CLINICAL RESEARCH

Gastric exocrine "failure" in critically ill patients: incidence and associated features

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Abstract

Following the observation that many critically ill patients cannot maintain their gastric juice pH below 4 without treatment a study was performed to measure the gastric juice pH in such patients and relate it to other clinical data. The case notes of 64 patients who had been admitted to the intensive care unit and taken part in two trials of ranitidine treatment were reviewed. During those trials gastric juice was aspirated hourly and the pH and volume measured. In this study the values recorded during a six hour untreated control phase were used. Data on age, diagnosis, treatment, outcome, episodes of hypoxia, episodes of hypotension, and use of inotropic drugs were also reviewed. Full data were available for 61 patients: 27 had a mean baseline pH of >5 during the control phase and 34 a mean baseline pH of <5 . Significantly more of those with a high pH suffered hypotension (21/27 *v* 13/34) and received inotropic drugs (16/27 *v* 8/34).

These findings suggest that hypotension in critically ill patients adversely affects gastric exocrine function; prophylaxis with drugs that can improve gastric mucosal blood flow may be more effective than with antacids.

Introduction

Stress ulceration is a serious complication in critically ill patients, and previous work has emphasised the importance of maintaining gastric juice pH above a critical level of 4 in such patients.¹ Patients may, however, still bleed from stress ulceration despite adequate prophylaxis.²

We observed that many critically ill patients were unable to

maintain their gastric juice pH below 4 without any treatment. We therefore studied the incidence and associated features of their apparent gastric exocrine failure.

Patients and methods

The case notes of patients previously included in two trials of treatment with ranitidine were reviewed.³ All patients aged between 16 and 75 admitted to the intensive care unit and requiring ventilation were considered for entry to the trial. Patients were entered immediately on admission to the unit. Patients who had previously undergone gastric surgery, had a history of recent peptic ulceration or carcinoma, or had recently received antacid or H_2 antagonist treatment were excluded.

A size 14 French gauge Salem sump nasogastric tube was positioned in each patient and its position confirmed by a water recovery test. Hourly aspiration of gastric juice was performed and the pH and volume measured. All patients had a control phase without treatment of at least six hours. We report here on the pH measurements taken during this six hour phase.

We recorded details of age, sex, diagnosis, total duration of ventilation, and operative procedures and their duration and clinical outcome. The blood pressure and arterial oxygen concentrations were also studied in the phase immediately before entry to the trial, and episodes of hypoxia (defined as $P_{aO_2} < 10$ kPa for two or more hours), episodes of hypotension (defined as systolic blood pressure < 80 mm Hg for two or more hours), and administration of inotropic drugs were recorded.

We chose an arbitrary mean pH of 5 during the control phase to divide the patients into those with a high pH (> 5) and those with a low pH (< 5). Data on the two groups were analysed by Student's *t* test and the χ^2 test of independence for a two way table.

Results

The case notes and pH data were available for 61 of the 64 patients originally included in our ranitidine trials. No patient suffered macroscopic bleeding during the control phase. Twenty seven (43%) patients were found to have a mean baseline pH > 5 during the control phase, while 34 (57%) patients had a mean baseline pH < 5 (table).

Significantly more patients with high pH (78%) had suffered episodes of hypotension than those in the low pH group (38%; $p < 0.01$). Those with a high pH were also significantly ($p < 0.02$) more likely to have been treated with inotropic drugs. There was no significant difference in age, sex ratio, mortality, duration of ventilation, or incidence of hypoxia between the two groups.

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Comparison of patients in low pH and high pH groups

	Low pH group (n=34)	High pH group (n=27)	p Value
No (%) of patients	34 (57)	27 (43)	
Mean (SEM) baseline pH	2.9 (1.1)	6.7 (0.9)	
Mean (SEM) age	41.1 (19.5)	55.4 (20.2)	NS*
Male to female ratio	1:6	3:5	NS**
Mean (SEM) duration of ventilation (h)	146 (141)	177 (156)	NS*
No (%) of patients who underwent surgery	15 (44)	15 (55)	NS**
Mean (SEM) duration of surgery	2.3 (1.9)	3.2 (1.5)	NS*
No (%) of patients who suffered hypoxia	15 (44)	10 (37)	NS**
No (%) of patients who suffered hypotension	13 (38)	21 (78)	<0.01**
No (%) of patients who received inotropes	8 (23)	16 (59)	<0.02**
No (%) of patients who died	12 (35)	8 (30)	NS**

*Student's *t* test. ** χ^2 test.

Discussion

All patients in this study were critically ill and would be considered to be at high risk of stress ulceration and subsequent gastrointestinal bleeding. We observed that almost half of our patients failed to maintain a normal acid gastric juice of <5 in the fasting state and that this seemed to be related to episodes of severe hypotension immediately before the six hour control phase.

While gastric pH may be one of the most important factors in the aetiology of stress ulceration, maintenance of optimal intramural

pH is probably related to normal oxygen delivery to the gastric mucosa.⁴ In addition tissue hypoxia has been shown to contribute to the production of acute gastric mucosal injury in animals,⁵ and it has been suggested that decreased gastric mucosal blood flow may be important in the pathogenesis of stress ulceration.⁶

Our study suggests that severe hypotension in critically ill patients has a profound effect on gastric exocrine function. The risk of erosive gastritis in this subgroup of patients with high pH gastric juice is currently unknown, but prophylaxis with antacids or H_2 antagonists perhaps seems less logical than with drugs that improve gastric mucosal blood flow.

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Prevalence of microalbuminuria, arterial hypertension, retinopathy and neuropathy in patients with insulin dependent diabetes

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Abstract

Diabetic nephropathy is the main cause of the increased morbidity and mortality in patients with insulin dependent diabetes. The prevalence of microalbuminuria was determined in adults with insulin dependent diabetes of five or more years' duration that had started before the age of 41. All eligible patients (n=982) attending a diabetes clinic were asked to collect a 24 hour urine sample for analysis of albumin excretion by radioimmunoassay; 957 patients complied. Normoalbuminuria was defined as urinary albumin excretion of ≤ 30 mg/24 h (n=562), microalbuminuria as 31-299 mg/24 h (n=215), and macroalbuminuria as ≥ 300 mg/24 h (n=180). The prevalence of

microalbuminuria and macroalbuminuria was significantly higher in patients whose diabetes had developed before rather than after the age of 20. The prevalence of arterial hypertension increased with increased albuminuria, being 19%, 30%, and 65% in patients with normoalbuminuria, microalbuminuria, and macroalbuminuria respectively. The prevalence of proliferative retinopathy and blindness rose with increasing albuminuria, being 12% and 1.4%, respectively, in patients with normoalbuminuria, 28% and 5.6% in those with microalbuminuria and 58% and 10.6% in those with macroalbuminuria. An abnormal vibratory perception threshold was more common in patients with microalbuminuria (31%) and macroalbuminuria (50%) than in those with normoalbuminuria (21%).

This study found a high prevalence (22%) of microalbuminuria, which is predictive of the later development of diabetic nephropathy. Microalbuminuria is also characterised by an increased prevalence of arterial hypertension, proliferative retinopathy, blindness, and peripheral neuropathy. Thus, urinary excretion of albumin should be monitored routinely in patients with insulin dependent diabetes.

Introduction

About 40% of all patients with insulin dependent diabetes develop diabetic nephropathy, which is the main cause of the increased morbidity and mortality in these patients.^{1,2} Several longitudinal studies have shown that raised urinary albumin excretion (based on

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