LETTERS TO THE EDITOR

Scope

Heart welcomes letters commenting on papers published in the journal in the previous six months. Topics not related to papers published earlier in the journal may be introduced as a letter: letters reporting original data may be sent for peer review.

Presentation

Letters should be:

- not more than 600 words and six references in length
- typed in double spacing (fax copies and paper copy only)
- signed by all authors

They may contain short tables or a small figues. **Please send a copy of your letter on disk.** Full instructions to authors appear in the July 1997 issue of *Heart* (page 97).

Iatrogenic atrioventricular bypass tract following a Fontan operation for tricuspid atresia

SIR,—Rosenthal *et al* recently documented the presence of an atrioventricular bypass tract after a modified Fontan operation in which the right atrial appendage was anastomosed to the right ventricular outflow tract.[1] Their patient developed persistent supraventricular tachycardia resulting from atrioventricular re-entry within the surgical right anastomosis, which was abolished by radiofrequency ablation. They also mentioned a previous report of ablation after the Fontan operation.[2] Based on the evidence of these cases and other reports that document conduction across the atrio–atrial anastomosis[3 4] the authors suggest that growth of excitable tissue across the surgical scar may be possible in patients who have undergone this type of the Fontan operation.

We have observed the de novo appearance of a pre-excitation pattern after a Fontan operation. A 16 year old woman had been diagnosed with tricuspid atresia at birth, and an atrioventricular type of Fontan anastomosis was undertaken when she was 5 years old. Twelve months after surgery the ECG pattern suddenly changed suggesting an atrioventricular bypass tract that had not been recorded previously (fig 1). Although we cannot rule out that the bypass tract was congenital in origin, it is possible that this could be a new case of conduction across the surgical scar. The direction of the initial forces of the depolarisation suggests a right anterolateral location of the bypass tract, which would be unusual in cases with absent right atrioventricular connection, as in our case. In contrast with the two previously reported cases who had concealed accessory pathways, our patient had an overt pre-excitation pattern with short PR and delta wave.

Arrhythmias after Fontan operation may be related to the surgical dissection around the sinoatrial node or to a deterioration in function.[5] The appearance of acquired atrioventricular conduction as in our case and others,[1 2] complicates even more the scope of postsurgical arrhythmias in Fontan patients.

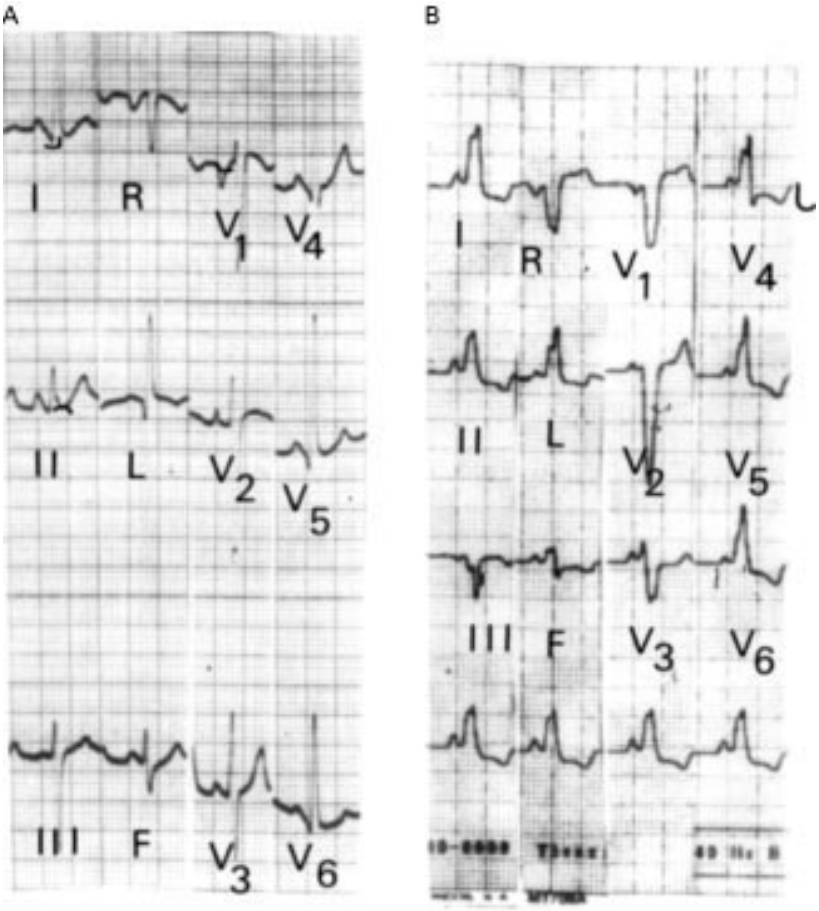

Figure 1 (A) ECG one year before the operation shows a normal PR interval and a narrow ascending limb of the QRS. (B) One year after the Fontan operation the ECG reveals a short PR interval and a widened QRS with delta wave.

It seems therefore appropriate to avoid atrioventricular anastomosis in favour of lateral tunnel techniques.

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1 Rosenthal E, Bostock J, Gill J. Iatrogenic atrioventricular bypass tract following a Fontan operation for tricuspid atresia. *Heart* 1997;**77**:283–5.
2 Case CL, Schaffer MA, Dhala AA, Gillette PC, Fletcher SE. Radiofrequency catheter ablation of an accessory atrioventricular connection in a Fontan patient. *Pacing Clin Electrophysiol* 1993; **16**:1434–6.
3 Anselme F, Saoudi N, Redonnet M, Letac B. Atrioatrial conduction after orthotopic heart transplantation. *J Am Coll Cardiol* 1994;**24**: 185–9.
4 Rothman SA, Miller JM, Hsia HH, Buxton AE. Radiofrequency ablation of a supraventricular tachycardia due to interatrial conduction from the recipient to donor atria in an orthotopic heart transplant recipient. *J Cardiovasc Electrophysiol* 1995;**6**:544–50.
5 Peters NS, Somerville J. Arrhythmias after the Fontan procedure. *Br Heart J* 1992;**68**:199–204.

Atrial fibrillation and the thyroid

SIR,—We read with interest in the editorial by Forfar[1] that both clinical and subclinical hyperthyroidism are associated with the subsequent development of atrial fibrillation. The association of hypothyroidism with atrial fibrillation is less recognised.[2 3] For example, the Canadian Registry of Atrial Fibrillation Investigators[4] reported that 1.5% of 726 patients with atrial fibrillation had hypothyroidism over a period of 1.7 years. However, Tajiri *et al* reported that up to 8% of the 75 elderly patients with atrial fibrillation (mean age 75.6 years) studied were found to be hypothyroid, following a thyrotropin releasing hormone test.[5]

We recently encountered a 61 year old man who was referred by his general practitioner with a two month history of peripheral oedema and hypertension. He was found to be in atrial fibrillation, with blood pressure of 160/100 mm Hg. There was no evidence of heart failure, and he was clinically hypothyroid. Thyroid function tests revealed a thyroid stimulating hormone (TSH) concentration of 160 mIU/l (normal range 0.4–5.5) and free T4 of 3 pmol/l (normal range 9–19) confirming hypothyroidism. Transthoracic echocardiography showed normal left ventricular systolic function with borderline enlargement of the left atrium (4.1 cm) and the absence of left ventricular hypertrophy or pericardial effusion. After treatment with aspirin 300 mg, and thyroxine replacement for four months (dose titrated to 100 µg daily) he was found at outpatient review to be in sinus rhythm. A repeat 24 hour Holter monitor recorded a few short episodes of paroxysmal atrial fibrillation. At four months he appeared clinically euthyroid and repeat

thyroid function tests showed a TSH of 20.8 mIU/l and free T4 of 15 pmol/l.

In the west Birmingham atrial fibrillation project, we reported the presence of hyperthyroidism in 16 of 213 white patients (7.5%) who were admitted to hospital with atrial fibrillation.[6] No cases of thyroid disease were found among black or Asian patients. In our recent general practice survey, we found 17 cases (15.3%) of previous hyperthyroidism among 111 patients with atrial fibrillation, although only about half of the patients in the survey had thyroid function blood tests at any time.[7]

Although excessive chronotropic stimulation by thyroid hormones and activation of the sympathetic system may lead to the development of atrial fibrillation in thyrotoxicosis, our patient developed atrial fibrillation despite the low chronotropic "drive" with his hypothyroidism. Hypothyroidism may also be associated with cardiomyopathy or pericardial effusion, but there was no evidence for this on the echocardiogram. However, our patient was hypertensive, which may have led to a high left atrial pressure as a result of a reduced compliance in the left ventricle, although the latter is more common when left ventricular hypertrophy is present. Although our patient did not have left ventricular hypertrophy, the possibility remains that he may have had underlying coronary artery disease. This case should remind clinicians that hypothyroidism, as well as hyperthyroidism, can be associated with the development of atrial fibrillation, and careful vigilance is necessary.

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1 Forfar JC. Atrial fibrillation and the pituitary-thyroid axis: a re-evaluation. *Heart* 1997;**77**:3–4.
2 Siddiqui AS, D'Costa DF, Moore-Smith B. Covert hypothyroidism with weight loss and atrial fibrillation. *Br J Clin Pract* 1993;**47**:268.
3 Barnes DJ, O'Connor JD, Bending JJ. Hypothyroidism in the elderly: clinical assessment versus routine screening. *Br J Clin Pract* 1993; **47**:123–7.
4 Krahn AD, Klein GJ, Kerr CF, Boone J, Sheldon R, Green M, *et al*. How useful is thyroid function testing in patients with recent-onset atrial fibrillation? The Canadian Registry of Atrial Fibrillation Investigators. *Arch Intern Med* 1996;**156**:2221–4.
5 Tajiri J, Hamasaki S, Shinada T, Morita M, Higashi K, Ohishi S, *et al*. Masked thyroid dysfunction among elderly patients with atrial fibrillation. *Jpn Heart J* 1986;**27**:183–90.
6 Zarifis J, Beevers DG, Lip GYH. Acute admissions with atrial fibrillation in a British multiracial hospital population. *Br J Clin Pract* 1997;**51**:91–6.
7 Lip GYH, Golding DJ, Nazir M, Beevers DG, Child DL, Fletcher RI. A survey of atrial fibrillation in general practice: the west Birmingham atrial fibrillation project. *Br J Gen Pract* 1997;**47**:285–9.

Cardiac rehabilitation: economic evaluation should be interpreted with caution

SIR,—I thank Taylor and Kirby[1] for drawing attention to the cost effectiveness of cardiac rehabilitation but feel that the issue should be opened to further debate.

Cardiac rehabilitation, like any therapeutic intervention, should of course be subjected to economic evaluation. However, it is not sufficient to focus solely on effectiveness measures without taking into consideration issues such as health related quality of life (HRQOL).[2] Indeed, in reporting the study by Oldridge *et al*[3] the authors have highlighted this point. While the adaptation of the 1988 Oldridge data to current UK cost-utility figures for selected cardiovascular interventions can be justified, interpretation of the figures may be misleading. Of particular note is the fact that if HRQOL factors are ignored then the current £6900/quality adjusted life year gained for cardiac rehabilitation may be expected to triple.

Furthermore, it may be argued that too much attention has been paid to rate of survival (although obviously important) following cardiac rehabilitation, when improved HRQOL is the expected main benefit.[4] This is likely to create potentially misleading data and obviously does not allow a well informed economic judgment.

In economic analysis, additional costs may have to be included.[5] With respect to cardiac rehabilitation direct costs such as exercise clothing and shoes are likely to be minimal; however, indirect costs such as loss of wages for time spent in rehabilitation could be considerable. Considering that return to work is a favourable outcome measure following myocardial infarction or coronary artery bypass grafting, the economic implications of rehabilitation stalling return to the workplace are considerable. Of course, cardiac rehabilitation may also hasten return to work.

Finally, there remains the difficult question of accurate economic analysis of an intervention that as yet is not fully defined. The authors acknowledge that the term "comprehensive cardiac rehabilitation" is rendered imprecise by the differences between individual programmes. Thompson and Bowman[6] in the most recent review of the effectiveness of cardiac rehabilitation recommended that further work be done to evaluate the most appropriate means of delivering cardiac rehabilitation. Therefore, until consensus is achieved as to what comprehensive cardiac rehabilitation actually entails, economic data should be interpreted with caution and be used to guide decision making, rather than be the absolute basis for decision making with respect to a cardiac rehabilitation service.

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1 Taylor R, Kirby B. The evidence base for the cost effectiveness of cardiac rehabilitation. *Heart* 1997;**78**:5–6.
2 Kuntz KM, Lee TH. Cost-effectiveness of accepted measures for intervention in coronary heart disease. *Coron Artery Dis* 1995;**6**:472–8.
3 Oldridge N, Furlong W, Feeny D, Torrance G, Guyatt G, Crowe J, *et al*. Economic evaluation of cardiac rehabilitation soon after acute myocardial infarction. *Am J Cardiol* 1993;**72**: 154–61.
4 Williams A. Economics of coronary artery bypass grafting. *BMJ* 1985;**291**:326–9.
5 Kupersmith J, Holmes-Rovner M, Hogan A, Rovner D, Gardiner J. Cost-effectiveness analysis in heart disease, part II: preventative therapies. *Prog Cardiovasc Dis* 1995;**37**:161–84.
6 Thompson DR, Bowman GS. Evidence for the effectiveness of cardiac rehabilitation. *Clinical Effectiveness in Nursing* 1997;**1**:64–75.

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

SIR,—We thank Grant for his comments, which raise important questions about economic evaluation. We agree that the idea of economic evaluation of cardiovascular interventions should aim to take account of HRQOL measures and, moreover, undertake cost-utility analysis such as cost per quality adjusted life year as presented in table 2 of our paper; but it is equally important to bear in mind that there are methodological problems in doing so.[1] The evidence supporting the statement that "HRQOL is the expected main benefit" of cardiac rehabilitation at present remains limited, as recently highlighted in a review by Oldridge.[2]

The issue of the indirect costs (as the result of work non-attendance) associated with attending a cardiac rehabilitation programme is an interesting one. To address this we revisited the data of Levin *et al*[3] discussed in our editorial, and calculated the costs that would be incurred as the result of loss of work. Assuming patients attended 36 sessions (three sessions per week for three months) of three hours per session of outpatient cardiac rehabilitation, the average indirect cost would be approximately £1300 per patient (in 1994–95 prices). From a societal perspective, this indirect cost would offset by the ~ 15% savings gained by the health service over five years following cardiac rehabilitation.

Finally, as we emphasised in our conclusions, this editorial is based on a synthesis of a relatively small evidence base. Moreover, there is an urgent need for further research, including formal evaluation of the relative cost effectiveness of the various elements of so called comprehensive cardiac rehabilitation.

1 Taylor RS, Kirby BJ, Caves R, Burdon B. The assessment of recovery in post-myocardial infarction patients using three generic quality of life measures. *J Cardpulm Rehabil*. [In press.]
2 Oldridge N. Outcome assessment in cardiac rehabilitation: health related quality of life and economic evaluation. *J Cardpulm Rehabil* 1997; **17**:179–94.
3 Levin LA, Perk J, Herbeck B. Cardiac rehabilitation—a cost analysis. *J Intern Med* 1991;**230**:427–34.