Alcohol tolerance after proximal gastric vagotomy

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SUMMARY Alcohol tolerance has been studied in 10 patients after proximal gastric vagotomy and six patients after truncal vagotomy and antrectomy. No difference in alcohol tolerance was found before and after proximal gastric vagotomy, while an increased rate of absorption with higher blood levels of alcohol were found after truncal vagotomy and antrectomy.

Rapid absorption of alcohol may follow gastric operations. Elmslie *et al.* (1964) found an increased rate of absorption after partial gastrectomy. Fleming *et al.* (1971) found that alcohol tolerance was also impaired after truncal vagotomy and pyloroplasty, and truncal vagotomy and gastroenterostomy. Elmslie *et al.* attributed the increased rate of alcohol absorption to an increased rate of gastric emptying for liquids; several studies (Argyropoulos and White, 1966; Colmer *et al.*, 1973) have shown that gastric emptying of liquids is faster after a drainage procedure. This paper reports the results of a study of the effects of proximal gastric vagotomy (PGV) on oral alcohol tolerance.

Methods

PATIENTS

Twenty male patients were studied. Their ages ranged from 26 to 61 years; all suffered from chronic duodenal ulceration, without evidence of pyloric or duodenal stenosis. The patients had all been entered into a controlled clinical trial of truncal vagotomy and antrectomy (TV + A) versus proximal gastric vagotomy. Ten patients had undergone PGV, and six TV + A. In these subjects, an oral alcohol tolerance test was performed before operation and again four months afterwards. Six healthy volunteer subjects were also studied as a control group; these had one test only.

The subjects were tested after a 12 hour fast, lying in a semirecumbent position on a couch. The

patient was asked to drink as quickly as possible 0.65 g/kg body weight absolute alcohol flavoured with raspberry essence, and diluted to a volume of 400 ml with water.

Blood samples were collected at 5, 10, 15, 20, 30, 40, 50, 60, 80, 100, and 120 minutes. Measurements of blood alcohol were carried out by the enzymatic method of Bonnichsen and Theorell (1951). In this method the enzyme alcohol dehydrogenase (ADH) catalyses the reaction

$$\text{C}_2\text{H}_5\text{OH} + \beta\text{DPN} \xrightarrow{\text{ADH}} \text{CH}_3\text{CHO} + \beta\text{DPNH}$$

The quantity of dihydro-diphosphopyridin nucleotide (βNPNH) formed is measured spectrophotometrically (O.D. 340) and is an accurate measure of the amount of alcohol present in the blood.

Results

BEFORE OPERATION

The alcohol tolerance curves of the control, PGV, and TV + A groups were similar. Peak blood concentrations were reached at 30-40 minutes and gradually fell during the remainder of the test.

AFTER OPERATION

The PGV group did not show any difference between pre and postoperative tests (Fig. 1). The peak blood alcohol level was reached marginally earlier, but there was no significant difference between the two tests, and neither differed from the results in the control group.

After TV + A (Fig. 2) the peak blood alcohol level achieved was significantly higher than before operation ($P < 0.005$ at 15 and 20 minutes) and occurred earlier (at 15 minutes as compared with 40 minutes). This high early peak was short-lived, blood levels falling until by 50 minutes they had

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Fig. 1 Alcohol absorption before and after proximal gastric vagotomy.

Fig. 2 Alcohol absorption before and after truncal vagotomy and antrectomy.

returned to the preoperative level. There was an apparent divergence at 120 minutes (Fig. 2) but this was not statistically significant.

Discussion

In this study we have found no alteration of alcohol absorption after PGV, while confirming that after TV + A alcohol is absorbed more quickly with initially higher blood levels. Elmslie *et al.* have suggested that alcohol absorption closely follows gastric emptying, alcohol being absorbed rapidly from the duodenal mucosa. Several studies have been performed of gastric emptying after PGV. Donovan *et al.* (1974) found initial 'cascading' of a 10% dextrose meal when patients were tested at three months. Wilkinson and Johnston (1973), using a semi-solid meal, and Kalbasi *et al.* (1975), using a

solid meal, found normal emptying times three months after PGV. If alcohol and dextrose solution were handled similarly by the stomach, then the studies of Donovan *et al.* (1974) would suggest that alcohol should be absorbed more quickly after PGV, but this apparently is not the case. Our results are more consistent with the normal gastric emptying found by others after PGV.

Alcohol absorption is of particular relevance since the Road Safety Act, 1967. Fleming *et al.* (1971) have stressed the need for warning patients of the dangers of higher blood levels after gastric operations. We have encountered one patient who was charged with driving with an excessively high blood alcohol, in whom a prior vagotomy and pyloroplasty was not accepted in court as a mitigating circumstance. This judgement was in accord with the Appeals Court ruling, that mitigating circumstances under the Road Safety Act, 1967, must relate to the offence, and not to the offender (Metcalf *et al.*, 1969). The case in point was that of a patient with cirrhosis, whose failure to metabolize alcohol normally was not considered to be an adequate defence. The law may thus recognize as mitigation certain unusual circumstances under which a breach of the Act has occurred, but cannot concern itself with the metabolic peculiarities of individuals. It is therefore especially important to warn patients of the effects of gastric operations where appropriate. It appears that PGV has an advantage over other operations for duodenal ulcer as far as tolerance of alcohol is concerned.

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