Pantopaque Arachnoiditis

Experimental Study of Blood as a Potentiating Agent

W. J. HOWLAND, M.D., J. L. CURRY, M.D., and A. K. BUTLER, M.D.

Conflicting opinions exist as to the advisability of removing ethylidophenylundecylate (Pantopaque; Mydil) from the subarachnoid space after myelography. American authors (1-5) usually favor as complete removal as possible, whereas British workers (6) frequently recommend that the contrast material be left undisturbed. One reason for not removing the medium is the fear of additional trauma to the subarachnoid space. A puzzling aspect of the problem is the fact that reports in the literature show most patients to have very little reaction to Pantopaque (7), while some have had severe late symptoms and at surgery (1, 3-5) or autopsy (3,8) a severe arachnoiditis has been encountered.

The idea occurred to us that subarachnoid bleeding during the course of needle positioning might produce an added irritant factor in an occasional patient and thereby explain the development of severe arachnoiditis. Review of the literature available to us has not disclosed any previous investigation of this possibility. Sarkisian (4), in 1956, suggested that “a bloody tap” should be considered a contraindication to the injection of oil intrathe tally, evidently basing this recommendation on the possibility of emulsification of oil. Jaeger’s (9) studies of the harmful effects of emulsified oils were cited.

Because of the difficulty of being certain whether or not subarachnoid bleeding has occurred in human clinical material, it was decided to evaluate the effect of blood mixed with Pantopaque in the subarachnoid space of dogs. The dog is the experimental animal most frequently used for studies of Pantopaque (1, 2, 4, 10).

MATERIALS AND METHODS

Four mongrel dogs in good clinical condition were used. In all, the material was injected into the cisterna magna through a posterior mid-line approach with a 20-gauge needle, under strict aseptic technic. Injection was made with the animal in a 60° tilt, the caudal portion lower and the neck flexed. The neck was extended immediately upon completion of the injection. In this position essentially all the material flowed slowly along the subarachnoid space of the cervical spinal cord to the lumbar region over a period of about one hour. After preliminary withdrawal of about 5 ml. of spinal fluid, the injection was made slowly, without trauma, and in a very easy manner in each animal. Radiographs were obtained at the completion of injection and at intervals until the opaque medium reached the lumbar region. The animal was maintained under light pentobarbital anesthesia during this period.

The first dog was injected with 3 ml. of Pantopaque alone; the second and third with 3 ml. of Pantopaque plus 3 ml. of blood. The blood was withdrawn from the animal’s leg vein immediately prior to injection, mixed with the Pantopaque in the syringe, and injected before clots occurred. The fourth dog was injected with 3 ml. of unclotted blood.

The animals were sacrificed seven weeks following injection, with the exception of dog No. 2, which had to be sacrificed after eighteen days.

RESULTS

Dog No. 1 (3 ml. of Pantopaque injected into the cisterna magna): Clinically slight nuchal rigidity and an expected post-anesthesia lethargy were noted during the first twenty-four hours after injection. However, the animal maintained good food intake and, in general, showed no ill effects. It exhibited no obvious neurological deficiencies during the period of observation and was in excellent health when sacrificed.

Radiographs at the time of injection showed a smooth, symmetrical oil column. At autopsy, seven weeks later, radiographs showed the Pantopaque to
Fig. 2. (Dog No. 2). Radiograph made at time of Pantopaque injection, showing fragmentation of the oil column into many large globules.

be more generally dispersed in droplets and globules throughout the subarachnoid space. Much of the material had been absorbed.

Grossly the spinal cord and integument showed multiple small areas of partially or completely encysted oily material with surrounding arachnoid thickening. The major portion of the Pantopaque was free within the subarachnoid space, and no ventricular dilatation was evident.

The microscopic appearance was one of chronic inflammatory reactive changes around the encysted oil droplets (Fig. 1).

Dog No. 2 (3 ml. of Pantopaque and 3 ml. of blood injected into the cisterna magna): Clinically this animal had a severe reaction. The day following injection there were severe nuchal rigidity and apathy. All food was refused from the time of injection until death, and only small amounts of water were taken. The animal was febrile the day following injection and remained so until death. Gradually increasing paralysis of the extremities developed, progressing to essentially complete paralysis of the hind limbs. For these reasons, this dog was sacrificed on the eighteenth day after injection.

Radiographs obtained at the time of injection showed the Pantopaque column to be broken into many large globules, and contrast material was not dispersed in the subarachnoid space as in the first animal (Fig. 2). The appearance was similar at the time of sacrifice.

Autopsy revealed a large localized area of inflammatory induration of the arachnoid in the lower cervical region. In addition, there were many smaller areas of inflammatory induration over other portions of the spinal cord and the base of the brain. Grossly there was some oily material associated with each of the visible lesions. It was difficult to find any free oil in the subarachnoid space. No ventricular dilatation was evident.

Microscopically the indurated areas showed a marked inflammatory reaction about cystic spaces, with acute and chronic components (Fig. 3). No bacteria could be identified.

Dog No. 3 (3 ml. of Pantopaque and 3 ml. of blood injected into the cisterna magna): For the first few days this animal had just as severe a reaction as dog No. 2, with marked nuchal rigidity, fever, anorexia, and weakness. On the third day, however, improvement began, and gradually recovery took place, over a period of about two weeks. Examination seven weeks after injection, just prior to sacrifice, showed no definite neurological deficit except for slight spasticity of the hind limbs.

Radiographs made at the time of the injection and at sacrifice showed a picture very similar to that of dog No. 2, that is, the opaque material was fragmented in large globules and did not flow in a uniform column in the subarachnoid space.

The gross appearance of the spinal cord and its membranes was of many large and small inflammatory thickenings of greater severity than in dog No. 1, but not as severe as in the second dog. No ventricular dilatation was seen.

Dog No. 4 (3 ml. of blood injected into the cisterna magna): Clinically this animal showed very little effect. There was minimal nuchal rigidity after the injection, but this rapidly disappeared, and the dog remained in good health until time of sacrifice. Autopsy showed no significant abnormality of the spinal cord or ventricles, and in microscopic studies no significant abnormality was apparent.

**COMMENTS**

Within the limitation of the number of experimental animals used, this study confirmed the impression that blood may act to potentiate inflammatory effects of Pantopaque in the subarachnoid space. This occurred in spite of the lack of significant inflammatory reaction to blood alone.

From our experimental studies and from the reports in the literature (1, 5, 8) of arachnoiditis caused by Pantopaque, it seems advisable to try to remove the medium from the subarachnoid space as completely as possible at the time of myelography. However, these studies suggest that it is vitally important to avoid traumatic bleeding.
Fig. 3. (Dog No. 2) Photomicrograph of cervical cord autopsy specimen, showing marked widening of the subarachnoid space by inflammatory reaction. Note the numerous cystic spaces enclosing oil droplets. Hematoxylin and eosin. X 100.

...g is produced during needle insertion or found in the spinal fluid removed at the time (from recent prior spinal punctures or spontaneous bleeding) it appears advisable to instill Pantopaque into the subarachnoid space.

The reason for the potentiating action of blood is unknown, since alone it seems to cause very little inflammatory reaction. We have speculated that blood may produce decomposition of Pantopaque into more toxic substances. Investigative studies on this aspect are planned and will be the subject of a subsequent report.

SUMMARY AND CONCLUSIONS

1. The effect of blood mixed with Pantopaque in the production of arachnoiditis in the dog was investigated.

2. Blood alone produced extremely little inflammatory reaction; Pantopaque alone produced multiple small foci of inflammatory reaction; Pantopaque mixed with blood produced severe localized inflammation.

3. A potentiating action of blood (traumatically produced) in the subarachnoid space suggests to us a logical explanation for the severe arachnoiditis occasionally encountered following Pantopaque myelography.

REFERENCES


