irregular. The bowels had not acted. An enema was returned clear. (vi) The patient fell out of bed on the evening of the 17th and broke an iron fender in her fall. The midwife noticed that the abdomen seemed larger after this accident. On being questioned she stated that the distension was more pronounced below the umbilicus—no bruising was seen on the abdominal wall. The midwife was not aware of the post-mortem findings.

Discussion

The most interesting question is, When did the volvulus occur? Had the injury on the evening of November 17 pre-disposed to this condition? The bowels had not been opened from November 14, when the result of an enema was clear. Clifford White (1914) recorded a case of volvulus of the caecum that was not diagnosed before operation, and asked, "When did the volvulus occur?" Margaret Basden (1934) reported the case of a woman in labour in whom laparotomy (and Caesarean section) was done for a suspected intra-abdominal condition and a volvulus of the caecum was found at operation. J. H. Spence (1937) quoted a case of volvulus shortly after delivery in which too much attention was paid to the associated uterine infection. He stated that "during pregnancy and the puerperium there should not be much delay in performing laparotomy in doubtful cases."

Extreme abdominal distension occurring in the puerperium may be due to (1) pelvic peritonitis; (2) a condition simulating paralytic ileus; (3) retroperitoneal haemorrhage from extraperitoneal rupture of the uterus; (4) an intra-abdominal catastrophe such as volvulus of the bowel; or (5) a combination of (1) and (4) or of (1), (2), and (4). The cause of the distension may be difficult to assess. Retroperitoneal haemorrhage would be suspected from the history of the labour and speculum examination under a good light. If the diagnosis is still in doubt intestinal decompression for twelve hours should be attempted. If dramatic deflation does not follow, it would be advisable to do a laparotomy. The error in the above case was in performing a small suprapubic incision for suspected peritonitis instead of a laparotomy. Even if a diagnosis of peritonitis is reasonably certain it seems preferable to do a laparotomy so as to exclude any associated abdominal condition.

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GIFT OF OXYGEN INSTALLATION TO HOSPITAL

A complete installation for oxygen and nitrous oxide has been presented to the Royal Infirmary of Edinburgh by Colonel S. J. L. Hardie, chairman of the British Oxygen Company. It incorporates three miles of copper pipe-line running to various parts of the building, and has 342 points, including points at bedsides in the wards where oxygen can be obtained, and in the theatres, for oxygen and nitrous oxide. There are two manifolds, one for the surgical side and the other for the medical, where big cylinders are housed in banks of four. If a bank of four oxygen cylinders begins to run low an automatic warning is given, a reserve bank of four cylinders comes into operation, and the four exhausted cylinders are replaced by four full ones, which in their turn become the reserve. Normally the cylinders require replacement every three or four days. Oxygen can be obtained at the bedside only when the valve attached to the ward has been turned on by the sister in charge. The oxygen is administered through a mask of American pattern, leaving the patient's mouth free, so that he can eat if necessary while breathing oxygen through the nose. At the opening ceremony the thanks of the managers to Colonel Hardie were expressed by Mr. John R. Little, chairman of the Royal Infirmary Board.

SOME FACTORS AFFECTING THE INCIDENCE OF POST-ANAESTHETIC VOMITING

BY

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The purpose of this article is to bring forward, with the aid of illustrative series of cases, some facts about post-anaesthetic vomiting which are well recognized, and some which I think have been less well recognized in the past. I shall try to show that the incidence of post-anaesthetic vomiting is modified by such factors as the anaesthetic used, the operative procedure, sex, etc., in a manner which does not seem to have been fully realized hitherto.

The cases making up these illustrative series are drawn from the anaesthetic records of the Westminster Hospital and from personal records obtained in the E.M.S. maxillo-facial unit to which I am attached.

Figures given regarding the incidence of post-anaesthetic vomiting vary widely according to their source, and also according to the observer's view as to when true post-anaesthetic vomiting begins and when it ends. The figures quoted below are from unselected series (except where otherwise stated), and represent anaesthetics, anaesthetists, and surgical procedures of every type and degree. The record is absolute—i.e., the patient who vomits once after the first post-operative drink is said for the purpose of obtaining these figures to have vomited once. In addition I have visited all cases in these series, whether referred to directly or indirectly, in an effort to eliminate any varying personal factor that might well arise if more than one investigator had been concerned.

First, taking as a basis 1,000 consecutive cases, the following figures for the incidence of post-anaesthetic vomiting were obtained:

Nausea only..	..	..	..	..	2.6%
Vomited once only..	..	..	..	..	15.7%
Vomited 2 to 5 times	..	..	..	..	20.9%
Vomited more than 5 times in less than 18 hours	..	..	..	..	6.5%
Vomited more than 5 times in more than 18 hours	..	..	..	..	0.8%

These degrees will be referred to as N, 1, 2, 3, and 4.

Secondly, it was decided to take four anaesthetic sequences: nitrous oxide, oxygen, and ether; pentothal, nitrous oxide, and oxygen; pentothal, nitrous oxide, oxygen, and ether; and pentothal, cyclopropane, nitrous oxide, oxygen, and ether. In all the series 100 consecutive cases of each anaesthetic sequence have been taken (see table on opposite page).

Series II and III.—It will be seen from the table that, as might be expected, the use of nitrous oxide, oxygen, and ether produces the highest incidence of post-anaesthetic vomiting. But it is rather surprising to find that the preliminary addition of pentothal sodium (the dose varying from 3.5 to 12 c.cm. of 5% solution) reduces the incidence by almost 20%. From the work of Seeley, Essex, and Mann (1936) this effect might well be considered possible, but that it is so great is indeed surprising.

Series IV.—The next effect that stands out is that, contrary to the opinion of some anaesthetists, the addition of cyclopropane to the anaesthetic sequence appears to have little effect on the post-anaesthetic vomiting rate. This may be because a large proportion of these patients suffered only a relatively small degree of surgical trauma; but this may well be offset, at any rate in part, by the fact that

Table showing Incidence of Post-anaesthetic Vomiting when using Four Different Anaesthetic Sequences, compared with that of 1,000 Consecutive Cases

Series	No. of Cases	Nausea N	Vomiting 1	Vomiting 2	Vomiting 3	Vomiting 4	Total N, 1, 2, 3, 4	Total 1, 2, 3, 4	Female	Male	Female Vomiting	Male Vomiting
I. General . . .	1,000	2.6%	15.7%	20.9%	6.5%	0.8%	46.5%	43.9%	—	—	—	—
II. Gas, oxygen, and ether . . .	100	3%	17%	31%	11%	0%	62%	59%	67	33	46 (68.6%)	15 (45.5%)
III. Pentothal, gas, oxygen, and ether . . .	100	6%	15%	20%	5%	0%	46%	40%	46	54	26 (56.5%)	14 (26%)
IV. Pentothal, cyclopropane, gas, oxygen, and ether . . .	100	0%	17%	21%	4%	0%	42%	42%	25	75	14 (52%)	28 (39.6%)
V. Pentothal, gas, and oxygen . . .	100	1%	10%	10%	6%	1%	28%	27%	61	39	23 (26.5%)	4 (10%)

most of them underwent an anaesthesia of more than average duration—averaging 72 minutes against 36.5 minutes.

Series V.—It is admitted that in this series the average duration of anaesthesia was less and the degree of surgical intervention also less than for Series II and III. It should, however, be stated that this series included all extra-abdominal procedures with the exception of cranial surgery, and also cases of less severe low intra-abdominal procedures. In addition, while the average duration of anaesthesia was 36.5 minutes, the longest when using this sequence was 175 minutes, while 60 to 90 minutes was considered a figure worthy of only passing note.

Another point is that of the 23 females who vomited 14 had undergone minor gynaecological procedures such as dilatation of the cervix, curettage, application of radium to the cervix, etc. If all cases of females undergoing such procedures are excluded the figures obtained become:

Nausea only (N)	..	..	..	..	..	2%
Degree 1	..	..	..	..	..	10%
" 2	..	..	..	..	..	6%
" 3	..	..	..	..	..	4%
" 4	..	..	..	..	..	1%

showing a reduction of 6% in the higher post-anaesthetic vomiting rates. The percentage of all females vomiting was 23. Thus it really does seem that the presence or absence of minor gynaecological cases in a series for which the post-anaesthetic vomiting rate is estimated has an appreciable effect on the figures obtained. This point will be referred to later.

Sex Incidence

It has been generally recognized that males tend to vomit less than females, but the difference is rather greater than expected. In Series II the ratio was 68.6 females to 45.5 males; with the addition of pentothal sodium it became 56.5 to 26 (see table). It will be noticed that the preliminary administration of pentothal sodium has a more pronounced effect in males than in females. A reason for this is suggested below.

Effect of Operation

While not dealing with this subject as fully as may seem advisable, it is interesting to note the effect of two types of operation.

Operations on Nose, Nasopharynx, and Mouth.—The figures obtained for 100 consecutive cases are as follows:

Nausea only	..	..	..	..	..	5%
Degree 1	..	..	..	..	..	24%
" 2	..	..	..	..	..	16%
" 3	..	..	..	..	..	4%
" 4	..	..	..	..	..	5%

These figures are comparable to those quoted for the general series of 1,000 cases, in spite of the fact that the patients' ages ranged from 2 to 70 years, and that it is a common remark that "patients are always sick after tonsillectomy." It appears that there is little truth in this remark.

Minor Gynaecological Operations (e.g., dilatation and curettage, etc.).—For 100 consecutive cases it has been found that the figures obtained are as follows:

Nausea only	..	..	..	..	..	4%
Degree 1	..	..	..	..	..	26%
" 2	..	..	..	..	..	22%
" 3	..	..	..	..	..	16%
" 4	..	..	..	..	..	3%

This gives the high incidence of 67% of post-anaesthetic vomiting—startlingly high seeing that pentothal played a part, even an entire part, in the anaesthetic procedure of nearly all these cases. This fact becomes more interesting when comparison is made with a shorter series of similar cases in which no pentothal sodium was used; it was then seen that the incidence of post-anaesthetic vomiting was only slightly greater (71% as against 67%). In a series of minor gynaecological operations, all of which included dilatation of the cervix, the post-anaesthetic vomiting rate was 64%, a figure which suggests that the factor causing the raised vomiting rate is the dilatation. Hence it appears that in these cases the anaesthetic given has comparatively little effect on the incidence of post-anaesthetic vomiting. This may well explain the relatively smaller decrease in the figures obtained for females in Series II and III as compared with the corresponding decrease in the case of males.

Treatment

The treatment of post-anaesthetic vomiting, while not within the scope of this article, requires one or two notes. It is as much pre-operative as post-operative. The co-operation of the nursing staff in reassuring the patient can bring about a most gratifying reduction in the figures obtained. The usual lines—absence of food in the stomach, pre-operative glucose, fluids, and avoidance of excessive purging—may be followed with success. Various authorities (Minnitt, 1932; Smith, 1934) suggest the combination of glucose with insulin. Smith found that 2 oz. of glucose given with 5 units of insulin pre-operatively, followed post-operatively by 4 oz. of glucose rectally with 5 units of insulin, reduced the post-operative vomiting rate by 50%. Premedication should be suitable and adequate, and be combined with the administration of a basal hypnotic. In this connexion attention should be drawn to the fact that the substitution of omnopon for morphine in the premedication reduces the incidence. Individual susceptibility to morphine appears to be a very definite entity. Adequate doses of atropine or hyoscine will prevent secretion, and possible swallowing, of ether-impregnated saliva and mucus. The effect of the barbiturates has been noted.

The post-operative supply of fluids in all cases in which fluid loss during operation has been in any way excessive, whether by actual blood loss or by sweating, will also reduce the incidence of post-operative vomiting. The rectal or even oral administration of normal saline to the point at which the patient complains has proved to be an effective measure, which may be further enhanced by the addition of glucose.

The patient should be moved as little as possible on his return to bed. He should be placed in the right lateral position, and be allowed to recover in peace, a careful watch being kept to prevent any obstruction of the airway. Apart from any other consideration, anoxaemia seems to be a pronounced predisposing factor in the causation of vomiting. Post-operative sedation should be applied, and the use of suppositories—e.g., nembutal—should not be forgotten.

Vomiting which is actually occurring may be treated by a variety of remedies. Drinks of hot water, to which 10 to 15 grains of sodium bicarbonate may be added, strong hot black coffee, Lugol's iodine, and sips of champagne all have their measure of success. Lenevitch (1892) advised washing out the stomach with warm alkaline solution (sodium bicarbonate). Though suggested at such a relatively early date, this line of treatment has proved most efficacious, especially in cases of persistent vomiting.

Summary

The incidence of post-anaesthetic vomiting in 1,000 consecutive cases is compared with that in four series, each of 100 cases, in which a different anaesthetic sequence was used.

The effect of sex and of certain surgical procedures on the incidence of post-anaesthetic vomiting is shown, particular reference being made to oro-nasal and minor gynaecological operations.

Lines of treatment for this condition are suggested.

My thanks are due to Dr. I. W. Magill for his advice on the Westminster Hospital cases and in the preparation of this article; and to Dr. John T. Hunter since my transfer to an E.M.S. unit.

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Medical Memoranda

Leiomyoma of the Stomach with Ulceration

Although cases of leiomyoma of the stomach have not infrequently been reported in the literature, the following case is considered worth while recording in view of the fact that the nature of the tumour was diagnosed pre-operatively, and because some light may be shed on the kind of ulceration occurring in conjunction with these tumours.

CASE REPORT

A lighterman aged 65 was admitted as an emergency, having had a severe haematemesis. Shortly after admission he vomited more bright red blood. His haemoglobin was found to be 30%. He had a history of intermittent indigestion for fifteen years, each attack lasting for from two to three months, and the periods of freedom from pain lasting for as long as two years. There had been no vomiting or loss of weight, and the pain had never been severe. Three weeks before admission there had been a small haematemesis, but since then, until admission, no abdominal pain.

On examination there were slight tenderness in the epigastrium and extreme pallor of the skin and mucous membranes, but otherwise no abnormal physical signs were seen. A transfusion of three pints of blood was given, and the patient improved considerably. X-ray examination performed a month after admission, when the haemoglobin was 68%, revealed a large filling defect high up on the anterior walls of the stomach. Rugae were obliterated over the filling defect, which was circumscribed and well defined. No niche, crater, or spasm was seen.

In view of the x-ray findings a diagnosis of a benign tumour of the stomach was made, and partial gastrectomy was performed on March 18, 1941. In order to section the stomach

above the tumour it was necessary to remove about three-quarters of that organ. The gastrectomy was of the modified Polya type. No glandular enlargement was found in the abdomen, and tissues surrounding the stomach were healthy and free from adhesions. There was no indication on the peritoneal surface of the nature of the tumour, but its mobility within the stomach suggested that it was benign. After an uneventful recovery the patient was discharged on April 8, with a haemoglobin of 105%.

The pathological report on the specimen (see Fig.) was as follows:

Macroscopic Examination.—The stomach is enlarged, the rugae on the body being well marked. There is a firm growth at the cardiac end in the anterior wall near the lesser curve. The growth is oval, measures $2\frac{1}{2}$ by $1\frac{1}{2}$ inches, and appears to be insinuated between the mucous and serous layers. Its borders are sharply defined, and the mucous membrane over it is stretched and rugae free. There is an ulcer measuring half an inch in diameter, the margins of the ulcer being sloping and its floor necrotic. The cut surface shows a definitely lobulated structure, many of the lobules showing marked congestion, and giving rise to the effect of a coloured pattern.

Microscopic Examination.—The growth consists essentially of muscular fibres with a whorl-like arrangement. There is, in addition, a fair amount of fibrous tissue derived from areas of resolving haemorrhage. The growth in parts is oedematous and throughout is richly cellular; no significant changes are present in the mucosa beyond congestion and some polymorph infiltration. There is no particular cellular infiltration around the ulcer on the summit. Its walls are sloping, and it appears to be a simple pressure atrophy of the mucosa.

Diagnosis.—Leiomyoma of the stomach.

DISCUSSION

Edwards and Lewis (1940) describe a case of leiomyoma that gave rise to haematemesis, which left the patient with only 30% of haemoglobin. Apart from this case, it would seem that the degree of bleeding in our case was unusually severe. They quote Starr Judd as saying that true peptic ulceration may occur on the surface. The microscopical and macroscopic appearances of our case, together with obliteration of rugae over the tumour, strongly support the view that ulceration was due to pressure atrophy. In view of this it is rather surprising that the haematemesis that ensued was so severe. The cause of the gastric symptoms, which had persisted for fifteen years, remains in doubt. The rest of the stomach mucosa showed no signs of gastritis, nor was it apparent how such a gastritis could result from the presence of the tumour. However, the proximity of the tumour to the cardia could, in view of the size of the tumour, undoubtedly have given rise to the considerable disturbance of the mechanics of gastric digestion, and this might be the explanation.

The recommendation of Edwards and Lewis that local resection is all that is required in these cases is undoubtedly a wise one, except that it is difficult to be quite certain of the nature of the tumour. Moreover, the technical difficulties involved in performing a sleeve resection with the tumour so highly situated would be very considerable.

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