Day.	Blood freezing.	Urine freezing.	Am't.	Sp. gr.	Urea.	Temp.	Pulse.	Resp.
1....	—0.11					102.4	136	32
2....	—0.23	Involuntaries.				103.3	140	40
3....	—0.702	—3.25	720	1031	3.4	103.8	120	36
5....	—0.728	—3.24	350	1030	3.2	106	144	42

(Patient was delirious. Died 3 a. m. next morning.)

This was a very severe case. The patient died on the fifth day after admission to the hospital. It will be noted that the freezing points of the blood and urine in this case were low, the freezing point of the blood being lowest before death. The patient died of heart failure.

The chlorids in the urine were also estimated in the above experiments. The following method (approximate) was used:

Urine, 5 c.c. .... (Shake, and note amount
HNO₃, 10 gts. .... of precipitate.
Agno₃, 10 per cent. sol., 2 c.c.)

The chlorids were found markedly diminished in amount up to the crisis, when they rapidly increased to above normal quantity, to recede later during convalescence.

In reviewing and summarizing the above data, it is to be noted that all the patients were males between the ages of 18 and 50, and were apparently healthy before taken sick with pneumonia. This excludes, therefore, differences which might be peculiar to the disease as manifested in children and old age. All the patients were on essentially the same diet: Milk, and later broths and plenty of water. As to the treatment, only regular stimulating treatment was given, consisting of strychnia, whisky or digitalis. A few mentioned had salt irrigations. I believe that, in view of the results tabulated above, the following conclusions will be considered logical and proper:

CONCLUSIONS AS TO BLOOD.

1. There is an absolute lowering of the freezing point of blood in pneumonia.
2. The freezing point lowering of the blood depends in some way either on the extent of consolidation of the lung or on the height of the temperature, or both.
3. The lowering of the freezing point of the blood is greater than would be accounted for by the increased venosity of the blood, due to deficient aëration in the lungs.
4. The concentration of the blood increases, as shown by the lowered freezing point, as the disease progresses up to the time of crisis. Some time is necessary for the elimination of the excessive accumulation of products in the blood. Hence, several days elapse before the freezing point of the blood rises again to normal.
5. In those cases where the heart weakens perceptibly, the freezing point of the blood becomes lower. In the fatal cases in which the heart gives out, the freezing point of the blood is extremely low.
6. The lowered freezing point of the blood is apparently not due to deficient kidney function, but may be due to the inability of the kidney to excrete the excessive products of metabolism.

CONCLUSIONS AS TO URINE.

1. The freezing point of urine in pneumonia is considerably lowered.
2. This lowering is greater than would be accounted for by a mere concentration of normal urine.
3. The chlorids excreted are constantly diminished, due to a decrease in amount taken in (Sollmann).
4. The freezing point of the urine times the number of cubic centimeters voided is increased.
5. The quantity of urine is decreased, whereas the freezing point is lower.
6. The lowering of the freezing point of the urine is not due to chlorids, but to metabolic molecules excreted.

7. The freezing point of the urine does not rise to normal until after that of the blood, that is, several days after the crisis.

8. The specific gravity of the urine is not an accurate index to the concentration of the urine.

9. The freezing point of the urine bears no constant relation to that of the blood normally, for in a case with a freezing point of blood at -0.54° C. the freezing point of the urine may normally be lower than in a case in which the freezing point of the blood is -0.57° C. or *vice versa*.

I wish here to express my thanks and gratitude to Prof. F. R. Zeit for suggesting this problem and directing the work; to Dr. W. H. Buhlig for many valuable suggestions, and to the directors of the laboratory and internes of the Cook County Hospital for assisting me to find the material.

PLEURAL EFFUSIONS IN CHILDREN.*

C. F. WAHRER, M.D.

FORT MADISON, IOWA.

These affections are probably as old as the creation of man, as the conditions producing them must have obtained ever since man first became sick. Hence, I scarcely think that much that is new can be said on the subject; it is possible, however, that I may say something that will cause some one to search deeper than ever before, and thus enable him to save a life that otherwise would have been sacrificed. But the best motive I have in writing is to provoke some discussion that may throw more light on diagnosis or treatment that may prove of benefit to the practitioner and to the one mostly concerned, the patient.

These pleural effusions, though fairly easily diagnosed by the expert, are too frequently overlooked by the rank and file of the profession, and, secondly, often when diagnosed, are not treated with sufficient vigor, but allowed to drift on expectantly, when only radical measures should be employed and thus give the patient the best chance and the most certain promise of recovery. It may seem strange to some of you whose daily life in large cities is so full of scientific certainty that I should make such observations unless you come in contact, more than I am aware, with that large number of routine physicians who are willing to bear or, rather, let their patients bear what they, either through ignorance or shiftlessness, are not able or willing to take the trouble to help. But some of you are, as I have been, a teacher, and you certainly remember some of the material that came before you as students and who graduated in medicine from your classes, I am sure, with many misgivings on your part. The power to generalize, and from that foundation to specialize, is not given all people; the ability to intelligently make comparisons, as we do in diagnosis, is not easy alike to all, even when they have a large stock of facts on hand. Hence, I want to emphasize this fact that throughout this great country of ours many patients with pleural effusions, both old and young, especially the latter, go to their deaths with the disease unrecognized by the attendant. You know, if these are not properly treated, and it must be surgically, that the vast majority will prove fatal.

First, there is a widespread idea that all pleural effusions must arise from a preceding attack of pleurisy. A little reading in pathology and text-books on diseases and their etiology would soon remind us such is

* Read in the Section on Diseases of Children of the American Medical Association, at the Fifty-sixth Annual Session, July, 1905.

not the case. Most cases in children, perhaps nine-tenths of them, have their origin in pneumonia—especially that form termed pleuropneumonia—yet many cases of effusion are secondary to Bright's disease, scarlet fever, rheumatism, amyloid disease, trauma, heart affections, typhoid fever, syphilis, affection of the spleen, articular inflammations, pertussis, osteomyelitis, appendicitis and others, not the least of which is tuberculosis. For reasons not supported by experience, it has been the routine of fashion to consider nearly all cases of pleural effusions of tuberculous origin, and, while it is not good practice to ignore tuberculosis as a factor in the etiology, yet there is no good reason to over-emphasize it. There are many more of these tuberculous in adults than in children, in the ratio of 4 to 8 times as many. This is as it should be, as we find many more cases of tuberculosis in adults than we do in children, especially in early childhood. It is most reasonable to think of the reverse, namely, that consumptives may be liable to pleural effusions as well as other people.

There are many other errors not only in etiology and anatomy, but in the pathology, prognosis and treatment of these cases. For instance, we speak of the pleural cavity. Physiologically and anatomically it may be said there is no such cavity. Only when filled with pathologic products do we have such a cavity—when filled with serum, pus, chyle, blood or air. Then the layers of the pleura normally contiguous become separated and a cavity forms, filled with these products. These fluids usually first make their appearance in the costophrenic sinus, then extend laterally and upward. When pleural exudates are examined we find many pathologic micro-organisms in them, often defining the character of the origin of infection. Staphylococci, streptococci, pneumococci, tubercle bacilli, gonococci and others. I am firmly convinced that the presence of any of the pathologic micro-organisms in sufficient numbers may provoke enough irritation to produce a pleurisy with an accompanying effusion.

As far as anatomy of the parts involved is concerned, it will not be necessary to go into detail, for text-books on anatomy and diseases of children will furnish that information more fully than I can, but will only draw your attention to the fact that the anatomy of the respiratory apparatus differs from that of the adult in that the pleural sinuses are deeper in children; hence, in puncturing an effusion it may be well not to wound the diaphragm, which rises comparatively high in the child. Even the stomach or intestines might be wounded if one should forget these relations. The relations of the two sides must be kept in mind. The pleural sinus of the left side is deeper than on the right, owing, perhaps, to size and position of organs on right side. The liver, especially large in the child, pushes the right lung up. The right lung is also smaller or shorter than the left lung. So when aspirating it is well to use the posterior axillary line, as that would lead to the most central point of all effusions—and to use the sixth or seventh interspace on the left side and the fifth or fourth on the right side, of course, combining these anatomic relations with each individual case.

As diagnosis in some cases is difficult, all the more should we use care in not allowing a case to escape undiagnosed. Ordinary percussion and auscultation carefully made, excluding pulmonary and respiratory affections, and when in doubt coupled with the use of an exploratory aspiration, will, in painstaking hands, usually lead to a correct diagnosis. Pleural sounds,

especially in dry pleurisy and serofibrinous pleurisy, by auscultation, imitate the creaking of a compressed snow ball or fine creaking sole leather. The breathing is of the bronchial variety. Percussion yields dullness, but in some cases when the child lies down the effusion may settle to the lowest point and, surmounted by gas or viscera, may give resonance and thus deceive. Diagnostic signs in effusions are rather deceiving, because both percussion and auscultation sounds vary owing to position of the child and number of places of adhesions. Percussion usually reveals flatness; absence of râles, friction sounds and bronchial breathing are found on auscultation. We also notice cough, pain, diminished fremitus, intercostal bulging of affected side, intense dyspnea, paleness and anemia, decubitus on diseased side by preference, and when all these signs do not give a satisfactory diagnosis they may be supplemented, as before mentioned, by exploratory aspirations; even then the latter procedure in careless hands may prove unsatisfactory and appear negative when effusion is present. The needle may be too small and may become occluded with coagula, the precise position of the effusion may not be reached by not going far enough or too far, being placed too high or too low; the aspirating apparatus may be faulty; in short, when effusion is strongly suspected and exploration is at first negative many patient and careful trials should be instituted before failure is to be accepted. It is scarcely necessary to add that all such efforts must be carried out only under most pedantic care as to asepsis, and the old surgical maxim, "*Nil nocere*," is here paramount.

The character of the effusion can by no means be diagnosed except by the exploratory method. It may be grossly stated as a matter of presumption that in children of 3 and under, the effusion is purulent. The difficulty of diagnosis is increased when an effusion is encapsulated, when it is a subphrenic abscess or when it is an empyema necessitatis, as the latter may be mistaken for superficial abscess, eroded or gangrenous rib or trauma or the outlet of some burrowing abscess, as, for instance, a perinephric or psoas abscess. But in cases of pleuropneumonia the effusion may be masked by the prominent symptomatology of the pneumonia, but this alone should put the attendant on his guard, especially if he have a case of retarded resolution, for an empyema may be mistaken for a case of delayed recovery in pneumonia. Many cases of empyema are often very insidious in onset and behavior, but if you will remember the proneness of children to develop effusion after respiratory diseases, after scarlatina, tuberculosis, pertussis, rheumatism, endocarditis, liver diseases, kidney affections and those of the spleen, especially when coupled with an increased leucocytosis, it is better to suspect empyema and act accordingly. Now, I do not imply that one should go to extremes and diagnose everything as effusions simply because we can not make it out a case of malaria or fits, but let us use caution and not be humiliated and fail in our diagnosis and lose a valuable, promising life that should by all means have been saved, for, while most undiagnosed cases will die *per contra*, nearly all properly treated cases recover in children, and that is my other chief contention in this paper, to which I will refer under treatment.

I wish to emphasize prognosis. This, especially in children, is good, but must materially depend on the treatment, the skill of the attendant and especially the

faithfulness with which a positive line of treatment is carried out. It also depends much on the primary disease that gave rise to the effusion and the length of time the patient has been afflicted. It is most unfavorable when the diagnosis has been delayed, where too much stress is placed on expectancy or, what amounts to about the same, medical treatment, when primary disease has seriously invaded or destroyed some of the principal organs, such as the kidney, lung, heart, endocardium or pericardium, in amyloid degeneration of the liver, also when operation is delayed too long. Prognosis is good when early diagnosis is made, when operated on early by proper method, when child's general condition is good, and causative disease has not made too serious inroads on the patient's constitution. But, to repeat, in general it may be stated the prognosis is better than in adults in proportion of two to three times as good. Of course, under 1 year of age the mortality is great, probably 50 per cent. of deaths; however, at that age the disease is rare. Also when the disease is bilateral, a rare condition. Some of my chief reasons for a better prognosis in children is that we have a more active metabolism, a smaller cavity, where in this case real, and not relative size, counts—a greater elasticity of chest wall so the cavity can more readily contract or collapse, a condition much to be desired. It may be well to pause here long enough to remind you that fully nine-tenths of all cases usually follow pneumonia, especially pleuropneumonia; the other one-tenth all the other causes previously mentioned.

I have already said enough to have committed myself to the treatment; that it must in the majority of cases be surgical. From the fact that over one-third of all cases of effusion are purulent, the treatment must be surgical; most of the others are serofibrinous and, while they often absorb under stimulation, poultices, heat and liniments and some other medical treatment, yet they would recover faster under incision, because the large fibrinous clots so frequently present can be mechanically removed instead of leaving them to tardy absorption and a possible prey to infection. The two chief surgical procedures are puncture and aspiration and incision with or without section of a rib or two. True enough, aspiration has cured some cases of effusion, both serous and purulent, yet why trust a doubtful method for one more certain? When we have a purely serous effusion, aspiration once performed, or once or twice repeated, will usually lead to a rapid recovery. The same is true when an incision is done for an empyema. It may be parenthetically stated that while children recover rapidly they also die very rapidly under operation if they succumb to it; so danger signals must be heeded. Aspiration may fail in such cases or it may delay the recovery; it may prolong the infection and thus endanger the recovery, and may also lay the foundation to a possible tuberculosis. As to accidents in operations, they are less liable than in adults.

Now, who should perform these operations? I claim that any physician who is competent to treat diseases at all should be able to aspirate a serous effusion or make an incision for an empyema in a child. Of course, it is self-evident that if a competent surgeon can be had it may be preferable to have him operate. In rare cases, and they are extremely rare, where an Estlander operation is required or the more serious and extensive Schede procedure, the highest possible surgical skill is none too good.

I shall not worry you as to surgical methods, how to operate, the best methods of drainage and the other

details; any modern text-book will supply this information if, indeed, any one is now present that may be in need of such. With a short report of two cases I will conclude.

CASE 1.—Girl, 3½ years old, had pneumonia, following measles; was supposed to be suffering from delayed resolution. I was called in consultation about the thirtieth day of disease; found child of naturally fleshy and buxom habit, very emaciated, pale, cadaverous appearance, increased leucocytosis, hectic cough, great dyspnea, left intercostal spaces bulging, heart displaced to right, and other symptoms classical. On inspection found just above left nipple in fourth interspace a red spot ⅝ inch in diameter, appearing like a common boil; I diagnosed an empyema necessitatis, proved by aspiration. I made an incision two inches long, beginning with the external lesion and extending toward the left. Fully 40 ounces of pus of a rich, creamy appearance was removed under cocaine anesthesia, double rubber drain introduced and child made a complete, uneventful recovery. This fine little girl would have died under her first attendant, who still treated her for pneumonia and gripe in a very dilatory manner, not even administering supportive measures.

CASE 2.—Boy, 31 months old, had some respiratory disease diagnosed by his attendant as pleuro-pneumonia. On the thirty-first day of the disease the physician, a bright country practitioner, observed bulging on left side, heart displacement and other signs which he interpreted either pleural or cardiac effusion, not being certain which, and exploratory aspiration being denied him, he sent for me. Under cocaine exploration was painlessly made, pus found at once and operation advised, which was done next day. This child was very thin, restless, cyanosed, pulse high, temperature 104.6, anxious expression of face and, as in other case, leucocytosis marked. Incision under local anesthesia was made in sixth interspace and between anterior and posterior axillary lines two and a half inches long. With each respiratory movement pus spurted out in streams. Child was held by father on lap, left arm raised high and placed around father's neck. After liberating about 50 ounces of pus patient got weak, I desisted further work, placed a double drain, dressed wound, bandaged and put child to bed. He also made a brilliant recovery, notwithstanding large quantities of pus were removed many times at subsequent dressings.

Both these children are now (one 4 years and the other 3 years since operation) in splendid health, whereas both would have helplessly perished without operation timely performed. True, cases of empyema necessitatis have spontaneously recovered, so have cases that ruptured into a bronchus, and pus expectorated, but it would be only proper to say of such that they got well in spite of poor treatment rather than that the attendant deserved any credit for their recovery.

In closing let me once more urge a thorough diagnosis in a painstaking, almost pedantic manner, with all clothing removed as well as bedding, leaving no means unused to confirm your findings. You may not believe me, but experience confirms me, too many auscultations are made with the unaided ear, too many percussions made through their clothes and poultices, and too many diagnoses arrived at by snap judgment processes and smart guesses.

It may not be amiss to remember that the microscope and blood counts may aid when we are in the dark, and that children having effusions usually die if badly treated, and almost always recover when treated correctly, fearlessly and courageously.

DISCUSSION.

DR. A. C. COTTON, Chicago, agrees with Holt that the apex beat should be located if possible in every case of suspected empyema, even when the needle shows pus. Left-sided effusion, if extensive, ought to displace the apex beat. Otherwise the source of pus may be a pulmonary abscess. Dr. Cot-

ton does not believe that Dr. Wahrer intended to convey the impression that he lost 50 per cent. of his cases. Some people's ears are built pretty well, and we have the authority of the Scriptures to let him who has ears to hear with his ears and not use the stethoscope.

DR. WILLIAM J. BUTLER, Chicago, is inclined to regard with great skepticism any diagnosis of effusion necessitating surgical interference when the dullness is obscured by slight change of the position of the patient.

DR. D. S. HARNSON, Cleveland, Ohio, believes that the diagnosis of pleural effusion can be made without the needle. Were he the child he should like that physician best who would make a careful examination and make the diagnosis without the needle because, simple as it is, it is both painful and unpleasant. A child with pleural effusion will nearly always lie on the back, and the man who carefully examines the back will nearly always make out these exudations very early.

DR. C. F. WAHRER stated that some of these patients go unrelieved and to their graves for want of proper diagnosis and treatment. In reply to Dr. Cotton's statement that 50 per cent. of cases is too great a mortality, he said that in children one year of age the mortality is great, and that the consensus of opinion of authors in this country and in Europe is that in about 50 per cent. of children under one year the mortality reaches 50 per cent. and over. The different sounds in auscultation and percussion vary as much as the number of authors speaking on them. Dr. Wahrer does not care about putting his ear on everybody's naked chest, and in some patients the intercostal space is so deep that his ear is not deep enough to place it in between. Those who depend on the unaided ear have not availed themselves of the best opportunities of making a diagnosis by the use of the stethoscope. In reference to Dr. Harnson's statement that he would prefer to have a diagnosis made without the needle, Dr. Wahrer said that there is no harm in inserting the needle into the chest if hands and instruments are pedantically clean. It is better to avail ourselves of all the diagnostic means rather than to let pity interfere with our best judgment.

THE MANAGEMENT OF TYPHOID FEVER IN CHILDREN.

A PLEA FOR ENTEROCLYSIS.*

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PHILADELPHIA.

In attempting to give a very brief outline of my methods of managing typhoid fever in children, it is well to preface my remarks by saying that I will confine myself strictly to those methods which my experience has found most satisfactory; it is hoped that by so doing I may invite a free discussion and thus gain some additional knowledge on this perennial subject.

To manage a case of typhoid fever in a child successfully, we must be sure of our diagnosis and fully understand the child. An early diagnosis is not an easy matter, because the disease is frequently ushered in under the guise of some acute disorder which greatly postpones a decision. Usually the child has been ill for six or seven days before the physician is called. At this time we may find a temperature ranging from 101 to 104 degrees. The symptoms may strongly suggest enteritis, meningitis, pneumonia or autointoxication. Indeed, it may be doubted whether we ever manage a case of typhoid as typhoid before the end of the first week. Generally at this period we will arrive at a correct diagnosis, and then only by the process of exclusion.

Typhoid in children may be accompanied by diarrhea or constipation; the latter seems to be as frequent as the former. The spleen is often chronically enlarged,

especially in children with rickets. This is a strong factor, however, in the diagnosis. The same is true of the liver. Chronic appendicitis comes in for its share of the blurring of an early diagnosis in typhoid. The general symptoms very frequently do not agree with the temperature, pulse or the physiognomy of the patient. In no other serious disease do we have the patient seemingly so well, in spite of some single, serious symptom. By reason of this conflicting array of early symptoms we frequently encourage relapses.

The Widal test and the diazo reaction are of very little value prior to the beginning of the second week, at this time we have additional symptoms to confirm the diagnosis, thus reducing the value of the Widal test. Undoubtedly most cases of chronic fever in children are diagnosed by the process of elimination, and not usually before the tenth day, the only exception being where we have an overwhelming toxemia with few complications. Many cases of typhoid fever brought under my notice had been previously treated for pneumonia, and many cases were classified as typhoid which were chronic food poisoning.

Regardless of our pathology, for the sake of clinical study, typhoid may be regarded as a general sepsis, and any treatment that will lessen the toxemia and shorten the leakage in the general circulation may be regarded as a step toward a specific treatment. As yet, however, we have no specific treatment for typhoid fever. It is very interesting to notice, in passing, how frequently specific medication gains recognition for a time, its limitations conceded, and then it is discarded and quickly forgotten. The same may be said of the Brandt system, while tepid bathing has universal application.

It has been my privilege to see a large number of very severe cases of typhoid fever in children ranging between the ages of 6 and 15 years, the most susceptible age as well as the age when tact and care are at a premium.

To me it seems that the two elements necessary to success in combating this troublesome and dangerous disease are to reduce the toxemia and supply food and fluid. The first step is quietude in a large, well-ventilated room with calomel, which has not lost its reputation as an intestinal antiseptic, and a daily colon irrigation. The emphasis of the whole treatment I wish to place on the manipulation of the colon washing; this I order daily unless some grave counter indication obtrudes itself. Enteroclysis will reduce toxemia and necessarily the temperature, and at the same time supplies much needed fluid to the body. If this is carefully performed, it will be acceptable to the child and greatly shorten the period of illness. The temperature of the colon irrigation is always governed by the temperature of the child's body. All text-books give the technic of enteroclysis, yet I fear that the nurses fail to gain the desired results from this mode of treatment, because the attending physician does not impart specific instructions. Frequently I assist the nurse in the first treatment, thus allowing me to discover any abnormalities of the bowel, if any should exist, as I recognize its limitations as a therapeutic agent, and this must be done before valuable time is lost or any mischief occurs. If nurse and physician have gained the confidence of their little patient, the work will be performed pleasantly and profitably.

It must be remembered that the intestinal tract is the seat of many troubles and dangers during a course of fever. Tympanites may be troublesome by reason of some previous enteritis or peritoneal irritation; this is

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