CASE REPORTS

Paradoxical Coronary Embolism

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In the presence of normal anatomical formation of the heart and great vessels, emboli that lodge in the lungs or in the right side of the heart arise from the periphery, and emboli that lodge in the systemic arterial tree have as their origin the pulmonary veins, chambers or the valves of the left side of the heart, or the walls of more proximal systemic arteries.

On rare occasions, however, in the presence of an actual, or potential, communication between the right and left sides of the heart, emboli from the peripheral veins may traverse the septum and be ejected into the systemic circulation. Such an occurrence has been termed "paradoxical embolism".

Up to the present time, embolism of a coronary artery has been reported on fewer than 100 occasions. Oakley, Yusuf, and Hollman (1961) reviewed 90 cases from published reports and added 5 of their own. Among these 95 cases are included 4 of paradoxical embolism arising from the pelvis and passing through a patent foramen ovale.

Blanck and Olanders (1963) reported 2 further instances of a similar condition, and 3 others have been recorded (Marchand, 1894; Abrikosoff, 1913; Vimtrup, 1941).

One further instance of paradoxical coronary embolism is now reported.

Case Report

A 75-year-old retired ship's plater, whose previous health had been excellent, was admitted to Knightswood Hospital for investigation of Jacksonian seizures.

On admission there was marked finger clubbing. He had a right-sided hemiparesis. The cardiac rhythm was sinus, and the blood pressure was 150/80 mm. Hg. No murmur was detected over the præcordium. The electrocardiogram showed slurring of QRS complexes

but no diagnostic abnormality (Fig. 1). The electroencephalogram showed a focus of delta and theta rhythm in the left fronto-temporal region. The chest radiograph revealed a normal cardiac contour and clear lung fields.

After a brief period of improvement, he developed a right upper lobe pneumonia, following which radiographs revealed an opacity in that region, suggestive of bronchial carcinoma.

During the ensuing 6 weeks, he had recurrent pneumonic episodes, and the focal epileptic seizures recurred with increasing frequency, culminating in a complete right hemiplegia. Again there was transient improvement, but after two further weeks, he suddenly collapsed and died.

Necropsy (Dr. W. I. B. Onuigbo) revealed a carcinoma of the right upper lobe bronchus with metastases in pleura, lymph nodes, liver, adrenal glands, and kidneys. The whole of the left parietal lobe of the brain was infiltrated with necrotic tumour. Both main pulmonary arteries contained large emboli, with antemortem thrombus in the pulmonary arterioles. The pulmonary veins were free from thrombus.

There was a 1.5 cm. circular defect situated antero-inferiorly in the atrial septum. The ostium of the left coronary artery was occluded by an embolus (Fig. 2). Antemortem thrombus was found in both femoral veins.

Histologically, the pulmonary artery emboli showed early organization, and the myocardium showed foci of necrosis in association with early migration of polymorphs, indicating acute infarction.

Discussion

The occurrence of paradoxical embolism of a coronary artery must, by its very nature, be of extreme rarity, depending as it does on the fortuitous occurrence of a number of conditions. First, there must be a source from which emboli may arise. Secondly, there must be a patency of the atrial or ventricular septum. Thirdly, there must be sufficient obstruction to pulmonary blood flow to produce a reversed flow through such a

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FIG. 1.—Electrocardiogram on admission.

septal defect. Thompson and Evans (1930) considered that this necessitated either the occlusion by embolus of one-third of the pulmonary arterial tree, or the presence of some other cause of increased

pulmonary vascular resistance. Fourthly, having negotiated the septal defect, the embolus must, by sheer chance, lodge in a coronary artery.

Even if all these conditions are apparently present

FIG. 2.—The heart, displaying the left atrium and ventricle. (1) Patent foramen ovale; (2) left atrium; (3) mitral valve; (4) thrombus protruding from ostium of left coronary artery; (5) left coronary artery cut longitudinally, showing thrombus; (6) aortic valve; (7) left ventricle.

TABLE
FEATURES OF PARADOXICAL CORONARY EMBOLISM

Case No.	Reference	Age (yr.)	Sex	Underlying disease	Artery involved	Comment
1	Marchand (1894)	69	M	Syphilis	Left	
2	Abrikossoff (1913)	Neonatal	M	Birth trauma	Left	Avulsed cerebellar tissue
3	Wolff and White (1926)	43	F	Ovarian carcinoma	Left	
4	Thompson and Evans (1930)	25	M	Teratoma of testis	Both	Tumour embolism
5	Saphir (1933)	35	M	Broncho-pneumonia	Left	
6	Jacobi, Kenler, and Silverman (1934)	47	F	Gastro-enteritis	Left	
7	Vimtrup (1941)	68	F	R. atrial thrombus	Right	
8	Blanck and Olanders (1963)	60	M	Pulmonary tuberculosis	Right	
9	Watt (1966) (present case) ..	62	F	Inguinal hernia	Left	
10		75	M	Bronchial neoplasm	Left	

at necropsy, the condition can be accepted as one of paradoxical coronary embolism only if there are no significant changes in the wall of the occluded vessel, and if there is no thrombus in the pulmonary veins, the left side of the heart, or the aorta (Blanck and Olanders, 1963).

This present case satisfied all the requirements for the diagnosis of paradoxical coronary embolism, and brings the total number of recorded instances to 10. The details of these 10 cases are summarized in the Table. As can be seen, only 8 of these emboli consisted of thrombus; the cases of Abrikossoff (1913) and of Thompson and Evans (1930) died following embolism of tissue, the former consisting of avulsed fragments of cerebellum, while in the latter, the tissue comprised fragments of testicular tumour.

The features of paradoxical coronary embolism are relatively inconstant. In the majority of cases, the left coronary artery has been occluded, the right being blocked twice, and both on only one occasion. The nature of the underlying disease varies widely, though in most it is chronic and debilitating, and of a nature predisposing to circulatory stasis and pelvi-femoral vein thrombosis. The sexes are affected in fairly equal numbers and the age range is wide, extending from birth to 75 years.

It has been generally accepted that the cardinal feature of coronary embolism is sudden death (Saphir, 1933). Nevertheless, it is of note that in the report of Case 6, after death had been presumed for two hours, the heart was found still to be beating. Oakley *et al.* (1961) reviewed 95 cases of coronary embolism from all sources and postulated that similar events might be incriminated as causes for the onset of angina pectoris in patients with mitral stenosis. If this is indeed the case, sudden death cannot be regarded as an inevitable sequel, and the diagnosis of coronary artery embolism should be entertained more frequently in survivors from myocardial infarction.

Summary

The published reports of paradoxical coronary artery embolism have been reviewed, and clinical and pathological details of a further case are presented, bringing the total number of recorded instances to 10. The characteristics of all the known cases are presented and it is suggested that further similar cases may have been overlooked, where sudden death has not been a feature.

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