GASTRO-INTESTINAL SUCTION

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Introduction

During recent years the many indications from reports in the surgical literature, and the reduction of the mortality from abdominal injuries of warfare, have indicated that gastro-intestinal suction can play a major role in reducing the mortality rate in a great number of surgical conditions. It is felt that although its value is well known to the majority of surgeons, there are many problems which require discussion, and there are still signs that gastro-intestinal suction is not employed in many conditions where it can be of particular value.

In this article it is proposed to consider the indications for its use and to discuss some of the problems associated with the management of the suction.

In the appendix at the end of this article are given the instructions which are issued to the surgical wards at Crumpsall Hospital. These instructions are supplemented and explained to the nurses at special lecture demonstrations, as it is felt that success or failure of gastro-intestinal suction depends primarily on the nursing staff.

Type of Suction

Suction may be used in one of two ways—continuous or intermittent, both of which have their advantages and disadvantages.

Continuous suction is produced by some form of negative pressure which is exerted continuously. The best known is that described by Wangansteen, but many forms of producing suction by mechanical means have been devised and are effective so long as there is a valve present in the system which will prevent the pressure rising above a certain point, in order to prevent the mucous membrane of the stomach or intestine from being drawn into the holes in the tube. The great advantage of continuous suction is that gastric or intestinal contents are withdrawn continuously and there is no time for them to accumulate and produce the ill effects of distension, but the disadvantage is that if the tube becomes blocked by mucus or other matter, the fact may not be recognised for some time, and the advantage is lost.

Intermittent suction is produced by attaching a syringe to the end of the indwelling tube and aspirating the gastric or intestinal contents at regular intervals, hourly or half-hourly. If the instructions detailed in the Appendix are carefully

followed this method is practically fool-proof, and in practice we have found it to be most satisfactory.

Indications for the Use of Gastro-Intestinal Suction. General.

Suction should be employed in all conditions where it is necessary to decompress the gastro-intestinal tract, and its use in many of these conditions is detailed below.

Its use is imperative in any case of intestinal obstruction or gastric retention, to which a general anaesthetic is to be given, to avoid the unfortunate happening of the patient vomiting and drowning in his or her own vomit. Even the use of an intra-tracheal tube will not prevent this, as the patient may vomit during the induction of the anaesthetic.

Much has been written concerning the diagnosis of intestinal obstruction in its early stages, and it is sometimes stated that so-called faecal vomit is a late sign. Some facts concerning intestinal obstruction are not sufficiently well understood. In large bowel obstruction, vomiting often occurs but it is reflex in nature and unless the ileo caecal valve is incompetent, the vomited material consists only of small amounts of gastric contents and is not the result of an accumulation of gastro-intestinal contents. Even if the ileo caecal valve is incompetent, the vomiting of gastro-intestinal contents may only occur in the very late stages.

However, in intestinal obstruction of the small bowel, vomiting occurs early, and consists first of gastric contents and then of the accumulated contents of the small intestine. The higher the obstruction the sooner will this material appear. It is this small bowel content which is often called faecal vomit, but which we propose to call intestinal content. This material is at first yellowish in colour but later becomes brownish, and in lower ileal obstructions may be almost black.

In our experience, the yellowish intestinal content appears within a few hours of the onset of small bowel obstruction and is absolutely diagnostic of the condition.

In a case of suspected intestinal obstruction, if a tube is passed into the stomach and the contents withdrawn for inspection, a great deal of information is obtained. If the material withdrawn is intestinal content, a definite diagnosis of small bowel obstruction can be made, but if the material withdrawn consists of gastric content and clinical signs of intestinal obstruction are present, it is probable that the obstruction is in the large intestine.

Use in Perforated Peptic Ulcer

As soon as the diagnosis has been made, gastric suction should be instituted and continued before, during, and after the operation. Aspiration before operation will lessen the further escape of gastric and duodenal contents into the peritoneal cavity, aspiration after operation prevents gastric retention and allows time for the oedema of the pyloric region to subside. It is our custom to allow these patients to take fluids by mouth in the immediate post-operative period and this greatly relieves their thirst and does no harm as the fluid is withdrawn and gastric retention with vomiting does not occur.

Recent reports, Wakeley (1944), have shown the value of gastric suction in reducing the mortality from perforated peptic ulcer.

A study of the amounts of fluid taken by mouth and the amount removed by suction gives an indication as to the progress of the case. In the early post-operative period, the amount withdrawn will exceed the intake but as the oedema subsides and the pylorus regains its normal function, the amount of fluid withdrawn diminishes, and its appearance becomes normal. At this stage, if there are no other contraindications, the suction is discontinued.

In cases of perforated peptic ulcer we use a Ryle's tube and intermittent suction.

An example of the intake by mouth and output by aspiration calculated at the end of every twelve hours is as follows:—

Intake by mouth	Output by aspiration	Difference	Hours Post Operative
150 c.c.	260 c.c.	+ 110 c.c.	12
330 c.c.	800 c.c.	+ 470 c.c.	24
420 c.c.	630 c.c.	+ 210 c.c.	36
540 c.c.	400 c.c.	— 140 c.c.	48
540 c.c.	90 c.c.	— 450 c.c.	60

It will be seen from the above example that after 48 hours the gastro-intestinal tract was retaining more fluid than was being removed and that gastric retention was no longer present. In some cases, it is noticed that the intake by mouth is greater than the amount withdrawn from the very beginning which indicates that in these cases gastric retention is absent, whereas in some cases gastric retention is present for some days after operation.

It should be stressed that the figures given above and subsequent figures to be given refer only to the intake by mouth and output by suction. All cases which are undergoing gastro-intestinal suction have a careful record of the whole fluid intake and output, additional fluids being given by rectal and intravenous routes when indicated.

In cases of perforated peptic ulcer where surgery is not available for some reason, and where the patient may require transport to some place where facilities for operation are available it is suggested

that continuous gastric aspiration, if commenced at once, will help to counteract a long delay before operation is available.

Use in Gastro-Enterostomy and Gastric Resection

A patient who is to undergo gastro-enterostomy or gastric resection is brought to the operating theatre with a tube in place, the end of which is lying in the stomach. This tube should be sufficiently long so that the tip may be drawn down into the afferent jejunal loop before the abdomen is closed. The ordinary Ryle's stomach tube is not always long enough, and a duodenal tube is preferable.

During the operation, the contents of the stomach are aspirated, and care must be taken that the end of the tube is not included by the blades of any clamp which may be applied to the stomach.

At the completion of the anastomosis, the tip of the tube should be manoeuvred through the anastomosis into the lumen of the afferent loop for a distance of about one inch. In order to make this manoeuvre easy, a stilette should be passed down the tube and then the tip of the tube is easily guided into the required position.

Suction applied to this tube will decompress the duodenal stump and the perforations in the part of the tube lying in the stomach will also allow decompression of the stomach.

Several other modifications have been suggested, and are illustrated in Fig. 1. Raffel (1941) has suggested a triple tube, the aspirated material being replaced through the tube lying in the efferent loop, in order to replace the lost electrolytes. In actual practice we have not found this to be necessary.

An example of the oral intake, and output by the tube, in a case of gastro-enterostomy is given below:—

Intake by mouth	Output by aspiration	Difference	Hours post operative
80 c.c.	280 c.c.	+ 200 c.c.	12
300 c.c.	900 c.c.	+ 600 c.c.	24
300 c.c.	400 c.c.	+ 100 c.c.	36
570 c.c.	100 c.c.	— 470 c.c.	48

When the amount of fluid taken by mouth exceeds the amount of aspirated fluid, and the appearance of the material is clear, the tube may safely be removed.

Since suction has been employed in all cases of gastro-enterostomy and gastric resection, we have not seen a case of post-operative vomiting, and vicious circle vomiting has never occurred.

In such cases it should be stressed that suction should be employed from the beginning and one should not wait for vomiting to occur.

Fig I.

In a carefully observed consecutive series of 71 cases of gastro-enterostomy and gastric resection, none of the following complications have been seen.

1. Post-operative vomiting.
2. Paralytic ileus.
3. Acute dilatation of the stomach.
4. Peritonitis.

Use in Obstruction of the Small Intestine

Gastro-intestinal suction may be employed in small bowel obstruction either as a form of conservative treatment or as an adjunct to surgery, and it is necessary to consider these two indications separately.

1. As a form of treatment.

Much has been written as to the indications and contra-indications for the use of suction as a form of conservative treatment, but the primary consideration is that the surgeon must exclude the presence of strangulation of the bowel, and must take the responsibility for failure. As it is by no means easy to exclude the possibility of strangulation this method is and will remain of limited use as a form of treatment in mechanical obstruction. If suction is to be employed, the Miller-Abbott tube is the one of choice and the nearer to the point of obstruction that the tip of the tube will reach, the better will be the result.

As a form of treatment in paralytic obstruction the problem is quite different, and gastro-intestinal suction is the sheet anchor in the treatment of such cases. This will be discussed in more detail later.

2. As an adjunct to surgery.

As soon as a diagnosis of intestinal obstruction has been made, or has been considered in a differential diagnosis, intubation should be performed. As has been described, the nature of the aspirated material may clinch the diagnosis, and give an indication as to the site of the obstruction.

Suction should be continued during and after operation until such time as normal intestinal function has returned. The return of normal function is shown by the normal unaided passage of flatus by the patient on at least two occasions, and any patient who is undergoing treatment for intestinal obstruction should be carefully questioned on this point several times daily.

The Miller-Abbott tube is the most suitable for the treatment of such cases, and if resection and anastomosis is necessary, one should endeavour to get the end of the tube down to just above the site of the anastomosis. The use of the Miller-Abbott tube in cases where resection and anastomosis has been performed is absolutely life saving and enterostomy is seldom if ever necessary, except in some cases where there are isolated distended loops of small intestine which fail to be decompressed by suction.

Use in Right Hemicolectomy and Ileocolic Anastomosis

The use of the Miller-Abbott tube is of definite value in resection of the right colon with ileocolic anastomosis, and in the ileocolic short circuit anastomosis for inoperable growths. If the tip of the Miller-Abbott tube can be brought down the

small intestine to a point just above the anastomosis, post-operative suction will prevent ileus and relieve strain on the suture line.

The tube should be passed before operation and if at operation the tip has not passed far enough down the small intestine, it can be brought down to the desired point by gentle manual manipulation.

Use in Acute Pancreatitis

One of the manifestations of acute pancreatitis is the persistent vomiting due in the later stages of the disease to the paralytic ileus produced by the acute peritoneal reaction.

Whether treated conservatively, or by operation because of doubt as to the correct diagnosis, gastro-intestinal suction, combined with intravenous therapy, plays an important part in the treatment of such cases.

Use in Conditions where Ileus may be expected

Practically any condition which results in a peritonitis will produce some degree of paralytic ileus, and should be treated by gastro-intestinal suction. Among such conditions may be mentioned particularly, acute appendicitis with peritonitis, and abdominal injuries of all kinds, particularly if associated with perforation of a hollow viscus, injury to the mesentery or retro-peritoneal haematoma. We believe that when the value of the adjuncts employed in the treatment of abdominal injuries of warfare have been fully assessed, that the greatest credit will be given to the use of gastro-intestinal suction.

Use in Acute Dilatation of the Stomach

The use of gastric suction in acute dilatation of the stomach is life-saving, and should be instituted as soon as the diagnosis is made.

The following record of intake by mouth, and output by suction in such a case shows the response to suction.

Intake by mouth	Output from suction	Difference	Time in hours
Nil	1,140 c.c.	+ 1,140 c.c.	12
Nil	230 c.c.	+ 230 c.c.	24
1,000 c.c.	1,270 c.c.	+ 270 c.c.	36
300 c.c.	520 c.c.	+ 220 c.c.	48
1,050 c.c.	490 c.c.	- 660 c.c.	60

The above example shows that gastric retention persisted for 48 hours, but after that time the intake by mouth exceeded the amount withdrawn by

suction. The gastric contents withdrawn were then normal in appearance and suction was discontinued after a further 12 hours had elapsed.

Practical Aspects

Many practical difficulties concerned with the use of suction arise from time to time, particularly with the use of the Miller-Abbott tube, and a high percentage of successful intubations will occur only with practice in its use. It is not within the scope of this paper to deal with all these difficulties, but some of the more common nursing difficulties are described in the Appendix.

Summary and Conclusion

The use of gastro-intestinal suction in a number of conditions has been described.

Attention is directed to the fact that suction should be employed early, and that one should not wait for complications to develop.

The importance of an adequate fluid balance in patients undergoing gastro-intestinal suction, is stressed. If suction is continued for any length of time, additional fluids should be administered intravenously.

It is suggested that the use of gastro-intestinal suction in a wide range of surgical conditions will have a marked effect in reducing the mortality rate.

REFERENCES

- RAFFEL, W. (1941), *Arch. Surg.*, **42**, 1083.
WAKELEY, C. P. G. (1944), *Lancet*, **1**, 11.

APPENDIX

GASTRO-INTESTINAL SUCTION

INTRODUCTION: Gastro-intestinal suction is used in many conditions; its primary object being to remove the contents of the stomach and small intestine in order to prevent distention of the small intestine in conditions where for some reason the contents are prevented from passing along the intestine.

It prevents post-operative vomiting.

Gastro-intestinal suction is used in the following conditions:—

1. Perforated peptic ulcer.
2. Gastrectomy and gastro-jejunostomy.
3. Intestinal obstruction, including strangulated hernia.
4. Peritonitis, including acute appendicitis.
5. Paralytic ileus.
6. Acute dilatation of the stomach.

Instructions for passing the tube:—

1. The tube should not be perished. Before it is used some plain water should be injected through it with a syringe to make sure that the tube is patent. The outside of the tube should be lubricated with a little liquid paraffin.
2. The patient should if possible be sitting up in a comfortable position. Tilt the patient's head up and examine the nostrils; it will often be noticed that one appears to be wider than the other. The wider nostril should be chosen through which to pass the tube.
3. Pass the tube through the nostril and instruct the patient to swallow several times as soon as the tube is felt to be at the back of the throat. With each swallow, advance the tube. If the patient's mouth and throat are dry it may be of assistance to give small sips of water to help swallow the tube.

MANAGEMENT: Suction can be carried out by one of two methods:—

1. Intermittent suction performed by the nurse.
2. Continuous suction by a suction apparatus.

1. *Intermittent Suction:* Equipment required and its use. The following equipment should be placed on the locker beside the patient:—

1. Bowl of plain water.
2. Receiver in which is placed a syringe (20 c.c.).
3. Receiver into which the gastric contents are emptied from the syringe.
4. A graduated measure for measuring the amount of gastric contents.

If fluids are allowed by mouth, there should also be:—

5. A jug of known capacity containing the fluid (1-2 pints).
6. A feeder of known capacity.
7. A towel to place in front of the patient to prevent soiling the clothes, and some swabs for cleaning up any of the gastric contents which escape.

The Aspiration: The nozzle of the syringe is connected with the end of the tube, the plunger withdrawn slowly, and the contents of the syringe emptied into the receiver. This process is repeated until no further material is aspirated. Then 5-10 c.c. of water is injected down the tube to make sure that it is still patent and the aspiration is again attempted. If no further gastric contents are withdrawn it is considered that the stomach is empty. A spigot is placed in the end of the tube and the amount of fluid which has been aspirated is measured, deducting from it the amount of water which has been injected down to clear the tube. The amount and time of aspiration is recorded on a separate slip of paper attached to the patient's chart.

If when commencing the aspiration, nothing is withdrawn, the tube is probably blocked by mucus or undigested food and should be cleared by injecting 5-10 c.c. of water through the tube, and aspiration again attempted.

Fig II

If the patient is allowed fluid by mouth, it should be given by the feeder between times of aspiration.

Aspiration is performed at regular intervals either every hour or half-hour according to instructions.

The aspirated material must always be saved for inspection.

2. *Continuous Suction:* A study of the diagram (Fig. 2) will explain the work of the apparatus, and particular attention must be paid to the following points:—

1. The reservoir A must never be allowed to become empty.
2. The end of the tubing in bottle B must be below the level of the water.
3. The clips D and E must be clamped before and during the changing of the bottles A and B. They are then released to re-commence suction.

4. If the apparatus does not appear to be working, the clips should be clamped, the apparatus disconnected from the gastric tube and some water injected down the tube to make sure that it is patent.

The Time for Removal of the Tube: The tube is removed under the Doctor's instructions. In cases of intestinal obstruction this is usually after the patient has had one bowel action, and has passed flatus on at least two occasions. After operations on the stomach, the tube is removed when the aspirated contents appear clear and contain bile.

Vomiting: If a patient who is undergoing gastrointestinal suction vomits, it indicates that there is some fault in the procedure, and is a reflection on the management of the suction. Every effort should be made to discover and correct the fault.

RECENT DEVELOPMENTS IN WOUND ANTISEPTICS

By H. E. DALE

During recent years a considerable amount of work has been carried out with the object of finding a non-toxic antiseptic which would be effective against all the bacteria likely to be present in wounds. From 1939 onwards sulphonamides, especially sulphanilamide, have been used extensively by local application in the prevention and control of wound infection, and they are undoubtedly effective bacteriostatic agents. Their action is, however, inhibited by pus and necrotic tissue, and they are ineffective against some organisms. Penicillin has and will be used extensively, and may well replace many antiseptics, but it is not effective against gram-negative organisms such as *Ps. pyocyanea* and *Proteus* and supplies are at present restricted.

Acridines

The acridines or flavines, as they have been called, were introduced by Browning in 1917, and recent work on their properties and methods of application has brought to light many interesting facts. For some time acriflavine was considered to be the most suitable acridine for use as an antiseptic, but in 1941 proflavine sulphate was included in the 4th Addendum to the British Pharmacopoeia. Acriflavine is much more soluble in water than the other acridines, and it would

appear that it was selected primarily for this reason as the bacteriostatic powers of acriflavine, neutral acriflavine (or euflavine) and proflavine against various organisms are approximately the same. In 1934 acriflavine was shown to be a mixture of the hydrochlorides of 2 : 8-diamino-10-methylacridinium chloride and 2 : 8-diaminoacridine, and neutral acriflavine a mixture of 2 : 8-diamino-10-methylacridinium chloride and 2 : 8-diaminoacridine hydrochloride. Proflavine is, however, not a mixture but a simple salt—2 : 8-diaminoacridine sulphate. It is the precursor of acriflavine and neutral acriflavine and is therefore simpler to manufacture.

In 1936 Albert Linnell and others began intensive investigations on the acridine series. They prepared all the possible aminoacridines and investigated the relation between chemical constitution and activity. They found that amino groups in positions 2, 3, or 5 increased the activity of the acridine molecule and gave compounds of high bacteriostatic activity. 2 : 7-diaminoacridine and 5-aminoacridine were considered to be the best of the series.

It is well known that chlorophenols are considerably more active than the parent phenol, and experiments were also carried out to determine the effect of introducing chlorine into aminoacridines. New chloroacridines were prepared but