Study of cardiac rhythm in healthy newborn infants

Sir,

The two papers by Southall and his colleagues^{1 2} in a recent issue of *British Heart Journal* highlight the relative frequency of arrhythmias in neonates and children, but there are inaccuracies in the measurement and interpretation of several of the electrocardiograms which detract from the potential value of these papers.

In the first paper,¹ the measurement of the longest PP interval in Fig. 1, page 15, is incorrect. The length of this pause is approximately 1.16 s and not the 1580 ms quoted by the authors. Neither of these intervals is an exact, or nearly exact, multiple of the preceding or following PP intervals and the diagnosis of complete sinuatrial block is therefore difficult to support. Furthermore, the pause of 800 ms in Fig. 2, page 15, appears to be terminated by a P wave which is quite different in shape from the previous and subsequent P waves. Where such a pause is terminated by an escape beat from a lower pacemaker the rhythm is quite distinct from a 2:1 sinuatrial block. Though Southall *et al.*¹ have shown convincingly that sinus pauses are relatively common in neonates, they have not been precise in differentiating between the various forms of sinuatrial exit block and sinuatrial arrest.

In the second article,² the rhythm illustrated in Fig. 2, page 24, is described as probable ventricular tachycardia. The first six intervals of the figure are quite variable, ranging from approximately 0.2 to 0.4 s, and complexes 1 to 7 are relatively narrow. We were unable to discern any regular P wave pattern throughout this trace and we suggest that the basic rhythm is atrial fibrillation. The run of broad complexes (beats 8 to 12) with regular RR intervals are more typical of ventricular tachycardia, but the wide variation of RR intervals and QRS complex widths seen throughout this tracing is consistent with atrial fibrillation. In the lower panel of Fig. 4, page 25, the ventricular response rate is at its fastest 250 a minute, rather than the 300 a minute indicated in the authors' legend.

The same electrocardiogram is illustrated in both papers (Fig. 1, page 15; Fig. 3, page 25). We presume that a clerical or printing error led to this mistake but was this recorded from a healthy neonate or from a child with complete transposition?

Finally, we suggest that in epidemiological studies which make use of taped electrocardiography, a technique prone to artefact and error, very precise diagnosis should be avoided.² In this context abnormal sinus node function, such as sinus arrest and sinuatrial exit block, are best classified together as sinus pauses.

K Hellestrand, A J Camm,
Department of Cardiology,
St Bartholomew's Hospital,
London.

References

- 1 Southall DP, Richards J, Mitchell P, Brown DJ, Johnston PGB, Shinebourne EA. Study of cardiac rhythm in healthy newborn infants. *Br Heart J* 1980; 43: 14-20.
- 2 Southall DP, Keeton BR, Leanage R, *et al.* Cardiac rhythm and conduction before and after Mustard's operation for complete transposition of the great arteries. *Br Heart J* 1980; 43: 21-30.

This letter was shown to Dr Southall and his co-authors who reply as follows.

Sir,

We thank Drs Hellestrand and Camm for their constructive observations and for pointing out two clerical errors. Fig. 1 in paper 1 is misplaced and is correct as Fig. 3 in paper 2 (a preoperative recording on a 2-year-old child with transposition of the great arteries). We enclose the correct illustration for Fig. 1, paper 1 (Fig. A). The pause in Fig. 3, paper 2 should be 1780 not 1580 ms. We do not accept their opinion on our interpretation of

Fig. A

pauses on the electrocardiograms and suggest they have misunderstood this section of our paper.

A reliable diagnosis of sinuatrial exit block or sinus arrest can only be made by recording potentials directly from the sinus node. Though it has been stated¹⁻³ that measurement of atrial potentials, that is PP intervals on the surface electrocardiogram, may be used to diagnose exit block, such measurements may be complicated by other factors. Thus, in electrocardiographic patterns described as sinuatrial block exact whole multiples of PP intervals may be disturbed by autonomic effects or by escape pacemakers whose inherent rates are only slightly slower than the sinus pacemaker. In our paper it was not the intention precisely to define electrocardiographic patterns of exit block or sinus arrest. We simply measured PP or PQ intervals and categorised pauses arithmetically into groups. On the basis of this categorisation and considering the effects of autonomic tone and escape pacemaker activity, we contend that it is impossible to differentiate on the surface electrocardiogram the pauses we have described, from those previously described as sinuatrial exit block or sinus arrest.

Thus the PP or PQ intervals of the pauses in Fig. 3, paper 2, and the new Fig. A, paper 1, both exceed the immediately preceding PP interval by more than 110 per cent. We maintain that this pattern cannot be distinguished on the surface electrocardiogram from intermittent third degree sinuatrial exit block or sinus arrest. Distinction cannot be made between sinus arrest and complete exit block because sinus node potentials cannot be seen. Drs Hellestrand and Camm state that a distinction could be made on the basis of a mathematical relation between PP intervals, but we maintain that on the surface electrocardiogram this argument is incorrect because of possible variations in autonomic tone and the high intrinsic rate of escape pacemakers present in this age group.

In Fig. 2, paper 1, the heart rate preceding the pause is 150 per minute, and at this relatively high rate P wave configuration may be distorted by the preceding ventricular repolarisation and succeeding depolarisation. In addition, variation in P wave shape, which may be artefactual, is frequently present on 24-hour recordings. We agree that the P wave following this pause may represent an

Fig. B

escape beat rather than an impulse of sinus origin and that this pattern is indistinguishable from the patterns of complete sinuatrial block or sinus arrest with a P wave fortuitously occurring at between 190 and 210 per cent of the previous PP interval. We enclose further examples of such pauses (Fig. B) which illustrate the difficulty of distinguishing between patterns of sinuatrial block and patterns of sinus arrest terminated by atrial or junctional escape beats. This impasse was a further reason for using arithmetical measurements of PP or PQ intervals for defining categories of pause rather than using established definitions with their emotive connotations.

We agree that the electrocardiographic trace in Fig. 2, paper 2, does not show regular P wave activity. The absence of regular P waves, however, cannot be taken as definitive evidence for atrial fibrillation, though this diagnosis is possible. We contend that the presence of broad complexes (beats 8 to 12) with regular RR intervals comprising the tachycardia and ventricular premature beats during sinus rhythm in the remainder of the 24-hour recording suggests that this electrocardiographic trace is more likely to represent ventricular tachycardia. We agree that in Fig. 4, paper 2, the fastest ventricular rate is 270 a minute for three complexes and 250 a minute for nine complexes.

Finally, we agree that the term "sinus pause" is appropriate for describing sudden PP interval prolongation and, in fact, used this term in our summary to paper 1. We maintain that some of these PP interval patterns cannot be distinguished on the surface electrocardiogram from those described as exit block or sinus arrest. Such patterns have been said to represent abnormal sinus node function but their high incidence in healthy infants and children strongly suggests that they are normal findings and that other electrocardiographic criteria are required to define abnormal sinus node function.

D P Southall, E A Shinebourne,
Cardiothoracic Institute,
London.

References

- 1 Myerburg RJ. Electrocardiographic diagnosis of sinus node rhythm variations and SA block. In: Schlant RE, Willis-Hurst J, eds. *Advances in electrocardiography*. New York: Grune & Stratton, 1972: 73-80.
- 2 Stock JPP, Williams DO. *Diagnosis and treatment of cardiac arrhythmias*. 3rd ed. London: Butterworth, 1974: 224-65.
- 3 Schamroth L. *The disorders of cardiac rhythm*. Oxford and Edinburgh: Blackwell Scientific Publications, 1971: 193-6.