

An Improved Closure for the Doster-Virtue Intestinal Loop.*

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Specially treated bone was used to close the intestinal loop previously described.¹ Experience has shown that it is difficult to obtain uniform preparations of bone which will not eventually disintegrate after an exposure of some months to the action of intestinal juices. This difficulty has been overcome by substituting stainless steel wire mesh for bone. A $\frac{3}{4}$ inch width of 30 mesh stainless steel wire mesh[†] is wound around the rubber tubing until the desired thickness of "bone" is obtained. The rough ends are closed by vulcanizing rubber onto them, which thus fastens the wire to the tubing. A porous matrix through which the serosa can grow is thus established. Loops closed in this manner are intact after 6 months of use, and show no sign of leakage or disintegration. Vitalium wire mesh was also satisfactory but costs several times as much as stainless steel.

One other troublesome factor, that of the inserted end of the rubber tubing puncturing the walls of the loop, has been eliminated. A roll of rubber was vulcanized around the end of the tubing which was inserted into the loop at the time of operation, thus eliminating sharp edges of hard rubber. No punctures have occurred since this practice was begun.

Sensitization of Blood Vessels to Acetylcholine by Sympathetic Denervation.

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Degeneration of the nerve supply to skeletal muscle and to certain smooth muscles contracted by sympathetic impulses is known to

* The authors wish to thank Dr. R. W. Whitehead for use of the animal quarters at the Medical School of the University of Colorado.

¹ Doster-Virtue, M. E., and Virtue, R. W., *PROC. SOC. EXP. BIOL. AND MED.*, 1940, **45**, 813.

[†] W. S. Tyler & Co. of Cleveland, Ohio, furnished the wire mesh.

sensitize those effectors to chemical agents. This subject has been reviewed by Cannon and Rosenblueth¹ and by Rosenblueth.² Cannon and Haimovici³ have demonstrated sensitization to chemical agents of motoneurons of the spinal cord after chronic hemisection, and Burrett⁴ has found that the chronically denervated heart is sensitized to adrenaline.

It was desired to see whether the contractile elements in blood vessels that are subject to cholinergic nerves could be sensitized to acetylcholine by denervation as blood vessels subject to adrenergic nerves are thus sensitized to adrenaline (Meltzer and Meltzer⁵). Experiments were accordingly carried out on the chronically sympathectomized blood vessels of the posterior limbs of cats, in which there is evidence for the presence of cholinergic vasodilator control (Rosenblueth and Cannon⁶).

Method. The abdominal sympathetic chain was removed unilaterally with aseptic precautions in 10 cats which survived the operation without complications. In each animal approximately 2 cm of the sympathetic chain, embracing usually 3 or 4 ganglia, were removed from deep in the pelvis. According to Langley^{7, 8} sympathetic vasomotor fibers to the lower limb of the cat are supplied by the 6th and 7th lumbar ganglia (*i. e.*, 4th and 5th according to present nomenclature) and by the 1st and 2nd sacral ganglia. For degeneration of the nerve supply 20 to 44 days were allowed before testing for possible sensitization to acetylcholine. The cat was then anesthetized with dial, a tracheal cannula was inserted, the right or left external jugular vein was exposed for injection and the carotid artery was cannulated for blood-pressure recording. Both posterior limbs were inserted in glass plethysmographs for simultaneously recording leg volumes on the two sides, a rubber cuff making junction between leg and tube. The unshaven legs were sealed in the plethysmographs by vaseline, the remaining air displaced by water at a temperature of approximately 37°C. It was thus possible to obtain kymograms of blood pressure and limb-volume measurements as indices of the effects of intravenous injections of acetylcholine. Eser-

¹ Cannon, W. B., and Rosenblueth, A., *Autonomic Neuro-effector Systems*, New York, 1937.

² Rosenblueth, A., *Ann. Rev. Physiol.*, 1940, **2**, 263.

³ Cannon, W. B., and Haimovici, H., *Am. J. Physiol.*, 1939, **126**, 731.

⁴ Burrett, J. B., *Ibid.*, 1940, **131**, 409.

⁵ Meltzer, S. J., and Meltzer, C., *Ibid.*, 1903, **9**, 252.

⁶ Rosenblueth, A., and Cannon, W. B., *Ibid.*, 1935, **112**, 33.

⁷ Langley, J. N., *J. Physiol.*, 1891, **12**, 347.

⁸ Langley, J. N., *Ibid.*, 1891, **12**, 375.

ine was not used in any of the experiments. The response of the chronically denervated limb to injections was compared to that on the normal side, after which, in some cats, the remaining abdominal sympathetic chain was acutely removed and the experiments repeated. The acute sympathectomy had no systematic effect on the response of the chronically denervated limb as compared to the previous response. There was, moreover, no systematic difference in limb-volume response to acetylcholine measured before and after the acute sympathectomy.

After each experiment the plethysmographs were calibrated by the injection from a hypodermic syringe of measured volumes of water into the rubber tubes connecting the limb vessels with float microrespirometers which were used, with suitable levers, for the recording. Each plethysmograph gave displacements on the drum of approximately 16 mm per 0.5 cc and they seldom deviated from each other by more than 1 mm per 0.5 cc. For experiments in which deviations of one or more millimeters per 0.5 cc occurred between the two plethysmographs, correction factors were applied to make the readings comparable.

Results. When all 4 of the abdominal ganglia in question (from the 6th lumbar caudad) are removed unilaterally, and when care is taken to avoid injury to the contralateral chain, there is clear evidence of sensitization to acetylcholine on the chronically denervated side. The importance of these conditions was not realized until negative results were obtained with a number of cats in which fewer than the 4 ganglia had been removed and in which possible damage to the contralateral chain during the operation was not ruled out.

Immediately after injection of acetylcholine the limb volume at first usually falls slightly and then increases markedly. The initial fall is variable and may be absent. It is possible that skin volume and muscle volume in the limb are affected in opposite ways. Fig. 1 shows increases of leg volume and changes of blood pressure in response to 0.3, 3.0 and 5.0 γ of acetylcholine. The upper tracing is from the leg on the side partially denervated 24 days before the experiment by the removal of 2 ganglia and the crushing of a third in a way that may have injured the contralateral side. Clearly there is no difference in response on the 2 sides in this cat. Operations on 6 out of 10 cats were unsatisfactory for the reasons mentioned. In this group the mean ratio of maximal plethysmograph rise (in mm) on the chronically denervated side to that on the intact or acutely denervated side for 26 intravenous injections of acetylcholine

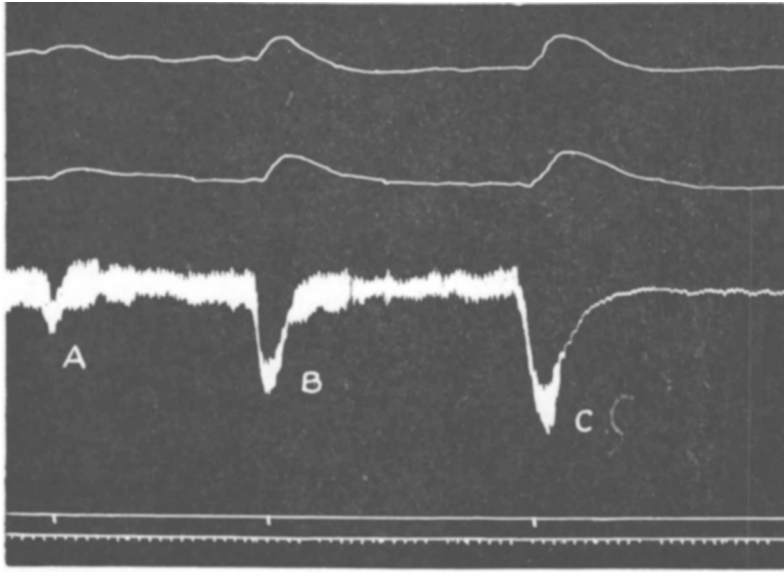


FIG. 1.

Cat in which only part of the sympathetic supply to the right hind limb (upper tracing) had been removed 24 days earlier. A, B and C correspond to injections of 0.3, 3.0 and 5.0 γ acetylcholine, respectively. The responses are the same on the normal and chronically denervated sides. Lower tracing shows blood pressure.

(ranging from 0.1 to 5.0 γ) was 0.96, or practically unity, with extremes for the ratio ranging from 2.0 to 0.4.

In 4 of the 10 cats all 4 of the ganglia (L6 and 7, S1 and 2) were removed unilaterally. Fig. 2 shows leg-volume increases and blood-pressure changes in one of these cats in response to doses of 0.3, 0.8, 2.0 γ acetylcholine. The lower tracing from the chronically denervated leg clearly reveals a larger rise. One of these 4 cats gave no response at all to acetylcholine on its normal side, while giving typical responses on its denervated side. In the remaining 3 cats, 18 intravenous injections of acetylcholine, ranging from 0.1 to 5.0 γ , were made. The mean ratio of the responses on the chronically denervated side to those of the intact or acutely denervated side showed an average sensitization, thus measured, of 230%. Extremes for the ratio for this series ranged from 1.4 to 5.0.

The writer wishes to express his thanks to Dr. W. B. Cannon and Dr. A. Rosenbluth for suggestions and operational aid in connection with this study.

Summary. Sensitization to intravenous injections of acetylcholine by sympathetic denervation of the hind limbs of cats is demonstrated plethysmographically. It is emphasized that care must be

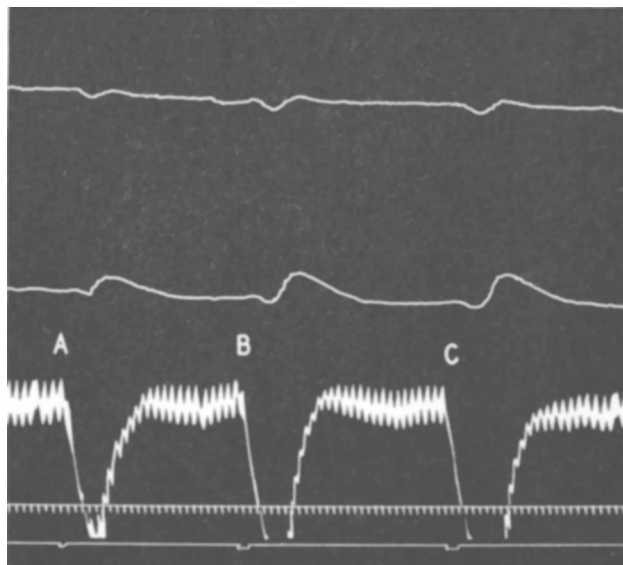


FIG. 2.

Cat in which 4 ganglia, the last 2 lumbar and the first 2 sacral, were removed on the left side (lower tracing) 20 days before the experiment. A, B and C correspond to the injection of 0.3, 0.8 and 2.0 γ acetylcholine, respectively. The chronically denervated side shows a considerably larger response to acetylcholine than does the normal side.

taken to remove completely the sympathetic supply to the limb in question in order to observe sensitization.

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A Protein-Free Medium for Primary Isolation of the Gonococcus and Meningococcus.

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It is desired to report the development of a transparent, reproducible medium, containing no heat-labile material such as serum, which is sufficiently stable to withstand autoclave sterilization and storage, and which will support satisfactory primary growth of either meningococci or gonococci. The latter were used as the test

* Aided by a grant from the Commonwealth Fund.