

make extravagant claims for the intravenous method, but I do claim that there is nothing which the intraspinal method achieves that cannot be accomplished by the intravenous.

When it is remembered also that in more than a thousand intravenous injections given to patients under my care at the hospital, we have had but two or three untoward results and not a single fatal termination that could in any way be attributed to the salvarsan injections, there seems to be no reason to resort to the more dangerous and to the patient more costly intraspinal method.

My impressions, based on experience of the actual achievements by the intravenous injection of salvarsan are as follows:

The best results are obtained in the cases of cerebrospinal syphilis that are either distinctly vascular in origin or are of the meningo-encephalitic and meningo-myelitic type. The meningosyphilitic cases that so often suggest the possibility of latent paresis have been cleared up by a few salvarsan injections. The immediate effect has often been most striking; but however great the immediate effect may have been, I have always made it a practice, even in such cases, to push the intravenous treatment until I was reasonably certain that the morbid process had either been checked or at least made less active. There is often difficulty in establishing the differential diagnosis between these meningo-encephalitic cases and those of true general paresis, so that the doubt may arise whether or not some of the cases of general paresis claimed as cures may not have been cases of this type. Meningomyelitis of the syphilitic type also yields to intensive treatment in the most satisfactory way. The spastic forms of spinal paralysis, the Erb type in particular, which is in all probability a form of a true degenerative disorder, gives unsatisfactory results. In a number of these patients I have been able to bring about all degrees of reductions in the Wassermann reaction and in the cell count, but have never been able to cure, rarely enough ever to improve, a true spastic paraplegia such as Erb described.

As for *tabes dorsalis*, I cannot claim any actual cure, but in reviewing my cases and seeing the patients months and years after treatment had been instituted, there is no doubt that the patients were satisfied with the results of treatment; that they are better in many ways, and that we cannot afford to disregard this treatment in *tabes* without, however, claiming more for it than the results justify. There is no doubt that in many instances the vesical symptoms, the sexual impotence, the lightning pains, even the gastric crises, have disappeared under intensive intravenous treatment. On the other hand, I am firmly convinced that in a large number of cases, particularly in private practice, in which the intravenous treatment has been given from the outset, the symptoms have progressed, and full-fledged *tabes dorsalis* has been developed in much the same way that it would have progressed if no active treatment had been given. The meningo-myelitic forms of a tabetic type are the ones that can be benefited most readily.

Finally, in general paresis, salvarsan treatment has not helped me to effect a cure, but it has in some instances retarded the rapid progress of the disease. It has permitted, if not caused, marked remissions to be established for a considerable period of time. Some believe these remissions are the expression of antibody formation. Following the treatment, a number

of the patients have been enabled to return to their accustomed work for one, two or even more years, but I do not claim that a single patient suffering from general paresis has been cured of his disease by this or any other method.

The problem for the future is to find some more diffusible remedy, lipid soluble and less toxic than salvarsan that would be able to pass through the blood stream into the tissues of the brain through the choroid plexus into the spinal canal and attack the foci of spirochetes wherever they may happen to be located. We need not despair of the future, and I believe that if the neurologist and the laboratory worker will cooperate with one another in a rational and impartial manner, an era of satisfactory antisyphilitic therapy may happily dawn on us.

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## INTRAVISCERAL AND INTRA-ABDOMINAL PRESSURE \*

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The peripheral abdominal wall is a flexible structure, composed chiefly of flexible and elastic muscle enclosed in a flexible but nonelastic aponeurosis. While the wall is flexible to a large degree, it is collapsible only in its front portion. The collapsible portion, or anterior abdominal wall, contrary to the ordinary belief, is but slightly elastic under an ordinary acute strain, owing to the strong layers of aponeurosis surrounding the muscles. Except in chronic processes, such as the development of a tumor by cellular increase, a cyst or ascites, which has behind it the blood pressure or pregnancy, there is but little change in the capacity of the abdomen of an otherwise normal person. Extreme distention of the abdomen may noticeably enlarge the abdominal cavity by pushing up the diaphragm at the expense of chest capacity. By elevation of the ribs, the girth of the upper portion of the abdomen may be increased, but the lower or middle part of the abdomen will be correspondingly diminished. Elevation of the ribs plus extreme distention of the abdomen make tense and collapsible part of the abdominal wall, and increase the girth of the abdomen at all points; but the only actual increase of abdominal capacity is made at the expense of chest capacity by elevation of the diaphragm. The abdominal cavity is air tight, but is by no means a vacuum.

There is always a variable and indefinite amount of pressure in the peritoneal cavity, known as intra-abdominal pressure. This pressure may be greater, but is usually less than the atmospheric pressure.<sup>1</sup>

The degree of intra-abdominal pressure depends on the variable contents of the abdominal cavity. The variable contents are: (a) extraperitoneal and mesenteric fat; (b) the visceral contents. The visceral con-

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1. This paper was presented in New York from hurriedly prepared notes and lantern slides. At that time I made the unwarranted statement that the pressure within the abdomen was greater than atmospheric pressure. Dr. Edward Martin of Philadelphia, who opened the discussion, very properly assailed this statement. I think Dr. Martin was entirely right in his statement that the pressure within the abdomen is ordinarily less than atmospheric pressure, but the question of whether the pressure is more or less than atmospheric pressure need not influence the vital part of this subject, which is "the relative amount of intravisceral and intra-abdominal pressure."

tents are liquids and gases and may be intermittently expelled at any time, thus acting as an immediate safety valve for the establishment of an equilibrium and a normal intra-abdominal pressure. The extra-peritoneal and mesenteric fat is included within the inelastic abdominal wall, and lessens the abdominal cavity in exact proportion to the amount of fat thus included.

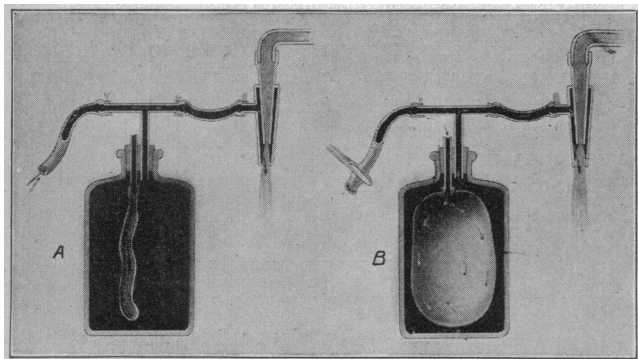


Fig. 1.—Experiment to illustrate the relation of intra-abdominal to intra-visceral pressure: *A*, air in jar and in bag in state of equilibrium; suction not operative on contents of jar; *B*, pressure in jar being reduced by suction apparatus, showing inrush of air and distention of rubber bag in the effort to reestablish equilibrium.

The law of osmosis, by which fluids of different densities pass through an animal membrane and establish an equilibrium, has its counterpart in the relation of intra-abdominal and intravisceral pressure.

I made an interesting experiment, as follows: An ordinary suction apparatus, connected with a water faucet by a rubber tube, which in turn is connected with an aspirating bottle by a T connection, tends to create a vacuum in the bottle, provided the distal end of the horizontal portion of the T is closed. If it is not closed, the air is drawn directly through the tube from the outside, and the air in the bottle remains in a state of equilibrium. If a very thin rubber bag

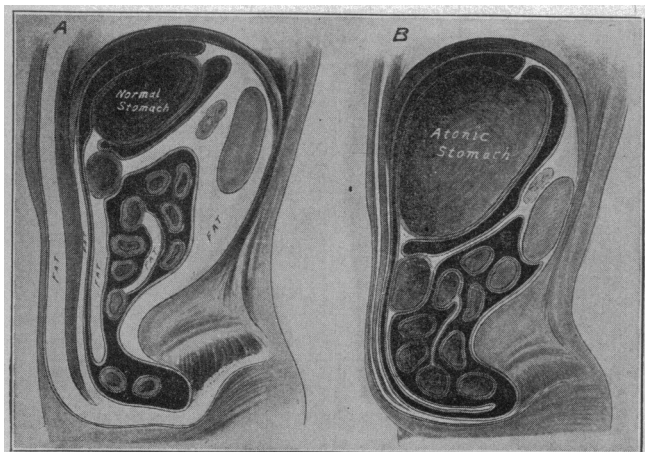


Fig. 2.—Diagram illustrating the rôle of fat in maintaining the tonicity of the hollow viscera: *A*, normal amount of fat in fairly stout person (fat represented by white); stomach and intestine of normal thickness and size; *B*, patient reduced in health, fat having been absorbed; abdominal cavity is enlarged, intra-abdominal pressure is reduced, and hollow viscera are extended and thinned in an effort to establish an equilibrium as shown in Figure 1B.

is suspended in the bottle by a hollow tube passing through the cork and connecting the bag with the outside atmosphere, the air within the bag and within the bottle remain in a state of equilibrium so long as the distal end of the T connection remains open (Fig. 1 *A*).

If this distal portion of the T connection is closed by forceps (Fig. 1 *B*), suction at once begins to reduce the pressure within the jar and thus tends to make a vacuum. Immediately the atmosphere rushes into the enclosed, suspended rubber bag and distends it in proportion to the degree of vacuum thus produced in the jar.

Thus, a law parallel to the law of osmosis can be formulated: If a thin, elastic container with an outside connection for a source of supply of fluids or gases is enclosed within an inelastic container, there is a constant tendency to establish an equilibrium of pressure. Thus, if a portion of the contents, consisting either of gas or of other substance, is withdrawn from the outside, inelastic container, the pressure on the outer surface of the elastic container is reduced, and a corresponding inflow of contents is brought into the elastic container from the outside, for the purpose of establishing an equilibrium.

In the case of the abdomen, the abdominal wall is the outside, inelastic container, and the hollow viscera represents the inside, elastic container with the outside source of supply through the mouth. Within, and partially filling the abdominal cavity, is a variable

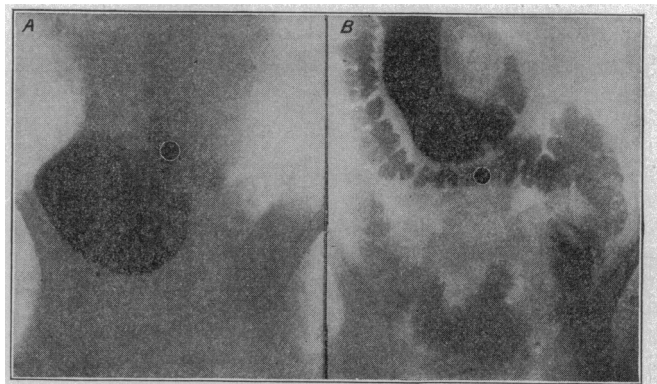


Fig. 3.—Roentgenogram illustrating the influence of fattening on position and tonicity of the hollow viscera: *A*, prolapsed, dilated, atonic stomach of a young woman who was a bed invalid, weighing 62 pounds; *B*, small, tonic stomach, with normal peristaltic waves, observed in same patient two months later, after forced feeding and increase of weight to 119 pounds; patient restored to perfect health by no other treatment than forced feeding. (Courtesy of Dr. Sears, who directed the treatment.)

quantity of fat. Intra-abdominal fat is apparently deposited under much lower pressure than are the cells of a tumor, pregnant uterus or ascitic fluid. The deposition of fat, therefore, within the abdominal cavity does not materially stretch the abdominal wall in a normal person. However, it is sufficient to increase the size of an already existing umbilical or postoperative ventral hernia. If a large umbilical or postoperative ventral hernia exists for a long time in a fat patient, intra-abdominal fat is deposited in proportion to the contents of the hernial sac, making it difficult, and at times impossible, to replace the hernial contents without removing some of the abdominal contents, such as the great omentum.

A patient who has been moderately fat for some reason loses flesh; the fat in the abdomen is correspondingly absorbed (Fig. 2 *A* and *B*). The intra-abdominal pressure is lowered, and there is a tendency to a gradual, atonic dilatation of the hollow viscera in establishing an equilibrium. Digestion is disturbed, bowel action becomes torpid, and all of the secretions are below par. The patient often develops into that low state of health ordinarily referred to as "asthenic,"

and, in extreme cases, has even been referred to as "neurasthenic." If this poor state of health is permitted to go on for months or years, the abdominal muscles become weak and flabby and give way under the malnutrition and gas distention as well as the weight of the lowered organs, until finally the entire shape of the abdomen is changed.

The late Weir Mitchell evolved a successful empiric way of treating these patients by rest, recumbency, forced feeding and massage. Being a neurologist, he attributed his success to "padding the nerves with fat." To the plan of treatment thus evolved by Mitchell, the orthopedic and postural phases of the subject have been added, and have been notably developed by Goldthwaite of Boston and Franklin H. Martin of Chicago.

Dr. N. W. Jones states that he has frequently been able by these methods to increase the girth of the abdomen at the rib arch 6 inches or more—largely by position and exercises which tend to lift the chest and upper abdomen and strengthen the muscles of the lower abdomen. Thus, we may say that by strengthening and

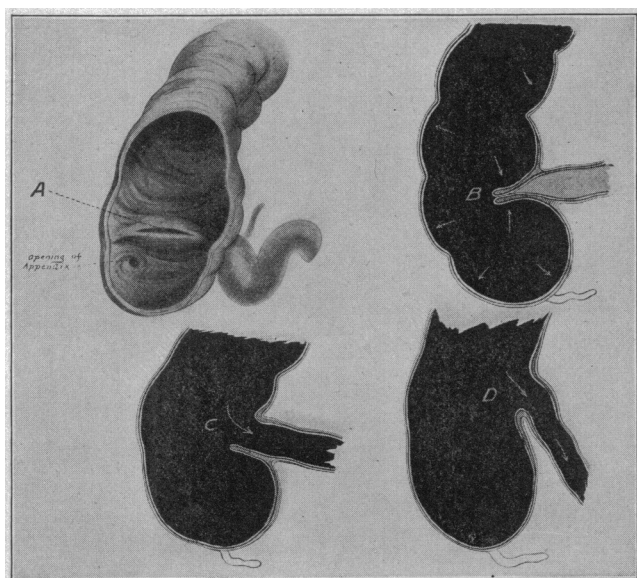


Fig. 4.—Anatomical importance of the ileocecal valve: *A*, ileocecal slit and valve (Gray's Anatomy); *B*, diagram illustrating a competent ileocecal valve (elaborated from Gray's Anatomy); *C*, partial incompetence of ileocecal valve (Kellogg); *D*, complete incompetence of ileocecal valve (Kellogg).

readjusting the abdominal wall, combined with the deposition of fat within the abdomen, the normal intra-abdominal pressure can be restored. Roentgenologic examination of patients relieved by these methods often shows that a stomach which is ptosed and atonic before treatment assumes its normal position, takes on its normal size and normal peristaltic action after treatment. Figure 3 *A* and *B* shows but one of many similar results which I could exhibit. In a certain percentage of these patients the cecum and ascending colon are entirely mobile and have a long mesentery with acquired bands, referred to by Lane, which may attach to the colon in an effort to hold it up, and which may cause great pain on the right side (usually taken for appendicitis), or may come across the duodenum, making a direct drag on the duodenum (producing symptoms similar to duodenal ulcer). These cases are often definitely surgical, but the surgical measures which, in my opinion, should always be limited to replacement and indirect fixation, must be followed by increase of intra-abdominal pressure through deposi-

tion of fat combined with athletic development of the abdominal wall.

Having briefly discussed the relation of intravisceral to intra-abdominal pressure, and its bearing on clinical medicine, I shall next consider the relative pressure in the various parts of the intestinal canal, and its clinical importance. The word "jejunum" means empty. Very

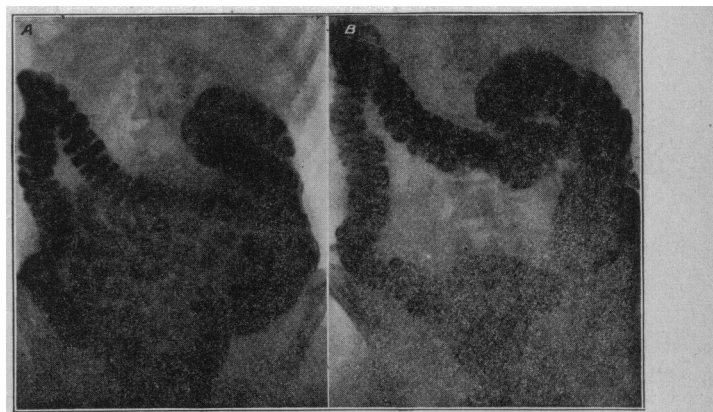


Fig. 5.—Roentgenogram showing case of completely incompetent ileocecal valve, before and after operation: *A*, complete incompetence of the ileocecal valve, showing filling of entire small intestine with barium enema; clinical symptoms very marked; *B*, intestine of same patient two months after operation; roentgenogram taken by same technic as in Figure 5 *A*; clinical symptoms entirely relieved. (Another picture taken one year after operation showed valve still competent. A picture taken two years after operation showed partial incompetence of valve, and partial return of clinical symptoms.)

little gas or fluid is found in it at one time. As the food passes down to the ileum, gas begins to form, and the intravisceral tension is greater. In the large intestine, a portion of the food and waste takes on bacterial digestion, producing a great deal of gas, and as a consequence the pressure within the large intestine is much greater than within the small intestine. So great is this liability to distention that nature has produced a valve, which has been done by a form of intussusception of the small bowel into the large (Fig. 4 *A* and *B*). This valve in a normal person is usually

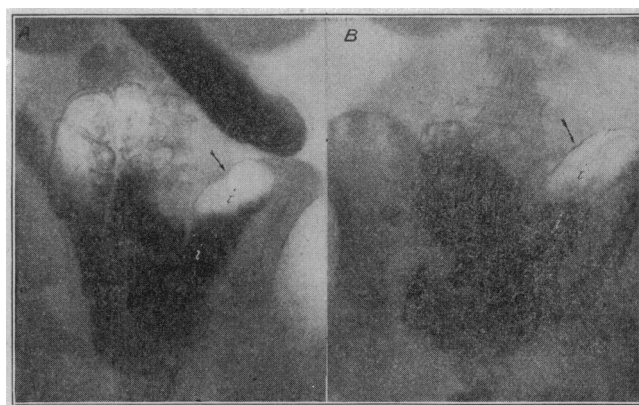


Fig. 6.—Roentgenogram showing distended ileum which commonly follows ileocolostomy: *A*, ileum distended with gas and barium, immediately after one meal and twelve hours after another; *B*, barium and gas in widely distended ileum twenty-four hours after meal.

competent, so it is often found that the large intestine is intensely distended while the small intestine is relatively collapsed. A peristaltic wave traveling from the cecum toward the hepatic flexure creates diminished intravisceral pressure behind it. This diminished intravisceral pressure, following in the wake of the peristaltic wave, permits the ileum to empty a portion

of its contents into the distended large intestine. When the wave has exhausted itself, the normal intra-intestinal pressure is again resumed and the valve again closed. The gradual obstruction of the large intestine in its lower portion, by a growth of any kind, often produces such extreme intra-intestinal pressure as to reduce the normal intussusception of the small intes-

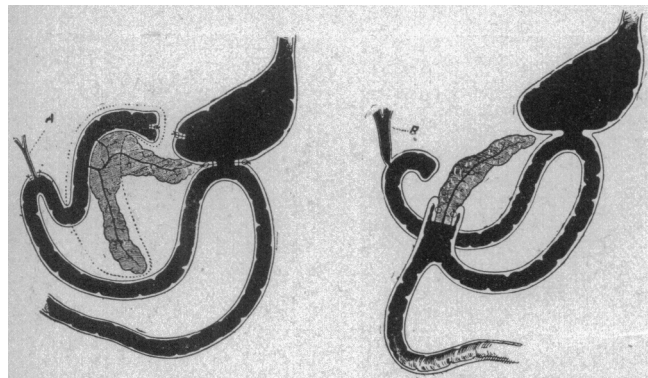


Fig. 7.—The result of the direct implantation of the bile duct into the intestine: *A*, direct implantation of the bile duct, without valve protection; *B*, bile duct a month later, showing distention from intra-intestinal pressure.

tine into the large and thus destroy the competence of the ileocecal valve. This I have demonstrated in doing Brown's ileostomy for obstruction in the sigmoid, for in those cases fluid passed through the distal segment of the ileum into the large intestine usually runs back, even though the obstruction has been removed below, while in ileostomy performed for ulcerative colitis, the colon may usually be flushed out through the distal segment of the ileum without a return from the colon through the ileocecal valve. Long-continued constipation, with large accumulations of gas in the cecum, is frequently followed by incompetence of the ileocecal valve, as pointed out by Kellogg and Case. If this incompetence is complete and the regurgitation

functional satisfaction and complete mechanical cure, as shown by the pictures before and after operation. Figure 5 *A* and *B* shows one of six similar cases. While I do not do the operation exactly as Kellogg recommended, I used his idea, and was surprised at the results, for I did not expect much of it. As yet, however, I am not prepared to say how valuable the procedure is.

I have had occasion to operate on a considerable number of patients who had had short-circuiting operations performed by other surgeons who used Lane's method. In some cases, performed by amateurs afraid to do the complete operation, a simple ileosigmoidostomy without severing the distal portion of the ileum had been performed. In all cases, whether or not the ileum was severed, it was very much dilated, showing that when the ileum is subjected to the greater pressure, of the large intestine by an absence of an ileocecal valve it becomes permanently dilated, no matter whether there are clinical symptoms or not. Figure 6 *A* and *B* shows this point in one of my own cases following ileosigmoidostomy. The colon in this case was later removed, at which time the ileum was found to be much distended and thick and contained semi-

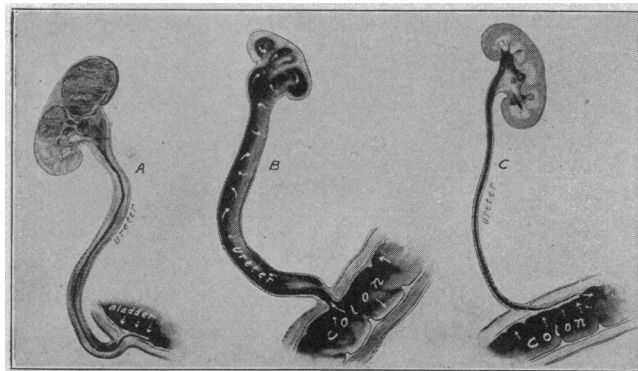


Fig. 9.—*A*, thickened ureter and pus kidney, which may be produced experimentally by infecting the tissues around the lower end of the ureter (true ascending infection); *B*, "dead kidney" and dilated ureter, following direct implantation of the ureter into the colon; this result has been questionably referred to as "ascending infection;" it is more probable that the kidney has been destroyed and the ureter dilated by intra-intestinal pressure applied to the inside of the ureter; *C*, normal kidney and undilated ureter which follows the submucous, or indirect, implantation of the ureter into the colon.

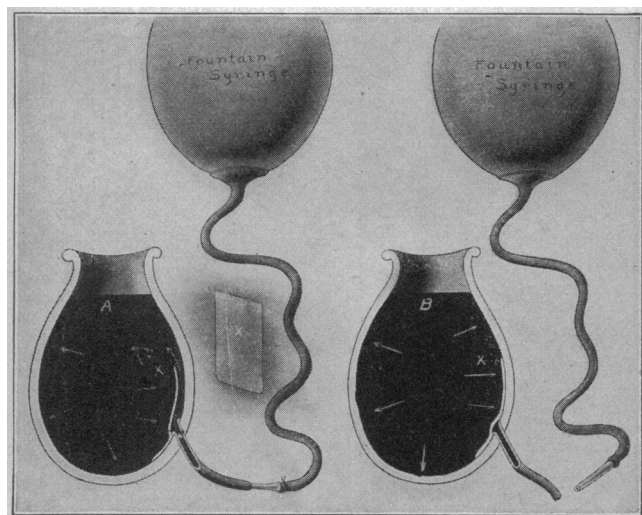


Fig. 8.—Artificial valve in a rubber bag, to illustrate the principle of intravisceral pressure: *A*, fluid flowing into a rubber bag under pressure; *B*, closure of valve as soon as extra outside pressure is removed.

is extensive, it often has important clinical significance. Kellogg has devised an ingenious operation for reproducing the normal intussusception. I have seen a few cases in which the incompetence of the ileocecal valve produced such serious symptoms that I performed a modified Kellogg operation for its relief, with

solid fecal matter for 3 or 4 feet above the point of anastomosis.

Next we may consider the relative degree of pressure in the hollow viscera themselves, and in the glands and ducts emptying into the viscera. In 1908-1909, while I was experimenting with methods for removal of the head of the pancreas in two stages, the first of which included the transplantation of the common bile duct to another portion of the duodenum, it was discovered that the duct which had been directly planted into the duodenum at the first operation was invariably found dilated at the time of the second operation (Fig. 7 *A* and *B*). In one instance the duct was as large as the duodenum itself. The opening of the duct into the intestine was large, and all of the ducts well up into the liver were much dilated. This phenomenon, being observed universally, left but one rational conclusion to be drawn, namely, the greater pressure within the intestine was too much when applied to the inside of the thin bile ducts. Investigation of the duodenum and bile ducts of dogs showed that the normal duct, after passing through the muscular wall of the intestine, passed along immediately under the loose,

movable mucous membrane for a distance of approximately half an inch before it entered the intestinal lumen. This was sufficient explanation of how the normal entrance of the bile duct prevented its dilatation by intra-intestinal pressure. To prove this abstract principle further, a catheter was cemented into a hole in the wall of a fountain syringe. On the inside of the fountain syringe a thin flap, or pocket, was cemented. Another fountain syringe, hung some distance higher, was attached to the catheter through which the fluid was permitted to run from the higher bag into the lower one. When the nozzle was withdrawn from the end of the catheter, the weight of the fluid from within forced the valve closed and no fluid escaped (Fig. 8 *A* and *B*). This problem, then, was clear—the duct must be placed immediately under the loose, movable mucous membrane for some distance before it is permitted to emerge into the lumen of the intestine, if the intra-intestinal pressure is to

Surgeon General's Library, consisting of a review of some 254 articles on the subject, found the admission of practically every experimenter that up to that time a successful method of implanting the ureter into the bladder had not been devised. In the beginning of my experiments with the ureter I found that it also emptied into the bladder in a submucous position. My first set of experiments included six ureters implanted

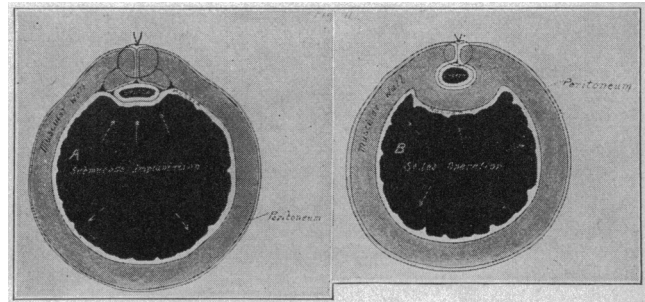


Fig. 11.—Cross section scheme of submucous implantation and of Stiles' operation, for comparison. (See *Surgery, Gynecology and Obstetrics* for technic of Stiles' operation, 1911, 13, 127.)

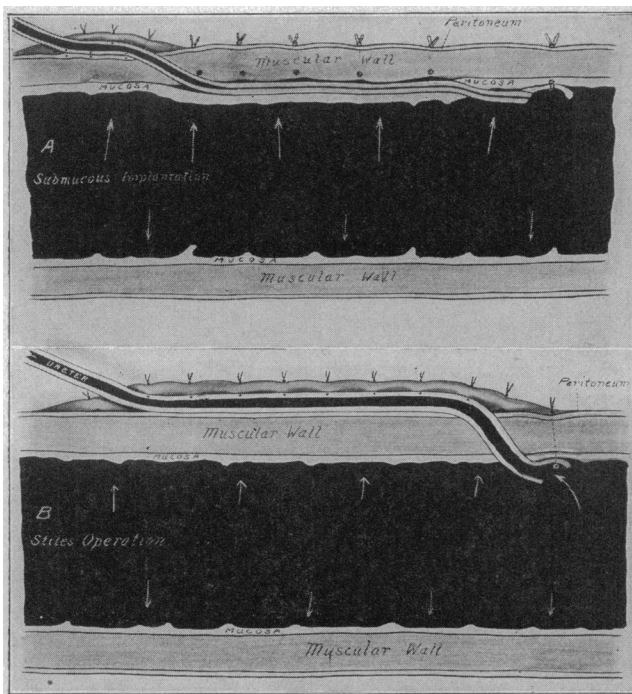


Fig. 10.—Scheme of two methods of ureteral implantation into the colon: *A*, diagram illustrating technic of submucous implantation into the intestine; showing how the intra-intestinal pressure, acting on the movable mucous membrane, collapses the ureter and makes a valve; *B*, diagram illustrating the scheme of Stiles' operation, which is a direct implantation, supplemented by the application of the Witzel principle as applied to gastrostomy; in this instance the ureter runs along on the outside of the intestine, and is covered by folding over it the wall of the intestine; valve action is not probable in this operation, owing to the thickness of the intestinal wall.

be brought to bear in closing the duct. The technic of implanting the duct in this manner was quickly devised and tried on the living dog. Six ducts were implanted by this method, and not a single one of the ducts thus implanted showed material dilatation, in contrast with six implanted by the direct method, all of which were enormously dilated, as stated before.<sup>2</sup>

While this experiment with submucous implantation of the bile duct had been a complete success, so far as creating a perfect valve was concerned, there seemed to be some doubt as to whether the ureter, which entered the bladder in much the same way, could be implanted into the intestine with the same degree of success. A complete search of the literature of the

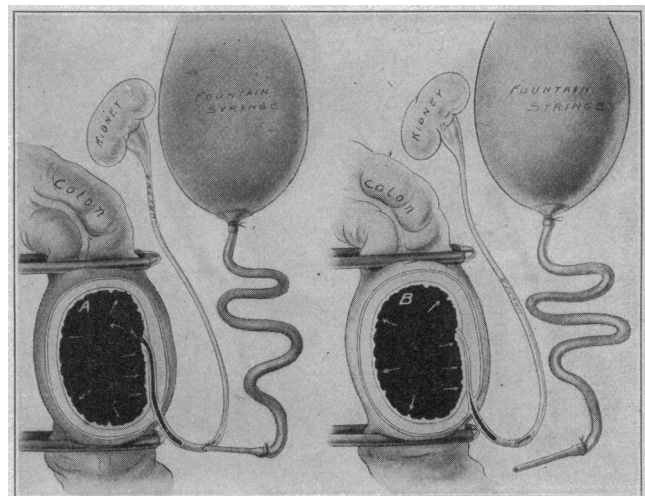


Fig. 12.—Testing competence of the valve in a removed specimen following submucous implantation in a dog: *A*, fluid run into the segment of intestine including the implantation area under pressure; *B*, outside pressure has been removed; intra-intestinal pressure closes valve completely.

the large intestine and is accompanied by destruction of the kidney (Fig. 9 *B*).

Six kidneys in which the ureter was implanted into the large intestines of dogs by the submucous method (Figs. 10 *A* and 11 *A*) showed that in not a single instance had the kidneys become infected or diseased

2. The technic of this operation and the details of the experiments were published in the *Annals of Surgery*, December, 1909.

in any manner.<sup>3</sup> The dogs in these cases were killed from four to six months after the implantation. The intestine, ureter and kidney were all removed for tests. The intestine in each case was clamped above and below the implantation, thus isolating and making a closed sac of this segment. The ureter was split, the nozzle of a fountain syringe was inserted into the opening, and the water run into this clamped segment of the intestine under pressure. When the nozzle was withdrawn, not a drop of water flowed back through the ureter, even though the intestine was squeezed with a good deal of pressure (Figs. 12 and 13, *A* and *B*). In one instance the intestine was actually squeezed to the point of rupture elsewhere before a single drop of water would flow back through the ureter.<sup>4</sup> I feel that I have proved my principle mechanically and experimentally, but one may ask,

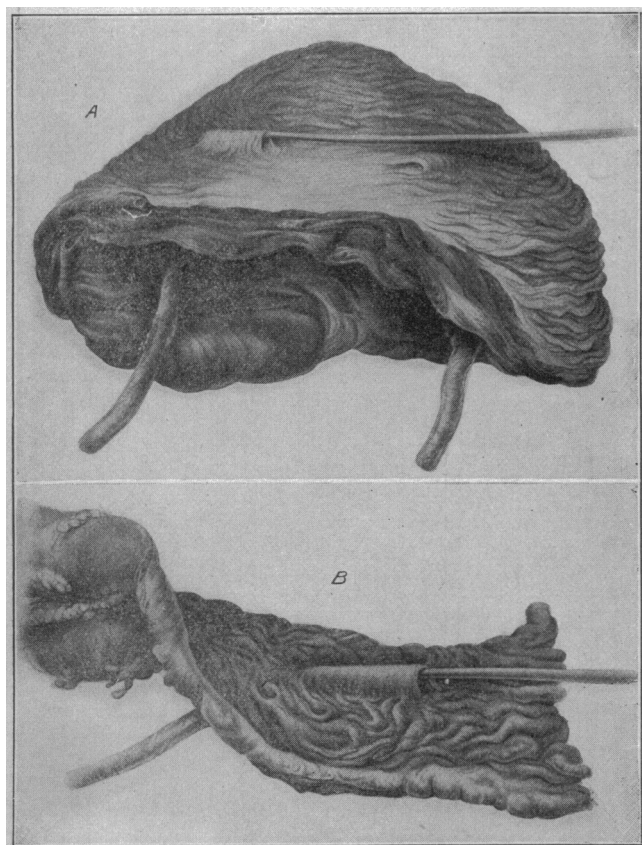


Fig. 13.—Comparison of normal valve in dog's bladder (*A*) with postoperative valve, following submucous implantation of ureter in a dog's large intestine (*B*). This represents the same specimen shown in Figure 12 *A* and *B*, in which the valve acted perfectly, without leakage.

"How about clinical results?" Dr. Charles H. Mayo, who was chairman of the section when these experiments were presented, immediately applied the principle clinically, and in an interview (December, 1916) he told me that he had implanted both ureters (doing the operations one ureter at a time) in something like fourteen cases, making twenty-eight ureteral implantations in all. Some of these were done for cancer and some for exstrophy of the bladder. In only one case has there been a bad result, or evidence of destruction of the kidney. In this case (which was

for cancer of the bladder) the ureter was much thickened and dilated at the time of the operation so that it was not collapsible. This patient died. Dr. Mayo says that he has realized that this was not a proper case for this operation and recommends that in cancer cases in which the ureter is much dilated and not easily collapsible, the ureter should be drawn out through the loin. One of Dr. Mayo's patients lives in Rochester, and, therefore, has been under close observation

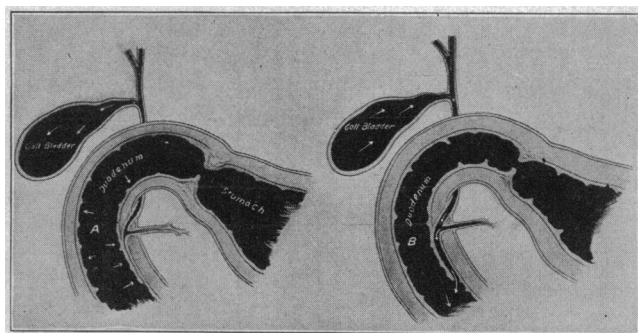


Fig. 14.—Scheme showing theory as to the probable function of the gallbladder: *A*, intra-intestinal pressure, being normally greater than pressure in the liver ducts, closes the valve during intervals of digestion when bile flows into gallbladder; *B*, intra-intestinal pressure is diminished or released in the wake of a peristaltic wave; this permits the opening of the valve, and a consequent outpouring of bile.

for more than five years. This series of cases, when Dr. Mayo reports them, will, I believe, mark a new era in urologic surgery, for no such successful report of cases in which the ureter has been transplanted into the intestine has been made up to date. While I myself have had the opportunity to implant only four ureters in three patients, these cases have been equally successful.

In connection with this subject, I wish to call attention to two other points: 1, Every surgeon has noticed that the common bile duct becomes dilated sometimes to a large size after the gallbladder has been removed or has been functionally destroyed by contraction down on gallstones. In one instance of contracted gallbladder I found the common duct dilated

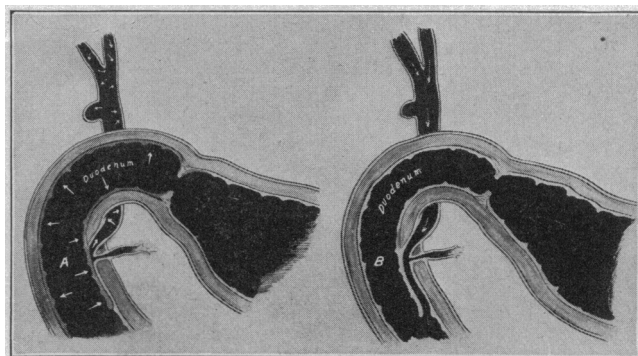


Fig. 15.—Diagram illustrating a theory as to the probable cause of dilatation of the common duct following removal or destruction of the gallbladder: *A*, during intervals of digestion (as at night) the valve is closed by intra-intestinal pressure, thereby producing an equal pressure in the ducts, causing them to dilate; *B*, during digestion, local intra-intestinal pressure is intermittently released in the wake of peristaltic waves, permitting the emptying of the dilated bile ducts, just as the normal duct and gallbladder is emptied.

to fully three-fourths inch in diameter, which caused me to open the bile duct looking for a duct stone, notwithstanding the fact that the patient had shown no jaundice or other evidence of common duct obstruction. Nothing was found in the duct, and the mouth was

3. The details of these experiments were printed in *THE JOURNAL A. M. A.*, Feb. 11, 1911, p. 397.

4. The specimens resulting from these experiments were exhibited to the Section on Surgery at the St. Louis Session of the American Medical Association, 1910.

well open into the duodenum. 2. When a gallbladder fistula is established with the surface, all observers have noticed that the bile flows more freely during the night or during intervals of digestion than during digestion. In other words, the bile flows into the gallbladder during the intervals of digestion. The gallbladder seems to serve as an elastic safety reservoir which takes off the pressure from the bile duct during certain times of the day. It seems likely that this may be explained on the basis that during active digestion peristaltic waves are intermittently passing down the intestine. In the wake of these waves there follows a diminution of the intra-intestinal pressure, which permits the temporary flow of bile from the duct. As soon as the wave has ceased, the normal intra-intestinal pressure is resumed and the valve is closed. During long intervals of digestion, and particularly during the night, the peristaltic waves are few. The intra-intestinal pressure is more nearly constant, and the bile is forced out into the gallbladder, or out through a gallbladder fistula as the case may be (Fig. 14 *A* and *B*). If the gallbladder has been removed or destroyed, an equilibrium of pressure in the gall ducts and intestines is established in the long intervals between peristaltic contractions, with the result that the full degree of intra-intestinal pressure in the bile ducts during the intervals of digestion produces permanent dilatation of the duct (Fig. 15 *A* and *B*).

In connection with this problem, it is well to mention the fact that the urine coming into the bladder through the normal valve is seen to come in jets of several drops at a time, while it passes through a ureteral catheter with a steady drip. Is it, therefore, not probable that the jets seen in the first case are due, partially at least, to the rhythmic contraction of the bladder which at certain intervals increases the intravesical pressure and temporarily closes the valves, while, when the catheter is passed up into the ureter, the bladder contraction is not operative on the flow?

#### ABSTRACT OF DISCUSSION

DR. EDWARD MARTIN, Philadelphia: As to the statement in regard to inelasticity of the belly wall, it is one of the most elastic of all structures, to wit: the circumference changes before and after dinner, as shown by the relative bigness of your garments. As to intra-abdominal pressure, on operation, with the first admission of air there is a cavity, hence a negative pressure. The pressure is constantly varying; at times it is life-threatening from its effect on the circulation and the respiration. Every vital process and every reparative process depends on the freedom and rapidity of the blood supply, and probably the underlying reason for abnormal abdominal conditions associated with ptosis is a circulatory interference and not a mechanical interference with the progression of the intestinal contents. Of all deceiving factors, the roentgenogram ranks among the first. Ochsner has shown that any viscus may be in any position and function normally if the blood supply is not interfered with.

Concerning the mechanism of the valves, going back to fundamental principles, the law of sphincters is that when irritated they contract. Flaccidity is almost unknown; the anal, the pyloric, the cardiac, urethral sphincters give us trouble only by contracting. In the first few months of life the cardiac valve is normally incompetent, a period for quantitative errors of judgment. Later, if abnormal, it becomes permanently tight. Any neighboring pathologic condition may cause it to grip tight, the sphincter having its own centers which respond in only one way. An incontinent ileosphincter is extremely rare. They all yield to continued abnormal back pressure. The cecum is usually empty and the stimulus

to the cecum to contract is a sudden, violent gush from the ileum. A slow ooze, as through a spasmodically contracted sphincter, will not give this stimulus. I cannot see the mechanism of a vacuum formed in an absolutely soft gut. It is probable that the beneficial effects of operation are not from tightening a loose sphincter, but from loosening a spasmodically tight sphincter. We are cursed by pylorospasm. How do we cure pylorospasm? Usually by curing the lesion reflexly responsible for it, and sometimes by paralyzing and putting out of service the muscle. The rule of the sphincters is that they are always tight. Why is a patient with chronic appendicitis constipated and toxic? Because he has a loose sphincter? No; because he has a tight sphincter. The lower ileum is the portion where the intestinal contents remain longer than in any other part of the intestinal canal. With a teasing chronic appendix the reflex spasm prevents that rapid distention of the cecum which excites cecal contraction. Why do these patients get well of their constipation by the taking out of a fibrosed appendix? And why do so many of them suffer from pylorospasm? Because the sphincters work together; that is, the ileocolic and the pyloric. We have had no success in implanting the ureters, and we have done it very carefully; no success because there always occurs a narrowing at the point of implantation and an ascending infection. Sweet has attempted it many times. In only two reputed cases has it been done successfully without a segment of the bladder wall. I agree that the mechanism of the vesical sphincter of the ureter is, in part, a mechanical one.

#### ORGANIC CHANGES IN THE CENTRAL NERVOUS SYSTEM PROBABLY DUE TO FOCAL INFECTIONS\*

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It is with a full knowledge of the vulnerable points which may be cited in reasoning from cause to effect that I present the history of these cases which compose the nucleus on which this paper is based. However, clinical evidence and resulting treatment in other cases not here reported encourage me to present this article, for I realize the fact that the chain of infection leading from the tonsils and teeth to the central nervous system in these cases is not complete, since two of the patients are still living.

Orr and Rows<sup>1</sup> state that infections may ascend from deep foci of infection through the lymph channels which surround the spinal nerves and roots, and extend to the pia and there set up inflammatory reaction. They have observed such conditions in staphylococcus infection. They state that toxins can spread along the roots of these nerves without injuring the individual nerves. They have shown that bedsores may produce degeneration in the lumbar enlargement, and sores on the arms have produced degeneration in the posterior columns of the cord on the same side as the focal infection. They have demonstrated similar changes in the lower portion of the cord arising from a pelvic cellulitis and renal abscess. While in their experience the dorsal columns of the cord have more often become involved than other regions, yet they have explained that these toxins may so spread as to produce changes in the anterior radicular fibers, and also in the lateral columns of the cord. Such changes, according to their statement, are the direct result of absorption from some peripheral septic focus.

\* Read before the Section on Nervous and Mental Diseases at the Sixty-Eighth Annual Session of the American Medical Association, New York, June, 1917.

1. Orr and Rows: Brain, 4, 1906.