of milk, eggs, cocoa, etc., to the dietary, or by supplementing this with some readily assimilable carbohydrate as, for example, lactose in a beverage.

22. For the roentgen examination of old cavities with fistulas, we have found thorium nitrate in 10 and 15 per cent. solutions to be of value. Its advantages over pastes of various kinds are its ease of introduction and of withdrawal. A 20 per cent. aqueous solution of potassium iodid appears to give results about equivalent to those secured with the solution of thorium, and is more easily obtained and less expensive. Like thorium nitrate, it is distinctly though mildly irritating.

23. The increased expansion of the lung following the use of Dakin's solution leads to the hope that extensive intrathoracic operations, such as decortication of the lung, may in most cases prove unnecessary. Such procedures should be undertaken only after most prolonged efforts to obtain expansion of the lung have failed, and then only when the surgeon has at his command every facility in the shape of intratracheal anesthesia, assistants and armamentarium.

MEASURES FOR THE PREVENTION AND CONTROL OF RESPIRATORY INFECTIONS IN MILITARY CAMPS*

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The two great surprises of the last year in the Army camps have been, first, the rarity of gastro-intestinal infections, and, secondly, the frequency of respiratory infections, particularly of the streptococcus group.

In former wars, infections of the alimentary tract, such as typhoid and dysentery, were responsible for the great epidemics. In our training camps of today, typhoid and paratyphoid are curiosities and dysentery is an exceptional occurrence. The disappearance of this formidable group of diseases can be attributed in part to the general use of typhoid inoculation and in large measure to the safeguarding of the drinking water from contamination.

During the Spanish-American War the danger arising from polluted water was well known, but careful and comprehensive methods of protection were not carried out. Today an army camp digs its own wells, builds reservoirs, subjects the water to frequent bacteriologic examinations, and in other ways rigidly and scientifically applies the knowledge gained by previous failure. No expense is too lavish, no effort too great, to provide this insurance of soldiers against water-borne infections. And the results abundantly justify the expenditure.

Are we employing equally rational and efficient methods in our efforts to control respiratory infections? Are we not neglecting to apply certain preventive measures that are logically suggested by our knowledge of their etiology and of their modes of dissemination?

MILK AS A CARRIER OF STREPTOCOCCI

Infected milk, cream and ice cream may be playing a rôle in the causation of respiratory infections, especially those due to the streptococcus, somewhat similar to that of contaminated water in the causation of gastro-intestinal diseases. That virulent streptococci flourish in milk is well known. The epidemics of streptococcus sore throat in recent years in Boston, Chicago, Baltimore and many smaller cities, traced as they were to contaminated milk, fully demonstrate that milk must always be reckoned with as a potential cause of any streptococcus outbreak. Even ice cream may preserve these germs in a virulent form for several weeks. Milk is capable also of carrying the germs of scarlet fever, diphtheria and perhaps of other contagious respiratory diseases.

During last winter a sharp epidemic of septic sore throat at Camp Grant was attributed, with a high degree of probability, to the milk. Following these cases came a wave of scarlet fever. Both of these diseases decreased when the milk was boiled.

The prevalence of streptococcus infection, both primary and secondary, has been remarkable in all the camps. It is not far from the truth to say that the streptococcus has been responsible for more deaths than all other organisms combined. Sore throat, bronchitis, sinusitis, pleurisy, bronchopneumonia and pericarditis, have been the more common manifestations. Of course, the contagion spreads from one person to another, but it is quite possible that a fresh stream of streptococci is constantly flowing into the camp and being disseminated by milk, cream and ice cream. A comprehensive and exhaustive study of this whole subject by competent investigators is imperatively needed at the present time.

In the meantime, however, in view of the constant danger of contamination, all milk and cream products should be pasteurized under direct supervision of the camp authorities. The most satisfactory and reliable means of accomplishing this end is to build and equip a pasteurizing plant in the camp proper, and have the process carried out and supervised by Army men. Such a plant could also manufacture all the ice cream used at messes and canteens.

Thorough pasteurization of milk in its various forms might reasonably be expected greatly to cut down the incidence of streptococcus infections and possibly that of scarlet fever and diphtheria.

ISOLATION OF SOLDIERS BY MEANS OF THE FACE MASK

As previously stated, most of the diseases encountered in the training camps are infections of the respiratory tract such as meningitis, diphtheria, scarlet fever, mumps, measles, German measles, pneumonia, whooping cough, streptococcus tonsillitis, bronchitis and bronchopneumonia. All of these communicable diseases are transmitted from one individual to another by means of the secretions of the nose and throat. Talking, coughing and sneezing force a fine spray of mucus and bacteria into the air which may directly infect another person and which contaminates clothes, bedding and furniture.

Crowding in barracks, at the mess table, and in recreation rooms facilitates the transmission of these infections and explains their rapid spread in Army camps. Crowding in the ambulance, in the receiving office and in the wards is even more favorable to germ transmision, because a large proportion of these soldiers are already affected with some contagion, and they simultaneously expose themselves and their comrades to a secondary infection.

* Read before the Section on Practice of Medicine at the Sixty-Ninth Annual Session of the American Medical Association, Chicago, June, 1918

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The remedy for crowding is group separation and, as far as possible, individual isolation. The segregation of newly arrived troops for three weeks in detention camps is one of the most vital measures in checking contagion.

The expedients of increasing the space between beds in barracks, of placing the head of one soldier opposite the feet of his neighbor, of stretching tent flaps between beds, and of suspending a curtain down the center of the mess table, are all of proved value. But the most efficient method for securing isolation of the individual is the use of a face mask, made with three or four layers of gauze in the shape of a rectangle measuring 5 by 7 inches.[1] The mask has long been employed by surgeons as a filter for the expired air in the operating room. It has been used successfully at the Durand Hospital by Weaver[2] for the protection of physicians and nurses engaged in the care of patients with contagious disease.

So far as we can learn, however, the use of the face mask for patients had never been practiced. In a hospital where each patient is confined to a separate room, there is no reason for masking the patients. But in hospital wards where, even with cubicles, patients must mingle and expose one another to respiratory infections, the face masks on theoretical grounds promised protection.

The experiment was started at Camp Grant[3] in the latter part of January, 1918, and was so successful that it was instituted as a routine measure in most of the medical wards early in February.

The system is carried out (1) at the regimental infirmary, (2) in the ambulance, (3) in the receiving office, and (4) in the wards. The directions observed are as follows:

1. At the regimental infirmary every patient with contagious disease is masked immediately after the diagnosis is made.

2. Every patient on entering the ambulance, whether infected or clean, is masked. Each ambulance carries a box of clean masks, which is replenished at the receiving ward.

3. At the receiving office the ambulance patients continue to wear their masks. Other patients who walk to the hospital for minor ailments are masked at the door by a noncommissioned officer. All retain the mask in place during the examination and on the trip to the ward, and remove it only when they are in the ward cubicles. Since the initiation of this practice, the occurrence of cross-infection from contact in ambulance and receiving ward, previously quite frequent, has been rarely observed.

4. In all wards for contagious and respiratory diseases (this includes nearly all the medical wards) the mask is worn by patients as well as by physicians, nurses, ward men and visitors. As long as the patient remains within the shelter of the cubicle he need not wear the mask, but he puts it on whenever he leaves the cubicle for any reason. Patients must either have their meals served in bed or while masked procure their tray of food and carry it to the cubicle. All eating utensils are sterilized after each meal.

Smoking is absolutely prohibited, as it necessitates the removal of the mask.

In view of the danger of transmission from the wash bowls, the plugs are removed, so that only running water is available for washing the face and teeth. Only one person at a time is allowed in the wash room, as the mask is necessarily removed therein. On the other hand, there is no objection to several persons occupying the latrine at the same time. The latrine is kept separated from the wash room in the double wards by locking the communicating door, in the single wards by hanging up sheets between closets and wash basins. To enforce the wash room regulations, a guard, who is usually a convalescent patient, sits outside the door.

Much depends on stimulating a lively interest in the scheme on the part of nurses and ward men. The ward surgeon very easily wins the cooperation of the patients themselves by frequent short talks, explaining the purpose of the masks and pointing out their similarity to the gas masks.

From February 1 to June 1, 1918, the cubicle and mask were in continuous operation. Whenever a case of scarlet fever broke out the ward was placed in quarantine for one week; when measles broke out, the ward was quarantined for two weeks.

In twenty wards exposed to scarlet fever as a secondary infection, only one subsequent case of scarlet fever developed during the week of quarantine.

In eight wards exposed to measles as a secondary infection, not a single case of measles developed during the two weeks of quarantine.

The system may be said to have been efficient in 95 per cent. of the exposures to scarlet fever and in 100 per cent. of the exposures to measles.

If this experience can be taken as a criterion, we soon shall be justified in ignoring the quarantine of the ward in these cross-infections, provided the system of masking and the cubicle is in good working order at the time of their appearance.

1. Commercial gauze varies greatly in weight and closeness of weave, so that it is important to fix a standard texture and the number of layers required to afford protection. Major Haller, chief of the laboratory at this hospital, is completing bacteriologic experiments for this determination and will publish his results in an early number of THE JOURNAL.

2. Weaver, G. H.: The Value of the Face Mask and Other Measures in Prevention of Diphtheria, Meningitis, Pneumonia, etc., THE JOURNAL A. M. A., Jan. 12, 1918, p. 76.

3. Capps, J. A.: A New Adaptation of the Face Mask in Control of Contagious Disease, THE JOURNAL A. M. A., March 30, 1918, p. 910.

ABSTRACT OF DISCUSSION

DR. JAMES S. MCLESTER, Birmingham, Ala.: We have used the method suggested by Dr. Capps at Camp Sheridan with satisfactory results. At one time in the measles ward almost every patient had coryza or bronchitis, and bronchopneumonia was developing rapidly. We removed every case of bronchopneumonia as soon as recognized, but that did not stop the spread. Finally, we put all the beds in that ward in cubicles and washed all the patients. Very soon the bronchopneumonia ceased to appear. That was to me a graphic demonstration of the value of the mask and of the cubicle system of isolation. Later on we had a similar experience in an epidemic of so-called grip. This disease spread rapidly through the hospital. Finally we made universal use of the mask and the cubicle and were thus able effectually to control the epidemic.

DR. JOHN A. LICHTY, Pittsburgh: In a large civilian hospital during the past winter our experience was much like that of Major Miller and Major Stone. We had two epidemics of pneumonia in the Mercy Hospital at Pittsburgh. The first epidemic came early in the winter and seems to have occurred mostly in colored men who had come from the South in the summer and who had never lived in the North. They came poorly clad and were improperly housed. They did not use the large wages they received to feed themselves properly. These men had a typical lobar pneumonia. They came into the hospital late, usually on the seventh day; and the mor-

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tality was very high. We did not have time to group them all or to treat them with the serum after they were grouped because they died so soon after entering the hospital. The other group came in the latter part of the winter when the cold weather began to break up. This was an entirely different class, and it corresponded with the class of pneumonia which seems to have occurred in the camps where there were abscesses of the lungs, empyema, etc., because they were very irregular, they were hard to diagnose, and, no matter whether they came in early or late, the cases were almost invariably fatal.

There should be propaganda work with reference to pneumonia just as there is with cancer. The laity should know what the early symptoms of pneumonia are, or the laity should be as keen about pneumonia as they are about appendicitis. Then, I believe, we can do much more with serum treatment than we have done heretofore.

DR. H. P. GREELEY, Madison, Wis.: This symposium has brought out the fact that pneumonia is, first and foremost, an upper respiratory tract disease. The question which I want to ask is, In what proportion of cases in the epidemics at the cantonments was the upper respiratory tract the seat of an acute inflammation? Dr. Capps has shown conclusively the value of masking in the prevention of pneumonia. Is local treatment of value in the preliminary stage of upper respiratory tract inflammation, the stage of invasion? Can any antiseptic local treatment be employed as a prophylactic?

DR. ALBERT R. TRAPP, Springfield, Ill.: I have often observed infected teeth and tonsils antecedent to pneumonia. These chronic infections increase the susceptibility and decrease the resistance to pneumonia. In treatment it would seem wise to combat these infections. Another thing I should like to have seen taken up is the viscosity of the blood. Wright has spoken of the citrates as diminishing the viscosity of the blood. It would seem that this could be tried out.

DR. CHARLES N. LOVEWELL, Fort Snelling, Minn.: I have had somewhat the same experience at Snelling as you did at the other camps. We are located near the University of Minnesota, and one of the things I have been grateful for since coming into the service is the fact that we were so assigned. The men there have been exceedingly kind to us in confirming some of our work, and because of the help they have given us we have been able to do better work than we otherwise could have done. In our work on pneumonia we have been able to classify the cases according to types. We had a comfortable, satisfactory time with our pneumonias in October, November and December. About the 1st of February troops from Kelly Field were sent to us, and then our troubles began, for with them came a type of pulmonary disease I had seldom seen before. Major Miller spoke about the great variance in the physical findings. It filled me with a great deal of satisfaction and, I declare, I felt better when I realized that others, and men of skill and ability, should be annoyed by the difficulties presented in arriving at correct diagnoses from their physical signs. We found every variety of physical sign disproved at necropsy. We found apparent empyema disproved by the surgeon going in and finding no empyema there. The pleuritis due to streptococci was associated with an exudate of gelatinous material which we have examined at necropsy and found by squeezing to be full of pus, although it would appear to be free from fluid. We have at the present time in our hospital fifteen cases of streptococcic pneumonia followed by empyema. Some of them, over half of them, have been in the hospital since March 1. Among the patients that are not there now, some having been discharged and some having gone to Fort Bayard, we have noted quite a large percentage of cases developing tuberculosis. I have not heard that mentioned here this morning. There is another thing that impressed me very much, and that was the apparently almost simultaneous occurrence of suppurative peritonitis with empyema, simulating appendicitis and pneumonia at the same time. We have made the mistake of operating in one of these cases, in which we found that condition. We have had some patients die of severe toxemia within an hour of their admission to hospital in whose chests we were unable to satisfy ourselves that there was any amount of pus, and in the abdomen we have found up to 200 to 300 c.c. of fluid, a most distressing condition for anybody who tries to make a diagnosis.

We used the commercial serum at first, although we found later that the serum had little or no agglutinating power against Type I. We gave our patients standardized tincture of digitalis, and in the last series of thirty cases we used the autolyzed pneumococcic antigen prepared by Rosenow, and I believe that, while the epidemic has lost its virulence, the antigen has markedly affected not only our mortality but the incidence of the crisis in the true cases of pneumococcic infections.

DR. EDWARD F. WELLS, Chicago: The paper is of great and timely interest. The principle of protecting other persons from contact with infective organisms thrown into the air by pneumonia patients is clearly beyond question; the details may be adapted to meet the varied requirements, and have been mildly and incidentally mentioned at intervals during the past three or more decades. Recognizing the fact that the pneumococcus, once it obtains lodgment in the nose and throat, remains a permanent potential danger to its host, and that it may be conveyed to others by air which has been contaminated by coughing and sneezing, I have long, and frequently, advocated the placing of signs in public places to the effect that "In coughing or sneezing hold your handkerchief before your mouth and nose." I have no doubts as to the widespread beneficial prophylactic results which would follow the general adoption of this measure, and desire again to recommend its employment.

DR. EDWARD E. G. FRANING, Camp Dodge, Iowa: I was at Camp Dodge from the beginning and saw this whole epidemic. We were going along smoothly until all at once we were thrown into a sort of a convulsion by an epidemic striking us. There was nothing important about pneumonia before this epidemic came on. It seemed that we had said everything about pneumonia, but we found that there was a great deal to say. We are classifying pneumonias. We have divided them into two classes. One is the old-fasioned pneumococcus pneumonia and the other is the streptococcus pneumonia, which causes an interstitial type of disease. I am on the surgical side at Camp Dodge. We had some infections in our hernia work and in some cases of chronic appendicitis. We did everything we could to stop those infections, but we did not succeed. After a short time we were able to put the dirty work in one pavilion and the clean work in another place, and after that we had no more infections, showing that the infection was general throughout the hospital.

We had cultures made of the throats of the twenty surgeons on the service and found that about 18 per cent. had streptococci. The *Streptococcus hemolyticus* was present in probably 15 per cent., and there was one man who had the short-chained streptococcus—the nonhemolytic streptococcus. The point I want to make is that some of you will have those same germs in your own throats, and when an epidemic comes the percentage of these streptococci increases. The streptococcus was found in 60 or 70 per cent. of these sore throats. Any infectious disease will increase the streptococcus flora in the throat, so that it is no wonder that these streptococcus infections increase in the measles cases.

We could do necropsies. We found that those sore throats, the ulcerative throats, were accompanied by very red congested tracheas and bronchial tubes and interstitial pneumonias. A very simple streptococcus pneumonia resolves itself very easily, but at the top of the wave it is more severe, the infection is more virulent, more of the lung is involved.

The worst complication we had was empyema, and it was my misfortune to operate on nearly half the cases. Practically all those empyemas got well until the epidemic struck us, and then the death rate of the empyemas went up, in spite of any operative procedure. At the end of the wave, or when the wave was breaking, the death rate dropped right down, showing that any operation we did in those virulent cases was of no avail. It made no difference what operation you did, when the pneumonia was on the decrease the wave of death rate went down. So that we have to be very careful in deciding on the kind of treatment.

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DR. GRANVILLE N. RYAN, Des Moines: It is our experience that you will get a favorable result in using glucose intravenously in the presence of an approaching coma or a dry tongue that is evidence of a dehydrated condition of the general system. It has been our experience that even a 10 per cent. solution of glucose has given very good results. We have added sodium bicarbonate in a 5 per cent. solution not only in pneumonia but in any dehydrated condition of the system or acidosis. I have not used glucose in 25 per cent. solution. In a delirious patient, instead of using opiates, try glucose, either alone or with sodium bicarbonate. You can make many of these patients more comfortable and, besides, these injections have a nutritive value.

ACUTE MASTOIDITIS AS A COMPLICATION OF INFECTIOUS DISEASES

BASED ON A STUDY OF ONE HUNDRED AND TWENTY-THREE CASES IN THE BASE HOSPITAL, CAMP SHELBY, MISS.*

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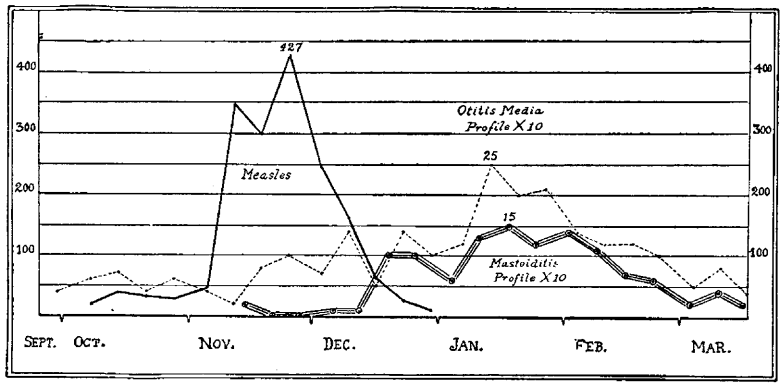
During the past winter the southern Army camps seem to have been invaded by a widespread streptococcus infection, expressing itself somewhat differently here and there; but in its most virulent form, and with highest mortality, in the shape of an involvement of the lung or pleura or both, by the *Streptococcus hemolyticus*.

Camp Shelby was no exception to the general rule, but for unexplained reasons, which the epidemiologist must elaborate for us, the infection was not of the severest type, as there occurred only about 300 cases of pneumonia and thirty-five cases of empyema. However, in studying the streptococcus cases as a whole, a striking variation from the general rule is at once apparent, in that, among the empyemas, the hemolytic streptococcus is not the prevailing agent of infection. While there are a few due to this type of streptococcus, by far the larger number, as shown in the study by Captains Todd, Moore and Zingher, are due to a streptococcus of the *S. viridans* group. There have been a considerable number of patients having streptococcus infections of organs other than the lung and pleura, and when one glances over this division another exception is evident, in that there is a large number who suffered invasion of the middle ear and mastoid. It is this group that constituted our peculiar problem. By itself, this cannot be considered as an entity but as a curious phase of the broad streptococcus problem; and as one phase only of that larger question do I propose to deal with it.



Curve designed to show measles, otitis media and mastoid admissions to the hospital by weeks. The otitis media purulenta and mastoid scales bear a ratio to the measles scale of 10: 1; i. e., to read, substitute the numbers 10, 20, etc., for 100, 200, etc. The numbers at the acme of each curve indicate the largest total admissions for one week.

In all, 123 soldiers developed acute mastoiditis of one or both sides. Invariably there was a preceding middle ear involvement; though in several cases the invasion of middle ear and mastoid had the appearance of being synchronous, so rapidly did the infection mature.

It was a common occurrence that a patient complained in the night of earache, and the next morning was found to have a reddened, bulging drum, which would be opened at once. Mastoid tenderness was an accompaniment of the middle ear symptoms, and the second morning, the tenderness persisting, and the temperature remaining high, even with free drainage, the roentgenogram would reveal a cloudy mastoid, leukocytes would be high, and at operation within forty-eight or seventy-two hours of the onset of the first symptoms, an extensive involvement of the mastoid with necrosis and thick pus would be found. Others of our cases were slower in onset; there were some in which we felt that we had not attacked the middle ear early or vigorously enough; but so many developed rapidly right under our eyes, despite the promptest care in the shape of paracentesis and roentgen examination of the mastoids, that we could not escape the conclusion that we were dealing with a highly virulent organism which had a definite predilection for these tissues.

Turning now to the relation of this "epidemic" of mastoiditis to preexisting diseases in the camp, our attention is first attracted to the outbreak of measles. The graphic chart shows that the mastoid cases occurred mainly in the period from December 15 to February 1. The curve of the measles epidemic begins in October, reaches its height in late November, and declines abruptly in January. The curve of the otitis media and mastoid cases follows this rather graphically. The otitis media curve here shown represents 240-odd cases. This number must not be misunderstood to represent the total number of otitis media purulenta cases in camp. It gives merely those cases treated in the wards of the base hospital and does not include either the cases treated by the ear clinic or at the regimental infirmaries, which never entered the hospital, and of which we have there no record. Consequently it does not represent, nor is it intended to represent, anywhere near the total number of otitis media cases from which the mastoid series developed. It is merely put in as exhibiting in a general, but fairly accurate way, the determination of the curve of the entire group of middle ear infections. It must be remembered that December and January were the months of the greatest incidence of all the acute respiratory affections, and these too, as we shall see, played a most important part in the development of mastoiditis.

Table 1 shows the relation of the mastoid cases to the various diseases that preceded them immediately

* Read before the Section on Practice of Medicine at the Sixty-Ninth Annual Session of the American Medical Association, Chicago, June, 1918.

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