where the ordinary needles or trocars would be inadmissible; for example, in aspirating the bladder with it, we may draw off the last drops of urine, as with a catheter, and search the interior of the viscus, as with a sound; in operating for hydatids, the protruded dome may stir up and dislodge the parasites, while the aspirator is extracting them through the same instrument. In tapping the thorax, there is no danger of hurting the pleura or the lung; and in paracentesis pericardii, the dome-guarded needle will not injure, more than a smooth probe, the interior of the pericardium, or the beating heart. (Dr. Roberts, in his book on *Paracentesis of the Pericardium*, designates this dome-needle as the most perfect instrument for the purpose, p. 53.)

A close-fitting india-rubber ring on the trocar, slid down to near the surface of the part entered, will conveniently indicate the distance to which the instrument is inserted or retained. To examine deep-seated bone, and to search for shot or other foreign substances, we may insert a dome-needle with the point projecting, till we reach the proper depth; then, advancing the dome, we have a probe with which to make exploration, without entrance of air or exit of blood.

The aspirator-attachment deserves attention; by it either of the dome-needles or smallest trocars may be connected with any exhausting and injecting apparatus, without moving the apparatus or the trocar, and without twisting the connecting tube. It is a hollow metal cylinder, two inches long, with a nozzle at each end, one nozzle bulbous, the other conical; the bulbous nozzle having been previously inserted into the free end of the flexible tube of the apparatus, the connection is effected in a moment, when required, by pushing the conical nozzle into the funnel-socket of the dome-needle, and the ring-nut clasps the coupling into an impervious joint. The cylinder of one of the attachments is curved, to prevent sharp bending of the india-rubber tube where the instrument is used with a simple exit-tube, or with the syringe in mediate transfusion.

The handy aspirator is a very portable and inexpensive apparatus, which I now use almost universally, to the exclusion of every other form of aspiration; it is like a Higginson syringe, but with treble thickness of all the walls, which gives strong resilience and powerful suction to the bulb, and impossibility of sharp bending, or of collapse to the tubes. In emptying a cavity with it, the bulb is firmly compressed in the hand till the trocar is inserted; then the compression is relaxed, and the flow, thus initiated, continues by mere syphon-action, unless the fluid be very thick; but if it be necessary to quicken the current, by occasional or repeated working of the bulb, then the india-rubber tube between the bulb and the trocar should be pinched with the thumb and finger at each compression of the bulb, to prevent possibility of regurgitation. Either exhaustion or injection may be effected by attaching the trocar to the end of one or other tube of the apparatus. The trocar-needles for the handy aspirator, if it be desired to lessen their cost, may have their proximal ends bulbous, to be inserted directly into the orifice of the india-rubber tube, without intervention of the aspirator-attachment. (Vide *New York Medical Journal*, November, 1877.)

The larger trocars are made of German silver, with the cutting part of steel; the trocar-catheter has the dome or catheter-end of silver, the perforating cannula of thin steel; the aspirator-trocars have both cannulae of thinnest steel tubing, without seam; the aspirator-attachment is steel, its conical nozzle brass. The best material for the connecting tube between trocar and exhauster is pure india-rubber, so thick that it cannot collapse. When used without exhauster, the india-rubber exit-tube should have the middle expanded into a bulb, to be used for the ordinary emptying of cavities, and for aiding the current in transfusion, whether direct or mediate; but there should be no joints between the bulb and the tube, and no valves to impede the easy flow of fluids, or to whip the blood in transfusion; and there should always be, near the end of both connecting-tube and exit-tube, a bit of glass tubing, through which the current may be observed, or its absence noticed.

To clean these trocars and needles, the inner tube is fully retracted, and then revolved as far as it will go, when the several parts are easily pulled asunder. The trocar-catheter is taken apart by unscrewing the button on the proximal end of the instrument, and then drawing out the dome and spring through the distal end of the outer cannula. Messrs. Tiemann and Co., of New York, have perfectly made these instruments for me; and Messrs. Krohne and Sesemann will have all of them made with careful accuracy.

The dome-trocar will, I think, be found—(1) easy of insertion; (2) harmless when inserted; (3) safe as a probe or sound for internal exploration; (4) adaptable to every form of exhauster and injector; (5) competent for uninterrupted passage of fluids; and (6) certain to leave only an incised wound, ready to heal, thus realising the requirements demanded of a perfect trocar.

ON THE PRACTICABILITY OF ESTABLISHING AN ARTIFICIAL FISTULOUS OPENING IN THE HUMAN SUBJECT BETWEEN THE GALL-BLADDER AND THE DUODENUM.¹

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Duodeno-Cholecystostomy.—This term is applicable to the operation of uniting the gall-bladder and the duodenum with an opening for the passage of the bile. The process which I have proposed for effecting this consists in connecting their walls by a single loop of suture, which shall attach their surfaces by adhesive inflammation, and cut an opening between their cavities, passing away in the intestinal canal. If there exists any disintegration of the tissues of the sac, extirpation would be proper. Should such degeneration not be present while the cystic and common ducts can be freed from obstruction, cholecystotomy would be warranted. But if there is permanent occlusion of the common duct without obstruction of the cystic duct, then duodeno-cholecystostomy is the appropriate operation.

This proceeding is simplified by the dilated condition of the sac, which brings it into close proximity to the duodenum, and facilitates the passing of a needle with a silk thread to unite their walls by moderate constriction.

In my autopsic lecture, reported in the *Southern Medical Record* for March 20th, 1885, will be found a description of the demonstration of this process on the human subject. This attachment is illustrated in the accompanying modification of Hinke's plate, Fig. 1.

Fig. 1.—L. The gall-bladder. o. Duodenum with attachment. M. The colon partly removed. N. Severed suspensory ligament, with liver and stomach.

In my first series of experiments on dogs, a circular row of catgut-sutures was applied around the elastic ligature, connecting the walls of the gall-bladder and the duodenum. But it was observed afterwards that sufficient inflammation ensued from a single stitch of silk thread to unite the walls, while it cut an opening between their cavities.

In case of an incision into the sac for the removal of its solid contents, this may be closed by Lembert's suture, separate from the loop for attachment, or may be secured to a corresponding incision in the duodenum, dispensing thus with the loop for effecting a communication. Other modifications will be noted in referring to my second series of experiments on dogs at the close.

Inflammation of the tissues of the gall-bladder seeks relief in the direction of the duodenum; and my observation of the ulcerative opening of the gall-bladder into this canal, directed my investigations originally to effecting a direct communication between them. This result is well shown in the accompanying copy of Jeançon's cut, Fig. 2.

¹ Read in the Section of Surgery at the Annual Meeting of the British Medical Association at Brighton.

The operation of Winiwarter, uniting the gall-bladder to the colon, and afterwards to the small intestine, by suture, opening the gut on the fifth day, and puncturing the opposed surfaces through the incision, failed to realise the advantages expected from this cholecysto-duodenal outlet. Yet his procedure demonstrates the great tolerance of the structures for similar operative procedures, and there were no complications from the coils of intestine, the constriction of its lumen, or regurgitation of contents into the gall-bladder; hence these not likely to occur in attaching the sac to the duodenum.

Fig. 2.—Copy of plate from Jeannon. A A. Section of duodenum. B B. Common bile-duct. C. Hepatic duct. D. Cystic duct. E. Excised wall of gall-bladder. F. Probe in ulcerated opening. G. Two small gall-stones.

Dr. George Harley says that "the triumph of operative surgery would be to establish an artificial fistula between the gall-bladder and the duodenum. For then, not only would the pent-up bile be removed, but the disturbances arising from the non-admittance of bile into the intestines likewise be, at the same time, overcome. I am not quite sure," he remarks, "if in these days of antiseptic surgery, the operation is not practicable; for I can see no reason why the adjacent surfaces of the gall-bladder and duodenum should not be eroded by potassa fusa, and speedily stitched together" (*Diseases of the Liver*, p. 1110).

This process presents difficulties which do not hold against the plan of uniting the walls by a loop of suture, which shall unite their surfaces by adhesive inflammation, while it cuts through the tissues, and gives a passage for the bile. Some other process may, however, be found preferable to either, and it rests with surgeons to adopt that which proves best.

As Harley's book on *Diseases of the Liver*, containing this suggestion, appeared prior to the publication of my proposition in *Gaillard's Journal*, he is justly entitled to priority of publication. But it is due to the facts of the case to state that his work had not been read, nor was I even aware of his suggestion when my paper was published.

It is proper, also, to state that I did not then know of the operation of Winiwarter, though it was recorded in 1882 in a foreign journal, and published in October, 1884, in the *American Journal of Medical Sciences*. His procedure, however, is entirely different from the measure suggested by Harley, and from that process which I have proposed for carrying the bile into the duodenum.

My experiments on dogs were undertaken to verify a predetermined method of making an opening from the gall-bladder into the duodenum, and it only remains to test its applicability to man for this operation to be adopted.

In the *Centralblatt für Chirurgie* of June 12th, 1886, we find an abstract of the practical investigations of Golzi, touching the operative surgery of the gall-bladder, and the establishment of a cholecysto-intestinal fistula. He considers the possibility of uniting the gall-bladder and duodenum by suture; the probability of such connection leading to derangement of the contents of the gall-bladder from the entrance of any alimentary substances; the prospect of disorder to the alimentary canal from the continuous entrance of bile; the feasibility of keeping open a fistulous communication without disturbance of the digestion.

Experiment proved the practicability of attaching the gall-bladder and duodenum by suturing an orifice in each, so as to secure separately the mucous and the serous membranes in apposition. The operation led to no trouble, either in the gall-bladder or duodenum; but slight disturbance resulted from the constant entrance of bile at first, and eventually the ductus choledochus became dilated so as to afford a new reservoir for the bile.

I reported a series of experiments on dogs, intended to show the aim and end of this process for connecting the gall-bladder with the duodenum, in the *Atlanta Medical and Surgical Journal* for September and October, 1884. All these have an important bearing on the proposed operation in the human being, but, as space does not admit of full details, I will only give some account of the sixth of the series, on August 20th, 1884. In the first experiment upon this animal an incision was made below the right costal arch into the abdominal cavity, and a loop of silk thread was passed through the approximated walls of the gall-bladder and duodenum. The second laparotomy on the same subject, eight days afterwards, verified their firm union by adhesive inflammation. A third was undertaken after the complete restoration of the animal, on February 4th, 1885, with a view to re-open the communication, if it had been obliterated by the lapse of so long a time; and also with the intention of ligaturing the common bile-duct, as as to prevent the escape of bile by the natural channel. But, unfortunately, the dog died from imprudent administration of the sulphuric ether as an anæsthetic, though it had borne it well on the previous occasions.

The two stages of this operation, the passing a single stitch of silk through the respective walls (Fig. 3), and their intimate union from the adhesive inflammation of their serous surfaces (Fig. 4), are represented in the accompanying drawings.

Fig. 3.—View of relations in the dog. 1. Duodenum with pyloric curve. 2. Attachment by stitch to gall-bladder. 3. Common, cystic, and hepatic ducts.

The necropsy presented a firm septum between the gall-bladder and duodenum, with a well marked depression, indicating that an opening had been made by the thread in cutting its way through into the intestine, which would doubtless have continued to give a passage to the bile had the common duct been ligatured. There was no obstruction to the passage of bile in either duct, as, prior to incising the sac, the duodenum was opened, and upon pressure on the gall-bladder, the bile was seen to pour out at the orifice of the common

Fig. 4.—Union by adhesive inflammation. 12, 14. Duodenum and pyloric extremity. 16, 15. Gall-bladder and ducts. 13. Agglutination of walls of gall-bladder and duodenum.

duct. It is therefore clear that the various ducts escaped the inflammation propagated from the suture to the serous investments of the attached walls. An important phase of this necropsy was the absence of any evidence of extensive peritonitis. The contained viscera had not contracted adhesions to each other or to the parietes of the abdomen; and there was no attachment at the line of hare-lip sutures that closed the external wound with the needles penetrating through the skin, the subcutaneous tissue, and the peritoneum.

It will be observed that this animal survived the first operation and the second exploratory laparotomy, being entirely restored within one month, and continued in a healthy condition, completing five and a half months, when its death occurred from an overdose of the anæsthetic.

I have preserved some specimens from the necropsies of other animals that died at varying periods after the use of the elastic ligature for attaching the gall-bladder and duodenum in this first series of experiments. One of these specimens was taken from a dog, whose death occurred on the fourteenth day following the operation, and shows the fistulous communication between the gall-bladder and duodenum from the cutting out of the elastic ligature which united their walls, and the firm adhesion of their surfaces surrounding this opening, induced by the inflammatory action set up in their serous investments from the traumatic irritation of the ligature in doing its work. This result is illustrated by the cut, in which the gall-bladder

Fig. 5.—Posterior view of attachment. 4. Excised gall-bladder. 7. Curvature of duodenum. 6. Entrance of common duct. 5. Artificial opening through their walls.

is laid open, so as to display the opening in the septum formed by the agglutination of the two adjacent walls.

In this case the well knotted elastic ligature was found lying loose within the sac, having been liberated by cutting its way through the tissues. This observation led subsequently to securing the knot of the loop, whether elastic or simple silk, in close contact with the wall of the duodenum, which promoted the detachment and passage of it into that canal.

Another specimen, from a dog that died on the eleventh day after attaching the gall-bladder and duodenum with the elastic ligature, presents an opening between their cavities. Fig. 6 represents the

Fig. 6.—Incision in duodenal wall. 8. Fistulous communication of cavities. 9. Entrance of common duct. 10. Adhesion of surfaces forming septum. 11. Pyloric curvature of duodenum.

wall of the duodenum laid open, and shows the natural orifice of the duct as well as the artificial opening in the septum.

A report of my second series of experiments on fifteen dogs appeared in the *Atlanta Medical and Surgical Journal* for September and November, 1885. It will be observed that the results of attachment of the gall-bladder to the duodenum by a single stitch of white

silk suture thread are the intimate and firm union between their serous surfaces by adhesive inflammation of the tissues, and the formation of a fistulous opening through this septum, which affords a communication between their cavities, thus affording an outlet for the bile artificially when the discharge is promoted by the natural channel.

In repeating this measure of attaching the gall-bladder to the duodenum by a single loop of suture silk, that was applied in Case 6 of the first series of experiments, 5 deaths occurred respectively in 18, 20, 24, and 48 hours, and in 20 days after operation. I resorted, in some instances, to ligation of the common bile-duct on the same occasion, as illustrated in the Fig. 7. But death

Fig. 7.—Modification of plate from Cloquet. The duodenum is drawn up with the liver. i. Knotted loop, attaching it to gall-bladder. j. The cystic duct. k. Hepatic ducts. n. Ligation of common bile-duct.

ensued early in all these subjects, with extravasation of bile into the hepatic structure, and, in one case, there was exudation through the diaphragm into the thoracic cavity.

In four cases of attachment of the gall-bladder and the duodenum by a single loop, the common bile-duct was also ligatured at the same time with catgut, and fatal results ensued respectively in thirty-six, forty, and fifty-six hours, and in three and a half days afterwards. In one case of securing the gall-bladder and the duodenum together by suture of the circular margin of an opening, made in the walls of each with a shoemaker's punch, while the common bile-duct was left free, death occurred in thirty-six hours.

In two similar operations, with ligation of the common bile-duct, death resulted in twenty and twenty-two hours respectively. The fatality attending the ligation of the common duct before another outlet for the accumulation of bile was secured, induced me to undertake these experiments for effecting an immediate communication between the gall-bladder and duodenum, which process is well illustrated in Fig. 8.

Fig. 8.—Immediate communication of cavities. 18. Temporary attachment of walls. 17. Circular excision from each by punch.

The gall-bladder was secured temporarily in contact with the duodenum by a ligature passed through their walls, and a fold of each wall was excised into the punch, thus leaving a round aperture into their

cavities. The margins of these openings were united in two cases with a continuous catgut suture (Fig. 9), and in one with interrupted

Fig. 9.—Exterior view of operation by punch. 21-22. Stitches in margin of aperture through walls of gall-bladder and duodenum. 23. Ligation of common duct.

suture of Snowden's iron-dyed silk, as exhibited in Fig. 10. In the two

Fig. 10.—Result of direct opening in walls. 19. Orifice with sutured margin. 20. Incision into duodenum.

cases in which the common duct was ligatured, the necropsies showed some yielding of the suture around the circular openings in the walls, and hence escape of bile into the peritoneal cavity. It was inferred that the contractile tissue of the duodenal canal led to the closure of the orifice made by the punch, as is sometimes observed in the perforations of small balls in gunshot wounds of the intestines, which prevented the passage of the bile directly from the gall-bladder into the duodenum, so that it was forced out between the stitches. With proper precautions, in the removal of a larger portion of tissue from the duodenal wall, so as to make allowance for its contractility, and the union of the margins by Galy's suture, instead of the ordinary continued or interrupted suture, success is likely to follow this operation, and it may be used to separate a circular disc of their walls in cases not demanding immediate communication.

Only three dogs of the fifteen in this series of experiments survived the primary operations, and I sought, by secondary experimentation on these, to test the practicability of turning the bile entirely into the artificial channel, which there was sufficient grounds to conclude had been made by the silk loop cutting an opening through the attached walls. The object of re-opening the abdominal cavity was to ligature the common duct, which remained open in each of these cases; but the adhesions of the duodenum with the lower surface of the liver completely shut out any view of the ducts, so that only the touch could be used in attempting to pass the ligature. As a consequence of this uncertain guide in the proceeding, failure resulted in my own efforts, and in those undertaken, at my request, by a colleague, to secure the common duct.

In a second laparotomy, one month and three days after the primary operation upon one of these subjects, death took place within forty-eight hours.

Another animal, that underwent a second laparotomy one month after the attachment of the gall-bladder and duodenum, survived this, and at the expiration of a like period, was subjected to a third opening of the abdomen. The wall of the duodenum was incised, and there was a cicatricial depression in the septum, indicating that an opening had recently existed, into which a trocar passed with slight resistance, re-establishing the communication with the cavity of the gall-bladder. This dog died four days subsequently, two months and four days having elapsed from the primary operation.

The third, that resisted the attachment of the gall-bladder and duodenum, was, at the expiration of twenty-five days, submitted by my colleague, Dr. W. D. Bizzell, to a second operation, and he verified the firm union of the walls of the gall-bladder and duodenum around the point of suture. He felt assured that an opening existed through this septum for the flow of bile, and attempted, without effect, to ligature the common duct.

The abdominal cavity of this animal was opened for the third time two months subsequently, when it was corroborated by a number of medical men present, that a strong attachment existed between the gall-bladder and duodenum, while it was inferred that the sac was drained by an artificial outlet into the duodenal canal. After tearing loose some of the adhesions, with a view to expose the common duct, another fruitless attempt was made to pass a ligature around it. This dog died ten days after the third laparotomy, and the necropsy showed a free communication between the gall-bladder and duodenum, from the action of the single loop of silk thread passed through their walls more than three months previously. There was also found to exist a solid compact union of their walls around this aperture, resulting from the adhesive inflammation set up between their serous surfaces, which had been brought in contact by the loop of suture. It was ascertained, by exploration, that the ductus choledochus communis was pervious, but that one of the branches of the hepatic duct had been ligatured by mistake, and that there was partial disintegration of the parenchymatous structure of the corresponding lobe of the liver, which most probably led to the fatal result.

It is evident that the preservation of this artificial communication between the gall-bladder and duodenum for three months and five days, while the natural outlet was open, affords strong ground for belief in the maintenance of such an outlet for the bile, when obstruction of the common bile duct exists, as in cases requiring surgical interference in the human subject.

FIFTY CASES OF OVARIOTOMY.

By SKENE KEITH, M.B., C.M. EDIN., F.R.C.S. ED.

THE point of greatest interest in my second series of fifty cases of ovariectomy, is to be seen in the diminished number of tumours which had been tapped before operation. Only eleven of the number, or 22 per cent., had been treated in this way, as against 32 per cent. in the first fifty. This is most satisfactory, and I hope to be able to show, ere long, that the tapping of an ovarian tumour by anyone other than the surgeon who is to have charge of the case, is as rare in Scotland as it has been for some years in England.

The advance which has been made in abdominal surgery, since the operation of ovariectomy was established by Sir Spencer Wells in the south, and by Dr. Keith in the north, is shown very distinctly by comparing the death-rate of those who have begun their abdominal surgery in the last few years, with the mortality in the first fifty cases of ovariectomy, of several of the older operators. In Dr. Keith's first fifty completed operations there were ten deaths; advancing a stage of rather more than ten years, we find that beginners still had a heavy death-list. Thornton, Bantock and Tait having nine, fourteen and nineteen deaths respectively in their first fifties. A second stage onwards of about seven years, and Mr. Meredith and myself are able to show less than one-third the number of the deaths of the surgeons already mentioned. What is the reason of the greatly diminished number of deaths? One of the most important, and one of which little notice has been taken, is that the operations are less severe than they used to be. Twenty-five years ago, when it was almost a crime to remove an ovarian tumour, the unfortunates who had them, were allowed to live as long as possible: and, when it was certain that their lives were worth little, they were then, and not till then, handed over to the surgeon, almost as to the executioner. In the *Edinburgh Medical Journal* of August 1864, Dr. Keith mentions that he had refused to operate on three cases only up to that time, and that one of these died in forty-eight hours, another in a week, and the third three weeks after being first seen by him. A second and most important factor in the production of the diminished death-rate is the principle of perfect cleanliness of Lister. Even those who scoff most, would never think of putting a dirty finger, or sponge, or instrument into the abdomen, yet this regular and systematic use of the nail-brush is the direct outcome of Lister's antiseptics.

Increased experience is not to be lost sight of. Now, no one ought to do abdominal surgery unless he has watched others at work, and one ought not to hear it gravely suggested, as I have, when there