

A CASE OF
CARDIAC BALL-THROMBUS.

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THE occurrence in the heart's chambers of loose thrombi having a laminated structure and a spherical or oval form has been noted from time to time since Wood first described such a thrombus in the *Edinburgh Medical and Surgical Journal* of 1814. To this formation the name of ball-thrombus has been generally applied. Welch points out that a ball-thrombus, properly so-called, presents the following three definite characters: (1) Entire absence of attachment and consequent free mobility; (2) imprisonment in consequence of excess in the diameter of the thrombus over that of the first narrowing in the circulatory passage ahead of it; and (3) such consistence and shape that the thrombus must not of necessity lodge as an embolus in this passage.

This definition excludes from the category of ball-thrombus certain cases in which an irregular soft mass has been found free in one or other of the chambers of the heart, and others in which small rounded thrombi have been found free in the heart after death, so minute that they must have been swept out of it in the blood stream had they actually been loose during life. The true ball-thrombus occurs in the left auricle, and in all the cases mitral stenosis is present, often to an extreme degree. The thrombus varies in size from rather less than that of a walnut to that of a hen's egg. The laminated structure and rounded form are ascribed to the deposition of fibrin from the surrounding blood upon a detached and freely movable body. In some cases the thrombus displays upon its surface a roughened area which may indicate its former point of attachment to the auricular wall. Some 20 cases in the literature conform to Welch's definition.

The following case which we have recently observed is typical of the condition.

Mrs. M., aged 49, was admitted on April 17th last to Dr. Edwin Bramwell's wards in the Edinburgh Royal Infirmary. She complained of shortness of breath and of giddiness occurring mainly on exertion, but occasionally while at rest. These symptoms had troubled her for an indefinite period, but had been more pronounced since an attack of pneumonia two months before admission. There was no history of rheumatism or of infective disease other than the pneumonia, but she had suffered from epileptic fits for 17 years. The patient was a thin, pale-faced woman of fair intelligence but with very defective memory. There was no cyanosis or oedema. The pulse-rate at the wrist was 60-70 per minute with complete irregularity and great variation in the strength of the beats. The apex beat was completely irregular and considerably more frequent than the radial pulse. The apex was in the fifth interspace just internal to the mammary line. There was well-marked epigastric pulsation. A short systolic murmur was audible at the apex and over the lower part of the sternum, and at the apex a short diastolic murmur immediately following the second sound could be heard at times. The second pulmonary sound was accentuated. The lungs presented no abnormal physical signs. There was a slight degree of polyuria, the maximum secretion in 24 hours being 88 ounces. The urine contained no albumin or casts. She was kept at rest and digitalis was administered. Under this treatment her condition improved considerably, and the disparity between the rates of the apex beat and radial pulse disappeared. She was allowed to get up for the first time on May 7th. The heart's action was still completely irregular and electrocardiograms taken on May 13th showed auricular fibrillation and preponderant right-sided hypertrophy. On the same day the patient was sitting up in bed when she suddenly became deeply cyanosed, drew a few gasping breaths, and died immediately.

Post mortem (May 14th).—Serous sacs: Pericardium and peritoneum healthy. No pleural effusion. Right lung adherent below and behind; left free. Heart shows enlargement affecting chiefly the left auricle and right chambers, which are covered with much subepicardial fat. The left ventricle looks atrophic, and its surface vessels are prominent and tortuous. There are some minute epicardial ecchymoses

over the left auricle. The right auricle is considerably dilated, its wall much thinned, and endocardium thickened at places. The right ventricle is also dilated and shows some fatty infiltration of its wall. There is no clot in either auricle or ventricle; they contain only dark fluid blood. The tricuspid orifice admits four fingers and the valve cusps are slightly thickened towards their bases. The pulmonary valve is healthy. The pulmonary artery appears normal and contains only fluid blood; there is no contained clot or embolic blocking of it or of any of its main branches. Left auricle is markedly dilated and the auricular appendix is enlarged. On cutting into the auricle a ball-thrombus presents itself in the incision, being apparently free in the cavity. The thrombus is about the size of a walnut and greyish-pink in colour. The surface is somewhat irregular, granular, and pitted, and in some of the pits there is a layer of p.m. clot. The shape is oval, but at one part there is a sort of flattened spur, probably indicating that the mass had been previously engaged in the auricular appendix. On section made up chiefly of closely packed concentric layers of old fibrin and is mostly cream-coloured. Peripherally there is a narrow zone of more recent greyish-red deposit. The endocardial lining of the left auricle is uniformly thickened. There is a considerable layer of adherent organising fibrin near the entrance to and partly within the auricular appendix. An isolated small oval and slightly raised plaque of similar deposit is present on the posterior wall of the auricle, both evidently of some standing. The mitral orifice is narrowed to a button-hole-like slit which only admits one finger, the cusps being greatly thickened and fused. The auricular surface of the valve shows irregular puckering and calcification. The chordæ tendineæ are bunched together and hard. The left ventricle is small, not notably dilated, and its wall somewhat atrophied though of normal colour. There is no naked-eye fibrosis. The aortic valve is healthy. The aorta shows slight early atheromatous change in the ascending part and the arch. The coronary arteries show a few very small atheromatous patches here and there. Both lungs show slight chronic venous congestion with some oedema. The right shows old and recent organising pleurisy over the lower lobe with two pale infarcts; the left shows slight apical scarring with a little limited fibrosis of lung substance. The stomach and intestine are unaltered, except for some prominence of lymph follicles in the ileum. The spleen is congested. The kidneys show marked chronic granular contraction. The other abdominal and pelvic organs, and also the brain, show no striking alteration naked eye.

Microscopically.—Ball-thrombus shows externally a coarse reticulum of fairly dense, deep-staining fibrin; internally layers of very old decolourised fibrinous material. Some red blood cells are seen within the clot, probably due to percolation but very few leucocytes. Left ventricle shows a patchy interstitial fibrosis, especially round blood-vessels. Slight granular change in the muscle fibre. Left auricle: Vessels are congested and muscle fibres separated by young interstitial connective tissue. The endocardium shows fibrinous deposit, superficially recent, deeper exhibiting active organisation. Organisms are not demonstrable. Lung: A zone of fibrosis with lymphocytic reaction round the necrotic infarcted area; vessels in the immediate vicinity seen having their lumina obliterated by fibrous tissue. General emphysema and catarrhal change; heart failure cells numerous; organising pleurisy and slight bronchitis. Kidney shows advanced arterio-sclerotic change; many areas in the cortex where glomeruli are totally fibrosed; marked catarrhal change in the tubular epithelium. Spleen: Pulp spaces and capillaries greatly engorged; some slight fibrosis round some of the larger vessels. Liver: Slight central congestion with some secondary atrophy of liver cells. A very few isolated foci of lymphocytic accumulation are seen within the lobules.

Summary.—Mitral stenosis; early interstitial myocarditis; thrombosis in left auricle and free ball-thrombus; arterio-sclerotic kidneys; chronic venous congestion of liver, spleen, and lungs; infarctions of right lung with old and recent pleurisy.

Remarks.

Clinical interest in these cases has centred mainly round the two following questions: (1) May the ball-thrombus in the left auricle so modify the symptoms or signs of the accompanying heart lesion that its presence can be inferred with reasonable certainty? (2) Can the thrombus cause sudden death by plugging the narrowed mitral orifice? With regard to the first of these questions Von Ziemssen's observations are of interest. He described three cases of mitral stenosis, one with a ball-thrombus in the left auricle, the others with pedunculated thrombi in that chamber. Basing his opinion upon the symptoms observed in these cases, he suggested that a probable diagnosis of ball or pedunculated thrombus could be made when, in

addition to the physical signs of mitral stenosis, there were also evidences of severe interference with circulation in the left side of the heart (dyspnoea, cyanosis, and coldness of the extremities), all developed to a degree seldom seen in simple mitral stenosis. He laid special stress upon a symptom which occurred in all three cases and also in one described by Hertz—viz., circumscribed gangrene of the feet along with oedema and cadaveric coldness. He considered that the defective arterial supply to the lower limbs might sometimes be due to primary arterial thrombosis.

While one or two other cases of ball-thrombus have displayed similar symptoms, the majority have not done so. In this connexion it is interesting to note that Welch mentions, in discussing plugging of the abdominal aorta, that he found mitral stenosis in nearly 34 per cent. of 59 cases and is inclined to interpret many of them as primary thrombosis of the aorta. He also states that "the circulatory conditions in extreme uncompensated mitral stenosis seem favourable to the occurrence of arterial thrombosis, and if this view be accepted for the plugging of the abdominal aorta, the question arises whether thrombi frequently present in smaller arteries in association with this form of valvular disease may not oftener be primary than is generally supposed?" In view of these observations it seems unnecessary to regard the gangrene of the feet occurring in a few of the cases of ball-thrombus as indicating anything more than the existence of that extreme mitral stenosis which is almost always associated with this condition. In reviewing the cases in the literature, no other single symptom or syndrome emerges which may not be equally well displayed in severe mitral stenosis, altogether apart from this unusual thrombus formation. This is reflected in the fact that the condition is never diagnosed during life.

With regard to the second question, as to whether sudden death may occur from plugging of the stenosed mitral orifice by the thrombus, divergent views have been held by writers on the subject. It may obviously be supposed that the thrombus is forced by the auricular contraction into the stenosed orifice, and that remaining there it produces a sudden arrest of the circulation. To this it has been objected that a loose spherical body cannot readily occlude a shallow elliptical funnel so completely as to arrest circulation, and that unless the thrombus fits the orifice so accurately as to become fixed in it the regurgitant stream during ventricular systole will tend to displace it again. Welch notes, however, that an oval thrombus seems more likely to occlude the mitral orifice than a spherical one. It certainly seems significant that in five of six cases of sudden death the thrombus was oval, and that out of six cases of oval thrombus four died suddenly. It has also been pointed out that the thrombus cannot be pressed against the orifice by the auricular systole owing to the incomplete nature of the emptying of the auricle, dilated as it is in severe mitral stenosis. To this we would add that in the case observed by us in which the auricles were fibrillating, and so standing in the diastolic position, such a pressure of the thrombus down upon the orifice seems out of the question.

Two of the cases of sudden death, however, seem to prove the possibility of plugging of the orifice by the thrombus. In Osler's case the thrombus was found occupying the funnel-shaped space leading to the orifice, and he was of opinion that death was due to occlusion of the narrow opening by the thrombus. In Wadworth's case, in which death was apparently sudden, "the ball was clearly obstructing the mitral opening, causing practically complete occlusion." In both these cases the thrombus was of oval form. The conclusion reached from the evidence available is that in a case of cardiac ball-thrombus occlusion of the mitral orifice may occur and prove immediately fatal, but that this event is quite exceptional.

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References.—Professor W. H. Welch in the article on "Thrombosis" in Allbutt and Rolleston's *System of Medicine*, 1910, vol. vi., 691, and J. H. Hewitt in *Johns Hopkins Hospital Reports*, 1916, vol. xvii., 1, may be referred to for detailed systematic accounts of the condition and for references to all the recorded cases.

ORBITAL CELLULITIS.

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As oculist to the Corporation of Glasgow Fever Hospitals, which include Belvidere, Ruchill, Knightswood, and Shieldhall, it has been my fortune to see quite a few cases of orbital cellulitis, some terminating in abscess and others not. I have noted the following cases of orbital cellulitis in the order of their occurrence, and they exhibit four cases in scarlet fever, three in erysipelas, and one in puerperal fever. A ninth case occurred in an adult male who was admitted to Ruchill as suffering from cerebro-spinal fever with symptoms suggestive of D.T., and who developed an orbital cellulitis from venous sinus thrombosis. An incision made to relieve tension was followed by some relief to the proptosis, but the other eye became affected and the patient died a few days afterwards. As my appointment dates from 1914 only, I exclude for statistical purposes the first case which was seen in 1911. Thus in a period of rather under five years I have seen only eight cases in all of orbital cellulitis; of these three only occurred in scarlet fever.

CASE 1.—M. C., male, aged about 7, was seen first by myself at the Glasgow Eye Infirmary on July 11th, 1911, with an exophthalmos of the left eye. A definite history of scarlet fever was obtained at a later date, in which there were sore-throat, rash, and involvement of the parotid and submaxillary glands of the right side, followed by pain and swelling of the left eye. When seen first the feet were desquamating and the left eye was much proptosed. The child was transferred to Ruchill Fever Hospital, where on the following day under a general anaesthetic I incised a swelling at the inner canthus and found pus. A probe passed back touched bare bone over the ethmoidal plate. The cavity was mopped out with gauze and a gauze drain inserted. Unfortunately an ulcer with prolapse of iris rapidly formed in the cornea close to the wound in the conjunctiva. The wound did well and the proptosis subsided completely, but the anterior chamber remained full of purulent lymph. On the 24th haemorrhage from the bowel set in and the child collapsed. Recovery, however, took place, and in a couple of days an attempt was made to save the eye by excising the prolapsed iris and washing out the anterior chamber. Ultimately it was decided to remove the eyeball, which was done on the 31st. Beyond an attack of chicken-pox further recovery was uneventful.

CASE 2.—M. F., female, aged 22, was admitted to Belvidere Fever Hospital on Oct. 19th, 1915, having been ill for about a week with scarlet fever and desquamation having commenced. Temp. 102° F., pulse 120, respirations 26. There were abundant rhonchi present in the chest. On the 31st the conjunctiva of the left eye became injected; next day the eyelids were oedematous, and an incision was made to relieve this. The following day I was asked to see the case. There was distinct proptosis and pain on backward pressure of the eyeball. A smear taken from the conjunctiva gave a negative result. On Nov. 3rd temp. was still 102°, hearing of the left ear was impaired, there was oedema of the left forehead, temple, and cheek, and patient was talkative although rational. Finding fluctuation on the following day, an incision was made through the outer third of the upper lid, pus evacuated, and a probe introduced touched bare bone in the orbital plate of the frontal bone. A culture taken from the pus evacuated showed a growth of staphylococci. By the 20th the patient was progressing well, but the proptosis remained; temp. was 99°. Breakfast had been taken well, but an hour later she vomited suddenly, became livid, and in another hour there began a series of convulsions, five in all, with intervals of about 15 minutes. On the 23rd the wound was enlarged to facilitate drainage. On the 27th a convulsion began and lasted three minutes, followed by three others, an hour's rest, and then four more. On Dec. 3rd the wound was enlarged still further to the inner side and pus was coming away freely. On the 16th pain was complained of in the back of the head. On the 23rd a counter-incision was made at the inner side and a drainage-tube passed through. By the 28th drowsiness had set in, there was slight rigidity on flexing the neck, and Kernig's sign was present. Internal strabismus was noted at a latter date, yawning, wasting, marked drowsiness, passage of the urine and faeces involuntarily. Death occurred on Jan. 9th following a slight convulsion.

Autopsy.—On removing the scalp an area of bare bone about one inch square was visible just above the operation wound of the left eye. The vault of the skull was removed. The cerebral blood-vessels were engorged and enlarged, and the dura mater was thickened. The dura was adherent over the left anterior frontal region. The brain was removed, and there was found to be a definite bulging in the anterior superior aspect of the left frontal lobe caused by a yellowish-looking mass. On horizontal section of the left frontal lobe this mass was opened up and a considerable quantity of yellowish-green pus was evacuated. There were three abscess cavities. The most anterior one was definitely encapsuled and was the size of a walnut. The two other cavities were smaller and seemed confluent, and were nearer the external surface and were not so definitely encapsuled. A sequestrum of bone the size of a threepenny-piece was observed at the operation wound, nearer the crista galli of the ethmoid and foramen in the frontal bone just below the supraorbital notch, covered by periosteum.

So far as my own observation goes there was no frontal sinus on the left side, so that there was no intervening air