Reversion to sinus rhythm 11 years after surgically induced heart block

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A patient is presented in whom the heart reverted spontaneously to sinus rhythm 11 years after surgical closure of a ventricular septal defect complicated by complete heart block. It seems unlikely that regeneration of fibres in the bundle of His, if these had indeed been destroyed, could account for the restoration of sinus rhythm after so long an interval.

The outlook for most patients with the congenital form of third degree atrioventricular block is excellent (Campbell and Emanuel, 1967), but when acquired as a complication of cardiac surgery it is usually of grave significance unless it reverts to sinus rhythm soon after operation (Fryda, Kaplan, and Helmsworth, 1971). We report a patient in whom complete heart block developed during surgical repair of a ventricular septal defect and who experienced spontaneous reversion to sinus rhythm 11 years later.

Case history

A girl found to have a heart murmur in infancy attended the cardiac outpatient clinic at the Royal Hospital for Sick Children, Glasgow, until admitted at the age of 4 years for further investigation. She had no symptoms but the clinical findings were those of a large ventricular septal defect with cardiomegaly (cardiothoracic ratio 60%). The electrocardiogram indicated incomplete right bundle-branch block, left ventricular hypertrophy, and delta waves (Fig. 1). Cardiac catheterization and angiocardiography confirmed the presence of a large ventricular septal defect ($Q_p:Q_s=2.5:1$), with no gradient across the right ventricular outflow, and only mild pulmonary hypertension (35/12 mmHg (4.7/1.6 kPa) in the main pulmonary artery).

Repair was recommended and operation was performed a few weeks later. Through a bilateral anterior thoracotomy and with the support of normothermic cardiopulmonary bypass, the right

ventricular outflow was opened to reveal a ventricular septal defect measuring 2 cm in diameter and with a thick muscular inferior margin. A double layer of pericardium was used to close the defect, the main sutures being of mattress type. Over the upper half a continuous suture was used to secure the gap between the main sutures. Third degree atrioventricular block became apparent almost immediately, and pacemaker leads were secured in the right ventricle and pectoralis major muscle. Heart block persisted and the heart was paced continuously during the first 7 postoperative days. Thereafter the pacing wires were removed and oral drug therapy with both prednisolone and ephedrine was instituted. On dismissal from hospital three weeks after operation she was active and free of symptoms in spite of a fixed heart rate of 40 per minute. All drug treatment had been discontinued. Outpatient supervision was maintained, and she remained apparently well but with some limitation in exercise tolerance until five years after operation (1967) when minor Adams-Stokes attacks were recognized. The resting heart rate between attacks was 44 per minute and third degree atrioventricular block persisted (Fig. 2). Long acting isoprenaline ('Saventrine') was introduced, and though the heart rate was not appreciably altered (varying between 40 and 50 per minute) she had no further Adams-Stokes attacks over the next 6 years. Towards the end of 1973 (11 years after operation) she developed episodes of palpitations suggesting paroxysmal supraventricular tachycardia and these were accompanied by chest pain. Because of this she was readmitted to hospital

FIG. 1 Preoperative electrocardiogram, showing sinus rhythm, left axis deviation, and right bundle-branch block. Possible delta waves (type A, pre-excitation) in V1.

and her resting heart rhythm was found to be sinus tachycardia. After the omission of Saventrine, normal sinus rhythm replaced sinus tachycardia at 120 per minute. A soft, early 2/6 systolic murmur which had been present since operation persisted at the left lower sternal border. There was no cardiac enlargement on the x-ray examination. There was right bundle-branch block, and inversion of the T wave in leads V1 to V4 (Fig. 3). Cardiac catheterization confirmed closure of the ventricular septal defect. The echocardiographic appearances were normal. Normal sinus rhythm persists 20 months later.

Discussion

Third degree atrioventricular block acquired during cardiac surgery is caused by trauma (either haemorrhage or oedema) to the bundle of His as it courses along the caudal edge of the membranous septum. It is regarded as having a poor prognosis (Cooley and Hallman, 1966; Fryda *et al.*, 1971). Fryda *et al.* (1971) reported 40 children with this complication of whom 11 died immediately and 18 reverted to sinus rhythm within the early weeks after operation; of the remaining 11 with persistent block, 6 who were not paced died.

As far as we can discover there have been no previous reports of heart block reverting spontaneously to sinus rhythm after so long an interval as 11 years. Because of the highly unfavourable outlook most authors recommend the implantation of a permanent pacemaker (Cooley and Hallman,

FIG. 2 Third degree AV block. Electrocardiogram recorded 5 years after operation.

FIG. 3 Electrocardiogram after spontaneous reversion to sinus rhythm 11 years after operation. Right bundle-branch block is still present.

1966; Fryda *et al.*, 1971; Nadas and Fyler, 1972). We did not do this because our patient had initially no symptoms attributable to her heart block, and also because the pacemakers available to us at that time (1962) seemed somewhat unreliable. Even when syncopal attacks appeared five years later, these were so easily prevented with long-acting isoprenaline that the implantation of a pacemaker seemed unnecessary. It is difficult to explain the spontaneous return to sinus rhythm after an interval of 11 years. Regeneration of fibres in the

bundle of His seems improbable after so long a delay and the development of new accessory pathways is for the same reason difficult to understand.

Perhaps a more tenable but none the less conjectural explanation for the restoration of sinus rhythm would be that the impairment of the conducting system was caused not by direct injury to the pathway but by a surgical manoeuvre causing distortion of the pathway from tension or pressure, and that eventual relief of this functional impairment was related to two features of the 11-year interval, namely, the gradual postoperative restoration of a normal intracardiac architecture and the overall growth of the heart.

The preoperative electrocardiogram suggested the presence of delta waves which are usually found in association with pre-excitation due to an accessory pathway from atrium to ventricle. An alternative and equally attractive explanation, therefore, is that the spontaneous return of sinus rhythm was related to this pathway.

Heart block may arise as a result of damage in either the atrioventricular node or bundle of His, and the site may to some extent influence prognosis. There is evidence to suggest that damage to the bundle of His is not so serious as damage to the node (Wolff, Freed, and Ellison, 1973). To locate the precise site of the block, it is necessary to perform His bundle recordings, and these were not available in our patient.

References

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