References

- 1 McLauchlan G, Fullarton GM, Crean GP, McColl KEL. Comparison of gastric body and antral pH: a 24 hour ambulatory study in healthy volunteers: *Gut* 1989; **30**: 573–8.
- 2 Fimmel CJ, Etienne A, Cilluffo T, *et al.* Long-term ambulatory gastric pH monitoring: validation of a new method and effect of H₂-antagonists. *Gastroenterology* 1985; **88**: 1842–51.
- 3 Savarino V, Mela GS, Scalabrini P, Sumberaz A, Fera G, Celle G. 24-hour study of intragastric acidity in duodenal ulcer patients and normal subjects using continuous intraluminal pH-metry. *Dig Dis Sci* 1988; **33**: 1077–80.
- 4 Merki HS, Fimmel CJ, Walt RP, Harre K, Roehmel J, Witzel L. Pattern of 24 hour intragastric acidity in active duodenal ulcer disease and in healthy controls. *Gut* 1988; **29**: 1583–7.
- 5 Moore JG, Halberg F. Circadian rhythm of gastric acid secretion in man. *Nature* 1970; **226**: 1261–2.
- 6 Blum AL, Heading R, Müller-Lissner S, Olbe L. Is duodenogastric reflux clinically relevant? *Gastroenterol Intern*. 1989; **2**: 3–8.
- 7 Hostein J, Bost R, Faure H, Lachet B, Fournet J. Valeur diagnostique de la pHmetrie gastrique au cours du reflux duodeno-gastrique. *Gastroenterol Clin Biol* 1987; **11**: 20–11.

Reply

SIR,—We are grateful for the interest which Drs Savarino and Mela have expressed in our work and for their detailed comments.

The aim of our study was to determine whether there was significant regional variations in intragastric pH. In view of the constant changes in gastric size and shape, we believe that anchoring the electrode to the mucosa is essential in order to monitor local intragastric pH over a period of time and while the subject undertakes normal activities. The endoscopic procedure for clipping the electrode to the mucosa is technically difficult and we do not advocate its use for routine studies of intragastric pH. It is, however, a valuable new technique for scientific studies in which precise localisation of electrodes in the upper gastrointestinal tract is required. The loss of satisfactory 24h recordings in two of our subjects was not because of damage to the electrodes by the fixation procedure but to malfunction of the digitrapper recording boxes.

We analysed nocturnal pH from 2300 to 0500 h as the patients all remained recumbent and fasted over this period. On looking at the individual pH traces, there is no evidence of differences between antral and body pH later in the morning.

We agree that taking all the patients together, there was no statistically significant difference in night time antral and body pH. We felt, however, it only honest and correct to draw attention to the episodic rise in nocturnal pH which occurred in two

of our subjects and which was different in the antrum and body. The cause of this episodic rise of nocturnal pH is unclear and duodenogastric reflux is only one possible explanation. We have recently performed more detailed studies in a further subject, showing intermittent rise of night time pH.¹ Aspiration of gastric contents during some of the episodes produced abundant amounts of non-bile stained fluid with a pH the same as that registered by the *in situ* electrode. On other occasions, however, when the pH was raised no aspirate could be obtained from the stomach raising the possibility that the electrode was recording mucosal pH caused by contraction of the stomach. We certainly agree with Drs Savarino and Mela and also with Dr Hostein and colleagues that studying intragastric pH (even with fixed dual electrodes) is not a specific tool for diagnosing duodenogastric reflux.

KENNETH E L MCCOLL, G McLAUCHLAN,
AND G M FULLARTON

Department of Medicine,
Gardiner Institute,
Western Infirmary,
Glasgow G11 6NT

References

- 1 McLauchlan G. *pH Electrodes: studies and applications in the upper GI tract*. University of Glasgow: M D Thesis, 1989.

Piezoelectric shockwave fragmentation of biliary calculi

SIR,—We were interested to read that Ell and colleagues (*Gut* 1989; **30**: 680–5) observed no macroscopic or light microscopic changes in the walls of their 10 stone containing human gall bladders subjected *in vitro* to 1000–4000 discharges from the Wolf Piezolith 2200 lithotripter.

We compared the macroscopic, light microscopic and scanning electron microscopic changes in stone containing gall bladders from 16 patients treated by 2000–2500 discharges from a Wolf Piezolith 2300 lithotripter at power level 3–4 for between four hours and five days before planned cholecystectomy. In comparison with stone containing gall bladders from age and sex matched control cases, the gall bladders excised within 48 hours of lithotripsy showed focal epithelial denudation, mural oedema, and serosal and mucosal vasodilatation with petechial haemorrhages.¹ Scanning electron microscopy of the mucosa showed denudation of groups of columnar epithelial cells, while intact cells were seen in the mouths of crypts. Our one gall bladder removed five days after lithotripsy was lined by intact epithelium.

Although human gall bladder epithelium normally