neurasthenia is primary, in many cases producing general myasthenia. Not until the muscular power of the stomach fails, from general causes, does the patient suffer.

Dr. J. DUTTON STEELE, Philadelphia.—I agree with everything that has been stated with regard to the etiology. I can not take issue with what Dr. Turk has stated for I have never been able to see how gastric motor insufficiency from gastropnoxis is different from an insufficiency from any other cause. I think it is very important that every physician should outline the stomach in all patients who come to him with symptoms of such a condition. It may influence the kind of treatment employed.

THE PURSE-STRING SUTURE IN GASTRORRHAPHY FOR GUNSHOT WOUNDS.—AN EXPERIMENTAL CONTRIBUTION.*

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One of the important elements of success in the treatment of gunshot and stab wounds of the stomach is time. Unnecessary time lost in finding and suturing the visceral wounds is a source of immediate danger to life which should be eliminated as far as possible by means which enable the surgeon to make a quick and correct diagnosis and by resorting to a method of suturing which closes the wound safely and securely with the least possible delay and which leaves it in a condition most favorable for speedy definitive healing. It is well known that small penetrating wounds of the stomach often heal without operative intervention. By contraction and relative displacement of the different muscular layers of the thick wall of the stomach the tubular wound is contracted and obstructed sufficiently to prevent leakage until the canal on the peritoneal side becomes hermetically sealed by firm plastic adhesives which prevent extravasation during the time required for the repair of the visceral wound. If in larger wounds of the stomach the same degree of occlusion can be accomplished by the simplest mechanical means then such a procedure should take the place of the more time-consuming methods of suturing now in general use. This can be accomplished with the purse-string suture. (To Dr. Dawbarn of New York belongs the credit of having first suggested the use of the purse-string suture in the treatment of small perforations of the gastrointestinal canal.)

In gunshot injuries the defect in the stomach wall is circular, the wound margins contused, hence the deep sutures could at best furnish a barrier to the escape of stomach contents only for a short time, as their hold in the necrosed tissues would be imperfect and only of brief duration. In small, round wounds the circular suture is the one which will bring and hold together in permanent, uninterrupted contact the serous surfaces in the most efficient manner. In the treatment of gunshot wounds of the stomach the principal object of suturing should be to close the perforation in such a way as to guard securely against extravasation and at the same time approximate and hold in apposition a maximum surface of intact healthy peritoneum. This is accomplished by making a cone of the injured part of the stomach with the apex corresponding with the wound directed toward the lumen of the organ. The purse-string suture applied in a manner that will be described in the experimental part of this paper, will maintain this cone until the healing of the visceral

wound has advanced sufficiently to render further mechanical support superfluous. The cone on the mucous side of the stomach acts in the manner of a valve, which in itself is an effective barrier against the escape of stomach contents, while the circular suture constitutes almost an absolute safeguard against leakage and brings in contact the serous surfaces in the interior of the cone. For wounds of the posterior wall of the stomach I recommend a purse-string suture of heavy durable catgut to be applied through the anterior wound. The anterior wound is closed with a purse-string suture of silk of medium size applied to the base of the cone on the serous side. It is desirable that the circular suture should cause no necrosis of the included tissues. By using an absorbable suture in closing the posterior wound in the interior of the stomach this object is gained, as only a small part of the thickness of the stomach wall is subjected to pressure, and the tension caused by the ligature is gradually lessened by softening of its material and is entirely removed by the absorption and digestion of the ligature in less than three weeks.

The wound of the posterior wall of the stomach is

Fig. 1.—Case 4. Showing irrigation of bursa omentalis through the opening in the posterior wall of the stomach.

found and made accessible by inserting through the anterior wound a grasping forceps with which the posterior wall is seized at a point where, from the course of the bullet, the second wound is supposed to be located. Through a wound large enough to admit the index finger the greater part of the posterior wall of the stomach can be made accessible to sight and touch, and the perforation can be located and closed with the purse-string suture in a few moments. In doubtful cases inflation of the stomach should invariably be practiced for the detection of a second and possibly a third perforation.

EXPERIMENTS.

The following experiments were made for the purpose of demonstrating the practical utility of the purse-string suture in the treatment of perforating wounds of the stomach.

CASE 1.—Dec. 23, 1901, a white and brown medium-sized male dog was chloroformed and through a median incision three inches in length the anterior surface of the stomach was exposed and brought forward into the wound. A vertical visceral incision was made an inch in length about one inch above the curvature and half-way between the cardiac and

* Presented to the Surgical Section of the British Medical Association, Manchester, July 30, 1902.

pyloric ends. Through this opening the posterior wall was seized with a forceps and drawn into the wound in the form of a cone. Around the base of this cone a purse-string catgut No. 3 ligature was applied, taking four seizures which included all the tunics except the peritoneum. The apex of the cone was then amputated, making a perforation large enough to insert the tip of the little finger. The anterior wound was next closed by taking five seizures half an inch from the wound margins with a needle armed with medium-sized silk which included all of the coats except the mucous membrane. Before the circular suture was tied the margins of the wound were deeply inverted in order to secure apposition of large serous surfaces. The abdominal incision was closed with four deep silk sutures and three superficial sutures of fine silk and the wound sealed with collodion. The dog was fed as usual,

Fig. 2.—Case 4. Purse-string silk suture in place.

took his food with a relish and at no time manifested any untoward symptoms.

Postmortem.—The dog was killed five days later, when the following conditions were found: External wound firmly united, no peritonitis. Anterior wound of stomach healed, a narrow strip of omentum adherent over the encysted silk purse-string suture. Posterior wall of stomach free and wound healed. On opening the stomach small granulating points indicated the location of the wounds.

CASE 2.—Small brown poodle dog. Operation the same as in the preceding case only with this difference, that the wound in the posterior wall made by the circular excision was large

Fig. 3.—Showing result of purse-string silk suture closing anterior wound in stomach wall.

enough to insert three fingers; consequently, more seizures were made in applying the catgut purse-string suture, and the ligature was applied after the wound was made. Before tying the ligature the peritoneum of the wound margin was seized with forceps at two opposite points and traction made so as to include as much as possible of it in the grasp of the circular suture. In applying the anterior suture the seizures, four in number, were taken three-quarters of an inch from the margins of the visceral incision and with forceps the peritoneum was pushed as far as possible in the direction of the cavity of the stomach with the same object in view. The dog recovered without any untoward symptoms notwithstanding he was fed on the coarsest kind of food from the time of operation until he was killed, twenty days later.

Postmortem.—External wound firmly united. Firm adhesion over a point corresponding with the location of the underlying encysted silk suture. Posterior wound healed perfectly without any external adhesions. The stomach was removed and opened at the lesser curvature. The mucous membrane over the entire surface of the stomach was normal and it was exceedingly difficult to locate the minute scars in its folds. The catgut ligature had disappeared and the cone was reduced to the level of the surrounding mucous membrane. The silk ligature was firmly encapsulated.

CASE 3.—Small black bitch. Anterior and posterior wounds were made before the ligatures were applied. The external incision was closed by six deep silk sutures and sealed as usual with collodion. The experiment was made January 3 and the dog killed on the 31st with chloroform.

Postmortem.—Anterior surface of the stomach smooth and only a very circumscribed omental adhesion over the silk suture. The stomach was removed and no mark could be discovered on the posterior surface to indicate the location of the perforation. On opening the stomach the exact location of the anterior wound could only be determined by a circumscribed thickening of the wall, covered by normal mucous membrane, which was thrown into radiate minute folds the center of which corresponded with the exact location of the wound. The posterior wound healed in the same ideal manner.

CASE 4.—Small brown male dog. In this experiment the feasibility of flushing the retrogastric space was demonstrated after making wounds in the anterior and posterior walls of the stomach as large as wounds inflicted by large-caliber bullets. The nozzle of the irrigator was firmly fixed in the posterior wound by tying the purse-string in the form of a loop over it (as shown in the illustration). After the irrigation the nozzle was removed and the suture tied in the usual manner. Anterior wound closed with circular silk suture. The dog was killed four weeks later.

Postmortem.—Findings the same as in the preceding experiment.

REMARKS.

The above experiments demonstrate the safety of the circular suture in the treatment of gunshot and other penetrating wounds of the stomach. All of the animals operated on in this manner recovered, and the repair of the injuries as shown by the specimens was ideal. The absence of adhesions over the posterior wound and their constant presence over the anterior wound indicate that the presence of the silk ligature and the needle punctures were the causes of the circumscribed plastic peritonitis which produced them. In none of the specimens could any indications be found of necrosis of any of the inverted tissues and included in part by the circular suture.

In the course of three weeks the continuity of the mucosa at the seat of the injury was completely restored. The result of these experiments have convinced me that the circular suture compares favorably with the methods of suturing in general use and besides has the great advantages over them in the ease of its application and the saving of much valuable time.

Suturing of the posterior wound by partial eversion of the stomach through the anterior obviates unnecessary handling of the organ, and the necessity of interfering with the vascular supply incident to exposure of the posterior wound as is done by the methods now generally practiced. If extravasation into the lesser peritoneal cavity has taken place, flushing through the posterior wound and a vertical slit in the gastrocolic ligament and gauze drainage through the latter are invariably indicated.

When a urinary antiseptic is needed try lithium benzoate. It is eliminated through the kidneys, increases the flow of urine and sedates the urinary tract.