tracheotomy tube when in position. On two subsequent occasions, at fortnightly intervals, the tubing was replaced by a piece of larger bore, but on the latter occasion it would not pass through the tracheotomy stoma and was therefore introduced through the mouth, with the aid of the laryngoscope. A third attempt to replace this tube by one still larger was unsuccessful, and the same tube was reinserted with some difficulty, owing to persistent exuberant granulations. Some discomfort and swelling followed this manipulation, and continuous dilatation was stopped on Sept. 20. At that time it was feared that external operation would ultimately be necessary.

On Oct. 18 the airway appeared to be remarkably good, and direct laryngoscopy revealed the entire absence of granulations and a somewhat small healed lumen below the vocal cords. Dilatation from above by direct laryngoscopy and from below through the tracheotomy stoma was begun with Hegar's dilators—a procedure which the patient bore with remarkable ease. This was carried out on three occasions at weekly intervals, size No. 11 being easily passed on each occasion. During this period progressive "corking" of the tracheotomy tube was effected, and by Nov. 4 complete occlusion was being maintained throughout the 24 hours. Good movement of rather irregular vocal cords was observed on indirect laryngoscopy. The patient's voice was excellent, and he could undergo considerable exertion without embarrassment. On Nov. 18—13½ months after the accident and 4 months after continuous dilatation was started—the tracheotomy tube was removed. The stoma closed in three days.

Having been discharged from the Service, he was allowed to return to his home, with instructions to attend the nearest hospital for subsequent periodic dilatation.

Comment

This case presents some interesting features: (1) In the literature which we have been able to consult we have failed to discover any reference to the occurrence of stenosis following exposure to screening smokes, and though reference has been made to the possibility of such an occurrence after exposure to mustard gas, no report of an actual case has been found. (2) The persistence of granulations, which disappeared only after continuous dilatation was abandoned—at which juncture it was thought that this method of treatment had been unsuccessful. (3) The employment of Hegar's dilators: the circumstances of this case justified any method of improvisation that was available. These dilators proved to be satisfactory and reasonably convenient.

Continuous Dilatation.—Brief reference to another case which came under the care of one of us (R. B. L.) illustrates the trial of a further method.

A lieutenant aged 25 was wounded in Syria in June, 1941. He was admitted to hospital with a large gaping wound of the right side of the face, mouth, and neck, with loss of a portion of the mandible and thyroid cartilage. A high tracheotomy and gastrostomy had already been performed. There was a fistula between the floor of the mouth and the neck wound, resulting in a constant flow of saliva to the laryngeal wound and tracheotomy opening. This was controlled by the frequent application of an improvised hand-suction apparatus by a special attendant. Six weeks after being wounded he was fit to have a low tracheotomy performed through a transverse incision. At the same time it was thought advisable to attempt to improvise a temporary method of continuous dilatation of the larynx in case this should subsequently prove necessary while the neck wound was still under treatment. A tracheotomy tube, to the end of which a piece of stout rubber tubing was attached, was inserted in an upward direction through the upper tracheotomy stoma. This was left in position for a day or two, in order to demonstrate that the method was satisfactory. Fortunately its later adoption was not necessary, as the larynx healed without any appreciable degree of stenosis.

Our thanks are due to Major-Gen. J. C. A. Dowse, C.B.E., M.C., D.M.S., M.E.F., and to Col. G. H. Haines, M.C., officer commanding a general hospital, for permission to publish this record. We are indebted to Major J. A. Kilpatrick, R.A.M.C., for the early notes on the case, and to Major W. S. Kerr, S.A.M.C., for his help in providing us with some of his personal instruments.

The Scientific Instrument Manufacturers' Association of Great Britain (123, Pall Mall, S.W.) announces that Mr. W. Bowen has presented a substantial capital sum, the income of which he wishes to be devoted towards the encouragement and development of invention, design, research, processes, and manufacturing technique in the scientific instrument manufacturing industry. The Council of the S.I.M.A. have drawn up a deed of trust under which the income from the fund is to be devoted each year to prizes to be awarded to the employees of members submitting papers fulfilling the objects of the Trust.

INTESTINAL OBSTRUCTION BY GALL-STONES

BY

MAURICE LEE, F.R.C.S.

Acute intestinal obstruction by gall-stones, although one of the rarer causes of bowel obstruction, has the highest mortality rate of all the obstructions of the intestine. Vick's (1936) figures are as follows:

Simple Obstruction		%	Strangulation		%
Intussusception		15.0	Strangulated inguinal hernia		20.0
Carcinoma		13.0	Strangulated femoral hernia		19.5
Adhesions		7.35	Strangulated umbilical hernia		5.4
Gall-stones		0.7	Other herniae		2.5
Congenital atresia		0.6	Internal strangulation		11.4
			Volvulus		2.6

Mortality of the Main Types of Acute Intestinal Obstruction

Gall-stone obstruction		50-60%
Carcinoma of colon		35-40%
Adhesions		30-35%
Internal strangulation		30-35%

The rarity of the condition is shown by the following figures. Barnard (1902), at the London Hospital in a period of 8 years, was able to collect only 8 cases of gall-stone obstruction—i.e., an average of one case a year. Gibson (1900), in a series of 646 cases of intestinal obstruction, had only 40 due to gall-stones. Prof. Grey Turner informed me that he has had 15 cases in all his surgical experience.

Many of the cases reported have been in very elderly patients, and in more than a few a second laparotomy has been required to remove a second stone. For example, Hinchey (1940) reported a case in a patient aged 79, and Dulin and Petersen (1939) had a patient of 83 who survived operation. Prof. Grey Turner (1932-3) reported a successful and very unusual case, in a patient aged 81, in which the obstruction occurred in the transverse colon. In my own case (described below) the patient was 87 years old and required two laparotomies within two months. The death rate (50%) is high because of two facts—late diagnosis (or no diagnosis) and the advanced age of the patient. Many of these cases give no history of previous gall-bladder trouble and have been quite well until the intestinal obstruction has occurred.

Gall-stones which give rise to intestinal obstruction are always large and have entered the bowel by a process of ulceration from the gall-bladder. The fistulous communication is usually between the gall-bladder and duodenum, though other internal communications have been described. Neligan (1915) reported an instance in which gall-stones were vomited into a pan by a patient with such force that the sound suggested a volley of buckshot being fired into a metal utensil. In this case the fistulous communication must have been between the stomach and the gall-bladder.

Not all gall-stones that get into the intestine cause acute obstruction. Some are passed naturally per rectum; others travel as far as the anus and there become impacted. It is very rare for the condition to be diagnosed previous to operation; a review of the literature reveals that only 7 cases were so diagnosed. In many cases the obstructive symptoms are at first temporary; the patient is relieved for a while and then the symptoms recur. This is very misleading to the diagnostician, and accounts for the high mortality of the condition. The remissions and recurrences of the obstruction are due to the fact that the gall-stone becomes temporarily obstructed in the bowel, is dislodged by vigorous peristalsis, and becomes impacted lower down in the bowel, where the lumen is narrower. It therefore follows that in most cases of gall-stone obstruction the stone is found obstructing the bowel in the terminal ileum. In my patient this occurred in the first obstruction, but in the second laparotomy the stone was found in the bowel much higher up in the ileum because it was a large stone and therefore could not travel further down. In view of the insidious onset of gall-stone obstruction and the difficulty in diagnosis of the condition in its early stages, the practitioner is faced with a case in which treatment is applied late, and perhaps when the patient is moribund. As in other types of intestinal obstruction, any means that can assist early diagnosis must be used. It is not

even now generally realized that vomiting and abdominal pain which last for over 24 hours denote a serious abdominal condition. Again, too rarely is the stethoscope used to auscultate the abdomen. Just as a clinician can diagnose an abnormal heart sound or chest sound only by repeatedly listening to the normal sounds, so only by listening repeatedly to the normal sounds in a normal abdomen can he differentiate these from the abnormal conditions when they present themselves. The chief object of auscultation is to find out if borborygmi are absent or not. Increased borborygmi associated with pain suggest the presence of intestinal obstruction. Increased borborygmi without pain, on the other hand, signify bowel hyperactivity. A silent abdomen on auscultation indicates absence of peristalsis in the bowel and therefore the presence of ileus.

X-ray examination of the abdomen can be very helpful in the diagnosis of cases of intestinal obstruction running an obscure course. It must be emphasized, however, that the interpretation of straight x-ray films in the diagnosis of acute abdominal conditions must be made in conjunction with the clinical picture. In gall-stone obstruction the outline of a stone in the intestine may be seen (see Radiograph). This, of course, depends upon the amount of calcium salt present in the stone. But even in the absence of this or in other cases of intestinal obstruction a straight radiograph of the abdomen can often be of help in determining the degree of obstruction as well as its site.

Treatment

In gall-stone obstruction, operation at the earliest moment is the treatment of choice. Because of the excessive vomiting general anaesthesia should not be used. Once the stone is located the intestine over it is incised and the stone removed, the segment of intestine containing the stone having been isolated by careful packing. The incision in the intestine is then carefully sewn up, transversely if possible. The intestine should be examined for the presence of other calculi, but this examination should not be unduly protracted.

In the general textbooks on surgery it is advised that the stone be pushed into a segment of the bowel either proximal or distal to the site of the obstruction before the bowel wall is incised. In the two laparotomies which I have performed for this condition I found that this was impossible. The stone appeared to be grasped in the intestine in what seemed to me to be a state of spasm. It has been suggested that if this spastic condition could be overcome by injecting the mesentery of the intestine at the site of the obstruction by novocain 1%, the stone could then be milked along the rest of the ileum into the caecum, whence it would pass easily to the exterior. This procedure is feasible if the intestine is obstructed not far from the ileo-caecal junction and if the stone is not too large. In gall-stone intestinal obstruction there is not only an obstruction of the bowel lumen but also an additional spasm of the gut superimposed—a condition described in American textbooks as spastic ileus or dynamic obstruction. Certainly the less time that is taken and the less trauma there is in operations on these old and ill patients, the better is their chance of survival.

An alternative to this procedure is the possibility of crushing the stone *in situ* by the introduction of forceps into the lumen through a stab incision. Wangenstein (1942) states that he attempted this once, but was unable to crush the stone. In my own cases I noticed, while examining the stone (second stone at second operation) after laparotomy, that it crumbled up under the pressure of the scalpel when I attempted to divide it, much to my annoyance, as it would have made a lovely specimen.

Case History

The patient, a deaf woman aged 87, was admitted on Aug. 14, 1944, with intestinal obstruction. The obstruction had been absolute for three days and she had vomited everything for the same period. When she was admitted to hospital the vomit consisted of dark-brown foul material. There was generalized abdominal pain.

On examination, which was made difficult by her deafness, her tongue was dry and furred. The pulse was rapid and irregular because of auricular fibrillation. There was generalized tenderness and guarding of the abdomen but no rigidity. A glucose-saline intravenous drip was started and a laparotomy was performed under spinal analgesia, using heavy nupercaine. A large gall-stone about the size of a walnut was removed from the lower ileum; no other

stones were found. After operation she had some diarrhoea and vomited for two days, but on Aug. 19—i.e., five days after operation—she was sitting up in a chair and taking a light diet.

Straight radiograph (portable) of abdomen showing large gall-stone in small intestine.

Second Operation, Nov. 26.—For two days previous to readmission there were vomiting, absolute constipation, and abdominal pain. At operation (under spinal analgesia) the old scar was excised. A large stone about the size of a golf ball was found obstructing the ileum about 3 to 4 ft. from the ileo-caecal junction. The stone was removed and the incision in the bowel wall was sewn up transversely. The post-operative convalescence was complicated by a discharge from the wound, which cleared up by the local application of sulphonamides. The stone was found on analysis to consist principally of cholesterol, with the addition of calcium carbonate and bile pigments. It was light in weight and crumbled into many pieces when an attempt was made to bisect it.

Summary

An explanation is given why gall-stone obstruction carries such a high mortality—namely, the insidious onset, the absence of any previous history, and the advanced age of so many patients.

A history is given of an elderly patient on whom two laparotomies were successfully performed.

Suggestions are made for dealing with the stone in order to avoid any further trauma to the bowel.

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