Ebstein’s anomaly
Genetic study of 26 families

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The families of 26 patients with Ebstein’s anomaly were examined. There were 120 first-degree relatives, 100 of whom were living, and 93 of these were examined. Information was available on 14 of the 20 who had died. No case of Ebstein’s anomaly was found among the first-degree relatives, but 2 had ventricular septal defects and another, who died at 7 months, was said to have had congenital heart disease. In more distant relatives there were 6 with congenital heart disease, including 2 with ventricular septal defects and 2 with Fallot’s tetralogy.

The tendency for congenital heart disease to occur in more than one member of a family has been recognized for many years (Polani and Campbell, 1955; Lamy, de Grouchy, and Schweisguth, 1957; Carleton, Abelmann, and Hancock, 1958). Family studies have been undertaken in many of the common forms of isolated congenital heart disease. These include cardiomyopathy (Evans, 1949; Paré et al., 1961; Barry and Hall, 1962; Emanuel, Withers, and O’Brien, 1971), persistent ductus arteriosus (Polani and Campbell, 1960; Wilkins, 1969), coarctation of the aorta (Campbell and Polani, 1961a), secundum atrial septal defect (Campbell and Polani, 1961b; Zuckerman et al., 1962; Nora, McNamara, and Fraser, 1967; Williamson, 1969; Emanuel et al., 1975), pulmonary stenosis (Campbell, 1962), situs inversus (Campbell, 1963), congenital aortic stenosis (Zoethout, Bonham-Carter, and Carter, 1964), ventricular septal defect (Campbell and Goodwin, 1965), atrioventricular defects (Emanuel et al., 1968), transposition of great vessels and pulmonary atresia (Fuhrmann, 1968), and Fallot’s tetralogy (Boon, Farmer, and Roberts, 1972), and it has been possible to quantitate genetic factors in both secundum atrial septal defects and atrioventricular defects.

The familial incidence of Ebstein’s anomaly has not been studied though more than one case in a single family has been reported on several occasions. Gueron et al. (1966) reported a 20-year-old man with Ebstein’s anomaly who died of cardiac failure, and a 12-year-old sister similarly affected. Both diagnoses were confirmed at necropsy. Donegan et al. (1968) reported a 6-year-old boy with a 29-year-old maternal uncle with Ebstein’s anomaly, in both of whom the diagnosis was confirmed by cardiac catheterization without angiography. Simcha and Bonham-Carter (1971) noted 2 families: in one a father and daughter, and in the other 2 brothers were affected, but no investigations were reported; and Watson (1974), in his assembled series of 505 cases, found another family in which 2 sisters were diagnosed clinically as having Ebstein’s anomaly.

The present study was undertaken to assess the familial incidence of Ebstein’s anomaly and to determine the frequency of other congenital cardiac defects in the first-degree relatives. In view of the frequent association of Ebstein’s anomaly and secundum atrial septal defect in individual cases, the presence or absence of atrial septal defects in the first degree relatives was of particular interest.

Subjects and methods
Data on the propositi and first-degree relatives were collected as in previous studies (Emanuel et al., 1968, 1971,1975). There were 26 propositi from the National Heart Hospital, The Middlesex Hospital, and The Hospital for Sick Children. Clinically, all had the classical features of Ebstein's anomaly. In 9 the diagnosis was confirmed by cardiac catheterization and angiography and in 2 by cardiac catheterization alone. In a further 11 the anatomy was examined at either operation (5) or necropsy (6). The remaining 4 propositi were not investigated, but accepted on clinical

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grounds. The age range was 5 to 65 years, with a mean of 17-6 years.

There were 65 siblings, 51 of whom were living and 14 dead. Forty-six of the living siblings were examined and this included a chest radiograph and an electrocardiogram. Diagnostic information was available on 10 of the 14 who had died. Of the 52 parents, 46 were living and of these 44 were similarly examined. Six had died and diagnostic information was available on 4. There were 3 children, and all were examined. Diagnostic information was, therefore, available on 107 (89%) of the 120 first-degree relatives.

**Results**

None of the first-degree relatives had Ebstein's anomaly, but ventricular septal defects were present in one sibling and one child. Another sibling, who died in infancy, was said to have had congenital heart disease, but no further information was available.

In more distant relatives, a ventricular septal defect was present in 2, in one of whom the diagnosis was confirmed at necropsy and in the other by cardiac catheterization and angiography. A further 2 relatives had Fallot's tetralogy which was surgically corrected in both. Two other relatives may also have had congenital heart disease but neither was investigated (Table).

There was no incidence of consanguinity between the parents. Information relating to pregnancy was obtained from all 26 mothers; 108 pregnancies were reported, 15 (13-8%) of which ended in miscarriages. In addition there were 2 stillbirths. These figures are well within the accepted range quoted by Logan (1959).

**Conclusion**

There was no evidence of a familial incidence of Ebstein's anomaly in these 26 families, and no relative with an isolated secundum atrial septal defect. The frequency of congenital heart disease in first-degree relatives was considerably higher at 2-8 per cent (3 out of 107) than in the general population, 0-05-0-07 per cent (Carlsgren, 1959; McKeown and Record, 1960; Mustacchi, Sherins, and Miller, 1963; Smithells, 1968). This finding was in keeping with the results from other family studies of isolated congenital heart disease.

The frequency of ventricular septal defects in these families, either as a simple lesion (4 cases) or as part of Fallot's tetralogy (2 cases) was noted, but no embryological explanation for this association could be found.

We are grateful to Dr. R. E. Bonham-Carter for access to a number of patients who were originally seen at The Hospital for Sick Children, Great Ormond Street, London.

**References**


**Table**  Congenital heart disease in 9 affected relatives

<table>
<thead>
<tr>
<th>Relationship and sex</th>
<th>Diagnosis</th>
<th>Method or source of diagnosis</th>
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<tbody>
<tr>
<td><strong>First degree</strong></td>
<td></td>
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<tr>
<td>1. Sibling (M)</td>
<td>Ventricular septal defect</td>
<td>Clinical*</td>
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<tr>
<td>2. Sibling (F)</td>
<td>‘Congenital heart disease’</td>
<td>Death certificate (died at 7 months)</td>
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<td>3. Child (M)</td>
<td>Ventricular septal defect</td>
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<td><strong>Second degree</strong></td>
<td></td>
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<tr>
<td>4. Niece</td>
<td>Ventricular septal defect</td>
<td>Cardiac catheterization and angiocardiography</td>
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<tr>
<td>5. Maternal uncle</td>
<td>‘Congenital heart disease’</td>
<td>Death certificate (died at 6 months)</td>
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<tr>
<td><strong>Third degree</strong></td>
<td></td>
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<tr>
<td>6. First cousin (M)</td>
<td>Ventricular septal defect</td>
<td>Necropsy</td>
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<td>7. First cousin (M)</td>
<td>Pulmonary valve stenosis</td>
<td>Clinical*</td>
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<tr>
<td><strong>Others</strong></td>
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<td></td>
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<tr>
<td>8. (M)</td>
<td>Fallot’s tetralogy</td>
<td>Surgery</td>
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<tr>
<td>9. (M)</td>
<td>Fallot’s tetralogy</td>
<td>Surgery</td>
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*Clinical investigations = physical examination, electrocardiography, and a chest radiograph but excludes haemodynamic investigations.


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