The paradoxical behaviour of the nodules with regard to size, and of the entire thyroid tissue with respect to function, can in our opinion best be understood in the light of the peripheral theory (Zondek, 1924, 1935), which postulates that primary rise of oxygen consumption in the peripheral tissues may result in secondary hyperfunction of the thyroid, eventually with corresponding increase of its volume. It may therefore be assumed that in our case the artificially induced hypermetabolism led to a secondary stimulation of thyroid function as far as a response of the seriously damaged thyroid tissue could be expected. (Increased formation of an active thyroid hormone was regarded as all the more unlikely, since the B.M.R. subsequently fell.) At the same time only those parts of the gland which exhibited hypersensitivity towards growth-stimulating influences—namely, the nodules—would and did also increase in size. The fact that functional increase was evident throughout the whole thyroid tissue, whereas the increase in size was restricted to the nodules, confirms the claim that function and growth within the thyroid are not necessarily correlated (see above).

It may therefore be assumed that complete regression of thyroid nodules cannot be achieved either in the hypothyroid or in the hyperthyroid respectively hypermetabolic stage, but only if and when a euthyroid state is maintained through adequate and prolonged substitution therapy.

Summary

The case of a 14-year-old girl with familial sporadic cretinism and a very large goitre of partly diffuse and partly nodular nature is reported in which the induction of a euthyroid state resulted in the disappearance of the diffuse goitre and a decrease in the size of the nodules. On the strength of the generally accepted thesis that nodular and diffuse thyroid enlargements are ultimately due to increased T.S.H. secretion and activity, and their regression to T.S.H. suppression, attempts were made to reduce the size of the nodules further by achieving the utmost degree of T.S.H. suppression—that is, by making the patient artificially hyperthyroid. Following the ingestion of large amounts of active thyroid substances (30 mg. of tri-iodothyroacetic acid—"triac"—in three days) a steep but spurious rise of the B.M.R. was obtained, whereas the other indices of thyroid function remained in the euthyroid range. Simultaneously the nodules not only failed to decrease but actually considerably increased in size, almost attaining their pre-treatment volume within six days. Radio-iodine uptake, which before treatment had been very low (with the exception of the two-hour value), rose to abnormally high "hyperthyroid" levels at the height of the hypermetabolic phase; hormone synthesis was not affected.

The unexpected and paradoxical behaviour of the nodules with regard to size and of the entire thyroid tissue with regard to function during the hypermetabolic phase is discussed.

In the light of our observations, regression of thyroid nodules may be expected to take place only in euthyroid conditions, and it must be the aim of treatment to maintain clinical euthyroidism through adequate and prolonged maintenance therapy.

We are greatly indebted to Dr. R. Pitt-Rivers, F.R.S., of the National Institute of Medical Research, for the supply of "triac." Our thanks are also due to Drs. Hochman and Stein, of the Isotope Unit, Hadassa Medical School, Jerusalem, for the ^{131}I examinations.

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ATRIAL SEPTAL DEFECT IN THE AGED

BY

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Atrial septal defect accounted for 17% of a series of 200 cases of proved congenital heart disease described by Wood (1950). In his series of cases a sex incidence of 4:1 in favour of the female was encountered and the average age at death was stated to be about 36 years.

Recent advances in anaesthesia and surgical technique (Edwards *et al.*, 1955) have resulted in the inclusion of atrial septal defect among the increasing number of congenital heart lesions now amenable to surgical treatment.

Whilst recognizing the value of surgery in the treatment of a congenital lesion which hitherto has carried such a gloomy prognosis, we feel that this is an opportune time to describe five cases of atrial septal defect in elderly patients which have come to our notice during the past twelve months. All our patients have lived full and active lives, and two of them are still capable of a degree of physical exertion compatible with their advancing years.

Case 1

A widow aged 79 was admitted to the cardiac centre on July 7, 1955, in congestive cardiac failure. She stated that her first episode of cardiac failure had occurred when she was 54 years of age. Prior to that time she had enjoyed good health and was unaware of any cardiac defect. During the last 25 years she had three further attacks of congestive failure, and for the past 10 years dyspnoea on effort had forced her to limit her activities considerably. One month before admission her dyspnoea had increased and was accompanied by swelling of her feet, legs, and abdomen.

On examination she was an alert, intelligent patient who looked younger than her stated age. Slight cyanosis was noted, but she was not anaemic, and there was no finger-clubbing. The pulse rate was 74 a minute, and irregular owing to auricular fibrillation. The brachial blood pressure was 110/80 mm. Hg. The apex beat was difficult to locate and presented as a tumultuous heave extending beyond the midclavicular line. There were no palpable thrills. Marked jugular venous engorgement was noted. On auscultation the abnormalities found were a grade 1 systolic murmur together

FIG. 1.—Case 1. Auricular fibrillation and right bundle-branch block.

with a third heart sound at the apex. The second sound over the pulmonary area was accentuated and widely split. No diastolic murmurs were heard. The liver was enlarged, sacral and ankle oedema was noted, and moist rales were present at both lung bases.

FIG. 2.—Case 1. Generalized cardiac enlargement with enlarged pulmonary arteries.

Investigations.—

An electrocardiogram revealed auricular fibrillation and a right bundle-branch block (Fig. 1). Chest x-ray film showed marked cardiac enlargement with prominent pulmonary arteries (Fig. 2). Cardioscopy confirmed the presence of pulmonary plethora, right ventricular enlargement, and vigorous pulsation of the pulmonary arteries. No selective left auricular enlargement was detected.

FIG. 3.—Case 2. Supraventricular paroxysmal tachycardia and right bundle-branch block.

FIG. 4.—Case 2. Sinus rhythm and right bundle-branch block.

Case 2

A retired butcher aged 68 attended a surgical clinic in March, 1955, complaining of prolapsing haemorrhoids. Routine examination revealed a marked tachycardia, and he was referred to the cardiac centre for further investigation.

On examination he was seen to be a short thick-set man of cheerful disposition and in no obvious distress whilst at rest. Slight jugular venous engorgement was noted, together with slight pretibial oedema. The pulse rate was regular at 160. The brachial blood pressure was 160/100 mm. Hg. Because of his obesity and emphysematous chest contour, the apex beat could not be defined. No thrills

FIG. 5.—Case 2. Generalized cardiac enlargement with pulmonary plethora and prominence of the pulmonary conus.

or murmurs were detected. An electrocardiogram showed a supraventricular paroxysmal tachycardia with right bundle-branch block (Fig. 3). The paroxysm terminated spontaneously, the pulse rate falling to 96. Sinus rhythm was confirmed by electrocardiogram, the right bundle-branch block remaining unchanged (Fig. 4). Further examination revealed a grade II systolic murmur over the pulmonary area, a third heart sound at the apex, and accentuation of the aortic and pulmonary second sounds. In addition wide splitting of the pulmonary second sound was noted.

Investigations.—An electrocardiogram revealed sinus rhythm with right bundle-branch block. Chest x-ray examination showed generalized cardiac enlargement, pulmonary plethora, and prominence of the pulmonary conus (Fig. 5). Cardioscopy confirmed these findings, and vigorous pulsation of the pulmonary arteries was seen. Cardiac catheterization was performed, when evidence of moderate pulmonary hypertension was obtained and blood sampling confirmed the presence of atrial septal defect (see Table).

Catheter Studies in Case 2

Catheter Tip	Pressure (mm. Hg)	Blood O ₂ Saturation (%) (Van Slyke)
Superior vena cava	—	59
Right auricle, high	—	62
mid	—	72
Inferior vena cava	—	56
Right ventricle	40/0	66
Pulmonary artery	50/20	67

Case 3

A man aged 67 was referred to the heart clinic of the Liverpool Royal Infirmary in August, 1954, with a request from his general practitioner that his dyspepsia and tachycardia be investigated. So far as the patient could recollect, he had suffered no serious illness in the past. When he was a child some cardiac enlargement had been noted, but the cause was not specified.

He was working a 40-hour week as a fitter, the work involving moderate physical exertion, and he had lost no time off work in 40 years. During the previous four months he had suffered from recurrent attacks of dizziness, associated with a feeling "as if my heart missed a beat." There had been no chest pain, dyspnoea, cough, or haemoptysis.

On examination there was no cyanosis, finger-clubbing, jugular venous engorgement, or oedema. The pulse rate

was 80, with a regular rhythm. The brachial blood pressure was 140/80 mm. Hg. The apex beat was difficult to locate because of emphysema, but was maximal in the left fifth interspace, 4 in. (10 cm.) from the midline. No right ventricular heave could be felt.

The first and second sounds were normal at the mitral, tricuspid, and aortic areas. No third heart sound could be

FIG. 6.—Case 3. Sinus rhythm and right bundle-branch block.

heard. The pulmonary second sound was accentuated and widely split, the second component being the louder. A grade I systolic murmur was confined to the apex; no diastolic murmurs could be heard.

Investigations.—An electrocardiogram revealed sinus rhythm with a right bundle-branch block (Fig. 6). Cardioscopy showed a moderately enlarged heart, mainly right ventricular, with unfolding of the aorta (Fig. 7). There was also some calcification in the aortic arch. The lung fields were plethoric and there was a well-marked "hilar dance."

FIG. 7.—Case 3. Moderate cardiac enlargement, pulmonary plethora, and prominence of pulmonary conus.

Case 4

A man aged 58 suffering from pulmonary tuberculosis was referred to the cardiac centre in September, 1955. Previous x-ray examinations of his chest had revealed an abnormality of the

cardiac contour and pulmonary vessels. He had been in hospital twice during the past three years. On the first occasion a gastric ulcer was treated conservatively, and on the second he had lobar pneumonia. No comment was made about his heart on either occasion.

On examination he was seen to be a short, thin man of sallow complexion with a marked dorsal kyphoscoliosis and "pigeon chest." He had a high arched palate, but no finger-clubbing or arachnodactyly. He appeared slightly cyanosed, but there were no signs of congestive cardiac failure.

His pulse rate was regular at 108, the brachial blood pressure was 130/70 mm. Hg. The apex beat was felt as a tumultuous heave in the anterior axillary line in the sixth left interspace. No parasternal pulsation was detected. At the apex a grade II systolic murmur was heard together with a third heart sound. The second sound over the pulmonary

area was accentuated and split; no other abnormal sounds were heard.

Investigations.—An electrocardiogram revealed a right bundle-branch block (Fig. 8). Chest x-ray examination showed marked cardiac enlargement with prominent pulmonary arteries. In addition, mottled opacities due to pulmonary tuberculosis were visible in both upper zones. Cardioscopy confirmed the presence of pulmonary plethora, right ventricular enlargement, and vigorous pulsation of the pulmonary arteries. No selective enlargement of the left auricle was detected, and the radiological appearances closely resembled the findings observed in all our other cases.

FIG. 8.—Case 4. Sinus rhythm and right bundle-branch block.

Case 5

A housewife aged 58 first developed congestive cardiac failure in July, 1950. Prior to that time she had enjoyed good health and her five pregnancies had been uneventful. She was alleged to have had rheumatic fever when aged 11 years, but could recall no other significant illness. A survey of her case notes recorded in 1950 revealed that she had auricular fibrillation with severe congestive cardiac failure. Cardiac enlargement, gallop rhythm, and a loud apical systolic murmur were heard. A pericardial friction rub maximal over the pulmonary area and left parasternal region was also noted, and was still audible three months later when she was discharged. The brachial blood pressure was 180/120 mm. Hg. Her electrocardiogram showed a right bundle-branch block with auricular fibrillation, and this record remained unchanged during the next five years (Fig. 9). Chest x-ray examination in 1950 was reported as showing "generalized cardiac enlargement with prominence of the pulmonary conus, and selective enlargement of the left

FIG. 9.—Case 5. Auricular fibrillation and right bundle-branch block.

auricle. Congestive changes are shown in the lung fields." A diagnosis of congestive cardiac failure secondary to rheumatic heart disease and hypertension was made. Between 1950 and 1955 she was readmitted to hospital on four occasions in severe congestive cardiac failure. The pericardial friction rub remained a constant finding throughout, and the diagnosis of rheumatic heart disease and hypertension was not questioned. Her last admission to hospital was in July, 1955.

On examination she was cyanosed, with marked jugular venous engorgement. No finger clubbing was noted. Pitting oedema of the legs and lumbar region was apparent, together with gross ascites. The apex beat was located in the sixth left interspace, in the anterior axillary line. There was no palpable right ventricular heave, but the pulmonary second sound was accentuated and widely split. The mitral and aortic sounds were normal, and no diastolic murmurs could be heard. The curious pericardial friction rub previously recorded was still present over the left parasternal area. The brachial blood pressure was 180/110 mm. Hg.

Investigations.—An electrocardiogram was similar to the first record taken in 1950, showing a right bundle-branch block with auricular fibrillation. Cardioscopy revealed generalized cardiac enlargement, pulmonary plethora, and vigorously pulsatile dilated pulmonary arteries. No selective left auricular enlargement was seen.

In view of these findings the previous diagnosis of rheumatic heart disease seemed unlikely; the right bundle-branch block, dilated pulsatile pulmonary arteries, and auricular fibrillation all being more compatible with a diagnosis of atrial septal defect.

The patient died in November, 1955, but unfortunately permission for necropsy was not granted.

Discussion

In this paper we have described five cases of atrial septal defect occurring in elderly patients. Their ages ranged from 58 to 79 years. All the patients were seen by us during a period of 12 months, a surprising fact when it is recalled that most patients with this type of congenital heart disease succumb before the age of 40 years (McGinn and White, 1933).

The criteria for diagnosis have been based mainly on radiological and electrocardiographic findings, as it is generally agreed that a purely clinical diagnosis cannot be made with certainty (Burrett and White, 1945).

All five cases showed the typical radiographic findings associated with atrial septal defect, as described by Roesler (1934) and Bedford *et al.* (1941)—namely, dilatation of the right auricle and ventricle, with marked dilatation and pulsation of the pulmonary artery and its branches. Associated left auricular enlargement was alleged to be present in Case 5, but we were unable to confirm this; the left ventricular enlargement noted in this case was thought to be due to the coincident systemic hypertension. Unfolding of the aorta with atheroma was present in Case 3, but otherwise the first four cases in the series showed no enlargement of the left auricle, left ventricle, or aorta.

The electrocardiographic pattern of right bundle-branch block was present in each case, thereby satisfying the criteria laid down by Barber *et al.* (1950), who pointed out that the diagnosis of atrial septal defect in the absence of partial or complete right bundle-branch block is almost untenable. In Case 5, negative T waves in leads V5 and V6 were thought to be due to the systemic hypertension. Two patients were shown to have auricular fibrillation, and one had episodes of supraventricular paroxysmal tachycardia.

Catheter studies were performed in only one patient (Case 2), and we are indebted to this man for his willing co-operation in a procedure from which he could derive no benefit. They revealed the presence of a left-to-right shunt in the atria and a mild degree of pulmonary hypertension,

the pulmonary artery systolic pressure being 50 mm. Hg. We did not consider catheterization justifiable in the other four cases, since it could have had no therapeutic application.

Apart from finding a widely split and accentuated pulmonary second sound in all our cases, clinical examination was of little help in establishing the diagnosis. No evidence of arachnodactyly was found in any patient, the only skeletal abnormality being a dorsal kyphoscoliosis in two patients. A high arched palate was found in only one patient, and finger-clubbing was uniformly absent.

Two patients, both of whom had auricular fibrillation, were in severe congestive cardiac failure when seen, two had marked dyspnoea on effort, and one (Case 3), apart from vague "palpitations," had no symptoms referable to his heart. In fact, three of the five patients were still capable of a degree of physical exertion compatible with their advancing years.

Apical or basal systolic murmurs (Grades I-III) were heard in all cases, but none had either pulmonary or apical diastolic murmurs, and in only three was a third heart sound audible. Splitting of the pulmonary second sound was a constant finding, and in three cases the tumultuous type of apex beat described by Barber *et al.* (1950) was found. The presence of the alleged pericardial friction in Case 5 deserves special mention, as it persisted for so long, and caused considerable confusion when first heard. It may have been mistaken for a "to-and-fro" pulmonary murmur due to relatively pulmonary incompetence, but it appeared to have a superficial quality and to become louder by increasing the pressure on the stethoscope on the chest wall. It seems probable, therefore, that the sound may have been produced by the enormously dilated pulmonary artery coming into contact with the anterior chest wall, its vigorous pulsation producing the friction sound.

In differential diagnosis, the presence of the bundle-branch block, together with peripheral pulmonary plethora and marked splitting of the pulmonary second sound, excluded the presence of idiopathic dilatation or of post-stenotic dilatation of the pulmonary artery. The absence of left ventricular enlargement in all except Case 5 excluded so far as was possible the existence of ventricular septal defect and persistent ductus arteriosus. Case 5 showed some left ventricular enlargement, but this was thought to be due to the systemic hypertension present in this case.

We have already stressed the difficulties in establishing the diagnosis of atrial septal defect on purely clinical grounds. In the present series Case 1 had been regarded as a case of congestive heart failure for over 25 years, presumed to be due to coronary artery disease until the diagnosis of atrial septal defect was made, and Case 5 had at varying times been thought to have coronary artery disease with hypertension and mitral stenosis. Case 4 had been thought to have chronic cor pulmonale, and Cases 2 and 3 had not been diagnosed. With these facts in mind the purpose of this paper has been to show that atrial septal defect and longevity are not incompatible; and we would therefore stress the importance of excluding this not uncommon congenital anomaly as a cause of obscure congestive cardiac failure in the older age groups. We suspect that many cases of this type occurring in the sixth and seventh decades have been missed in the past because the possibility of encountering a congenital heart lesion in an aged patient has not been entertained. It is all too easy in such patients to ascribe auricular fibrillation, when present, and bundle-branch block to coronary artery disease, and the pulmonary plethora to congestive cardiac failure or even uraemia occurring as a terminal event in an aged patient.

Summary

Five cases of atrial septal defect with clinical, radiological, and electrocardiographic findings are described in patients between the ages of 58 and 79 years.

The possibility is stressed of this anomaly being present in older patients with congestive cardiac failure of obscure origin.

It has been shown that atrial septal defect and longevity are not incompatible.

We are indebted to Drs. E. Noble Chamberlain, E. Wyn Jones, C. S. McKendrick, H. Fuld, and F. C. Crawley for allowing us to publish details of patients under their care at Sefton General Hospital, Liverpool, and the Royal Infirmary, Liverpool.

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EPIDEMIC OF PULMONARY TUBERCULOSIS IN A CLOSED COMMUNITY

BY

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The first scientific study of the epidemiology of tuberculosis was made by Villemin in 1868. He stressed the high incidence of the disease among those living in closed communities, such as prisoners, inmates of mental institutions, soldiers, and religious bodies. Tuberculosis among troops living in barracks was very common compared with those in the field or those living at home. He quoted, as an example, the Allied armies before Sebastopol during the winter of 1854-5. Although these troops were living under most unhygienic conditions, with poor food, and subjected to severe cold and excessive fatigue, cases of tuberculosis were rare. At this time the mortality rate in the Army due to tuberculosis varied between 5 and 12.5 per 1,000.

To-day we have the same modes of spread of the disease. It is only by the detection of early cases and by adopting strict precautions to prevent its transmission by the occasional "open" cases that we are able to improve on these figures. The following is an account of its rapid spread in a comparatively closed community in which normal precautions are taken but in which the opportunities for spread are so great.

The Closed Community

This community was a military band which returned to the United Kingdom from a tropical station at the end of September, 1954. Its members were given leave for four weeks before returning to barracks. In February, 1955, they went to Germany.

In peacetime, military bands have approximately forty members, mainly between the ages of 16 and 25 years. Few are married and live in quarters; the rest live together in barracks. Occasions arise, such as touring, when they all live together. Sleeping accommodation varies from station to station; while in the United Kingdom these men lived in rather old barracks and slept sixteen to a room, in Germany their barracks were excellent, and they slept four to a room. Food was good and there were ample facilities for recreation. These men are specialists and have little in common with other members of the regiment; their friends are usually other bandmen.

The regiment to which a military band belongs has little bearing on the background of its bandmen. They originate

from all parts of Britain, mainly large industrial cities. There is no reason to believe these people lacked natural immunity. When Mantoux tests were performed at the end of March, 1955, only one person under 21 years was Mantoux-negative. Of the seventeen members joining since, all are Mantoux-positive, none having received B.C.G.

The practice-room usually allocated to the band is a small one on the outskirts of the station, where their music does not interfere with other military activities. Rarely have they large particularly well-ventilated rooms.

On returning from tropical conditions to the wintry conditions in the United Kingdom, approximately half of the band developed some form of minor respiratory tract infection. Six of the finally proved cases experienced this change, which may have played a small part in lowering their resistance.

Presentation of Cases

On March 22, 1955, Case 1, a youth aged 17, reported sick with pleuritic pain in the right side of his chest. Clinically and radiologically he had a large right-sided pleural effusion. E.S.R. (Westergren) 38 mm./hour. White cells, 10,900 per c.mm. (polymorphs 69%, lymphocytes 27%, monocytes 4%). Aspirated pleural fluid: white cells, 4,900 per c.mm. (lymphocytes 80%); red cells, 6,400 per c.mm.; specific gravity, 1012. Gram stain: no organisms seen. Ziehl-Neelsen stain of concentrated fluid: scanty distribution of *Mycobacterium tuberculosis*. These organisms were later cultured. This patient produced no sputum, and no organisms were detected in his resting gastric juices. Mantoux 1:10,000 was positive.

There was no family history of tuberculosis or any known contact with the disease. He had joined the band four months previously while in the United Kingdom, and his contacts were confined to the members of the band and the bandmaster's family, whom he visited frequently. These contacts were x-rayed and two further cases found—Case 2 and the bandmaster's wife.

Case 2, a man aged 23, had an advanced fibro-caseous lesion spread throughout the left upper lobe. There were two medium-sized cavities, one at the apex and the other in the mid-zone. He gave a history of having had cough with sputum for four months, and on one occasion a small haemoptysis. For some time he had noticed that playing his clarinet had become more exhausting. E.S.R. (Westergren) 30 mm./hour. Sputum contained a scanty distribution of acid/alcohol-fast bacilli. He had slept in the next bed to a man with pulmonary tuberculosis in Hong Kong in 1952. The band had been x-rayed in Hong Kong and again in the United Kingdom in the summer of 1953, but no further cases were detected.

The bandmaster's wife had an early infiltrative lesion at the right apex. She had no symptoms and no signs. No organisms were isolated from her sputum or resting gastric juices. Case 1 was a frequent visitor to the bandmaster's home, and she had met Case 2 socially on several occasions.

Further cases presented as shown in the accompanying Table, either clinically or with abnormal chest x-ray finding during follow-up examination. The last cases (Nos. 9 and 10) were admitted to hospital at the beginning of May, 1956. There were no cases when mass miniature radiographs were taken at the end of December, 1955.

All family contacts of infected bandmen have been examined radiologically. No cases have been found. Case 2 had regularly seen his wife until going to Germany. She remains well.

Source of Infection

Myco. tuberculosis was isolated from three cases of this series. It was seen in the Ziehl-Neelsen stain and later cultured. In Case 1 the organisms were found in the pleural fluid; he produced no sputum, and no organisms were found in his resting gastric juices. X-ray examination revealed no pulmonary lesion to suggest he had had "open" pulmonary tuberculosis at any time. Case 2 had organisms in his sputum, and x-ray appearances were compatible with