

shows a low mitotic rate, it has regenerative potential when subjected to mechanical stresses.² We consider it possible that re-epithelialisation had occurred from a reservoir of intact epithelial cells lying in crypts, in a manner analogous to the re-epithelialisation of a split thickness skin graft from epithelial cells preserved in adnexal structures.

Our observation of relative preservation of crypt lining epithelium during lithotripsy may suggest that contrary to the authors' hypothesis of damage by acoustic cavitation, surface epithelial damage may result from direct stone fragment abrasion. Crypt lining cells would be protected from such abrasion, although still subject to acoustic cavitation.

In vitro lithotripsy to stone containing gall bladders may not faithfully reproduce the full range of *in vivo* changes. In particular vascular damage and haemorrhage, known to be direct effects of shock waves,³ together with the release of oedema fluid, may force apart tissue planes (such as the interface between epithelial cells and stroma) in the perfused organ.

T J STEPHENSON, A G JOHNSON, AND B ROSS
 Departments of Pathology, Surgery and Radiology,
 Royal Hallamshire Hospital,
 Glossop Road,
 Sheffield S10 2JF

References

- 1 Stephenson TJ, Johnson AG, Ross B. What does extracorporeal shock wave lithotripsy do to the human gall bladder? [Abstract] *J Pathol* 1989; **157**: 174A.
- 2 Putz P, Willems G. Cell proliferation in the human gallbladder epithelium: effect of distension. *Gut* 1979; **20**: 246–8.
- 3 Delius M, Enders G, Heine G, Stork J, Remberger K, Brendel W. Biological effects of shockwaves: lung hemorrhage by shockwaves in dogs – pressure dependence. *Ultrasound Med Biol* 1987; **13**: 61–7.

Reply

SIR, — We completely agree with Stephenson *et al* that *in vitro* shockwave application to tissue may not faithfully reproduce the full range of *in vivo* changes. Thus, in our experimental design we concentrated on acute and chronic *in vivo* studies. For scientific and ethical reasons we used animals to analyse the tissue reactions under piezoelectric shockwave application.¹ In addition to the extensively described acute *in vivo* shockwave effects in the wall of the gall bladder (bleeds, oedema), the liver (subcapsular and interstitial bleeds, venous thrombosis) and other organs, it is of particular interest, that in our *in vitro* experiments with surgically removed human gall bladders no noteworthy lesion could be detected in the gall bladder wall under piezoelectric shockwave application. The finding, that shockwave induced

damage only occurs in perfused tissue, supports the hypothesis that cavitation is the main cause for tissue damage under shockwave application.²

Stephenson *et al* found focal epithelial denudation in stone containing human gall bladders excised within 48 hours after shockwave lithotripsy. He states that focal epithelial denudation is a mechanical effect induced by rubbing between the stone(s) and the epithelium during shockwave application. This idea is supported by our findings in non-stone containing gall bladders of dogs. Here, the epithelium itself was intact, whereas relevant lesions in the gall bladder wall, liver, etc, could be detected.

In conclusion, two types of tissue damage may occur in shockwave lithotripsy of gall bladder stones due to different mechanisms: first, slight mechanical damage as seen in the focal denudation of the gall bladder epithelium, which regenerates, as described by Stephenson *et al* within five days. Second, more important and still not yet completely explicable tissue reaction under piezoelectric shockwaves consists of lesions between the interfaces of the organs in the shockwave path. Even if we did not observe persisting noteworthy morphological changes in the animals of the chronic study autopsied three weeks after shockwave application, an unreserved application of shockwaves is not justified.

CH ELL, H TH SCHNEIDER, U MISCHKE, AND J GIEDL
 Department of Medicine, Pathology and Surgical
 Pathology,
 University of Erlangen-Nuremberg,
 Erlangen,
 West Germany

References

- 1 Ell Ch, Kerzel W, Heyder N, *et al*. Tissue reactions under piezoelectric shockwave application for the fragmentation of biliary calculi. *Gut* 1989; **30**: 680–95.
- 2 Delius M, Enders G, Heine G, Stork J, Remberger K, Brendel W. Biological effects of shockwaves: lung hemorrhage by shockwaves in dogs – pressure dependence. *Ultrasound Med Biol* 1987; **13**: 61–7.

Chronic colitis after *Aeromonas* infection

SIR, — We were interested by the cases described by Willoughby *et al*. (*Gut* 1989; **30**: 686–90). We wish to report a similar case where chronic colitis developed after an infection with *Aeromonas hydrophila*.

A 59 year old man with a past history of pulmonary tuberculosis and partial gastrectomy for duodenal ulcer developed diarrhoea while on holiday in France. He became pyrexial and dehydrated and was admitted to hospital on his return. On examination he was unwell and sigmoidoscopy to 15 cm revealed diffuse erythema and friability. Investigations revealed *Aeromonas hydrophila* in three consecutive