Pancreatic exocrine function after truncal and highly selective vagotomy

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SUMMARY We have measured plasma glucose and immunoreactive trypsin concentrations and serum pancreatic amylase activities in single blood samples following truncal vagotomy (TV) in 13 patients and highly selective vagotomy (HSV) in 14 patients. Our results show that an increased incidence of exocrine pancreatic insufficiency occurs postoperatively regardless of the type of vagotomy. Glucose concentrations were significantly higher after TV, suggesting that HSV is preferable for patients at risk of or suffering from diabetes mellitus.

Reduction of gastric acid secretion by section of the vagal nerve supply of the stomach (vagotomy) is widely used in the treatment of duodenal ulcer. The vagus innervates both the stomach and the pancreas. Section of both vagal trunks, truncal vagotomy (TV), in addition to reducing gastric acid, may also impair both endocrine and exocrine pancreatic function, as shown by reduced insulin,¹ glucagon¹ and pancreatic polypeptide,² and abnormal duodenal enzyme release.³ Selective vagotomy (SV), and highly selective vagotomy (HSV) which unlike TV, preserve the vagal nerve supply to the pancreas, cause less impairment of pancreatic function.¹⁻³ We have compared pancreatic function in post-TV and post-HSV patients using recently developed laboratory methods which allow the specific measurement in serum of enzymes of pancreatic origin and permit the non-invasive assessment of pancreatic exocrine function.

Material and methods

Twenty-seven postvagotomy patients were studied. Operations were performed by several surgeons over a period of two years. Patients with conditions known to affect pancreatic function (including diabetes mellitus, pancreatitis, or clinical or radiological evidence of gallstones) were excluded. All patients were asymptomatic. The type of vagotomy, age and sex composition of the patients, and the time elapsed postoperatively at sampling are shown in Table 1.

Pancreatic exocrine function was assessed by the determination of serum immunoreactive trypsin

Table 1 Characteristics of patients included in the study

	Truncal vagotomy	Highly selective vagotomy
Number of patients	13	14
Males	11	10
Females	2	4
Mean age $\pm$ SD	62 $\pm$ 12	49 $\pm$ 13
Age range (yr)	43-78	36-69
Time elapsed postoperatively before sampling (months $\pm$ SD)	18 $\pm$ 14	21 $\pm$ 14

(SIRT) and serum pancreatic isoamylase (SPA) activity in a single fasting postoperative sample. Patients were fasted overnight and blood samples were collected between 9 and 10 am. A fasting glucose concentration was also measured to assist in the exclusion of diabetes. Serum was separated and stored at -20°C until analysis, which was generally carried out within one week of sampling. Plasma glucose was estimated on the morning of sampling using the Beckman glucose analyser (glucose oxidase-oxygen electrode method). No patient had fasting glucose values less than 3.3 (59.4 mg/100 ml) or greater than 5.2 mmol/l (93.7 mg/100 ml). SIRT and SPA were determined by methods previously described.^{4,5} Statistical comparisons were carried out using Students' unpaired *t* test and the χ^2 test (with Yates' correction). Reference ranges were obtained by testing normal healthy volunteers (96 subjects for SIRT, 97 subjects for SPA values).

Results

The number of patients with low SPA values was

significantly greater (χ^2 : $p < 0.01$) when both patient groups (TV and HSV) were considered together and compared with the controls (Table 2). There was no significant difference observed when the TV and HSV groups were compared individually with the controls. Similar comparisons for SIRT showed no significant differences.

Table 2 Subnormal (that is, mean $\pm$ 2SD) SPA and SIRT values in TV and HSV groups and in controls

	Serum immunoreactive trypsin	Serum pancreatic isoamylase
Patients		
Truncal vagotomy	1/13	3/13
Highly selective vagotomy	0/14	2/14
Both	1/27	5/27*
Controls	0/96	2/97

*Patients v controls $p < 0.01$.

There were no significant differences in mean SIRT and SPA values when the two vagotomy groups were compared using Student's t test (Table 3). However, the mean fasting glucose values were significantly higher in the TV group ($p = 0.02$).

Table 3 Comparison of mean SIRT concentrations, amylase activities, and glucose concentrations in the two vagotomy groups

Test	TV ($\pm$ SD)	HSV ($\pm$ SD)	p value (TV v HSV)
Amylase			
Total amylase (ref range: 209 $\pm$ 52 IU/l at 37°C)	227 (72)	232 (72)	NS
Pancreatic amylase (ref range: 115 $\pm$ 27 IU/l)	115 (67)	107 (33)	NS
SIRT (249 $\pm$ 51 μ g/l)	277 (118)	241 (49)	NS
Glucose (3.5 mmol/l)†	4.8 (0.3)	4.4 (0.5)	0.02

†Reference range at Royal Free Hospital.
NS = not significant.

Discussion

The prevalence of subnormal SPA values in the post-vagotomy patients as a whole was significantly higher than expected. When each group was separately compared with controls, no significant differences were observed, probably because of the small numbers in each patient group. These results suggest that some degree of pancreatic exocrine impairment does occur after vagotomy, even if the operation was a HSV. This may be due to variation in surgical technique with resulting damage to the pancreatic

vagal supply or to a mechanism not involving the vagal supply.

Mean plasma glucose values were significantly different in the two patient groups, glucose concentrations being higher after TV than after HSV. This finding is consistent with previous work¹ reporting impaired insulin release following interruption of the vagal nerve supply to the pancreas.

The TV group underwent a drainage procedure (pyloroplasty) whereas the HSV group did not. Such a procedure might affect gastrointestinal transit time and release of various gastrointestinal hormones thus influencing insulin response and other pancreatic function. Furthermore, vagal denervation of the gut may render it hypersensitive to physical and chemical stimuli.⁶ Thus the observed changes cannot, with confidence, be solely ascribed to the effect of vagotomy on the pancreas.

The tests we have examined were of no value in providing an index of the completeness of vagotomy. Although mean values of glucose differed significantly in both patient groups, there was considerable overlap. There was also considerable overlap when the SPA and SIRT values were similarly compared. Perhaps better discrimination could be achieved if pre- and postoperative samples were compared.

Our finding of significantly higher mean glucose values, together with the previously reported impairment of insulin release¹ in patients who had undergone TV, and the absence of these effects after HSV suggests that the latter is preferable for patients suffering from or likely to develop diabetes.

References

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