PROCEEDINGS OF THE BRITISH CARDIAC SOCIETY

AN AUTUMN MEETING of the British Cardiac Society was held at the Royal Society of Medicine, London, on October 26, 1949.

The Chairman, S. Boyd Campbell, took the Chair at 10 a.m.; 91 members and 32 visitors were present.

SHORT COMMUNICATIONS

TRANSPOSITION OF THE AORTA AND PULMONARY ARTERY

BY MAURICE CAMPBELL AND S. SUZMAN

Most cyanotic children with congenital heart disease have light lung fields on screening, and some hollowing of the pulmonary bay, showing a diminution in the amount of blood reaching the lungs. Some, however, show the lung shadows much increased round the hilum and for varying distances out into the lung fields. Sometimes in these cases the right and left pulmonary arteries are greatly enlarged, with striking pulsation there and even in the smaller branches out to the periphery, though the degree of prominence of the pulmonary arc is variable.

The picture is like that of auricular septal defect in acyanotic cases, and at first, we looked on these patients as having this septal defect in addition to some other factor causing their cyanosis. After conversations with Helen Taussig in 1948 we thought that this extra factor was transposition of the aorta and pulmonary artery and that the septal defect was more often ventricular, though we have little post-mortem evidence in support. This is very different from Taussig’s picture of transposition in infancy with its gloomy prognosis; if, however, the defects in the septa are such that more adequate mixing of the circulation of the two sides of the heart is possible so that the infant survives, there is no reason why it should not continue to do so.

Of children attending a clinic that is mainly composed of cyanotic heart disease, about 6 per cent belong with certainty to this group with increased lung shadows, that we have called pleonæmic. We think many of those with moderate or severe cyanosis have transposition of the aorta and pulmonary artery.

We have not subjected many of these children to special investigations, as at present they cannot be helped like cases of Fallot’s tetralogy. In three patients, however, cardiac catheterization has shown that the oxygen saturation of the pulmonary artery was considerably higher than of the systemic arteries and aorta, proving that functionally at least, there was transposition. In one, angiocardiography added good supporting evidence and proved that the aorta arose from the right ventricle in the normal position of the pulmonary artery and suggested that the pulmonary artery arose from the left ventricle, though possibly slightly over-riding the right. In the other two, the aorta certainly connected with the right ventricle but seemed more anterior and more in the position found in Fallot’s tetralogy, and again there was evidence of the pulmonary artery arising from the left ventricle.

We have selected 30 consecutive cases, that we thought pleonæmic, from about 400 patients with cyanotic congenital heart disease. The selection has been entirely on the appearance of the lung fields on radioscopy and the teleradiograms; and expansile pulsation of the pulmonary branches has been the most decisive criterion, though a few cases have been included on the general appearance without the certainty of expansile pulsation.

201
We thought 23 of these children had complete or partial transposition of the aorta and pulmonary artery and that 7 of the older patients, who will not be referred to further, had Eisenmenger's complex.

In these cases of transposition, the cyanosis is as severe as in Fallot's tetralogy and has even more tendency to be noticed from birth. Perhaps the hemoglobin is not so often above 140 per cent, but the appearance and clubbing of the fingers may be just the same. Only a few of these children squatted habitually.

The systolic murmur is generally maximal on the left rather below the pulmonary area, but is variable and is absent in a third. A thrill may accompany this, much less often than with Fallot's tetralogy. About a quarter of those children have a diastolic murmur, generally maximal in the pulmonary area.

The most important physical sign is the loudness of the pulmonary second sound, which may be palpable; it suggests that a large pulmonary artery will be seen on screening, probably with high pulmonary pressure. This alone may be enough to exclude Fallot's tetralogy.

Sometimes the pulsation seen on screening amounts to a well-marked hilar dance and we hoped we might get a good correlation between this and the presence of the diastolic murmur, indicating that it was due to pulmonary regurgitation, but the correlation is not close. The heart is larger and of a different shape, generally with some prominence in the pulmonary region. The general mottled density of the lungs is often obvious on the film, but is better judged on screening where there seem to be two types, those with great dilatation of the main branches of the pulmonary artery, and those with more general mottling.

The right ventricle is enlarged more than the left on radioscopy, though perhaps there is not as much difference as with Fallot's tetralogy. Right ventricular preponderance is as common electrocardiographically and it is not easy to distinguish between this group and Fallot's tetralogy as both also show a large pointed P wave in lead II.

Difficulty in diagnosis may arise when there is a heavy collateral circulation to the lungs. As a general rule this shows an increase of linear markings in the lung fields, or small rounded spots when the vessels are seen in section, as opposed to the denser and larger patchy shadows, often with clearly defined edges; these, if large enough, may show expansile pulsation or changing density on radioscopy, and this is really pathognomonic of increased pulmonary circulation or to a lesser extent of increased pulmonary pressure.

**LESSER KNOWN FEATURES OF VENTRICULAR SEPTAL DEFECT**

**BY PAUL WOOD**

It is generally understood that ventricular septal defect (V.S.D.) is the most benign form of congenital heart disease and causes little change of cardiac structure or function, and no abnormal signs except an impressive left parasternal systolic thrill and murmur; its sole past importance has depended on its predisposition to develop bacterial endocarditis. The object of this communication is to stress the rarity of the maladie de Roger, as so described, and to offer evidence suggesting that V.S.D. usually presents a very different picture.

During the last two years at the Institute of Cardiology more than 100 cardiac catheterizations have been carried out on cases of congenital heart disease of all types. There was little manifest selection, nearly all cases of congenital heart disease seen by the speaker being catheterized, and cases of all kinds being referred for diagnosis with no special emphasis on the cyanotic group or on those thought to be amenable to surgical repair.

Amongst the first 100 cases there were eight instances of isolated V.S.D., three of pulmonary valvular stenosis associated with V.S.D., and three with a loud left parasternal systolic murmur proved to have normal hearts. Cyanotic forms of congenital heart disease, with V.S.D. as part of the anomaly, were excluded from this study.
Of the eight with isolated V.S.D. only two were so diagnosed clinically by the physician who first examined them. Erroneous diagnoses were pulmonary stenosis with dilated pulmonary artery, patent ductus without a machinery murmur, mitral stenosis and atrial septal defect.

The clinical features included a small peripheral pulse, tumultuous cardiac impulse representing a greatly increased stroke volume of the left ventricle, a functional mitral diastolic murmur due to turbulence at the mitral orifice caused by the torrential mitral blood flow, a loud systolic murmur with or without a thrill over the dilated pulmonary artery, accentuation and splitting of the second heart sound, and occasionally pulmonary incompetence. Although a systolic thrill and murmur were noted as low as the fourth left intercostal space close to the sternum in six of the eight cases, it was usually insufficiently localized to determine the diagnosis.

X-rays commonly showed conspicuous dilatation of the pulmonary artery and its main branches, gross exaggeration of the pulmonary vascular shadows, hypoplasia of the aortic knuckle, considerable enlargement of the left ventricle, and slight dilatation of the left auricle.

The electrocardiogram showed partial right bundle branch block in six of the eight cases.

Catheter studies revealed considerable elevation of the right ventricular and pulmonary artery pressures in the majority, the actual mean pressure in the right ventricle in cm. of saline above the sternal angle being 15, 25, 39, 65, 59, 18, 30, and 32; and the pulmonary artery pressures being 18, 25, ?., 130, 100, 24, ?, and 57 respectively. Samples from the superior vena cava and right auricle showed ordinary venous blood about 70 per cent saturated; samples from the right ventricle, whether from low, mid or high positions, were conspicuously arterialized and were commonly 80-85 per cent saturated, pulmonary artery samples being similar. Samples from the femoral artery were 92-95 per cent saturated, none of the cases being cyanotic, by definition.

It is concluded that the left parasternal murmur, which gave rise to the belief that ventricular septal defect was the commonest form of congenital heart disease seen at school age, is in fact innocent; that the maladie de Roger as classically described is rare; and that ventricular septal defect usually results in the changes outlined above.

Since the facts have been known, considerable difficulty has been experienced in distinguishing clinically between ventricular and atrial septal defects. (Patent ductus without a machinery murmur is excluded by the peripheral circulation.) A small pulse, hypoplasia of the aorta, clinical and radiological evidence of pulmonary plethora, a mitral diastolic murmur, splitting of the second heart sound, and right bundle branch block occur in both. If the cardiac impulse is tapping, A.S.D. is probable; if tumultuous, V.S.D. is favoured, but not with much assurance. A relatively low systolic thrill and murmur to the left of the sternum favour V.S.D. If enlargement of the left ventricle can be demonstrated radiologically in the second oblique position, V.S.D. is probable. Finally, the right bundle branch block pattern in V.S.D. usually shows a conspicuous S wave in lead V1, indicating enlargement of the left ventricle; in A.S.D. the S wave is small.

Atrial Septal Defect with Special Reference to the Electrocardiogram

By J. M. Barber and O. Magidson (introduced by Paul Wood)

Until very recently the diagnosis of atrial septal defect (A.S.D.) has been based almost entirely on the radiological appearances; but it has become increasingly obvious, since the introduction of cardiac catheterization, that these X-ray signs may be far less conspicuous than those originally described, and that certain clinical features supported by a characteristic electrocardiogram are equally if not more reliable.

During the past two years at the Institute of Cardiology we have studied 60 cases of atrial septal defect, 15 of which were confirmed by means of cardiac catheterization. Special care was taken to exclude pulmonary heart disease, mitral stenosis, ventricular septal defect, patent ductus arteriosus and such uncommon conditions as primary pulmonary hypertension and idiopathic dilatation of the pulmonary artery; if there was any doubt, cardiac catheterization was performed.

There were 41 females to 15 males in this series, and the ages ranged from 6½ to 66 years, more
PROCEEDINGS OF THE

than half being over 30 years of age. Dyspnoea on exertion was the only common symptom. Persistent cyanosis was seen in only three patients, and each of these had heart failure. In all cases the pulse was of small volume. In the majority, the apex beat was displaced to the left and had a characteristically tumultuous quality associated with an overfilled right ventricle. A systolic thrill at the pulmonary area was felt in nearly one-third, and a systolic murmur was heard in all. The Graham Steell murmur of functional pulmonary incompetence was present in two-thirds, and was common to all age groups. Noticeable grade III splitting of the second heart sound was present in most cases, and a third heart sound was heard in about 30 per cent. Eight patients had a mitral diastolic murmur, and seven had congestive heart failure.

The electrocardiographic findings are shown in the accompanying table. The electrical axis was usually normal or deviated to the right, but left axis deviation occurred in seven. A slightly prominent P wave was seen in 22 cases, but a well defined "P pulmonale" was rare. This correlates well with the relatively low mean right ventricular pressures found on cardiac catheterization. The P-R interval was a little prolonged in 35 cases. There were seven instances of auricular fibrillation and one of auricular flutter.

The ventricular complexes were of great interest and showed the pattern of partial or complete right bundle branch block in 57 of the 60 cases (95%). The remaining 3 cases showed right ventricular dominance. Right bundle branch block was often by no means obvious in standard leads; the diagnosis depended largely upon the presence of an RSR complex in lead V1 associated with a slurred S wave in leads V5 and V6.

The pattern of right bundle branch block may be attributed to the overfilled right ventricle, a condition necessarily present from birth. While it is in no way specific to A.S.D., its relative rarity in other right-sided lesions is stressed. Thus we found but four such tracings in 64 unselected cases of mitral stenosis, three in 33 cases of Fallot's tetralogy, four in 100 cases of chronic pulmonary heart disease, and three in 11 instances of pulmonary stenosis.

It is concluded that partial or complete right bundle branch block is not only an extremely important positive sign of atrial septal defect, but that such a diagnosis may be virtually excluded in its absence.

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<thead>
<tr>
<th><strong>Electrocardiographic Data in 60 Cases of Atrial Septal Defect</strong></th>
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<tbody>
<tr>
<td><strong>Electrical Axis</strong></td>
</tr>
<tr>
<td>Normal</td>
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<tr>
<td>Right axis deviation</td>
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<td>Left axis deviation</td>
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<td><strong>P Wave</strong></td>
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<tr>
<td>Height greater than 2.5 mm. in lead II</td>
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<td>2.0 to 2.49 mm. in lead II</td>
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<td>Width of P in lead II greater than 0.11 seconds</td>
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<td><strong>P-R Interval</strong></td>
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<td>0.20 to 0.22 seconds</td>
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<td>0.23 to 0.25 seconds</td>
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<td>0.26 and greater (4 cases 0.26, 2 cases 0.28)</td>
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<td><strong>Right Bundle Branch Block</strong></td>
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<td>0.12 seconds or greater</td>
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<td>0.09 to 0.11 seconds</td>
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<td><strong>Right Ventricular Hypertrophy pattern without Right Bundle Branch Block</strong></td>
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<tr>
<td><strong>Height of R1 in Lead VI in Right Bundle Branch Block Cases</strong></td>
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<tr>
<td>Over 15 mm.</td>
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<td>10 to 14.9 mm.</td>
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<td>5 to 9.9 mm.</td>
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<tr>
<td><strong>Auricular Fibrillation</strong></td>
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<td>(Patients aged 43, 48, 49, 50, 51, 59, 62 years)</td>
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<tr>
<td><strong>Auricular Flutter</strong></td>
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<td>(Age of patient 63 years)</td>
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<td><strong>Normal Sinus Rhythm</strong></td>
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* 4 with mitral stenosis.
BRITISH CARDIAC SOCIETY

PRESENT-DAY TRENDS IN THE CARE OF THE CARDIAC PATIENT DURING PREGNANCY

BY RAE GILCHRIST

The main findings from an analysis of 20 years' experience in a Cardiac Clinic attached to the Ante-Natal Department of the Maternity Wing of the Royal Infirmary are presented.

The maternal death rate from rheumatic heart disease is falling steadily but there is still room for improvement. Obstetrical practice and the results obtained vary greatly in different teaching centres. The immediate prognosis for the mother is best gauged according to her myocardial capacity, her age, and her previous obstetrical experience. A statistical analysis shows the importance of these factors.

Maternal deaths can be prevented by improved selection of patients in the early days of pregnancy and by the avoidance of obstetrical interference in the later months. The main trends in present-day care of the cardiac patient in pregnancy are the enforcement of more prolonged periods of rest throughout the pregnancy and the avoidance of Caesarean section. Even in grave cardiac distress statistical evidence suggests that pelvic delivery is safer than abdominal, and with other means available sterilisation cannot now be held to justify Caesarean section amongst women with heart disease.

URÆMIA COMPLICATING LOW SODIUM TREATMENT OF HEART FAILURE

BY A. B. BLACK AND J. A. LITCHFIELD (introduced by O. BRENNER)

Eight cases are described in which uræmia developed during treatment of heart failure by a combination of restriction of sodium intake and mercurial diuresis. Evidence is presented to show that this was the result of salt depletion rather than of renal structural damage. The effect of salt depletion on renal function is briefly discussed and treatment is suggested to combat this complication.

LOW SODIUM DIET : EFFECT ON WEIGHT OF ADDED SODIUM

BY D. R. CAMERON

A number of patients with congestive heart failure who had lost oedema on routine digitalis and diuretic treatment in conjunction with the low sodium diet, were observed until their weights became stable. On the same regime, except for the addition of 2 g. sodium chloride daily, it was found that a significant weight increase occurred almost invariably. A similar weight increase occurred with the addition of 2 g. sodium bromide daily, but no significant increase occurred with lithium chloride.

A small control group of patients suffering from Ménière's disease, likewise given a diet low in sodium, did not show a similar weight increase when sodium chloride was added to their low sodium diet.

These variations in weight appeared to be associated with variations in urinary sodium excretion.

A REASSESSMENT OF THE EFFORT TEST IN ANGINA PECTORIS

BY M. MC Gregor, O. Magidson, W. Whitaker (introduced) and P. Wood

At least one-third of patients with angina pectoris, who give no history of cardiac infarction, have normal electrocardiograms at rest; when such patients are subjected to effort, the electrocardiogram may show significant depression of the S–T segment. There has been little agreement about the value of this test, and reported results have shown wide variation; positive curves have rarely exceeded 50 per cent. The Levy anoxia test has proved little better.
It has been the common practice to standardize the effort given according to age, sex, and weight, in the belief that the changes found in normal controls and ischaemic cases differ only in degree. In our opinion this is incorrect; there are certain changes never seen in controls that we believe are pathognomonic of myocardial ischaemia.

In this investigation cases were divided into two groups:

(i) 63 cases of typical angina pectoris with normal electrocardiograms at rest;
(ii) 87 cases made up of 50 normal subjects aged 20–68, and 37 patients with clinically innocent chest pain.

**Procedure.** Standard, unipolar limb, and multiple V chest leads were recorded at rest; with the electrodes still strapped on the limbs, the patient was then exercised to the limit of his capacity. Most frequently we used a small step 12 inches high upon which the patient climbed up and down as rapidly as possible. On the whole the controls performed two to four times as much work as those with angina, because their effort tolerance was less limited. The majority of patients with angina developed pain, but by no means all. Immediately the patient stopped the electrocardiogram was repeated. A direct writing instrument was favoured so that the most informative lead, usually V5, could be recognized at once. Records were then obtained from this lead at half-minute intervals until the graph returned to normal.

**Assessment of results.** Positive curves showed any of the following changes in left ventricular surface leads or their equivalents:

1. Complete flattening of the T wave.
2. A bisphasic T wave, the first part being negative.
3. Inversion of the T wave.
4. Flat depression of the S–T segment of at least 1 mm.

Depression of the S–T origin alone, followed by a sharp upwardly sloping S–T segment was common in controls.

Inversion of the U wave occurred in four cases, and partial left bundle branch block in one.

**Results.** In the controls there was one strongly positive and two doubtfully positive curves. Of the 63 ischaemic cases, 82 per cent yielded positive curves. Most of those with negative curves did not perform much work, and this was reflected in the lack of cardiac acceleration. Of those who developed a heart rate of 90 beats a minute or more, 90 per cent were positive. Greater weight should be attached, therefore, to a negative result when associated with tachycardia.

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**AN EVALUATION OF THE ANOXÆMIA TEST FOR CORONARY INSUFFICIENCY**

**BY R. W. D. TURNER**

Physicians have long felt the need for some confirmatory test when coronary insufficiency is suspected but cannot be proven; that is to say when physical examination and resting electrocardiograms are normal. Assistance would be particularly welcome when the history is not quite characteristic. Preferably too a negative result would exclude angina as the basis for an atypical pain. An objective test is better than a clinical impression. To this end a number of procedures have been devised and include adrenaline, pitressin, and anoxæmic and exercise tests. The latter is the most familiar and most closely reproduces the circumstances under which pain is naturally experienced but carries the disadvantages that electrocardiograms cannot be recorded until after the exertion is over, while not all patients can take sufficient exercise; moreover, though the exercise can be stopped should pain or any untoward symptoms ensue its effects may not be rapidly reversible. The anoxæmic test offers certain advantages. A mixture containing 10 per cent oxygen and 90 per
cent nitrogen is administered through an anaesthetic mask. The patient is resting and, if confidence has been gained, relaxed. Records are easily made throughout the test and should any untoward symptoms occur 100 per cent oxygen is always immediately to hand. Details of the technique are described and the criteria of abnormality analysed. Fifty patients including 20 controls have been studied as opportunity offered over the past two years. Reactions have been few, not serious, and related to cerebral rather than myocardial anoxia.

This review was undertaken because of doubts concerning some of the published claims. The dividing line between changes in normal controls and patients cannot be drawn exactly. A negative test does not exclude coronary disease. However, information of some value was obtained in 50 per cent of the patients. It is concluded that the test is safe but plays no more than a small role in the assessment of difficult cases.

**A Personal Follow-up in 111 Cases of Intra-ventricular Heart Block**

**By Henry Moore**

Criteria of the New York Heart Association (1946) were followed with the three standard limb leads and lead IV F. Amongst 3000 patients electrocardiographed 111 (or 4%) showed intra-ventricular heart block (I.V.B.), whereas there were only 13 cases of A-V block. In an analysis of the 111 cases of I.V.B., men were exactly twice the number of women; the heaviest incidence was between 50 and 70 years of age, but many occurred between 40 and 80; the longest survival rates in 88 patients who had died were 19 years in left branch block, 5 years in right branch block, and 10 years in indeterminate forms. Among the 111 cases there were 70 per cent of left branch block, 7 per cent of right branch block, and 23 per cent of indeterminate forms. Bundle branch block was clinically correctly suspected in 64 per cent. The average duration of life to the nearest month from the time of the original diagnosis was as follows: right branch block, 25 months; left, 26 months; and indeterminate forms, 33 months. The chief aetiological factors were vascular hypertension alone in 43 per cent, coronary artery disease alone in 15 per cent, and both together in 6 per cent—these three headings accounting for over 64 per cent of the cases. It is highly likely, however, that the importance of coronary artery disease is very considerably under estimated as several of the hearts showed gross coronary artery disease post-mortem, with no evidence of it during life. Four cases of left bundle branch block and one of right changed to indeterminate forms during observation and in one of them an old lesion was found blocking the left branch and a recent one blocking the right. Six cases showed at least temporary and two permanent disappearance of the bundle branch block (two indeterminate and six left). In four cases I.V.B. was associated with A-V block. In eleven cases the branch block seemed to cause no disability, and in another eleven the survival rate was five or more years (maximum 19 years). In itself I.V.B. is not incompatible with several years of life and with a reasonable degree of physical activity (22 cases in this series). The prognosis seems to depend, not so much on the block itself, but rather (1) on the conditions that caused the block, (2) on the degree of disability or strain to which the heart is subjected by the aetiological factors, and (3) on the ability of the myocardium to "stand up" to these factors. Detailed studies were made of five of these hearts by Professor Keenan with complete tracing of the conducting system. (This work was done under a technical grant from the Medical Research Council of Ireland).

**Congenital Absence of the Right Branch of the Bundle of His**

**By J. B. Coakley (introduced by Henry Moore)**

In May 1948 a boy, aged 19 years, was admitted to the Mater Misericordiae Hospital, Dublin, by Professor Henry Moore. His relevant previous history was, that he was "inclined to be blueish" and he complained of "lack of energy." Clinical examination revealed a considerably enlarged
heart with a mitral systolic murmur and a split first mitral sound; his pulse was 84 at rest, and his B.P. was 104/90; there were crepitations at both lung bases and a simple exercise test produced dyspnoea. X-ray examination revealed a markedly enlarged heart, involving especially the right atrium, with a scarcely discernible aortic notch. The electrocardiogram was of an indeterminate form of intraventricular heart block, with possibly lesions in both branches.

On post-mortem examination the heart was enlarged and hypertrophied; the cavity of the right atrium was larger while that of the right ventricle was smaller than normal. The aorta showed hypoplasia, its diameter being 16·5 mm.

The conducting system was investigated by serial section of blocks of tissue embedded in paraffin. The sections were stained with a modification of Masson’s trichrome stain, using light green.

The right and left coronary arteries and specially the anterior descending branch of the left coronary showed considerable evidence of atherosclerosis.

Both sinu-atrial and atrio-ventricular nodes were normal. The bundle of His was traced across the atrio-ventricular ring but did not divide into right and left branches as should normally occur. Instead the entire bundle passed into the left branch. This branch was traced carefully. It gave fibres to the muscle of the interventricular septum on the left side and became condensed into four main divisions. These also gave fibres to the muscle of the septum and then the continuity in all four left divisions was completely interrupted by fibrous lesions.

No right branch was present in this heart. The possibility of a lesion in the branch at the bifurcation of the bundle was investigated and excluded. Likewise the possibility of a right branch crossing the atrio-ventricular ring independently of the bundle of His was excluded. No bundle of Kent was present in this heart.

It was concluded, therefore, that the absence of the right branch in this heart must be due to a congenital defect. An attempt was made to explain this deficiency on the basis of the embryology of the heart. As far as we know, no such case has ever been recorded previously.

This work was done under a grant from the Medical Research Council of Ireland.

THE USE OF ANTI-COAGULANTS IN CORONARY THROMBOSIS: AN ANALYSIS OF 170 CASES

BY JOHN TULLOCH (introduced) AND RAE GILCHRIST

Coronary thrombosis occurring in 170 instances in 164 patients has been closely studied and personally observed. This group constitutes two series of patients (a) a control group of 100 cases treated by conventional methods, and (b) 70 cases receiving in addition anti-coagulant therapy.

Anti-coagulants were administered during the first three weeks after the onset of infarction. Heparin was employed for the first 4–5 days, by which time dicoumarol became effective. The dicoumarol dosage was regulated by daily prothrombin estimations.

The course followed by the control group has been analysed and the various features of importance in assessing the prognosis are stressed. The treated group has been similarly analysed and the improved prognosis noted.

THE INFLUENCE OF HEART RATE CONTROL ON CARDIAC OUTPUT IN HEART FAILURE

BY R. I. S. BAYLISS AND H. G. KELLY (introduced by J. McMICHAEL)

Published in full, Lancet, 1949, 2, 1071.