length of the inspiratory and expiratory sounds is not modified in health; (c) the vocal resonance, especially in men, is more marked on the right side; (d) vocal fremitus is more marked on the right side.

3. Of these differences the increase in the vocal fremitus is by far the most constant. Differences in the percussion note are only noted in half the cases examined.

4. The differences, except in percussion, are not so much alterations in the character of the signs as modifications in transmission of the sounds.

5. The modifications in the signs are apparently due to the direction and form of the main bronchus, which are not the same in the two lungs. The percussion note modification may possibly be influenced by the thicker covering of the right side of the chest, but is most probably also dependent upon the position and size of the bronchus.

CONSUMPTION IN THE NAVY.

By W. E. HOME, M.D., M.R.C.P.E.,
Staff Surgeon.

MR. SICHEL'S important paper on Consumption in the Navy, read at the annual meeting of the Association at Manchester, published in the *BRITISH MEDICAL JOURNAL* of October 4th is full of interest, and his demonstration of the waste of money and loss of efficiency produced by the disease is most valuable.

Personally, I think that he has underestimated the damage, as he has only considered cases returned as tuberculous. The Blue Book for 1900 gives in addition, at page 9, materials from which we may calculate the total deaths ascribed to phthisis, and these must be added to the "tuberculous," that we may have complete statistics of deaths from tuberculous infection. Diseases of the respiratory system are reported on page 9, and at the end of the very valuable annual discussion of the prevalence of these diseases in the training service, it is said that in that service about half (really two-thirds) the invalidings from respiratory diseases and about a quarter of the deaths are due to phthisis, probably tuberculous. If this proportion obtains in the service generally, we must add to the 49 deaths which occurred in 1900 from tuberculous disease one-fourth of the 106 deaths reported to have resulted from respiratory disease, that is, 26, and thus we get 75 as the total number of deaths in the service from tubercle in 1900, a rate of 0.79 per 1,000. This increased proportion gives even more weight to Mr. Sichel's contention that there is still room for improvement in the navy.

The loss of the training service from tuberculous diseases is nowhere shown in the Blue Book, but in the last ten years there has been on an average a yearly death-rate of 0.4 per 1,000 from phthisis and pleurisy, which may be pretty safely grouped together. The rate has been falling of recent years, such cases being increasingly returned as tuberculous. There is some reason for believing that in 1900 deaths from phthisis were proportionately more numerous in the training ships than in the general service, but there were only 3 in the training ships. In the three years 1896-7-8 the ratio per 1,000 of invalidings and deaths for phthisis pure and simple was higher in the training service (5 per 1,000 invalidings and 3 per 1,000 deaths) than in the general service (3 per 1,000 invalidings and 1 per 1,000 deaths). This is a serious consideration when it is remembered how lately those boys were passed into the service as free from physical defect.

Owing to alterations made in the form of the health statistics of the navy it is no longer possible to compare the death-rate of this disease in the army and navy, but from their respective reports for 1896, 1897, 1898 the deaths in each service on the large home station (in each case involving about half the men of the service) may be extracted. To get a complete account of the deaths from tubercle I add to those specified as "tuberculous" those also ascribed to phthisis, hæmoptysis, hæmorrhage of the lung, pleurisy, empyema, and broncho-pneumonia. We then find an average:—Army, force at home, 97,666; deaths, 67; rate per 1,000, 0.68; 1896-8; navy, force at home, 34,481; deaths, 31; rate per 1,000, 0.9; and as our men are better clothed and fed, I suppose the excess must be due to their closer aggregation in small cubic space, as Mr. Sichel believes; in fact, to the greater chance our life offers for the spread of infection. To reduce this risk we must diminish overcrowding by improving ventilation, and as in the management of other infectious diseases we must strive for early recognition and isolation or removal of

the patient. Mr. Sichel has done a most useful work in bringing this matter before the Association, and has greatly lessened the difficulties of securing increased prophylaxis by his skilful investigation and telling announcement of the loss to the navy caused by tubercle, furnishing us with a financial argument for improved sanitation which cannot but arrest the attention of those who concern themselves with the defence of the empire.

OBSERVATIONS ON EMPYEMATA IN CHILDREN.

By P. STANLEY BLAKER, M.R.C.S.ENG., L.R.C.P.LOND.,
Late Resident Medical Officer, East London Hospital for Children,
Shadwell, E.

In this paper I have put together the facts and impressions gathered from a personal experience of 81 cases of empyemata in children.

I think it is on the whole admitted that the disease during childhood is a less serious complaint than during adult life, but this statement does not hold good for all ages of childhood. It will not be denied, for instance, that the disease is a very serious complaint during infant life—that is, when it attacks a child under 2 years of age; under a year old, as the figures below will show, the recoveries are few and far between. Hence a record of a personal experience of the above number of cases may be deemed of value, and more especially the points relating to treatment.

I range myself with those who believe that an empyema is an empyema from the beginning—that it starts as such, and very seldom as a simple effusion, which later on becomes purulent. Only in one case did a secondary puncture (after an interval of a fortnight) of the chest reveal pus when the first exploration withdrew a syringe of clear pleural fluid. In this case, moreover, I am rather inclined to the belief that pyogenic organisms were introduced into the chest at the first operation. In every other case pus was found from the beginning.

Classification.

If I were to arrange all the 81 cases in some order of classification, I should, from a clinical standpoint, be disposed to divide them up into two main groups—those that I would associate with the name of "acute" or "primary," and the "late" or "secondary," which latter would include about 80 or 85 per cent. of all cases. To explain this classification, I would begin by saying that nearly all empyemata seen at a children's hospital are associated with an attack of pneumonia, either of the croupous or of the catarrhal form. An empyema due to initial disease of the pleura alone must be a very rare condition indeed, and then it would probably be associated with a similar condition of the other serous membranes or with some form of pyæmia. In the 81 cases to which reference is made, it was not found possible to attribute any one of them to an absolute primary morbid condition of the pleura. Further, many cases that were examined *post mortem* showed some trace of associated pneumonia. Of course, it is difficult to imagine how the lung tissue could escape implication when the contiguous pleura was diseased and vice versa, and hence it would be practically impossible to say which was the seat of the primary mischief. Now, the affection of the pleura is manifested either concomitantly with the attack of pneumonia or else subsequently to it, this period varying from ten days to three or four weeks, and even much longer; and hence those in the former group would be classed as acute or primary, and those in the latter as chronic or secondary.

In the acute cases the signs of fluid in the chest develop simultaneously with those of pneumonia, and the patient is very ill indeed from the first onset of the disease. The illness starts quite suddenly with vomiting and marked dyspnoea, the respirations are hurried and grunting, the *alae nasi* work vigorously, there is a good deal of recession of the lower part of the chest, the face is dusky and the lips markedly cyanotic; the temperature is found to be raised to 104° or 105°. On making a physical examination of the chest, there is marked dullness with increased resistance on one or both sides, and loud tubular breathing over a very extensive area. A puncture with an exploring needle withdraws a thin watery purulent fluid, very often blood-stained. Such cases practically always die when the patients are under 2 years old. They may live for a few days or as long as a fortnight after the onset, but they eventually die, not from the empyema, but mostly from extensive consolidation of the lungs, if they escape such complications as pericarditis, meningitis, and peritonitis.

As a rule the fluid withdrawn from the chest in these cases is teeming with the pneumococcus, and there may be at times an admixture of the streptococcus or the staphylococcus. At a necropsy the lungs are found to be very extensively consolidated with broncho-pneumonia, in the third stage, if the patient has lived long enough; the surface of the pleura is seen to be injected, sometimes looking quite red and inflamed (in the early stages), and covered over with large flakes of yellow lymph. So intense is the inflammation and infiltration of the pleura in such cases that I think if any are to be classed as primary pleural affections these acute cases should. There were altogether 9 such cases in the series of 81.

In the second group, that is in the chronic or secondary empyemata, are included all those cases where the signs of fluid developed after the attack of pneumonia, and it may be pointed out that in some of the cases the signs of pus were observed to follow immediately upon the attack of pneumonia, whilst in others some weeks had elapsed before they were evident, in other words the pus formed very gradually in these latter cases. In the first class the patient gets an attack of pneumonia with all the characteristic signs and symptoms, but he fails to have a crisis as far as the temperature is concerned, though the general symptoms may have improved; signs of fluid become evident, and when the chest is explored pus is found. In the later cases very often there is a history of pneumonia four or five weeks ago, or even longer; there is also a definite history of the child having had a crisis, in that the child seemed very well, and "seemed to be getting on," but two or three weeks later "he seemed to fall back again," and wasted. When the child is seen and the chest examined, the physical signs of fluid are obvious, and the exploring needle withdraws a syringeful of pus.

It may seem rather complicating to differentiate between the early and late secondary cases, but my object in doing so is to emphasize this important difference, that in the early cases the consolidated lung has not undergone complete resolution, but there is still probably a good portion of lung tissue quite solid, whereas in the late cases, from the fact that a much longer interval has elapsed, the patient has an empyema pure and simple without any lung consolidation. The secondary cases as a whole do very well when operated upon, but I think the late cases do best of all, provided the patient is treated within a reasonable time, because such cases, as a rule, are quite free from complications.

	Under 6 Months.	6 Months to 1 Year.	1 Year to 2 Years.	2 Years to 3 Years.	3 Years to 4 Years.	4 Years to 5 Years.	5 Years to 6 Years.	6 Years to 7 Years.	7 Years to 8 Years.	8 Years to 9 Years.	9 Years to 10 Years.	10 Years to 11 Years.	11 Years to 12 Years.	12 Years to 13 Years.	Total.
Number ...	2	6	23	8	11	5	6	3	5	1	1	1	0	1	81
Males ...	1	6	16	4	4	5	4	3	4	1	1	1	0	1	81
Females ...	1	0	7	4	7	0	2	0	1	0	0	0	0	0	81
Recoveries ...	2	6	17	5	7	5	6	4	4	1	1	1	1	1	81
Deaths ...	0	0	11	4	4	0	0	1	1	0	0	0	0	0	31
Right side ...	1	1	6	3	4	3	3	3	1	1	1	1	1	1	30
Left side ...	1	5	16	4	7	0	3	2	4	0	0	0	0	0	42
Double ...	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9

SUMMARY OF THE FACT OF 81 CASES OF EMPYEMA.

From the table it will be seen that the 81 cases were made up by 43 males and 38 females; that in 30 the empyema was right-sided and in 42 left-sided; 9 cases turned out to be double. Not a single case of apical empyema occurred, and in 2 cases only were there two cavities on the same side necessitating double operation to let out the pus. That empyemata are more common on the left side cannot be wondered at, since the croupous pneumonia of the lower lobe is more often met with on the left than on the right side; and the only reason by which one can account for the rarity of an apical empyema is that the pus gravitates to the base, for apical pneumonia of the croupous type is quite a common occurrence in young children. In 58 patients the onset of the illness was quite sudden, like that of pneumonia, and in 10 it began very gradually without being able to fix a definite date as to when the complaint commenced. A recent attack of measles from which the illness dated was noted in 5 cases, and 1 had a history of injury to the side the day before he was taken suddenly ill with symptoms pointing to pneumonia. In the remaining cases no reliable history could be got from the parents.

BACTERIOLOGICAL EXAMINATION.

Examination of the pus was made in 69 cases, with the following result:

Diplococcus in 61 cases.
Diplococcus and streptococcus in 3 cases.
Diplococcus and staphylococcus in 1 case.
Streptococcus alone in 3 cases.
Staphylococcus alone in 1 case.

In all but 4 cases, then, out of 69 was the diplococcus found. In most cases this organism was encapsuled, and of the lanceolate shape.

Tubercle is a very rare cause of empyema in children. At the necropsy made on 23 of the patients that died, tubercle was found in 3, and they showed signs of general disease. The question that may be asked with regard to these cases is, Does the illness begin as tubercle, or is tubercle grafted upon the original complaint of empyema? Two of these showed evidence of chronically enlarged tuberculous bronchial glands, which in all probability served as the focus from which general dissemination took place when the patients were taken ill. In the other case there were a few old tubercles in the spleen.

PROGNOSIS.

This depends very much indeed upon the age of the patient, the younger the patient the less are the chances of recovery. It will be seen from the series that 11 of the patients were under a year old, and out of this number only 1 recovered, a baby 10 months old. Between 1 and 2 years of age there were no less than 28 cases, the largest number in the series, and of these 11 died, and 17 (nearly 64 per cent.) recovered. And so with regard to the other periods of life, the same fact is evident that the older children have a better chance of recovery. Of the 9 acute cases included in the series 4 died and 5 recovered; the ages of those that died was 2 and under 2 years, and the youngest of those that recovered was 5 years. It would seem, therefore, that the acute affection is particularly fatal in infants. The older children recovered from the acute attack; but, nevertheless, their illness was very severe, and caused considerable anxiety.

From the cases it is also evident that the bacteriology must be taken into account in forming a prognosis. I have already mentioned that 4 cases had a mixed infection of pneumococcus and streptococcus or staphylococcus. All these died. Three cases showed the streptococcus only; one of these recovered after being in hospital 131 days; and lastly, one case was due to the staphylococcus alone, and that also proved fatal. Only 2 of the acute cases in the series had a mixed infection—the remaining 7 were due to the pneumococcus only.

THE CAUSE OF DEATH.

Of the 31 deaths that took place a necropsy was made in 23 cases, and the following is briefly what was found:

1. Pericarditis (blood-stained fluid in pericardium), mediastinitis, extensive broncho-pneumonia; acute case.
2. Pericarditis, non-purulent.
3. Early fibrosis of lung: scrotal abscess; had a good deal of diarrhoea and vomiting.
4. Double empyema; right lung collapsed.
5. Pyo-pericarditis and suppurative peritonitis.
6. Pyo-pericarditis and extensive broncho-pneumonia.
7. Pyo-pericarditis and extensive broncho-pneumonia.
8. Double empyema, extensive broncho-pneumonia, abscess of lung.
9. Double empyema; purulent meningitis.
10. Suppurative mediastinitis; extensive broncho-pneumonia.
11. Died under anaesthetic (chloroform); heart soft and flabby.
12. Extensive broncho-pneumonia.
13. Purulent meningitis; extensive broncho-pneumonia.
14. Early meningitis.
15. Pyo-pericarditis, oedema of pia mater; collapse of left lung.
16. Double empyema; gluteal abscess; tubercle of spleen.
17. Double empyema; purulent meningitis.
18. Broncho-pneumonia; collapse of right lower lobe of lung.
19. General tuberculous.
20. Extensive broncho-pneumonia; purulent peritonitis and considerable oedema of the pia mater.
21. Purulent peritonitis.
22. Double empyema and pyo-pericarditis.
23. General tuberculous.

Thus it will be seen that pericarditis occurred in 7 patients: 2 were in cases of right-sided empyema, 2 left, and 3 in double. Suppurative pericarditis is not always diagnosed during life, and it is evident from the fact that it occurred at least seven times in 31 patients that died that it should always be very carefully examined for in cases of empyemata. A pericardial friction is not always heard, and its absence is by no means indicative of the absence of pericarditis. One very striking feature that impressed me most in these cases of pericarditis was the intense pallor which was always present, and a diagnosis of this complication has mainly to be

that the ribs bounding the space are liable to become eroded and to give rise to trouble. This happily did not occur in any of the above cases.

A second point in favour of incision over rib resection is that the operation is a simple one, takes very little time, and can well be done without a general anaesthetic. In many of the cases operated upon the parts were simply first frozen with ethyl chloride. And lastly, the shock from the operation of simple incision is very slight as compared with the larger operation of rib resection. This is a most important point which must be taken into consideration with babies, who are not able to sustain as severe a shock as the older children.

After-Treatment.

I next turn to the question of the after-treatment of cases of empyema, whether treated by rib resection or by incision. To think that, once the operation has been done, there the treatment practically ends is a very grave error. It cannot be too strongly emphasized that very great care and attention is most essential during the whole period from the time that the operation is done to complete recovery and the ultimate success is dependent in a far greater measure upon the after-treatment than upon the immediate line of treatment adopted. A great many of the ill-effects of an empyema can be avoided if the after-treatment of a case is carefully attended to.

For one thing the duration of the illness in a great many cases can be reduced to as little as three weeks, or even a fortnight from the day of the operation. In many of the cases included in the series the wound had healed in three weeks, and in some cases before that period. The one great mistake that is repeatedly made is that the services of the drainage tube are not dispensed with early enough. The longer the tube is retained the longer will the wound go on discharging, and the more tedious will the healing process be. In a very large number of cases the lung soon expands, and the pleural cavity soon becomes obliterated, and the discharge for which the tube has been kept in comes not from the pleural cavity but from a sinus which has been produced and kept open by a tube which was not necessary.

The first point, then, to remember, is to get rid of the tube as soon as possible. In the earlier cases the tube was kept in for a very much longer period than in the later cases, and latterly it was frequently disposed with altogether within the first week after the operation. It is quite certain that this can be done in a great many cases, but every now and then a case will be met with where the utmost difficulty will be experienced in dispensing with the tube; still, if the case is very carefully watched, then there is no harm done by leaving the tube out, even though it may have to be reinserted. In one or two of the cases the tube had to be reintroduced several times before it was ultimately dispensed with altogether. How often one meets with cases of old empyema with a discharging sinus for months and even years after the operation, and when such a condition of things obtains it is only too well known what very great difficulty is experienced in trying to get the sinus to heal; repeated scrapings of the sinus or even fresh resection of a rib or ribs is done in the hope that the wound may heal. Necrosis of the rib would probably not occur so often if the prolonged source of irritation was early removed.

The following was the plan adopted with regard to the after-treatment of a case. The tube was not removed from the wound for two days after the operation, though it was invariably shortened by $\frac{1}{2}$ in. or more on the next day. This was done by withdrawing the tube and cutting off the protruding end. After this the tube was daily removed, cleaned, boiled, and shortened before being reinserted. Whenever the discharge became thin and watery it was very often found to be a good indication for leaving out the tube altogether, and was always considered a good sign. After removal of the tube, as a rule, a thin gauze drain was put into the wound for a couple of days, and each morning when the dressings were done a sinus forceps was introduced to let out any retained discharges. This had to be done only two or three times in most cases. In such cases where a double tube was inserted, one of them was removed on the first or second day, and then the remaining one treated in the usual manner. It was found to be a good plan to apply boracic acid fomentations to the wound when the tube had been omitted; it prevented any scabbing over, and so permitted egress to any discharges. On the whole, aseptic dressings were found to be preferable to antiseptic, since they were not irritating to the skin. Previous to applying

the dressings the wound was dusted with iodoform and a very liberal sprinkling of boracic acid powder all over the side of the chest. Another little detail which was invariably carried out each day, and which was found to be very useful, was to clean the surrounding skin thoroughly with methylated ether. By observing all these little details connected with the dressings there was seldom if ever any trouble with the skin.

Washing out of the pleural cavity was done in several of the cases in the series, not on account of any foul discharges from the wound, but as a means of clearing away any thick pus or flakes of lymph. During this operation (irrigation) patients frequently coughed out through the wounds large pieces of lymph, and there can be no doubt that the duration of their illness was materially shortened. The solution used was one of iodine (one drachm of the tincture to the pint), and great care was also taken to let it run in slowly. The coughing that very often accompanied the irrigation was beneficial in that it helped to expel any pus or lymph. With great care and attention, there is very little danger of any harm coming from washing out an empyema cavity.

With regard to the general treatment, there is nothing much to say. The patients were put on a very liberal diet, and when the weather was fine they were well wrapped up, and their cots wheeled out into the open.

In concluding this paper, I must express my indebtedness to Dr. Eustace Smith, Dr. A. J. Coutts, and Dr. Dawson Williams for giving me permission to make use of these cases which were under their care in the Shadwell Children's Hospital during the time that I held the posts of House-Physician and later of Resident Medical Officer to the hospital—a period extending over nearly three years.

SIX CASES OF EMPYEMA.

By OSWALD F. ROWLEY, M.R.C.S.ENG., L.R.C.P.LOND.,
Honorary Surgeon to the Beckett Hospital and Dispensary, Barnsley.

THE following cases show that pus may be present in the pleural cavity with but few symptoms and a moderate degree of pyrexia; that suspected serous effusions may unexpectedly be found to be purulent, and that in cases following pneumonia, especially in children, the effusion may be purulent early in the case.

CASE I.—A. B., a youth, aged 17, came to me on November 14th, 1891, and showed a small fluctuating tumour of one of the intercostal spaces in the right axillary line, giving a history of a past injury to the rib. The cold abscess was incised with a fine-pointed bistoury, when to my surprise a quantity of laudable pus flowed out soon accompanied by coughing and obvious signs that the abscess was continuous with the pleural cavity, being in fact an empyema apparently caused by caries of the rib with abscess of the chest wall pointing internally into the pleural cavity. The abscess showed no signs of pointing on the surface. Suitable dressing being applied, the patient returned home, where the opening was afterwards enlarged and a tube inserted, and the empyema drained. In six weeks he was quite well and had not much diminution in size of the affected side. Probably the healthy condition of the visceral pleura enabled the lung to more readily expand.

CASE II.—B. C., a girl aged 3, about June 4th, 1894, had an attack of broncho-pneumonia. On June 20th there was left pleural effusion with well-marked displacement of the cardiac apex beat. In this case there were no signs of the effusion being anything but serous. On July 16th aspiration was performed in the mid-axillary line in the sixth interspace, and pus was evacuated which was quite sweet; this was followed by incision and drainage. This child made a very good recovery. There resulted curvature of the spine with contraction of side, which, however, gradually but perfectly expanded.

CASE III.—C. D., aged 10, was found on April 8th, 1899, to have pleurisy with effusion on the right side. On May 20th he was admitted to the Beckett Hospital, aspirated, and the fluid found to be pus. In this case the fluid afterwards was found to be causing bulging in the pectoral region (fifth space), at which spot it was opened and drained. Recovery was protracted and followed by contraction of the lung and falling in of the thoracic wall.

CASE IV.—D. E., a farmer's boy, aged 18, about April 27th, 1899, had an attack of pneumonia on the right side. In this case the temperature fell by lysis on the eleventh day of the disease to 99°, then rose the following day to 102.5°, and then remained at 100° for two days; for the next eight days it varied between 103° and 104°, during which period signs of effusion were present (although exploration with the syringe was negative). On the morning of May 27th he expectorated about 5 oz. of healthy pus almost wholly in one coughing attack, and very easily; this was repeated in the evening, making 10 oz. expectorated that day. On June 1st I found him sitting up in a chair, his cough being very persistent. His daily temperature since voiding the pus had been 101.5° F. On the following day he was able to be removed to his own home two miles away. On June 5th I was shown 1½ pint of healthy pus and was informed that