолжалась, вызывая затруднения, особенно в нижней части нижней конечности. В мае 1952 г., правая дорсальная короткотомия была проведена. Это облегчило боль в нижней части нижней конечности, и было ожидать, что короткотомия будет необходима.

CASE 3. D. L., a white male, forty-nine years old, had onset of low-back pain while he was lifting on February 21, 1950. There were recurrences of low-back pain with some radiation to the left lower extremity, precipitated by lifting or sneezing. On March 23, 1950, cerebrospinal fluid was removed and pantopaque was inserted. This cerebrospinal fluid showed protein of 58 milligrams per 100 cubic centimeters, one cell, and negative globulin. The pantopaque was removed, except for what was reported to be a small residuum. Subsequently x-rays showed a relatively large amount of pantopaque which had not been removed. Roentgenograms made nine months later showed that most of the radiopaque portion of this residuum had disappeared.

On December 19, 1951, the patient was first seen by one of the authors. At this time there was bilateral limitation of straight-leg raising and saddle hypo-algesia, together with hypo-algesia over both dermatomes of the first sacral segment. Cerebrospinal fluid removed at that time showed the total protein to be 182 milligrams per 100 cubic centimeters, and a test for the presence of globulin was positive. A myelogram was made, but no significant abnormality was found. All but two cubic centimeters of the pantopaque was removed. Because of persistence of pain and saddle hypo-algesia, a third myelogram was made on May 1, 1952, again without significant positive findings. Cerebrospinal fluid removed contained seventy-five milliseconds of protein per 100 cubic centimeters and no cells.

**Fig. 4-A**
Case 1. First (normal) lumbar myelograms.

**Fig. 4-B**

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Fig. 4-C and 4-D: The second lumbar myelograms showed complete obstruction at the fourth lumbar level, as well as a globule of encysted pantoque 

(EP), which remained from the first myelography.

Fig. 4-E: The pantoque used in the second myelograms was removed, but the residual encysted pantoque (EP) remained from the first myelograms.
On May 9, 1952, a laminectomy was done. The fifth interspace was found to be almost completely devoid of disc material, but no protrusion of disc material was found. Upon opening of the dura, a mass of dense adhesions was found which extended from the tip of the dural sac about one and one-half inches rostrally. The cauda equina was incorporated in these adhesions. There was no evidence of encysted pantopaque. Following operation the patient received deep x-ray treatment (1,000 r) to the cauda equina with some apparent improvement.

**COMMENT**

Various observers have felt that the rate of absorption of pantopaque from the subarachnoid space was variable, but that it proceeded in a regular manner. These conclusions were usually based on follow-up roentgenograms. We have not been convinced that all of the substance is ever absorbed, but we have felt that perhaps only the radiopaque portion disappears, whereas the vehicle remains behind indefinitely. It is imperative to completely remove the pantopaque from the subarachnoid space immediately after myelography. The procedure of choice is to leave the needle through which the material was inserted in place during fluoroscopy and roentgen examination and then to aspirate the oil through the same needle immediately.

Variability of reaction to pantopaque in different patients has been attributed to differences in tolerance to iodine and to the "chemical condition of the material". Luce and his associates felt that severe reactions, seen nine days after myelography in one case and thirty days after myelography in another, were due to sensitivity of patients to the contrast medium. In their cases, delayed meningeal reaction was accompanied by exacerbations of reactions at the skin-test site. We have felt on several occasions that a series of immediate meningeal reactions more severe than usual seemed to be correlated with a new lot of pantopaque. This suggested to us that there might be some variation in the irritation produced by different samples of the opaque substance. Investigation of these offending lots by the manufacturer, however, did not disclose anything unusual. Variations in the degree of aseptic meningitis in the animals studied would correspond to the variations in clinical manifestation of meningeal irritation in patients and would seem to indicate variation in sensitivity in human subjects. This could be a variation in iodine sensitivity.

The immediate reaction to pantopaque which manifests itself clinically by signs of radiculitis and fever, is usually a transient one. It is often of sufficient magnitude, however, to obscure findings which had been present before myelography. It has led us to encourage consultation prior to myelography, rather than to condone myelography as a "screening" procedure. This immediate reaction is well illustrated in the case reported by Tarlov. Operation sixty hours after insertion of pantopaque in his case revealed an exudate simulating purulent material which was already adherent to the roots of the cauda equina. We have occasionally noted pantopaque, which is freely movable on the day of insertion, to become fixed and immovable twenty-four hours after insertion. We have been at a loss to explain this, but it would seem to correspond to Tarlov's exudate and probably represents solidification of the contrast medium.

Others who have observed adhesive arachnoiditis have attributed it to disc surgery or disc disease. The common denominator in these reports, however, seems to be pantopaque or some other iodized oil. Several of the myelograms in Smolik and Nash's paper are quite similar to those of Case 1 reported by the author. The operative findings in this case and in Case 2 are similar to the arachnoid cysts which Bucy and Speigel attributed to iodized oil.

In all three cases herein presented, severe arachnoiditis was proved by exploratory laminectomy. In one case (Case 3) most of the iodized oil had been removed. In the other two no attempt at removal had been made. In only one case (Case 2) could previous operation possibly have been a contributing factor. The localized nature of this arachnoiditis and the presence of fixed and completely encysted iodized oil deep within the con-
Fig. 5-A: Case 2. Lumbar roentgenograms showed residual lipiodol which had remained from the first myelography.

Figs. 5-B and 5-C: Later lumbar myelograms showed complete obstruction at the fifth lumbar level.
ective-tissue mass indicated that the adhesive process was, at least in part, a walling-off, foreign-body type of reaction to the iodized oil. The absence of any myelographic abnormality when the oil was first inserted and the development of complete obstruction to the flow of subsequently injected oil at a level above the older walled-off oil substantiated this conclusion. Pre-existing mild arachnoiditis could not be ruled out with certainty, however.

**SUMMARY**

1. Clinical and laboratory data presented suggest that pantopaque and other iodized oils may contribute to, or possibly cause, severe reaction within the subarachnoid space.

2. Verbal communication indicating similar experience among orthopaedists and neurosurgeons has suggested to us that there is need for a more critical evaluation of the properties of pantopaque and other iodized oils and a more conservative approach to their use than is often practised. The importance of complete removal of the substance is evident.

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**REFERENCES**


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**A SIMPLE EFFICIENT EXTRACTOR FOR REMOVING CLOVER-LEAF INTRAMEDULLARY RODS**

**BY HOWARD L. CHERRY, M.D., PORTLAND, OREGON**

When the usual instruments are employed to remove a clover-leaf intramedullary rod, there is often considerable difficulty in getting exposure through which the rod can be grasped. With the simple instrument illustrated, this difficulty is eliminated.

The instrument is made by welding a screw extractor to an appropriate handle. The extractor is a small, bitlike device, with left-handed threads, designed to screw out broken-