DURATION OF ANESTHESIA

One may start to operate as soon as desirable after the administration of the procain has been completed. The drug reaches its full depth within twenty minutes after inception. It does not begin to wear off until at least two hours have elapsed, and there is some persistence of the anesthetic for at least eight hours. The latter feature is of the greatest importance. We have learned that the blood pressure drops below the patient's normal anywhere from 10 to 50 mm. of mercury following a major operation, just as we have shown that it does following severe and exhausting exercise. This drop in pressure begins immediately after the operation is finished, and persists for from four to eight hours or longer. It has even been known to last for many days. If the element of severe pain is added when the patient is at his "zero" blood pressure hour he is much more liable to go into profound shock. With any anesthesia except regional, this happens. It is our opinion that this feature is one of the most important points in favor of the use of this type of procedure.

PRECAUTIONS

The total amount of procain used by us has never exceeded 150 c.c. of a 1 per cent. solution (of procain) or its equivalent.

The solution should be freshly made and sterilized just before use by boiling.

It is our practice to avoid the use of epinephrin entirely, because experimentation has proved that this solution adds considerably to the toxicity of the drug.

It is well before making each injection to withdraw the plunger of the syringe slightly to determine absolutely whether or not it is in a blood vessel. The injection of procain directly into the blood stream has been known to cause a partial paralysis of the respiratory system.

Clinical observations bear out the results obtained experimentally as cited above.

It must constantly be borne in mind that the supreme disadvantage of any injection anesthesia lies in the fact that what is injected cannot be withdrawn, and therefore the greatest attention should be given to the strength and proper sterilization of the solution used.

UNTOWARD RESULTS

Thus far, in approximately 100 cases of regional anesthesia done in the urologic department of the New York Hospital in the past year, we have had no fatalities or near fatalities. One patient had spasmodic contraction of the legs lasting about one minute. Two patients had short periods of excitement. Two others became flushed and confused for a minute or two. Several patients have shown an increased rate of pulse with lowered blood pressure. It is our custom to administer 5 grains (0.3 gm.) of caffein or epinephrin as a stimulant in such cases. This seems to be the best type of stimulation. In none of this series has it been necessary to use gum glucose, physiologic sodium chlorid or other solutions intravenously. Shock and preshock conditions have practically disappeared from our wards.

CONCLUSIONS

Our series of cases is not large enough to warrant conclusions, but our impression is that:

1. In properly selected cases, paravertebral anesthesia is the method of choice for operations performed on the kidney.

2. This method throws practically no burden on the unoperated kidney or any other vital organ.

3. Procain is the drug most suitable at present, although search should be continued for a less toxic substance. Not more than 150 c.c. of 1 per cent. procain or its equivalent should be used on one patient.

4. Epinephrin is more toxic than is generally believed, and should not be mixed with the solution used as a general practice.

5. The greatest advance in surgery of the future will probably not consist in devising new operations or altering old ones, but will be the discovery of new anesthetic agencies and the perfection of methods of administering them.

32 East Sixty-Fifth Street.

# INTRA-ARTERIAL INJECTION OF SODIUM IODID

PRELIMINARY REPORT *

BARNEY BROOKS, M.D.
ST. LOUIS

Until the present time there has been no accurate method for the determination in the living patient of the amount and extent of occlusion of the arteries of the extremities. I have already briefly described how this may be accomplished by intra-arterial injection of a solution of sodium iodid, and roentgen-ray photography. Further clinical experience with this method has demonstrated that it is a valuable method in the diagnosis of circulatory diseases of the extremities.

The solution injected is prepared by dissolving 100 gm. of sodium iodid crystals in 100 c.c. of distilled water. The solution is sterilized in the autoclave and is always used soon after its preparation. The solution should be colorless or very faintly yellowish. A solution that shows any considerable iodin color has not been used.

The method of obtaining the roentgenograms of the arteries of the lower extremities is as follows:

The entire thigh is prepared for operation. A sterile tourniquet is placed around the thigh as high as possible, but is not tightened. With a local anesthetic of 0.5 per cent. procain the femoral artery is exposed in the proximal end of Hunter's canal. Only enough of the artery is exposed to permit the application of a Crile artery clamp, which is not tightened. The roentgen-ray tube is placed over the knee region, and a large photographic film with a screen is placed under the knee and leg. The patient is now given nitrous oxid gas. It has been found that there is pain during the period the solution is in the artery, and the patient cannot be kept still enough to get a good roentgenogram unless a general anesthetic is used. The tourniquet proximal to the exposed artery is tightened enough to produce a filling of the veins. When the veins are full, the clamp on the artery is tightened enough to occlude the artery completely. A short interval is then allowed to elapse for the artery distal to the clamp to empty its blood. A medium sized needle is introduced into the lumen of the artery, and 10 c.c. of the sodium iodid solution is injected. The roentgen-ray tube is then operated for the briefest period possible to secure a good plate. A second plate may be taken of the distal third of the leg and foot. The tourniquet is released, the clamp removed from the artery, and the gas anesthetic discontinued. The wound is then closed.

* From the Department of Surgery, Washington University Medical School.

REPORT OF CASES

The practical application of this method is illustrated by the following brief reports:

CASE 1.—L. F., a white woman, aged 62, admitted to Barnes Hospital, Sept. 19, 1923, discharged, October 22, had ulceration of the leg. Her father died of old age. Her mother died of pulmonary tuberculosis. She had had five sisters, who had died of unknown cause. One brother died of inflammatory rheumatism. She was married at 24 years of age, and had eight children, four of whom were living and well, and one miscarriage. Her husband was living and well. She had always been well except for the present illness. Twenty years before admission, after the birth of a child, the patient developed "childbed fever." After she got up, ulcers developed on both legs. The ulcer on the left leg healed. The ulcer on the right leg had been open continuously ever since.

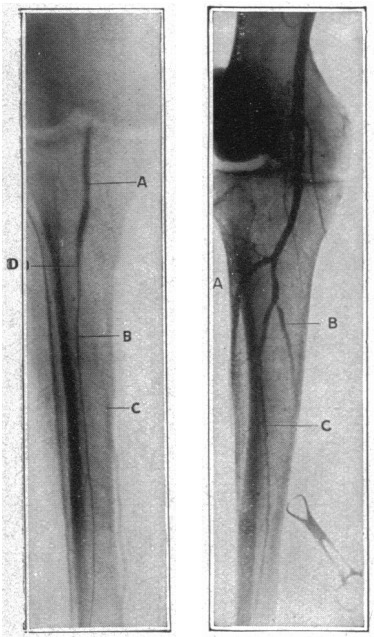


Fig. 1 Fig. 2

Fig. 1 (Case 1).—Appearance after intra-arterial injection of sodium iodid: The popliteal (*A*), peroneal (*B*) and posterior tibial (*C*) arteries are injected; there is no injection of the anterior tibial artery; a faint outline of the origin of this vessel can be seen (*D*). This injection was done without a general anesthetic, and the sharp outlines of the injected vessels are obscured by movement.

Fig. 2 (Case 2).—Appearance after intra-arterial injection of sodium iodid: The popliteal artery shows no obstruction; the anterior (*A*) and posterior (*B*) tibial arteries are injected for only a short distance; the origin of the posterior tibial artery is markedly constricted (Fig. 3); the lumen of the peroneal artery (*C*) shows marked irregularities.

General physical examination was negative. The distal third of the left leg showed some brown pigmentation and thickening of the skin on the medial surface. The entire circumference of the lower half of the right leg was dense, hard, dark brown scar tissue. On the medial surface there was a large ulcer, approximately 8 cm. in diameter. The base of the ulcer was covered with ragged, necrotic tissue. The edges were irregular in outline, but rather sharply defined. With the patient standing there was slight dilatation of the saphenous vein. There was a good pulse in the femoral artery in both groins. No pulse could be felt in either popliteal space or in the vessels of either foot. With the right foot dependent there was definite cyanosis of the foot. On elevation of the extremity, blanching was marked, but not complete.

Operation, September 27, consisted of injection of sodium iodid into the femoral artery, and perivascular sympathectomy of the femoral artery. There were no local or systemic manifestations following the operation. The roentgenograms showed the popliteal, peronal and posterior tibial arteries injected. There was no evidence of obstruction of these arteries. The anterior tibial artery was not injected. There was a faint shadow at the site at which the vessels should arise (Fig. 1).

October 3, there was distinct improvement. The base of the ulcer was red. Necrotic tissue in the base was separating.

October 22, the ulcer had completely healed. The patient was up and about.

The blood and urine were normal. The systolic blood pressure was 130; diastolic, 60. The Wassermann reaction was negative. The phenolsulphonephthalein test yielded 50 per cent. the first hour, and 5 per cent. the second hour.

CASE 2.—A. E., a white man, aged 50, entered the hospital, Dec. 21, 1923, because of diabetes, and gangrene of the right foot. He had been perfectly well with no symptoms referable to diabetes until about five weeks before, when the right foot was injured by a pocket knife falling on the little toe, and a few days later the patient was exposed in a heavy rain, after which he noticed that the toe was black. His family physician told him that he had diabetes. He was put on a restricted carbohydrate diet. The foot, however, continued to grow worse. Examination on admission showed gangrene involving the fourth and fifth toes and the neighboring portion of the plantar surface of the foot. There was sugar in the urine. The temperature was elevated. Immediate intensive treatment, including administration of insulin, was begun for diabetes. The area of gangrene in the foot increased slightly.

December 26, the femoral artery was exposed, sodium iodid was injected, and roentgen-ray examination was made. The roentgenograms of the injected arteries showed the popliteal artery unobstructed. The injected solution passed into the anterior tibial artery for a short distance. The origin of the posterior tibial artery showed marked constriction, and the injected fluid passed into the posterior tibial artery for only a short distance. The lumen of the peroneal artery was injected throughout the entire course of the vessel. Along this vessel, however, there were many areas of partial obstruction by irregularities in the wall of the vessel (Fig. 2).

December 28, the patient showed no ill effects from the arterial injection; on the other hand, he stated that the pain in the foot was not so severe after the injection. The foot, however, continued to be extremely pale. The extent of arterial occlusion, as revealed by the intra-arterial injection together with a continued irregular fever, was taken as indications that amputation was advisable. The fact that all of the major vessels of the leg were markedly obstructed indicated that the amputation should be done above the level of the knee.

Under gas and oxygen anesthesia, amputation through the distal third of the thigh was done. At this level it was noted that the femoral artery, although showing a moderate degree of thickening and calcification, had its lumen well preserved and showed approximately normal pulsation. The wound of amputation was closed without drainage.

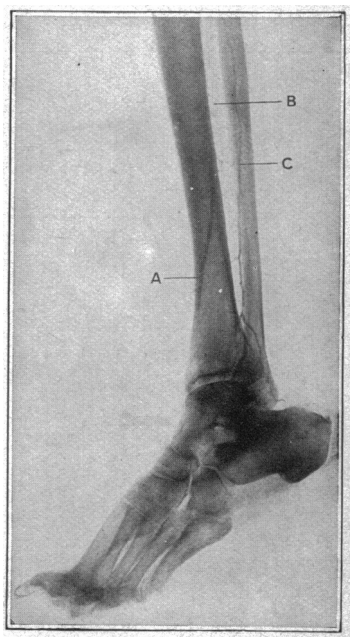


Fig. 3 (Case 2).—Appearance of the injected arteries of the amputated extremity: The anterior (*A*) and posterior (*B*) tibial arteries show only partial injection; the peroneal artery (*C*) is injected, but shows irregularities in outline due partly to arteriosclerosis and partly to postmortem clotting.

Jan. 7, 1924, the postoperative course of the patient was uneventful. All operative wounds were healed. Temperature and pulse were normal, and there was a marked improvement in the diabetes and general condition of the patient.

Examination of the amputated extremity by means of an injection of an emulsion of freshly precipitated barium sulphate (Fig. 3) confirmed the findings of the previous injection of the arteries during life. In this plate, however, the lumen of the arteries was made more irregular by postmortem blood clots that could not be washed out. The arteries of the amputated extremity were then dissected out. The popliteal artery was found only slightly thickened, containing a few calcified plaques, but in general the artery was elastic and the lumen was well preserved. The posterior tibial, the peroneal and anterior tibial vessels were all of the pipe-stem variety. The origin of the posterior tibial artery

was constricted to a pin point opening (Fig. 4), and the greater portion of the artery was entirely obliterated. The anterior tibial artery was also obliterated for the greater part of its course. The peroneal artery showed marked thickening of the entire course of the artery, and in many areas the thickening of the walls were so much as to markedly constrict the lumen of the vessel.

CASE 3.—F. C. Z., a white man, aged 53, had been under the observation of the Washington University Department of Internal Medicine for a period of five years for rather severe diabetes and chronic pulmonary tuberculosis. On admission to the hospital, Nov. 22, 1923, it was noted that there was marked decrease to pain sensation in both legs, and after admission he developed extensive ulceration of both legs.

Jan. 9, 1924, the right femoral artery was exposed. It was apparently perfectly normal. Injection of sodium iodid and roentgen-ray examination showed all the large arteries of the leg injected and apparently very well preserved (Fig. 5).

January 14, it was noted that no manifestations of any injury followed the operation. The ulcers on the legs were healing with the application of wet dressings. There was no perceptible difference in the healing of the two legs.

After the establishment of the fact that there was no disease of the circulatory system of the extremities, the patient recalled that, when taking a bath, he had stood in a tub of hot water before finding out that it was too hot.

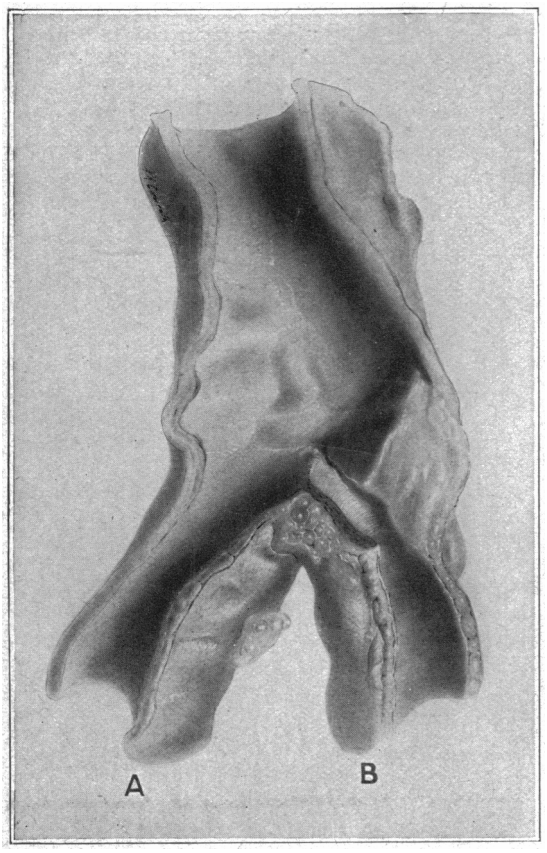


Fig. 4.—Marked constriction at origin of posterior tibial artery (compare with Figure 2): *A*, peroneal artery; *B*, posterior tibial artery.

COMMENT

In Case 1, there was ulceration of the leg of twenty years' duration. There were no evidences of varicose veins or venous obstruction. The pulse in the anterior and posterior tibial arteries could not be felt. The Wassermann reaction was negative. There were no other manifestations of syphilis. Injection of sodium iodid into the femoral artery and roentgen-ray examination showed the popliteal, peroneal and posterior tibial arteries unobstructed. There was apparently a complete obliteration of the anterior tibial artery. The injection was not followed by any manifestations of injury; on the other hand, the operative procedure was followed by rapid disappearance of pain and complete healing of the large ulcer in twenty-one days. It is interesting to note that the ulcer occurred on the leg in a site, the blood supply of which comes mainly from the anterior tibial artery, and that intra-arterial injection of sodium iodid and roentgen-ray examination showed a complete absence of the lumen in this vessel. The beneficial results that followed the operative procedure may be attributed to the periarterial sympathectomy which was performed at the same time as the intra-arterial injection; but we have not, heretofore, seen such striking improvement follow this operation. The possibility of the ulcer being syphilitic in origin and responding to the large dose of sodium iodid has also to be considered.

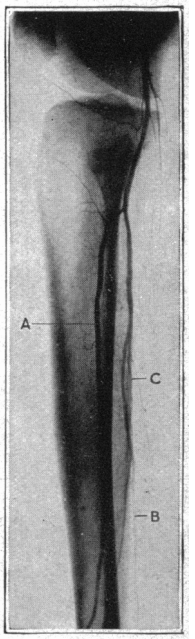


Fig. 5 (Case 3).—Appearance after intra-arterial injection of sodium iodid: All arteries are injected; there are only very slight irregularities and a slight narrowing of the origin of the anterior tibial artery; all the arteries are relatively small; this is interesting, since the patient was much emaciated and had been inactive a long period; *A*, anterior tibial artery; *B*, posterior tibial artery; *C*, peroneal artery.

In Case 2, in which the condition was one of diabetes with gangrene of the foot associated with great pain, injection of the arteries of the extremity with sodium iodid, and roentgen-ray examination showed the popliteal artery to be unobstructed; and there was almost complete obliteration of the lumina of the anterior and posterior tibial vessels. The peroneal artery showed marked arteriosclerosis, with multiple partial obstructions. Subsequently, the extremity was amputated and the findings of the intravital arterial injection were verified by injection and roentgen-ray examination and dissection of the arteries of the amputated extremity. In this case, three days intervened between the intravital injection and subsequent amputation. During this period there were no manifestations of any harm having resulted from the injection. In fact, the patient was relieved of pain after the injection. Furthermore, gross and microscopic examination of the injected artery revealed no evidence of damage to the artery by the injection.

In Case 3, the patient had diabetes, and extensive ulceration of the feet and legs, which had been attributed to deficient circulation probably because of arteriosclerosis, which is frequently associated with diabetes. Examination by means of arterial injection and the roentgen ray revealed no arterial obstruction, and subsequently the true cause of the ulcerative process was found to be burns sustained as a result of a loss of pain sensation. It is interesting to note in this case of long continued emaciation and inactivity that the arteries are all small.

From these and other clinical experiences and numerous animal experiments, this method has been found to give valuable information as to the location and extent

of arterial obstruction. In those instances in which the method has been used, there has been no manifestation of injury to the artery from the injection. In earlier experiences the injection was done without a general anesthetic, and it was found that the patients complained of severe pain during the period the arteries were filled with the injection solution. This pain ceased immediately after the clamp was removed from the artery, permitting the resumption of the flow of blood. The pain, however, was so severe that it was difficult or impossible to get a satisfactory roentgenogram without the administration of a general anesthetic during the brief period in which the injection solution was in the arteries.

An exact knowledge of the site and extent of occlusion of the arteries of the extremity is of great value in the prognosis and treatment of diseases of the extremities due to deficient arterial blood supply. The application of the method described in this paper has been of great value in determining the necessity of amputation in instances of peripheral gangrene, and in those instances in which amputation was indicated in determining the site at which the amputation should be done. It has also, in several instances, established the fact that conditions presumed to be due to arterial obstruction had other causes. Also, in cases of arterial obstruction it is possible to obtain valuable knowledge as to the site and extent of the collateral circulation. Further experimental and clinical work is in progress.

422 University Club Building.

## DERMATOMYOSITIS *

LOUIS G. HEYN, M.D.
CINCINNATI

Dermatomyositis, or nonsuppurative myositis, is a severe, generalized, inflammatory disease of the voluntary muscles, accompanied by certain characteristic changes in the skin. The comparative rarity of the disease prompts the publication of this case history.

### REPORT OF CASE

*History.*—J. G., a colored laborer, aged 35, entered the South Medical Service of the Cincinnati General Hospital, July 20, 1923, complaining of dull, aching pains in the neck and in all four extremities, aggravated by any movement of these parts. He stated that, four weeks previous to admission, after working for seven hours in a heavy rain, he had awakened the following morning with a stiffness of the entire body, and was unable to work for two days. He then attempted to work again, but could not do so on account of the increasing discomfort on moving. This discomfort was especially marked in the neck and shoulders, increasing in intensity toward evening and interfering greatly with sleep. The patient had had a syphilitic infection fifteen years before, and a gonorrheal infection twelve years before. He had had typhoid and malarial fevers. His health had been generally good, and he had done hard labor all his life. On admission, his temperature was 98; pulse, 90; respiration, 20.

*Physical Examination.*—As the patient lay in a rather erect position in bed, there was at once evident an edema of an unusual distribution, slightly marked in the face, increasing down over the neck to the shoulders and chest, and becoming less again from about the lower two thirds of the chest. It was only slightly evident over the abdomen, somewhat more extensive over the lumbar region, and increasing considerably over the hips and thighs. The arms were markedly edematous, but the hands almost not at all, and the lower parts of the legs were also spared. The distribution of the edema, as was quite evident, corresponded not at all to a cardiac or renal picture. As he was a negro, it was difficult to tell whether the skin was redder than normal, although there was a suggestion of this, and in numerous places there were small patches of dermatitis and also excoriations from scratching. A striking feature was the immobility of the patient, as if in a cast. It was due in part to the pain on motion. Touching of any of the parts was extremely painful. The skin was warm. The edema was somewhat brawny and did not pit readily. Cervical glands could be palpated, slightly enlarged. The epitrochlears could not be palpated on account of the edema, but the inguinals were enlarged. The patient also complained of frontal headache and was tender over the frontal sinuses. Further examination revealed a slight exophthalmos, but no Graefe or Stellwag signs. The ocular



Appearance of patient: There was puffiness of the face; diffuse swelling of the neck extended to the arms, but not over the lower arm or hand; at the bend of the elbows was a skin lesion, protected by a dressing held by adhesive strips.

muscles were not impaired; the pupils, though small, reacted normally. There was an injection of the inner half of the right ocular conjunctiva, and also there were a few excoriations about the lips and a slight purulent rhinitis. The teeth were carious and many were missing; the tongue was coated and somewhat tremulous. The pharynx was injected and edematous; the tonsils were submerged, and exposed with difficulty; the soft palate was edematous and moved with difficulty. The patient complained of difficulty in swallowing as well as in trying to bring up secretions which were continually accumulating in the throat. There was a suggestion of the thyroid enlargement and tenderness, but because of the edema, this could not be positively determined.

The chest signs were obviously difficult to elicit, but the lung sounds were apparently normal. The heart was slightly enlarged to the left, 10.5 cm. from the middle line in the fifth interspace. The pulse rate was somewhat accelerated, and this continued to be the case during the whole course of the illness. A soft systolic bruit was heard over the pulmonic area as well as at the apex.

* From the Medical Service of the Cincinnati General Hospital.