

PROCEEDINGS.

VOL. 29.

MAY, 1932.

No. 8.

Southern Section.

Tulane University, April 8, 1932.

6144

Treatment of Experimental Ileus by Hypertonic Saline Solutions.

ALTON OCHSNER, I. M. GAGE AND R. A. CUTTING.

From the Department of Surgery, Tulane University School of Medicine.

Largely due to the observations of Hughson and Scarff¹ that the intravenous administration of hypertonic sodium chloride solutions increased intestinal movement, hypertonic saline solutions have been used clinically in the treatment of ileus. To determine the relative effects of various hypertonic saline solutions the following investigation was undertaken. One hundred and twenty-four observations were made on 63 animals. Of this group only 113 are included in the present study, because in 8 of the instances a physiologic Ringer's solution was employed and in 3 the results obtained could not be used because of a leak in the intestinal balloon. In each instance, kymographic tracings were made of the intestinal movements, and the results presented are based on an analysis of these tracings. In 75 of the instances, the observations were made with the animal submerged in a normal saline bath² ("open abdomen" technic), whereas in 38 the observations were made in the intact, unanesthetized animal ("closed abdomen" technic), which was made possible by the use of a technic previously described.³ The following

¹ Hughson, W., and Scarff, J. E., *Bull. Johns Hopkins Hosp.*, 1924, **35**, 197.

² Ochsner, Alton, Gage, I. M., and Cutting, R. A., *Arch. Surg.*, 1930, **20**, 802.

³ Gage, I. M., Ochsner, Alton, and Cutting, R. A., *PROC. SOC. EXP. BIOL. AND MED.*, 1931, **24**, 264.

solutions were used for intravenous injection: sodium chloride, 20%; "hypertonic" Ringer's solution; "hypertonic" Hartmann's combined solution; sodium chloride, 20%, and calcium chloride, 5%; sodium chloride, 20%, and calcium chloride, 0.5%; sodium chloride, 20%, and potassium chloride, 0.5%. Ten observations were made on normal animals, 13 on animals with 24-hour intestinal obstruction, 49 on animals with 48-hour obstruction, and 41 on animals with 72-hour obstruction.

Twenty-one observations were made following the intravenous injection of 20% sodium chloride solutions, employing the "open abdomen" technic. The average dose was 8.4 cc. per kilo of body weight. In 90.4% of the instances there was an increase in intestinal activity, in 4.7% there was no change, and in 4.7% there was a decrease in intestinal activity. The average increases in tone and amplitude were 28.6 and 5.05 mm., respectively. The average duration of this activity was 11.1 minutes. The percentage increase in blood chlorides was 23.1%. "Hypertonic" Ringer's solution (sodium chloride, 18%; calcium chloride, 0.52%; potassium chloride, 0.6%) was used in 67 instances. The "open abdomen" technic was used in 39 and the "closed abdomen" technic in 18. The average dose in the former group was 2.5 cc. per kilo of body weight. In 97.3% of these observations there was an increase in gut activity, whereas in 2.6% there was no change. The average increases in tone and amplitude were 61.2 mm. and 18.4 mm., respectively. The average duration of the increased activity was 17.5 minutes. The average percentage increase in blood chlorides was 22.5%. The average dose employed in the "closed abdomen" experiments, using "hypertonic" Ringer's solution was 1.17 cc. per kilo of body weight. In 94.7% there was an increase in gut activity, whereas in 5.5% there was no change. The average increases in tone and amplitude were 13.1 mm. and 2.9 mm., respectively. The average duration of the increased activity was 17.6 minutes. The average percentage increase in blood chlorides in the "closed abdomen" experiments was 23.4%.

Twenty observations were made concerning the effect of "hypertonic" Hartmann's solutions* (sodium chloride, 11.7%; sodium lactate, 5.6%; potassium chloride, 0.74%; calcium chloride, 0.54%, obtained by adding 5 cc. to the contents of a 20 cc. ampoule of concentrated Hartmann's solution). The average dose employed was 1.16 cc. per kilo of body weight. In 95% there was an increase in activity; in 5% no change. The average increases in tone and am-

* Hartmann's solution was kindly furnished us by the Eli Lilly Company.

plitude were 20 mm. and 3.6 mm., respectively. The average duration of this increased activity was 20.2 minutes.

Four observations were made concerning the effect of sodium chloride, 20%, and calcium chloride, 5%. The average dose employed was 2.7 cc. per kilo of body weight. There was an increase in gut activity in all observations. The average increases in tone and amplitude were 25.7 mm. and 12.5 mm. respectively. The average duration of increased activity was 17.2 minutes.

Five observations were made concerning the effect of sodium chloride, 20%, and calcium chloride, 0.5%. The average dose was 2.2 cc. per kilo of body weight. In all instances there was an increase in gut activity. The average increases in tone and amplitude were 73.8 mm. and 16.6 mm., respectively. The average duration of the increased activity was 19.2 minutes.

Six observations were made concerning the effect of sodium chloride, 20%, and potassium chloride, 0.5%. The average dose employed was 4.6 cc. per kilo of body weight. There was an increase in intestinal activity in 83.3%, in 16.6%, no change. The average increases in tone and amplitude were 58 mm. and 19.4 mm., respectively. The average duration of the activity was 19 minutes.

It is evident from these experiments that "hypertonic" Ringer's solution or "hypertonic" Hartmann's solution is more efficacious than is 20% sodium chloride in stimulating obstructed intestine. Even though much larger doses of sodium chloride were employed (8.4 cc. per kilo of body weight) there was an increased intestinal activity in only 90.4%, as compared with 97.3% in which "hypertonic" Ringer's solution was used. The increases in tone resulting from the intravenous administration of sodium chloride, 20%, and "hypertonic" Ringer's solution were 28.6 mm. and 61.2 mm., respectively. The increases in amplitude were 5.05 mm. and 18.4 mm., respectively. The duration of the increased activity was 11.1 minutes and 17.5 minutes, respectively.

Conclusions. Hypertonic sodium chloride and hypertonic salts containing potassium and calcium chloride are efficacious in stimulating normal and obstructed intestine. Those solutions which contain calcium and potassium are more efficacious than when sodium chloride alone is used. Apparently the combination of sodium chloride and calcium is more efficient in its action than the combination of sodium chloride and potassium chloride.