one guinea-pig and one loopful together with one cubic centimetre of serum into the peritoneum of the other guinea-pig. The former died in five and a half hours and the latter is alive and well. This acute death was due to the peritoneal infection without any doubt. There was an extensive peritoneal exudation but no other sign of injury to the viscera or the blood-vessels. The exudation was full of the bacilli but contained very few cells. Cultures from the exudation were positive and an abundant growth was obtained on cultures inoculated from the spleen of Guinea-pig A. (c) These results with accurately measured amounts of an emulsion of typhoid bacilli amply confirm those of (a) and (b) above.

XII. The injection of the typhoid "toxin" was followed by a transitory illness, severe and acute while it lasted, and a local reaction at the site of injection. The serum from Horse 54 when injected along with the toxin protected the animal from the local and general effects.

CONCLUSIONS.

1. The best method of obtaining a typhoid toxin is by the digestion of the bacilli.
2. This product is toxic.
3. This product can excite a reaction in susceptible animals during which they develop immunity to the injection of living typhoid bacilli and the serum from such an animal can protect another animal against typhoid infection.
4. The injection, intravenously, of living typhoid bacilli may result in the production of a "negative phase" of resistance. (See X. on previous page.)

Herne Hill, S.E.

A CASE OF PYOPERICARDIUM FOLLOWING PUERPERAL SEPSIS; PARACENTESIS; EXCISION OF RIB AND DRAINAGE.

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A MARRIED woman, aged 38 years, was admitted to the Sheffield Royal Hospital on June 6th, 1903, suffering from pain and dyspnoea. For the following notes I am indebted to Dr. F. W. Schofield, house physician, and to my clinical clerk, Mr. F. J. Blackmore. The history of the illness was as follows. The patient was confined on May 9th. Four days later she got up and had a rigor. On the next day she had severe abdominal pain and distension. She was feverish but had no chest symptoms. About a week later she developed pneumonia, both bases being affected. The abdominal symptoms disappeared. The fever and weakness had continued and her breathing had got much worse. Her personal history was that she had inflammation of the lungs ten years ago but no other illnesses. There was nothing of importance in the family history. Her condition on admission was as follows. She looked very ill. There was marked orthopnoea and she lay half turned towards the left side. Her breathing was very shallow and laboured, 60 per minute, and there was slight frequent cough. The expression was extremely anxious and restless. The pulse was 132, small, weak, and regular. The tongue was dry but not furred and there were some old ulcers. The face was emaciated and anæmic, with bright hectic flush patches on the cheeks. There was much sweating of the face and head. The skin generally was moist. With regard to the chest, owing to the extreme dyspnoea and distress of the patient, the physical examination, especially of the back of the chest, was somewhat difficult and of necessity hurried. It was evident that the bulk of the breathing was being performed by the right side, the left hardly moving at all. No cardiac impulse could be felt. The area of cardiac dulness was greatly increased, extending from the upper border of the second left rib above, half an inch to the right of the sternum as low as the right fifth rib, and reaching on the left to the mid-axillary line, the upper margin passing above the left nipple and the lower along the left fifth space. The heart sounds were almost inaudible over the whole area. A slight pleuritic friction sound was heard at the fifth left space in the nipple line. There was some dulness at the right base behind and moist sounds were heard at both bases behind. There was a small patch of bronchial breathing at the angle

of the left scapula behind, but percussion and auscultation of the left base were very difficult. There was also some bronchial breathing above the cardiac dulness in the second left interspace in front. The abdomen was somewhat full and distended but no fluid was detected. The bowels were opened freely and the urine was scanty but normal in quality. The patient slept badly and was very restless. There was no cyanosis. The temperature was irregular, usually rising at night up to 100° or 101° F. and falling in the morning to 99° or less. A large pericardial effusion was diagnosed and seeing the history of the case and the septic symptoms following pregnancy, a purulent character was suspected. It was therefore determined to explore the pericardium and to proceed according to the nature of the contents found. Accordingly, on June 9th I asked my surgical colleague, Dr. G. Wilkinson, to see the case with me with a view to operative procedure. It was decided to explore the pericardium at first and to ascertain the nature of the fluid and if purulent to proceed to evacuation and drainage. A needle was therefore inserted into the left fifth interspace between the cartilages. It passed directly into solid matter and moved up and down with respiration, no fluid being obtained. This having failed we determined to try again in the fifth space further to the left, where the dulness was well marked. The needle was again inserted in the same space close to the left of the nipple line, but just as in the previous attempt the point entered solid substance, moved with respiration, and no fluid was obtained. It was evident that the fifth space was too low and that it was impossible in that space to get above the diaphragm, which the needle had entered each time. As the patient was considerably distressed and very restless a little chloroform was given and the needle was inserted into the fourth left space between the cartilages, and this time the needle was free and pus flowed into the syringe.

The patient being slightly under chloroform Dr. Wilkinson made an incision two inches long over the fourth left costal cartilage. A piece of rib and cartilage about one inch long was excised after carefully isolating it from the periosteum and underlying tissues, the inner end of the excised portion being about one inch from the sternum. The pleura was not exposed. On opening the pericardium greyish yellow thin pus gushed out with considerable force, its flow varying with the heart beat. Altogether 20 ounces of pus came away. Air was freely sucked in with each respiration. The pericardium was afterwards united by two stitches to the skin around and a soft collapsible tube of large bore was inserted into the pericardium. A profuse discharge of pus continued through this up to the death of the patient. After the operation the heart was plainly visible through the wound. The respirations became at once deeper and fuller, the pulse improved, and the patient was more comfortable. During the next few days the discharge from the pericardium was considerable, the temperature fell to nearly normal but the pulse and respiration rates kept much as before. The patient's appetite improved for a few days, but in spite of it she gradually failed and died a week after the operation on June 16th. She became almost maniacal for two days before death, trying to get out of bed and destroying the clothes, &c.

At the post-mortem examination in addition to the purulent pericarditis there was found a small purulent pleuritic effusion at the right base which explained the dull area noticed in that position during life. There were also great dilatation of the stomach and general suppurative peritonitis, with matting together of the abdominal contents and various local collections of pus; these were chiefly situated in the neighbourhood of the uterus and ovaries which were adherent to the intestines. A bacteriological examination of the pus from the pericardium showed various streptococci and staphylococci.

Cases of purulent pericarditis in which evacuation of the contents of the sac by operation have been performed are not of frequent occurrence. Unfortunately, when they do occur there is often, as in this case, a general condition of such a grave character that though the operation may be successful as far as it goes the concomitant pathological conditions are incompatible with life. But however hopeless the prognosis may be as to recovery there is no doubt that temporary relief from a very distressing cardiac obstruction is obtained by timely operative measures and the fatal termination may be postponed or rendered less painful. If, however, the purulent pericarditis is merely local and not part of a general septic process, all the more urgently is free

evacuation demanded and in such cases, though grave, ultimate recovery may be hoped for, as, for instance, in the first successful case recorded in this country by Dr. S. West in 1882¹ in which recovery was complete and permanent.

In looking over the present case and its symptoms and signs there are several points which seem worthy of notice. As stated in the notes of the case, it was difficult to make a very complete examination of the patient before the pericardium was evacuated, partly because of her great dyspnoea and distress and partly because of her mental condition, which later developing into mania was all through restless and she resisted any attempt at an examination. This made detailed percussion or auscultation by no means easy. In spite of this, however, the diagnosis of a large pericardial effusion was quite easy and must, I think, usually be so, provided there is no large accompanying pleural effusion. Particularly, I would lay stress on the appearance of the chest and of the respiratory movements, with the general decubitus of the patient, the full but motionless præcordial area, without any cardiac pulsation, the increased compensatory respiratory movement performed by the right side increasing the contrast between the two chest fronts, and lastly, the orthopnoic attitude of the patient, half turning to the left so that the left side was supported by the pillows. It was the position as of one having a heavy weight in the lower left thorax, which was actually the case. No pericardial friction sound was audible in this case. (A slight friction sound was heard at the fifth space in the nipple line but it was pleuritic.) The absence of this, which is usually a pathognomonic sign of pericarditis, has been many times recorded in pyopericardium; in fact, some authorities would deny its presence in any case. Possibly the very nature of the pericardial surfaces coated with thick soft purulent material prevents the formation of the sounds. I have certainly seen more than one tuberculous pericarditis in infants in which, although daily auscultation of the chest had been made up to the time of death, no signs have been observed of the extensive pericarditis which has been found post mortem.

The quantity of pus removed at the time of the operation—viz., 20 ounces—is large for a pyopericardium, though nothing like the amount which has been removed in cases of serous effusions or blood effusions. The force with which it was expelled was very considerable, showing the great pressure which must have been exerted on the cardiac walls. In these circumstances it is surprising how little obstruction it seemed to produce upon the venous circulation, for although the dyspnoea was great there was little noticeable distension of the great veins or cyanosis. There was no oedema of the chest wall over the pericardium. The pulse was very small before the pus was removed and improved in volume with its gradual withdrawal, whilst the heart, which was evidently lying above the level of the incision prior to the operation, came down to the wound and from that time forwards could be plainly seen beating (moving from right to left at each systole) each time the wound was dressed. The left portion of the front of the right ventricle was found post mortem to be the part visible. The pulsus paradoxus so often found in these cases was not observed at any time. The probable explanation of the fifth space being too low for the insertion of the exploring needle is that there were extreme dilatation of the stomach and general tympanites in connexion with the peritonitis, as observed at the necropsy. This had pushed up the diaphragm above its normal position and no doubt added considerably to the marked dyspnoea which returned even after the pericardial sac was emptied. As will be seen from the notes of the case the dulness found at the base of the right lung was due to a small purulent effusion in the right pleura; possibly it was owing to this that the small area of dulness, known as the “sign of Ewart,” at the left base was not detected. The other posterior basal sign—namely, the patch of bronchial breathing just below the angle of the left scapula, known as the “sign of Pin”—was very well marked. As regards these accessory signs, however, they are no doubt valuable as confirmatory in cases of doubt, but their importance is as nothing to the gross evidence of an effusion which is obtained from an examination of the front of the chest. In conclusion, my thanks are due to my colleague, Dr. Wilkinson, for his valuable surgical assistance in the case and for his report on its surgical aspect.

Sheffield.

FIVE ILLUSTRATIVE CASES OF CONGENITAL HEART DISEASE.

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WE are induced to describe the following cases of congenital cardiac defects as they form a somewhat remarkable series of the more common lesions and detailed descriptions of such anomalies in cardiac development are somewhat scanty in our own literature.

The pathogeny of congenital heart disease is so intimately bound up with the development of the organ that we are impelled at the outset to describe in as brief a fashion as possible the main features of this undeniably complicated process. The details of the development of the heart are fully described in Macalister's “Text-book of Human Anatomy,” Minot's “Human Embryology,” and Foster and Balfour's “Elements of Embryology,” &c. The best résumé of the pathology of congenital heart disease which we have met with, and to which we are greatly indebted, is Moussois's “Maladies Congénitales du Cœur,” Paris, 1895. We have not discovered its equivalent in the English language.

THE DEVELOPMENT OF THE HEART.

The primitive heart, which, it will be remembered, is formed by the coalescence of the two symmetrical ventral tubes of the hæmocœlom, soon becomes divided into several parts. Posteriorly the allantoic, hypoblastic, and lateral somato-pleural veins coalesce in the sinus venosus which opens by a single aperture into the auricle. A short and narrow segment, the auricular canal, separates the auricle from the ventricle, which is of considerable length and at its anterior end communicates through the fretum Halleri, the most constricted part of the vascular system, with the bulbus arteriosus. So far the heart is single, but at an early period septa develop within the different cavities and ultimately divide it into two halves, right and left. The septum of the ventricle is the first to make its appearance, and is closely followed by that of the bulb, but the latter is the first to be completed, usually in the seventh week and a few days before the completion of the former. The septum of the auricle is the last to commence and the last to be finished, and it is only in the fifth month that it attains its full development; but it must be remembered that the foramen ovale remains patent throughout intra-uterine life and only closes some weeks or months after birth.

The division of the auricular canal.—The division of the auricular canal commences with the appearance of two small tubercles on the anterior and posterior surfaces. These grow towards each other and ultimately fuse, thus dividing the passage into two parts.

The formation of the auricular septum.—The auricular septum makes its first appearance on the superior surface of the auricular cavity and is situated a little to the left of the median line. The anterior portion in particular grows rapidly downwards and soon extends to, and joins, the anterior tubercle of the auricular canal, which has not yet fused with its posterior complement. A similar development obtains posteriorly but authorities differ as to whether growth takes place downwards from the original fold, or upwards from the posterior tubercle of the auricular canal. The central part of the septum does not develop so rapidly as the anterior and posterior segments, so that at one stage the septum is sickle-shaped, a large aperture in the lower part still affording communication between the two auricles. This space, however, is soon filled up, and the tubercles of the auricular canal coalesce with the septum and with each other, so that for the time being the two auricles are completely separated. This complete separation is, however, not long maintained. The central portion of the septum is

¹ Transactions of the Royal Medical and Chirurgical Society, vol. lxvi.