wonders whether it is related to closing time in public bars.

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- 1 World Health Organisation Regional Office for Europe. Myocardial Infarction Community Registers. Public Health in Europe 5. Copenhagen, 1979.

This letter was shown to the authors, who reply as follows:

SIR,—We thank Professor Tunstall-Pedoe for his interesting comments on our paper. The confirmation of the finding of a secondary midnight peak in the onset of chest pain in acute myocardial infarction in a five year retrospective analysis of a five year prospective study makes it unlikely that the peak is a chance finding. Our discussion reaches no conclusion about its possible cause but our data do not exclude the possibility that the midnight peak is a local phenomenon whose explanation might lie in local circumstances. We find the explanation in terms of public house closing times intriguing but unlikely to be correct. Our data, which have also been analysed for the frequency of acute myocardial infarction on days of the week (unpublished), do not provide significant support for the Saturday hypothesis. Moreover, a change of licensing hours applied to Leicester which liberalised weekday public house opening, occurred during the prospective data collection and did not result in a measurably stronger trend in support of the midnight peak during the later stages of the study.

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Syndrome X and hyperventilation

SIR,—Syndrome X and hyperventilation have long been associated, and Lewis and colleagues (*British Heart Journal* 1991; 165:94–6) are to be congratulated for their discriminating contribution to the field and for raising several important questions. A central issue is whether hyperventilation can be dismissed on the basis of a rather limited schedule of testing. For example, it is no longer thought that the forced hyperventilation provocation test (FHPT) is the “gold standard” of hyperventilation testing,^{1,2} but that provocation by personally relevant stressors^{3,4} is at least as important. Indeed, in the context of cardiological patients, the latter stressors, which can also activate the adrenergic vasoconstrictive pathways⁵ are probably the triggers most relevant in everyday life. Furthermore, besides the interplay between hyperventilation and sympathetic nervous system activation (with consequences such as magnesium depletion⁶) it seems likely that it is the neuroendocrine setting that can determine whether or not a given episode of hyperventilation has vasoconstrictive consequences.⁷

It is a commonplace finding that many patients with recurrent hyperventilation illnesses do not hyperventilate during an exercise test, but readily overbreathe in response to an emotional challenge, particularly when

the challenge involves the recall of feelings of being trapped or of anger.^{4,7}

As far as the data presented by Lewis *et al* are concerned, besides noting the absence of figures for end tidal pressure of carbon dioxide (CO₂ ET) for their controls, we also note that the CO₂ ET values of 38 mm Hg at 50% of maximum exercise and 37 mm Hg at maximum exercise are well below expected normal values.⁸

The demonstration of increased minute ventilation for given minute carbon dioxide (VE/VCO₂) is quite consistent with chronic hyperventilation. It is due either to reduced respiratory centre buffering⁹ or a flywheel effect when regularly over-activated pathways promote breathing,¹⁰ or both. The observation of a raised VE/VCO₂ may well be the key indicator of a longer term tendency to hyperventilation, because as stated above, the FHPT is a single act of hyperventilation and is dependent upon the patient's starting point in terms of other influences upon vasoconstriction such as emotional arousal and depletion of the body's buffering systems.

A basic question about syndrome X patients is whether their responsiveness to recognised vasoconstrictive influences is greater than average, just as Europeans in general are more responsive than the Japanese.¹¹

We suggest that Lewis *et al* have sharpened the definition of characters in the drama of syndrome X and hyperventilation but have not yet brought down the final curtain.

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- 1 King JC, Rosen SD, Nixon PGF. Failure of awareness of hypocapnia. *J R Soc Med* 1990;83:765–7.
- 2 Roll M, Zetterquist S. Acute chest pain without obvious organic cause before the age of 40 years. *J Intern Med* 1990;228:223–8.
- 3 Lewis BI. Chronic hyperventilation syndrome. *JAMA* 1954;155:1204–8.
- 4 Nixon PGF, Freeman LJ. The “think test”: a further technique to elicit hyperventilation. *J R Soc Med* 1988;81:277–9.
- 5 Groen JJ. The measurement of emotion and arousal in the clinical physiological laboratory and in clinical practice. In: Levi L, ed. *Emotions: their parameters and measurement*. New York: Raven Press, 1975:727–46.
- 6 Ebel H, Gunther T. The role of magnesium in cardiac disease. *J Clin Chem Biochem* 1983;21:249–56.
- 7 Nixon PGF. Exhaustion: cardiac rehabilitation's starting point. In: Maes S, Spielberger CD, Defares PB, Sarason IG, eds. *Topics in health psychology*. London: John Wiley and Sons, 1986.
- 8 Chambers JB, Kiff PJ, Gardner WN, Jackson G, Bass C. Value of measuring end tidal partial pressure of carbon dioxide as an adjunct to treadmill exercise testing. *BMJ* 1988; 296:1281–5.
- 9 Brown EB, Jr. Physiological effects of hyperventilation. *Physiol Rev* 1953;33:445–71.
- 10 Folgering H, Colla P. Some anomalies in the control of P_aCO₂ in patients with a hyperventilation syndrome. *Bull Eur Physiopathol Respir* 1978;14:503–12.
- 11 Maseri A, Kaski JC. Pathogenetic mechanisms of coronary artery spasm. *J Am Coll Cardiol* 1989;14:610–2.

This letter was shown to the authors, who reply as follows:

SIR,—We appreciate the interest shown by Dr Nixon and colleagues in our paper. Our study refers of course to our carefully characterised patients—an important consideration given the widely differing patient groups

represented in published reports on patients with unexplained chest pain. Clearly the filing category of syndrome X is coming to the end of its useful life, particularly in view of the confusion now arising over a different “syndrome X”.¹

In specific comment on the points raised by Dr Nixon and colleagues—our patients with syndrome X all described typical angina and, in every case, exercise induced the same symptom. We would argue that an exercise test in such a group represents a “personally relevant stressor”. The finding of normal arterial PCO₂ values throughout exercise in our syndrome X patients formed the basis for our conclusion that they were not then hyperventilating inappropriately (which in common usage is the implication inherent in the term). Because we showed that end tidal PCO₂ correlated only poorly with arterial PCO₂ in these patients, their end tidal measurements, we agree, provided no evidence either for or against a diagnosis of hyperventilation. Chronic hyperventilation may indeed increase the VE/VCO₂ slope but only in the presence of low arterial PCO₂ (the modified alveolar gas equation states: VE = 863 VCO₂/Paco₂(1 – Vd/VT). The normal arterial PCO₂ in our patients implies an increase in deadspace ventilation.² We did not measure arterial PCO₂ in our control patients for ethical reasons.

We share the view that the final curtain is not yet drawn on the various players on this ill-lit stage, while our spotlights continue to weave. . .³

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- 1 Dean JD, Jones CJH, Hutchison SJ, Peters JR, Henderson AH. Syndrome(s) X. *Lancet* 1991;337:916.
- 2 Jones NL. *Clinical exercise testing*. 3rd ed. Philadelphia: W B Saunders, 1988:13–74.
- 3 Dean JD, Jones CJH, Hutchinson SJ, Peters JR, Henderson AH. Hyperinsulinaemia and microvascular angina (“Syndrome X”). *Lancet* 1991;337:456–7.

Alcohol ablation of atrioventricular conduction

SIR,—Dr Cunningham and Dr Rowland (*British Heart Journal* 1991;65:115) favour the use of “conventional” methods of ablation of atrioventricular conduction rather than the new method of ethanol ablation. “Conventional” methods include, according to them, radiofrequency ablation (with its known low success rate), higher energy shocks (with a known high complication rate), and low energy shocks (only three published reports of this—two abstracts and a small series). Long-term results with ethanol ablation remain excellent.¹ No deaths have been reported after alcohol ablation. Its success rate, even when analysed on the basis of intention to treat, is comparable to “conventional” methods. The results of “conventional” methods were never presented on an intention to treat basis.

It looks to me as if there are no “conventional” or “established” methods for the ablation of atrioventricular conduction. Only long-term results will show which method offers the best results at the lowest risk. Meanwhile, investigators and physicians

should remain open-minded about different treatments.

It takes a long time to become a "classic" or for a treatment to become established or "conventional". We should not allow our biases to make us discard any possibility of treating our patients better.

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- 1 Brugada P, de Swart H, Smeets J, Wellens HJJ. Transcatheter chemical ablation of atrioventricular conduction. *Circulation* 1990;81:757-61.

Echocardiographic diagnosis of a ruptured aneurysm of the sinus of Valsalva: operation without catheterisation in seven patients

SIR,—Dr Sahasakul and colleagues (*British Heart Journal* 1990;64:195-8) clearly described the echocardiographic diagnosis of a ruptured aneurysm of the sinus of Valsalva, but they made no suggestion about its aetiology other than to label this a disease of "congenital origin". The ruptured sinus affected the right coronary sinus in six of their seven patients. Figure 1 in their article clearly shows the absence of the subpulmonary infundibulum and fibrous continuity between the aortic root and the pulmonary valve (fig 1B), features characteristic of a doubly committed subarterial ventricular septal defect,¹ with protrusion of the right coronary sinus into the right ventricle (fig 1A).

The usually accepted explanation for a congenital aneurysm of the sinus of Valsalva is thinning of the wall of the aortic sinus just above the leaflet hinge,² although this alone does not explain why the left coronary sinus is hardly ever involved. The association of the aneurysm of the sinus of Valsalva with a ventricular septal defect was described in Japan. Sequential changes in morphology were proposed, leading to rupture of the right coronary sinus into the right ventricle in young adulthood when there was a ventricular septal defect in the outlet portion of the septum.³ It is notable that there is an increased incidence of ruptured aneurysm of the sinus of Valsalva in Oriental populations, just as there is of doubly committed subarterial ventricular septal defect. Large defects without deformity or offsetting of the aortic valve cause major haemodynamic disturbance in infancy, whereas smaller holes typically present in childhood with aortic regurgitation because of prolapse of the right coronary aortic cusp; but they may present with rupture of a sinus of Valsalva aneurysm in adult life.⁴ Indeed, during a 10 year period at one Japanese hospital 32 of 36 patients undergoing surgery for a ruptured aneurysm of the sinus of Valsalva had "subarterial infundibular" ventricular septal defects.⁵

Thus it should be emphasised that the likely substrate for aneurysm of the sinus of Valsalva in many patients is the presence of a doubly committed subarterial ventricular septal defect with offsetting of the arterial valves. Prolapse of the right coronary aortic cusp results in elongation of the sinus and thinning of the sinus wall just above the leaflet hinge. Mechanical stress leads to dilatation of the sinus over many years, and sometimes rupture into the right heart. Patients with doubly committed subarterial ventricular

septal defect and offsetting of the arterial valves, which can be observed echocardiographically, are at risk of this later complication.⁴

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- 1 Griffin ML, Sullivan ID, Anderson RH, Macartney FJ. Doubly committed subarterial ventricular septal defect: new morphological criteria with echocardiographic and angiographic correlation. *Br Heart J* 1988;59:474-9.
- 2 Kirklin JW, Barratt Boyes BG. Congenital aneurysms of the sinus of Valsalva. In: *Cardiac surgery* New York: John Wiley and Sons, 1986:655-78.
- 3 Sakakibara S, Konno S. Congenital aneurysm of the sinus of Valsalva associated with ventricular septal defect. *Am Heart J* 1968;75:595-603.
- 4 de Leval MR, Pozzi M, Starnes V, Sullivan ID, Stark J, Somerville J, et al. Surgical management of doubly committed subarterial ventricular septal defect. *Circulation* 1988;78(suppl III):40-6.
- 5 Momma K, Toyama K, Takao A, Ando M, Nakazawa M, Hirose K, Imai Y. Natural history of subarterial infundibular ventricular septal defect. *A Heart J* 1984;108:1312-7.

This letter was shown to the authors, who reply as follows:

SIR,—Dr Sullivan and Dr de Leval have correctly pointed out the association between a ruptured aneurysm of the sinus of Valsalva and a doubly committed subarterial ventricular septal defect in most cases reported in the Orient. Nevertheless, there are several other causes of a ruptured aneurysm of the sinus of Valsalva, chiefly a congenital lack of fusion between the media of the aorta and the annulus of the aortic valve.¹ Other reported causes include bacterial endocarditis, Marfan's syndrome, coarctation of the aorta, bicuspid aortic valve, trauma, and also the association with ventricular septal defect.²⁻⁵

The reason for the high prevalence of ruptured aneurysms of the sinus of Valsalva in Oriental patients is not known. We propose a genetic cause or perhaps a logistic one: patients with ventricular septal defect in the Orient may not see a doctor until symptoms develop—that is after the aneurysm has already ruptured. The latter proposal is particularly true in Thailand because many paediatric patients with ventricular septal defect went unnoticed for several years because they were born in remote provincial areas without modern medical facilities.

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- 2 Gonzalez-Lavin L, Scappatura E, Lise M, Ross DN. Mycotic aneurysms of the aortic root. A complication of aortic valve endocarditis. *Ann Thorac Surg* 1970;9:551-61.
- 3 Steinberg L, Mangiarsi JL, Noble MJ. Aneurysmal dilation of the aortic sinuses in Marfan's syndrome. *Circulation* 1967;16:368-73.
- 4 DeBakey ME, Dietrich EB, Liddecoat JE, Kinard SA, Garret HE. Abnormalities of the sinuses of Valsalva experience with 35 cases. *J Thorac Cardiovasc Surg* 1967;54:312-32.
- 5 Sahasakul Y, Panchavinnin P, Chaithiraphan S, Sakiyalak P. Echocardiographic diagnosis of a ruptured aneurysm of the sinus of Valsalva: operation without catheterisation in seven patients. *Br Heart J* 1990;64:195-8.

Impending paradoxical embolism: a rare but important diagnosis

SIR,—I read with interest the recent case report of impending paradoxical embolism by Speechly-Dick *et al.* (*British Heart Journal* 1991;65:163-5). However, I would like to offer two differing opinions on the points they made.

First, their statement that only two of 37 reported cases of paradoxical embolism were diagnosed during life was an underestimation. All of 25 cases reviewed and reported by Leonard *et al.*¹ and 10 of 27 cases reviewed by Jungbluth *et al.*,² cited by the Speechly-Dick *et al.* in their paper as references 4 and 6, respectively, were diagnosed during life. The two cases reported by me in 1976 were diagnosed during life.³

Second, the current treatment of choice for patent foramen ovale or minute atrial septal defect as a cause of paradoxical embolism is non-surgical transcatheter closure.⁴ If this defect could be closed during a cardiac catheterisation, the need for open heart surgery would be obviated together with the extended hospital stay, expense, need for blood, and all the morbidity, mortality, and psychological trauma associated with surgery.

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- 1 Leonard RCF, Neville E, Hall RJC. Paradoxical embolism. A review of cases diagnosed during life. *Eur Heart J* 1982;3:362-70.
- 2 Jungbluth A, Erbel R, Darius H, Rumpelt H, Meyer J. Paradoxical coronary embolism. Case report and review of the literature. *Am Heart J* 1988;116:879-85.
- 3 Cheng TO. Paradoxical embolism. A diagnostic challenge and its detection during life. *Circulation* 1976;53:565-8.
- 4 Mullins CE, Benson L, Hellenbrand WE, Perry S, Rocchini AP. Therapeutic cardiac catheterization in congenital heart disease. Presented at the American College of Cardiology 40th Annual Scientific Session, Atlanta, Ga on 3 March 1991.

This letter was shown to the author, who replies as follows:

SIR,—Professor Cheng is correct in saying that there are many cases of paradoxical embolism diagnosed in life and reported in the literature. However, our case report described the rare finding of impending embolism of which, to my knowledge, there are only two previously reported cases. The second point which Professor Cheng raised was that in his opinion the current treatment of choice for patent foramen ovale or minute atrial septal defect is non-surgical transcatheter closure. This is a relatively new procedure for which we have, as yet, no long term results. Surgical closure, however, is a well-established and accepted technique with very low mortality and morbidity and excellent long-term results.¹ Non-surgical transcatheter closure may well be the treatment of the future but is not yet the treatment of choice.

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- 1 Murphy SG, Gersh BJ, McGoon MD, et al. Long-term outcome after surgical repair of isolated atrial septal defect. *N Engl J Med* 1990;323:1645-50.