

Selection of patients for bile diversion surgery: use of bile acid measurement in fasting gastric aspirates

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SUMMARY Eighteen patients with dyspepsia and vomiting which followed surgery for peptic ulcer have completed a study to examine the role of diverting bile from the stomach by a Roux-en-Y procedure. Bile regurgitation and mild epigastric pain relieved by vomiting were abolished. Measurements of bile acids in the fasting gastric aspirate were useful in predicting the outcome of surgery; good results were obtained when initially there was reflux into the stomach of more than 120 $\mu\text{mol}/\text{hour}$ of bile acids. A wider group of patients than those selected in previous series may benefit from this operation, as good results can be obtained in patients with dyspepsia relieved by alkali and without achlorhydria or gastritis. Endoscopy was repeated one year after Roux-en-Y operation. Erythema of the mucosa was improved, but gastritis did not improve.

After gastric surgery, many patients experience discomfort associated with regurgitation or vomiting of bile which may persist for several years (Griffiths, 1974). Medical treatment, including cholestyramine, is unsatisfactory (Scudamore *et al.*, 1973), so that reconstructive surgery with a Roux-en-Y operation has been used and may relieve dyspepsia and bile vomiting (Conyers *et al.*, 1960; Coppinger *et al.*, 1973; Herrington *et al.*, 1974; van Heerden *et al.*, 1975). Most series of patients have been selected and include those with epigastric pain unrelieved by alkali or food (van Heerden *et al.*, 1975), with achlorhydria (Herrington *et al.*, 1974) or gastritis (Joseph *et al.*, 1973; Drapanas and Bethea, 1974). Such selection may be too restrictive. Furthermore, the reflux of bile has not been assessed quantitatively in previous studies.

We have studied 18 consecutive patients with postoperative dyspepsia and vomiting severe enough for patients to accept a further operation. The preoperative symptoms, endoscopic findings, gastric histology, and measurement of fasting bile reflux have been correlated with the results one year after operations

Method

PATIENTS

Eighteen patients were included in the study. All had

gastric surgery at least one year previously and recurrent ulceration or biliary disease had been excluded as a cause of their symptoms. Three were women and the average age was 50 years (range 33-66 years). The previous gastric operations were vagotomy and pyloroplasty in four, vagotomy and gastroenterostomy in two, vagotomy and antrectomy in three, Billroth I partial gastrectomy in two, and Billroth II in seven. On average the first operations had been performed 7.4 years ago (range one to 39 years). Ten patients had already had one unsuccessful revision operation that had not accomplished bile diversion.

PROCEDURE

Before the bile diversion operation, patients had a barium meal, endoscopy performed by one person (A.M.H.), gastric biopsies from the distal and proximal stomach, a pentagastrin test, and fasting gastric juice was taken for measurement (by the method of Fausa and Skålhegg, 1974) of the concentration of bile acids (Hoare *et al.*, 1977b). The severity of the patient's symptoms were assessed by one physician, and the biopsies were examined without knowledge of their order by one person (H.T.) using the criteria of Whitehead *et al.* (1972) for the stomach and Ismail-Beigi *et al.* (1970) for the oesophagus.

At operation a Roux-en-Y reconstruction was performed with the afferent loop of jejunum anastomosed to the side of the efferent loop at least 45 cm distal to the gastrojejunal stoma. If the insulin test

was positive before the reconstruction operation, a vagotomy was performed or completed. The antrum was removed if this had not already been done.

One year after the bile diversion operation, symptomatic assessment was repeated. Those who gave informed consent had a review endoscopy and samples of gastric juice taken for estimation of bile acids.

Two patients did not consent to a one year review endoscopy. Bile acid measurements were not available in two patients.

Fisher's Exact Test was used for the statistical analysis.

Results

At the assessment one year after bile diversion operation three patients were classified as Visick grade I (no symptoms), six as grade II (mild symptoms relieved by care), four as grade III (mild symptoms not relieved by care, but satisfactory), three as grade IIIu (mild unsatisfactory symptoms), and two as grade IV (not improved). All but one grade IIIu and the two grade IV patients were pleased that they had had the operation, even if some unsatisfactory symptoms persisted. Some patients did not improve until after six months. Some symptoms only were improved by the operation. Bile regurgitation was invariably abolished, as was bile-staining of the vomit. However, four patients continued to vomit. Epigastric pain was relieved in all those who originally had a 'mild ache only' or pain described as 'continuous but relieved by vomiting'. In patients who had other types of pain, such as 'intermittent severe pain', the pain was not abolished although it was often improved. Epigastric pain was abolished significantly more often in patients with reflux of more than 120 μmol bile acids/hour into the stomach than in those with little reflux. Five patients had dyspepsia relieved by alkali previously and in three the pain was relieved. In one patient 'constant pain' was relieved by antidepressants but not surgery. Heartburn, which was present in three patients before the operation, was relieved. Colicky lower abdominal pain was unaffected by the reoperation and this was the commonest cause of poor Visick grading. The five patients who were losing weight before the operations subsequently put on between 3.5 and 12 kg. The overall results are related to preoperative symptoms and results of investigations in Table 1.

The endoscopic and biopsy findings before and after reoperation are shown in Table 2. One year after bile diversion there was a significant improvement in mucosal hyperaemia. However, there was a slight increase in the severity of the gastritis after

Table 1 Outcome of Roux-en-Y operation and pre-operative symptoms and investigations

Preoperative symptoms	Visick grade after one year			
	Number	I-IIIs	IIIu-IV	Significance
Bile regurgitation				
Present	14	11	3	NS
Absent	4	2	2	
Pain				
None	1	1	0	} P < 0.05
Relieved vomiting	4	4	0	
Mild	4	4	0	
Severe	9	4	5	
Lower abdominal pain	6	2	4	P = 0.05
Diarrhoea	7	4	3	NS
Weight loss	6	6	0	NS
History > 10 yr			2	NS
Peak acid output (mmol/h)				
0	5	3	2	NS
0-3	3	3	0	
3-5	4	3	1	
5	6	4	2	
Bile acids ($\mu\text{mol/h}$)				
0-120	5	1	4	P < 0.05
> 120	11	10	1	
Mucosal hyperaemia				
Mild	1	0	1	NS
Moderate	7	6	1	
Severe	10	8	2	
Proximal gastritis				
None	4	2	2	NS
Chronic				
Superficial				
Mild	7	5	2	
Severe	7	6	1	

Table 2 Endoscopic and gastric surgery biopsy findings before and after surgery

Endoscopy	Before	One year after surgery*	Significance
Mucosal hyperaemia			
None/Mild	1	15	P < 0.001
Moderate/Severe	17	1	
Bile-staining of the mucosa			
Present	7	0	P < 0.02
Absent	11	16	
Erosions			
Present	5	1	NS
Absent	13	15	
Histology of distal stomach			
No gastritis	4	2	NS
Chronic superficial gastritis			
Mild	7	1	
Severe	6	12	
Mild atrophic gastritis	1	1	NS
Active gastritis	10	12	
Histology of proximal stomach			
No gastritis	4	3	NS
Chronic superficial gastritis			
Mild	8	2	
Severe	6	11	
Active gastritis	9	10	NS
Intestinal metaplasia	5	4	NS
Histology of oesophagus			
Normal	7	14	P < 0.05
Oesophagitis	9	2	

*Two patients did not consent to a second endoscopy.

surgery but the change was not statistically significant. In contrast, histological oesophagitis was improved significantly after the operation. Samples of gastric juice taken at second endoscopy all contained less than 150 $\mu\text{mol/l}$ of bile acids.

Discussion

These results confirm previous reports that bile diversion operations can relieve symptoms of dyspepsia and vomiting (Herrington *et al.*, 1974; Eckstam *et al.*, 1974; van Heerden *et al.*, 1975). We found that measurement of bile acids in gastric juice aspirated from the fasting patient was an objective test that could be used to select patients who might benefit from this operation. Patients with levels over 120 $\mu\text{mol/hour}$ before bile diversion had a good result one year after it.

Symptomatic assessment can be difficult in these patients, but the best results were obtained in patients with epigastric pain which was mild or relieved by vomiting. Other types of pain were not abolished, resulting in poor Visick grades, but this did not prevent the patients from considering the operation a success if their worst symptom, such as bile vomiting, was relieved. We did not confirm the need to restrict the operation to patients with (a) pain not relieved by alkali, (b) gastritis, or (c) hypochlorhydria.

We used a 45 cm limb in the construction of the Roux-en-Y diversion, but others have suggested that a 75 cm limb is needed to prevent bile reflux (Eckstam *et al.*, 1974). However, the concentration of bile acids in aspirates obtained at second endoscopy was less than 150 $\mu\text{mol/l}$ in all patients, which we have found indicates fasting bile reflux of less than 30 $\mu\text{mol/hour}$. Therefore our bile diversion operation reduced bile reflux into the stomach. It also abolished mucosal erythema as seen endoscopically, which suggests that bile reflux causes erythema. The gastritis, however, became slightly more severe. Lawson (1972) showed that a Roux-en-Y operation reversed after six months the gastritis caused by a Billroth II partial gastrectomy in dogs. Our study has failed to confirm this finding in man, and so it is unlikely that bile reflux alone causes gastritis after surgery for peptic ulcer. Gastritis is no more common in patients with dyspepsia and vomiting than matched symptomless controls (Hoare *et al.*, 1977a) and persists after bile-diversion surgery even if symptoms are abolished. Therefore gastritis alone is unlikely to be the cause of symptoms of dyspepsia or vomiting after surgery for peptic ulcer.

The failure of histological changes of gastritis to improve when bile was diverted from the stomach throws some doubt on the concept that the post-operation gastritis is largely due to bile reflux and reaffirms that gastritis does not correlate with symptoms.

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