ureter of the kidney which is known to be diseased and to collect the urine from the other by a catheter lying in the previously emptied bladder. This procedure is liable to the same sources of error as segregation, when the bladder itself is affected with the disease; it is also open to the objection that urine always will flow alongside the ureteral catheter and so reach the bladder and contaminate the result. So that in many instances the exigencies of the case seem to warrant the theoretical risk involved in catheterization of the supposedly healthy ureter.

The urine obtained by the ureteral catheters should be subjected to careful chemical, microscopic and bacteriological tests. If the urine from one ureter is free from albumin, pus and bacteria and contains a good percentage of urea, then the kidney of that side may be given a clean bill of health, and the other kidney, if tuberculous, removed. The presence of albumin, without pus and bacilli, in the secretion of the second kidney, the first being tuberculous, does not contra-indicate nephrectomy, since the albuminuria may be of toxic origin, and if so, will disappear with removal of the suppurating focus. Too much importance should not be ascribed to the presence of microscopic blood in the sediment, as it may result from the instrumentation; although this is not necessary and is to be deprecated, a certain number of ureteral cells will always be found. The presence of pus alone, in the urine of the second kidney, is a forbidding sign and calls for careful search for tubercle bacilli and the guinea pig test. If the latter is negative, a nephrectomy, while not positively contra-indicated, is dangerous.

It is in such cases as these that one might look to the newer tests of the functioning ability of the kidney, as the phloridzin test and cryoscopy of the blood, and the urine, for further proof. A bitter controversy is still being waged over these tests. Casper⁷ and Kummel are their chief champions, while Rovsing leads a host of adversaries.

The tests are complicated and delicate, and susceptible to many external influences, particularly cryoscopy of the blood, which on that account is practically unreliable. Cryoscopy of the urine, and the phloridzin tests are admitted by their advocates to be valuable only when used in conjunction with ureteral catheterization, and hence are subject to the limitations of the latter. These tests have not as yet been adopted generally, and it remains to be proven that they are of more value in estimating functional ability than the simple estimation of urea. My own experience has been too limited to allow of any conclusions as to their use.

Ureteral catheterization in the presence of tuberculosis of the bladder is not always possible even for the very elect, Rovsing failing in 19 out of 56 cases. Where it cannot be done, and simple cystoscopy is likewise unsatisfactory, the necessity of knowing that a second sound kidney is present demands exploratory incision.

It should be emphasized, however, that this

method is not only more dangerous than ureteral catheterization, but greatly inferior to it in the results yielded. Only the grossest lesions can be detected by palpation of the kidney, and no estimate whatever as to the functioning ability of the organ is afforded. The second case reported illustrates well the uncertainties of the method.

Having determined, as far as the nature of the case permits, that the renal tuberculosis is unilateral, to what extent is secondary involvement of the bladder a contra-indication to operation? It is a well known fact that after removal of the primary focus in the kidney, the secondary tuberculous infection of the bladder will heal spontaneously in many cases. In cases in which this does not occur, Rovsing lately has achieved remarkable results by his carbolic acid treatment of the disease in the bladder, so that he does not now regard tuberculosis of the bladder a contra-indication, however widespread it may be, so long as it is confined to the superficial layers; and has not invaded the muscular coat and perivesicular tissue. I have had no personal experience with this method and have not seen any reported instances of its use by others, but Rovsing's endorsement entitles it to serious consideration and trial.

As to the contra-indications imposed by complicating genital tuberculosis, an active process in the substance of the prostate gland should be so considered, probably also active double tuberculous epididymitis; inactive processes, even if quite widespread, in the genital tract, or an active process confined to one epididymis, do not contra-indicate nephrectomy, as long as there is a second sound kidney.

Contra-indications on the part of the general health are the same as for any major operation.

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THE VALUE OF VACCINE THERAPY TO THE GENERAL PRACTITIONER IN THE TREATMENT OF BACTERIAL DISEASES.*

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WITH the steady progress of medical science in the last few years, new methods of diagnosis and of treatment are being continually evolved. Many of these have proved of immense practical value, not only to the scientist, but also to the general

* Read before the Boston Society for Medical Improvement, Nov. 5, 1907.

practitioner. Each new method, therefore, should be accorded a thorough trial, in order that its value diagnostically and therapeutically may be ascertained and its limitations defined. In this field, the conservative type of mind is of value for, "by making haste slowly," many exaggerated claims will not be made and many disappointments avoided. The eager haste of many an exploiter has wrecked a new remedy when a more deliberate consideration would have placed a proper valuation upon it. No cure in medicine is absolute; quinine does not cure every case of malaria, nor mercury every case of syphilis. Neither will the bacterial vaccine cure all cases of acne, nor every patient with cystitis.

On the other hand, the ready condemnation of skeptical scientists of every new method will deprive the general practitioner — who leans on the laboratory worker for guidance — of many valuable additions to his armamentarium, for many years. The use of tuberculin is a case in point. At first heralded as a cure for phthisis by a number of men who had not learned its limitations, it speedily fell into disuse by the medical profession, as their claims could not be substantiated. Today, after fifteen years of practical disuse, we are only beginning to appreciate how valuable a means we have in it for diagnosis and treatment in most forms of tuberculosis.

The principle underlying all vaccine therapy is, as pointed out by Wright, "the scientific exploitation for therapeutic uses of the protective machinery with which the body is equipped." It is, then, the object of the bacterial vaccine to set in motion this machinery to its fullest extent. To accomplish this, active stimulation of those agencies which produce the antibacterial substances in the blood serum must take place, and through them increase leucocytic activity. In this way, the body is protected against bacterial invasion, and when infection has occurred it is more readily overcome. Among these protective substances in the blood, we have those of bacterial nature, bacteriolysins, agglutinins and opsonins. The latter is the only one whose amount can be ascertained at present, and the effect upon it of inoculation determined. It is probable, however, that these other substances are increased or diminished to about the same extent as the opsonic content of the blood, and their relative amount can probably be estimated.

The opsonic index of a serum is our guide as to the amount of circulating opsonin, and this index is more or less accurate according to the methods of technic and the experience of the individual. Clinical symptoms, however, must be the guide of the general practitioner not skilled in laboratory technic, and these are of great value in regulating the dosage of vaccine. The composition of a bacterial suspension is as important in determining the results in a case, as is the composition of various drugs in the effects they produce. The bacterial vaccine consists of the specific organism isolated in pure culture and, after destruction by heat, suspended in normal salt solution. To prepare it we cultivate the bacterium on suitable media at

37.5° for the proper length of time. When a profuse growth is obtained, this is collected in salt solution and sterilized at 60° C. This amount of heat is sufficient to kill the organism, but not to cause chemical protoplasmic changes. By comparing the number of organisms in solution with the number of red corpuscles per cubic millimeter in the normal blood, the strength of the bacterial vaccine is determined. A sufficient amount of this standardized suspension is then added to sterile salt solution in such quantity as to give proper concentration.

When the source of infection is not obtainable, and we have every reason to believe that the infection is due to the staphylococcus, a standard vaccine may be used if the opsonic index shows a lowered body resistance to this organism. The amount of vaccine required to increase the lowered standard of resistance or to produce artificial immunity, varies according to the age, the personal characteristics of the patient and the invading micro-organism. The child requires a much smaller dose for stimulation than the adult, and the immunizing machinery of some individuals is much more rapidly set in motion than in others. The type of infection, its duration, extent and severity are all important factors in determining the amount of a vaccine to be given.

The lesion that is in communication with the large lymph spaces of the body readily gives up its toxic products into the general circulation, and by this more or less constant absorption, auto-inoculation takes place. In such a patient there is much more sensitiveness to artificial inoculation. Where the general condition of a patient is good, response to inoculation is much more effective than in the case where exhaustion of the protective machinery makes stimulation almost impossible.

There should never be the association of two methods of stimulation going on at once in the body, — that from toxic absorption and by artificial vaccination. The first should be reduced to a minimum by rest and non-irritation of the affected part, and then the results of the injections of vaccine can be more accurately determined.

The type of infection running an acute course is not very favorable for vaccine treatment. In these cases, the disease is short and self-limited, and the general stimulation of the body by the toxemia is all that is required to aid in producing a cure.

In the cases of systemic infection, something may be accomplished by vaccine treatment, as here the whole volume of blood dilutes the toxic stimulant and more is required to cause the increase and production of opsonins by the subcutaneous tissue. Wright has reported several cases of endocarditis cured by vaccine therapy. Here the blood culture gave the offending organism. The sooner inoculation is begun, after the acute symptoms have subsided, the better the results. The localized lesion offers the best chance for a cure, but, if allowed to remain too long, the thick pyogenic membrane and granulations formed retard lymph flow into the focus of infection, and the blood

charged with anti-bacterial substances is hindered in its local action. Pus contains a much smaller amount of opsonin than the circulating serum, and by evacuating it and allowing an influx of lymph to the focus, we hasten its cure. When the organism is virulent and can be readily obtained in pure cultures, a stronger vaccine is produced, as attenuation is avoided, and the body more quickly and effectually responds to treatment. The indifferent results of many workers have probably been due to the failure to insure the use of pure cultures and from the loss of toxic potency in the vaccines used.

The size of the dose and the interval between injections depend upon the organism. The average dose of the staphylococcus in the adult is six hundred million organisms, repeated every fourth day. In beginning treatment, it is well to give one half the dose and increase as rapidly as required. The study of the ebb and flow of the opsonic tide has shown that the wave of increased resistance lasts about three days, and to prevent the succeeding ebb, the dose must be repeated. The same is true of other bacteria to a lesser degree, some requiring longer intervals between inoculations and smaller doses.

The method of clinical control of vaccine dosage has been used by Trudeau at Saranac Lake for years in the use of tuberculin, and our results with this method have not led us to see the necessity of a change. We have used small, gradually increasing, weekly doses of Koch's T. R. tuberculin or Trudeau's Bacillary Emulsion, beginning with 1-10,000 of a milligram and steadily increasing in amount. By this method and by closely following clinical symptoms we have avoided reactions, and a degree of immunity for tuberculin has been obtained which is highly desirable. Patients will take 10 to 40 mgm. of tuberculin without constitutional disturbance. When an overdose has been given, a reaction or negative phase occurs, as shown by temperature, general pains, nausea, vomiting, or diarrhea. If this accidentally takes place, we omit the tuberculin for a week or two and then return to one-half of the offending dose and work up again.

We have employed tuberculin as a routine therapeutic measure at the Massachusetts General Hospital and at the Samaritan Day Camp for over a year in selected cases. Only those with persistent temperature or recent hemorrhage have been excused from the treatment. At the Day Camp, we have about 35 patients—all having phthisis—who are receiving tuberculin weekly with good results. Several cases after six to eight months' treatment in sanatoria, still with active signs, are clearing up by the use of tuberculin at our Camp. Our arrested cases return to shop and home and do not relapse even after months of work in unfavorable surroundings, because, we believe, of the resistance conferred by injections of tuberculin used over a series of months. At the Massachusetts General Hospital in the treatment of tubercular iritis, adenitis, prostatitis and lupus vulgaris, as well as in pulmonary tuberculosis with tuberculin, all have

given very encouraging results. These cases have been followed clinically and clinical symptoms have been our guide in giving repeated and enlarged doses. In no case have we seen harm done, and even in the rare cases where a reaction has been produced, the subsequent exhilaration has more than made up for the slight untoward symptoms.

In many cases where the organism has been other than the tubercle bacillus, we have had the opsonic index as a guide to a greater or less extent, not because we always believed it necessary, but in order to follow a difficult case more closely. Some cases we have only given periodic inoculations, at an interval of three or four days, and controlled the dose by clinical symptoms. In no case where bacterial vaccines have been used, have we seen the least harm. The back in the scapular region or the abdomen has been the region selected for injection, and the vaccine put in subcutaneously. The constitutional effect of a good sized dose of vaccine generally shows itself in twenty-four hours. There may be malaise, slight general muscular pain and headache. Only twice have we seen a rise of temperature with nausea, vomiting and diarrhea, and that in children. These symptoms readily pass off and they are followed by a sense of well-being most gratifying to the patient, lasting several days.

The necessity for cultivating the infecting organism from the lesion not only aids in treatment, but in diagnosis. The case of J. W. is of interest in this connection. The child entered the Children's Hospital for empyema following pneumonia. Operation was done and drainage instituted. The sinus discharged for several weeks, and when first seen by one of us was still oozing pus from a small wound. A culture was made in order to prepare a vaccine for treatment. It happened that the boy was given 1,500 units of antitoxin on the same day, as is customary every three weeks, to children in this hospital to prevent an outbreak of diphtheria. The culture showed a pure growth of the diphtheria bacillus, and the antitoxin was all that was needed for treatment, as the sinus closed in about two days. Those cases where the staphylococcus vaccine has been used by us, include acne, generalized skin infection, boils, puerperal sepsis, carbuncles, osteomyelitis, empyema and secondary infection of the lung.

CASE I. A woman thirty-five years old, by occupation a nurse, who had had acne for seventeen years and was frequently prevented from working because it was so severe and extensive, came for treatment. She had been treated with little benefit by several dermatologists, and hydrotherapy alone had given any relief. Examination showed a well-nourished woman with numerous indurated acne lesions involving the face, back and chest. A culture from one of them showed a pure growth of staphylococcus albus and a vaccine was prepared.

July 18, 1907. Index, .79. Patient inoculated with 150,000,000 organisms. The next day there was slight general malaise and depression and tingling in the extremities.

July 22, 1907. Index, 3.1. Feels better. No new

lesions. Several old ones healed. Inoculated with 300,000,000 organisms.

July 27, 1907. Index, 1.07. Inoculated, 450,000,000 bacteria.

Aug. 1, 1907. Index, 2.3. Inoculated, 450,000,000 bacteria. No recurrences. Skin of chest and back is much improved. Feels stronger.

Aug. 5, 1907. Index, 1.9. Inoculated, 450,000,000 bacteria. Steady improvement. Back clear. Only one or two lesions on chest. One recurrence on face.

Aug. 10, 1907. Inoculated, 600,000,000 bacteria.

Aug. 14, 1907. Inoculated, 800,000,000 bacteria.

Aug. 18, 1907. Inoculated, 1,000,000,000 bacteria.

Steady improvement continued. Skin of face and body practically clear, less harsh and softer. General strength better than for many years. She has since returned to New York and has done well, receiving the vaccine once a week or ten days for some time.

CASE II. Woman. Age, twenty-five years. Acne of chin said to have been obtained in a hair-dressing parlor. Faithful treatment with ointments with only temporary benefit. Culture showed staphylococcus aureus and albus. A vaccine containing these organisms was prepared. Opsonic index, .904. First inoculation, 300,000,000 organisms. This was rapidly increased to 600,000,000 and injections given every four days. After three weeks' treatment the face entirely cleared up, and the patient has since been well. The interesting point in this case was that a stock vaccine of staphylococcus only gave slight temporary relief, but a specific, non-attenuated vaccine produced a cure.

CASE III. J. L. Boy four and one-half years. Entered Children's Hospital Jan. 25, 1907, with history of pneumonia three weeks before. Pain persisted on the right side. The day following entrance an operation was performed and one pint of green pus evacuated from the right chest. The child's temperature dropped, but the discharge persisted, and after three weeks he became thin and exhausted and in a serious condition.

Culture from the discharge showed only the staphylococcus aureus.

Feb. 15. Index, 1.3. Inoculated, 50,000,000 staphylococci.

Feb. 17. Index, 1.49. Inoculated, 100,000,000 organisms.

Feb. 20. Index, 1.59. Inoculated, 100,000,000 organisms. Discharge from wound very scanty. Child stronger. General condition improved.

Feb. 21. Index, 1.21. Inoculated, 100,000,000, and this dose repeated regularly every four days. From this date improvement was steady. The sinus closed in about ten days. Appetite returned. Gain in flesh was rapid, and he was soon running about the ward looking the picture of health. The index taken several times after the sinus had healed was persistently high, showing that the increased resistance to the staphylococcus from the vaccine was not of a few days' duration, but extended over some weeks at least.

CASE IV. A woman of fifty-one years has suffered several years with chronic, universal eczema of exfoliative type. Previous to this she had had numerous attacks of more or less localized eczema, some of which started with arsenical wall paper poisoning. She had gradually improved under careful diet in the past two years. Four or five months before beginning treatment she had an acute exacerbation, which was more or less controlled by use of an ointment, but left parts of the skin — especially on the face and neck — thickened and tender, and the deep glands were swollen and tender to touch. The rectum and lower colon gave considerable trouble by being tender from the

passage of large amounts of mucus. The patient was anxious to try the vaccine treatment to see if relief could be obtained. The staphylococcus aureus was cultivated from the scales of the skin and also from the urine and a specific vaccine prepared.

June 15, 1907. Index, .5.

June 17, 1907. Inoculated in the back with 300,000,000 staphylococci. That night she was restless. Back a little sore. Tingling in neck and arms and passage in next twenty-four hours of considerable quantities of mucus from bowels.

June 19, 1907. Index, 1.20. Feeling better.

June 21, 1907. Inoculated, 400,000,000 staphylococci. Previous sensations following the injection recurred, but were less marked. Has noticed scales coming off neck and fingers.

June 23, 1907. Index, 1.37. Old fissure behind the right ear better and healing. Scaling of skin more marked.

June 25, 1907. Inoculated, 600,000,000 organisms. Following day, discomfort in bowels. Passed large mucus sheets. Glands in neck less tender.

June 26, 1907. Index, .5. (Negative phase.) This shows dose of vaccine sufficient.

June 29, 1907. Inoculated, 600,000,000 organisms. Large sheets of old skin coming off exposed parts of body. Feeling much stronger. Can do more work and not tired so easily.

July 1, 1907. Index, 1.08.

July 3, 1907. Inoculated, 600,000,000 staphylococci.

July 5, 1907. Index, 1.4.

July 7, 1907. Inoculated, 600,000,000 staphylococci. Large glands have now practically disappeared. Skin softer and smoother and fissures between fingers and behind ears healed. Has greatly improved in strength and feels very well. Bowels cause little if any discomfort.

July 16, 1907. Index, .94. Has returned home feeling finely. Her own physician is to continue weekly dose of vaccine for one month. The report from him lately received says the patient has enjoyed the best health this summer in years. Her general condition is excellent.

CASE V. A girl of eighteen years, who had been under treatment for one and one-half years in the Good Samaritan Hospital and Day Camp for advanced tuberculosis. Both lungs were involved at the apices and also the lower half of the left lung. Here a cavity developed with characteristic signs over an area about two inches in diameter. Under treatment the general condition gradually improved. Gain in weight and strength was marked and tubercle bacilli disappeared from the sputum ten months ago. The signs of cavity have persisted with only a slight diminution in extent, and morning expectoration of about two and one-half ounces daily occurs. It was with the idea of stopping this expectoration that treatment was undertaken.

Aug. 16, 1907. Sputum collected in sterile bottle after careful washing of the mouth with peroxide of hydrogen. Cultures after twenty-four hours showed a nearly pure growth of staphylococcus aureus. Opsonic index, .65 to staphylococcus. A specific vaccine of the unattenuated organism was made and 200,000,000 injected into the arm. No constitutional effect was produced.

Aug. 23, 1907. Index, 1.8. Inoculated, 600,000,000 organisms. Cough and expectoration unchanged.

Aug. 29, 1907. Inoculated, 800,000,000 organisms and the dose repeated every four days for three weeks. Examination showed no diminution in size of cavity, but the increase of coarse râles about it. Expectoration remained unchanged. The vaccine has been steadily continued in increased doses up to 12,000,000,000 or-

ganisms. This dose has produced no general disturbance. There has been no improvement. In this case we have failed, but largely, we believe, through mechanical causes. If we could have had good drainage of the cavity and a non-impaired lymph flow into it instead of through a thick wall of fibrous tissue, we might have hoped for better results. One interesting fact in the case was that a pure culture of staphylococcus aureus was obtained from an old lung cavity.

CASE VI. We have said that, although some favorable cases have been reported of systemic infections treated by vaccines, they are few and the results generally not promising. Case VI illustrates this point. A girl of eleven years entered the Children's Hospital June 15, 1907. The temperature was elevated, child delirious and signs of infection present over the left tibia. The diagnosis of osteomyelitis was made and an operation performed. The tibia showed extensive involvement and was thoroughly cleaned out and drained. A culture showed a pure growth of staphylococcus aureus. Index to it was .89. On account of the severe symptoms and as the child was very toxic, small doses of vaccine were given beginning with 50,000,000 organisms.

June 17. Negative phase very marked. Pulse elevated and some cyanosis and dyspnea. Child not so well.

June 18. Index, .62. Inoculated, 150,000,000 organisms. Little if any constitutional symptoms. No attempt at repair of the wound and no formation of pus. Tissues have hardly reacted at all. Temperature high and irregular and child semi-conscious.

June 19. Index, 1.06. Condition unchanged.

June 20. Inoculated, 150,000,000 staphylococci. Signs of metastases in several joints of the body. General condition worse.

June 21. Foci of infection present in jaw and several fingers. Temperature high, 103°-105°. Child died.

Here we had an acute septic case with intense toxemia and the development of pyemia. Inoculations were of no apparent benefit.

CASE VII. A boy of four years. Entered Children's Hospital, April 13, 1907. For five weeks he had been complaining of abdominal cramps and these were followed by swelling of the right hip.

April 16, 1907. Swelling incised and about twelve ounces of thick pus evacuated. Abscess found just beneath the fascia behind the great trochanter. Culture showed staphylococcus aureus.

April 19. Opsonic index to staphylococcus, 1.14.

April 23. Opsonic index to staphylococcus, 1.11.

April 24. Opsonic index to staphylococcus, 1.09. Inoculated, 200,000,000 organisms.

April 29. Less spasm and tenderness in hip.

April 30. Index, .94. Inoculated, 200,000,000 organisms. No constitutional symptoms.

May 3. Inoculated, 200,000,000 staphylococci. Index, .66.

Practically no discharge. Wound nearly healed. From this date inoculations were given periodically and the child went to the Convalescent Home in about ten days in good condition.

CASE VIII. A woman of about fifty-five years. Previous health good, but never very strong. About a year ago general weakness began. In the course of from eight to ten months lost about forty pounds in weight. Has been troubled with discoloration of left foot and considerable pain in both legs. About two weeks before entering one of the Boston hospitals the left foot began to swell and several boils developed on the dorsum and discharged. Several abscesses also formed about the ankle. Two smaller ones developed one on the outer side of the tibia and one over the upper

inner portion of the left thigh. These were opened and drained. In spite of good care the areas of infection extended and in about ten days the tendons of the left foot were very extensively exposed and the other areas showed deep discharging sinuses. The general condition was serious. Examination of the urine showed about 6% of sugar with diacetic acid and acetone present. A diabetic diet as strict as consistent with the patient's condition was instituted. A culture from the wound of the foot showed a growth of staphylococcus albus.

July 31, 1907. Opsonic index to staphylococcus albus, .702. Inoculated, 150,000,000 from specific vaccine.

Aug. 4, 1907. Index, .6. Inoculated, 300,000,000 organisms.

Aug. 5, 1907. Patient had a restless night. Considerable discomfort in wounds from burning and tingling. No temperature or nausea. The wounds begin to look better. Slough coming away.

Aug. 8, 1907. Index, .98. Inoculated, 600,000,000 staphylococci. Improvement noticeable. Thigh wound closing in. Granulations more healthy.

Aug. 12, 1907. Index, .81. Inoculated, 600,000,000 organisms. Has evidently turned a corner and is on the road to recovery. Dressings less painful.

Aug. 16, 1907. Inoculated, 700,000,000 organisms. Patient has noticed since vaccine treatment began that finger nails which were broken and surface irregular are growing out normally. Hair also seems to be falling out less.

Aug. 20, 1907. Index, 1.18. Inoculated, 700,000,000 organisms.

Aug. 24, 1907. Inoculated, 800,000,000 organisms. Thigh wound healed. Wounds on foot are filled with healthy granulations, are much smaller, and tendons are almost all covered in.

Aug. 31, 1907. Index, .8. Doing well. The vaccination gives patient a restless night and as she was doing so well, they were discontinued.

Sept. 11, 1907. Index, 1.161. Foot healed but for a small granulating area on the dorsum about the size of a fifty-cent piece.

The rest of the convalescence has been uninterrupted, and to-day all that remains of deep gangrenous areas on the foot about the size of half the hand is a pin-point sinus down to a deep tendon. The sugar has diminished under diet to about 1-2%. General condition is good. We feel that the patient was rescued from a very serious condition by the aid of vaccine therapy. It has been of interest to watch the improvement in the nutrition of the skin, nails and hair as treatment progressed. The patient thought it made her hair grow, but we cannot substantiate that statement.

CASE IX. A boy of one and a half years, well developed and nourished, was taken under treatment on account of general furunculosis of face, back and chest. There had been several previous attacks of short duration. This one began about two weeks previously and was growing worse. Culture from some of the large furuncles gave a growth of staphylococcus albus and aureus. The opsonic index was .7 of normal, and we began with 50,000,000 organisms as the first dose. The index was followed regularly and the dose increased to 250,000,000. The inoculations were given every four days and the index was maintained constantly above normal. Improvement was steady and prompt. The first injection produced irritability, but nothing else in the way of constitutional symptoms, and later none at all. The skin began to clear after two inoculations and this rapidly progressed. As the foci of infection disappeared, not only did the skin lose its harsh, coarse look and feeling,

but became soft and delicate like that of the ordinary child. During the course of the treatment a large mass developed under the left jaw about the size of a walnut which was firm and tender. Incision allowed the escape of a few drops of serum. This rapidly healed. After about three and a half weeks of treatment the skin was clear and the general condition good. The child went into the country and has continued well.

CASE X. A man of forty years. Laborer. Applied for treatment of a carbuncle on the back of the neck about the size of a fifty-cent piece. The top of the carbuncle was yellow and a little sero-pus oozed from it. The patient absolutely refused to allow it to be incised, although strongly urged to do so. A culture was taken and inoculation of 300,000,000 staphylococci given from a stock vaccine. The case reported the next day. He had had a restless night, but the pain was nearly all gone from the neck, so much so that palpation and motion caused very little discomfort. The carbuncle had broken down and was discharging freely. A dry, sterile dressing was applied. The swelling on the neck rapidly subsided and the redness became localized. On the fourth day a second inoculation of 600,000,000 organisms was given. On the sixth day after treatment was begun the slough came away leaving a clean ulcer. This was rapidly filled with healthy granulation tissue. On the eighth day the same dose of vaccine was repeated as given before, and at the end of ten days the ulcer was covered with a small crust. This came off in about three days, leaving a soft, pliable skin with little if any scar. In this case the patient was saved the necessity of an operation with several painful dressings. The lesion healed rapidly and there was practically no scar.

CASE XI. Mrs. C. Twenty years of age. First child. Puerperal sepsis. Labor occurred on Nov. 3, which was long and tedious and was followed by a severe post-partum hemorrhage. Pulse 130. Stimulants and saline infusion were given. Patient did well for three days running a slight temperature varying from 99°-101°. Patient had a severe chill on the fifth day followed by a fever of 104° and pulse 140. Lochia profuse and of foul odor. An intra-uterine douche of sulpho-naphthol was given followed by another chill. On the eighth day the temperature came down to 101°. The chills continued each day, and on the tenth day the fever was again up to 104° and the pulse 110. The first dose of staphylococcus vaccine was given (300,000,000 bacteria) on the eleventh day when the temperature was 103° and pulse 110. The vaccine was from a stock culture.

There was no reaction or depression noticed but the temperature on the following day dropped to 101°. There were no chills after the first inoculation. The second inoculation of 600,000,000 bacteria was given on the fourteenth day of the disease and again on the eighteenth day. This vaccine was made from the staphylococcus albus obtained from a swab taken from the uterus. The temperature gradually dropped, reaching normal on the fifteenth day.

There was a decided reaction and depression after the second and third inoculations.

The opsonic index three days after the first inoculation was .801 and after the third inoculation was 1.18. Intra-uterine douches of bi-chloride, 1 to 3000, were continued until the temperature reached nearly normal, and saline infusion was given subcutaneously each day while the temperature was above 100°, then the infusion was given morning and evening per rectum until the temperature reached normal.

The temperature chart that could be obtained is shown on this page.

In this case the vaccine was of great value in sup-

plementing local measures in a woman who was much exhausted, following a severe post-partum hemorrhage and very septic.

CASE XII. This is of interest only on account of the action of the vaccine on symptoms occurring in this case. The patient was a strong, active woman of forty-five years. Previously well except for slight interstitial nephritis for two years and an attack of grip about six weeks before the present illness. On May 24, she had a chill following a long exposure to cold. Signs of pneumonia and pleurisy developed at the right base. These signs lasted only for four or five days when they cleared up. Prostration was extreme and the mind dull. Temperature continued irregular and moderately high. During the first part of the second week of illness there was some remission of all symptoms. Shortly, however, endocarditis developed, and this was followed by coma and hemoglobinuria. About the fifteenth day of the disease the breathing became Cheyne-Stokes in type and very labored. The pulse was hard, full and slow. There were other meningeal symptoms. On the seventeenth day of the disease we examined the urine and obtained a pure growth of what proved to be Friedlander's bacillus. The index to this organism was .7. On the eighteenth day of the disease the index was .7, and she was inoculated with 75,000,000 organisms from a specific vaccine. That night the respiration became easier and the Cheyne-Stokes type disappeared. On the twentieth day the index was .98, and an inoculation of 125,000,000 was given. The urine became

clear following the inoculation, the meningeal symptoms which had returned again disappeared and the breathing was very natural. On the twenty-first day the index was 2.00, with the patient resting quietly. On the twenty-third day the index was 1.07 and an injection of 150,000,000 organisms was given. A lumbar puncture was done, but nothing obtained. The urine, which had again contained hemoglobin, cleared up as before. The meningeal symptoms did not return. On the twenty-fifth day of the disease the patient died. Opsonic index on this date was 1.32. This case is of great interest in showing the effect of vaccine treatment in a case of systemic infection. The relief of symptoms following inoculation was striking. The opsonic index was well above normal on the day of death in this case, as we have seen it in several others.

The use of the pneumococcus vaccine in the treatment of infections has been of considerable benefit. The technic is considerably more difficult, however, on account of the cultural characteristics of the organism.

CASE XIII. A girl of two years entered the Children's Hospital, Feb. 19, 1907. For eight days previous to entrance there had been pain in the right side. On the day before admission the skin broke on the right front of the chest and considerable pus discharged. On the day of entrance a portion of the eighth rib was resected and a few ounces of pus evacuated. The child was thin and weak and in a precarious condition.

Feb. 22. Culture from discharge showed pneumococci. Index to the organism was .6. A stock vaccine was used and 50,000,000 organisms given.

Feb. 23. Index, .25 (negative phase).

Feb. 24. Index, 1.17.

Feb. 25. Index, 2.25. Child brighter. Sinuses discharging freely.

Feb. 26. Inoculated, 50,000,000 organisms.

Feb. 27. Index, .69.

Feb. 28. Index, 2.14. Discharge lessening. Eating better. Decidedly stronger.

March 1. Inoculated, 50,000,000 organisms.

March 2. Index, 1.38. Gaining daily. Inoculations were continued regularly and the child gained rapidly. After about three weeks she went to the country with no discharge from either sinus and in excellent condition.

CASE XIV. A boy of three and one-half years entered the Children's Hospital, Feb. 15, 1907. There was a history of pneumonia with a crisis of five days previous to entrance. This was followed by a second rise of temperature, and a diagnosis of empyema was made. The portion of the eighth rib in the posterior axillary line was resected and about a quart of pus evacuated. A culture showed a pure growth of the pneumococcus present.

Feb. 18. Opsonic index, 1.1.

Feb. 19. Patient inoculated with 50,000,000 pneumococci.

Feb. 22. Index, 1.59.

Feb. 23. Index, 1.50. Inoculated, 50,000,000 organisms.

Feb. 24. Index, .45. The child was restless following the last inoculation and the temperature rose to 105°.

Feb. 28. Index, 1.20. Temperature still elevated, but general condition improving.

March 1. Index, .72. Inoculated, 50,000,000. Discharge slight and there has been a steady gain in weight and strength.

March 5. Temperature normal. General condition good.

March 7. Index, 1.2.

March 13. Index, 2.00. Very slight discharge from

sinus. Up about the ward. Fairly well. The general gain continued and the sinus rapidly closed. Child sent to the country for a few weeks.

CASE XV. A girl of three years entered the Children's Hospital, Feb. 25, 1907, with signs of infection on right thigh. The following day an incision was made and about an ounce of pus evacuated from the femur. A culture from the wound showed the pneumococcus.

Feb. 28. Index, .71 to pneumococcus.

March 1. Fifty million pneumococci given.

March 4. Fifty million pneumococci given.

March 8. Index, 1.1: Condition of wound much improved. Very slight discharge.

March 10. Incision closing rapidly. No discharge.

March 19. Wound healed solidly. Child sent home well.

Infections of the urinary tract are among the most promising for the vaccine treatment. Here bacteria of the colon growth are most frequently found. The following cases are of considerable interest:

CASE XVI. A girl of eleven months entered the Infants' Hospital, April 15. For eleven days previous to entrance the child was restless, refused food and ran a temperature from 104°-105°. For three or four days there was painful urination. The napkins were stained brown and the urine had a strong odor. The temperature on admission was 104°, but in three days dropped to normal. The child was put on urotropin for about ten days. Buttermilk was substituted for modified milk. Under this treatment the child's condition improved, but the urine still showed considerable pus and large numbers of bacteria. A culture from the urine showed bacillus Escherich of the colon group in pure culture.

May 11. Index to the organism was 1.36. Child inoculated, 10,000,000 organisms of a specific vaccine.

May 13. Opsonic index, 1.4.

May 15. Inoculated, 50,000,000 organisms.

May 17. Index, 1.62.

May 18. Inoculated, 100,000,000 organisms.

May 21. Index, .92. Urine much less turbid. Child better.

May 23. Inoculated, 100,000,000 organisms.

May 28. Urine shows very little pus and bacteria much diminished. General condition improved. Index, .2. Inoculated, 100,000,000 organisms.

June 1. Inoculated, 100,000,000 organisms.

June 5. Urine shows only a rare cell in the sediment.

June 6. Inoculated, 100,000,000 organisms.

June 7. Urine normal. Child discharged well on June 11. It had regained the 2 lb. lost during its sickness. General condition satisfactory.

In the case with so young a child it was necessary to find the optimum dose before any result could be expected. Here it was 100,000,000 organisms, and after these amounts were regularly given improvement was rapid.

CASE XVII. A woman of thirty-three years. Married. About one and one-half years previously, when she was well along during the first pregnancy, had a severe attack of eclampsia which terminated it. The recovery was slow, but after three months she was apparently as well as ever. The urine was normal. After complete recovery she again became pregnant. The urine was followed closely, and the patient was kept upon strict hygiene. In spite of this precaution on exactly the sixth month in the second pregnancy the urine suddenly showed about 1½% of albumin. Edema appeared in the face and a miscarriage occurred. The fetus was well-formed, but had been dead a few days. The placenta showed marked thickening of the arteries, with considerable fatty degeneration. The

recovery was rapid. The third pregnancy began seven months ago. The patient went along well until the fourth month. At this time, without warning, she was taken suddenly with severe pain in the right lumbar region. Temperature rose to 103° F., and pulse to 120 beats a minute.

Examination.—July 2. Patient restless and perspiring freely. Pain all through the abdomen and back. Tongue coated. Throat negative. Chest negative. Abdomen negative. Considerable tenderness in the right lumbar region. Vaginal examination negative except for an enlarged uterus.

Urine.—High, acid, 1,012. Trace of albumin. Sediment: few blood globules and considerable pus. White count 8,200.

The disease ran an acute course for one week, then the temperature and pulse dropped to normal and the general condition improved. The urine continued about the same, with large amounts of pus, pelvic cells and few blood globules present, in spite of the use of urotropin. A culture from the urine showed a large spore-bearing bacillus with cultural characteristics of the uro-bacillus. A vaccine of this organism was prepared with considerable difficulty, as it required live steam to make it sterile.

July 24. Index to the organism, .8. Patient inoculated, 30,000,000.

July 29. Urine cloudy. Increase of pus for two days after vaccine injection. Inoculated, 50,000,000 organisms.

July 30. Poor night. Pain in right lumbar region. Large amount of pus in night urine, but much clearer this morning.

Aug. 2. Back ache improved. Urine shows some sediment in the morning, but very little during the daytime. Inoculated, 100,000,000 organisms.

Aug. 6. Improved. Urine clear except when first passed in the morning. Inoculated, 100,000,000 organisms. Index, 1.01.

Aug. 10. Better. Inoculated, 100,000,000 organisms.

Aug. 18. Inoculated, 100,000,000 organisms. Looks and feels very much better. No more discomfort in back. Urine normal in appearance. Sediment shows only an occasional leucocyte.

Aug. 25. Inoculated, 112,000,000 organisms. General condition good. Free from all symptoms. The patient went into the country at this date and on returning six weeks later had gained 13 lb. The urine was normal and free from any sediment. In this case a vaccine fit for use was only obtained after sterilizing it by live steam in order that the spores might be killed. If this had not been necessary, the duration of the case would probably have been shorter. Nevertheless, this vaccine stimulated the body as shown by increased symptoms referred to the affected part and the rise in the index after inoculation.

CASE XVIII. A child of ten months, previously strong and well, was suddenly taken with vomiting, diarrhea and painful micturition. The temperature ran a high, irregular course from 102° to 104°, and the urine showed blood, pus and a profuse growth of bacteria. The diet was modified and urotropin given. After ten days the acute symptoms subsided and the temperature reached normal. The urine remained unchanged and at times seemed nearly all pus. The stomach and bowels were frequently upset and the child lost weight and strength. After about a four weeks' illness it was decided to try vaccine therapy. The culture for this showed a pure growth of a bacillus of the colon group. On about the thirtieth day of illness the child was given 33,000,000 organisms, the index being 1.66. The following day there was nausea,

vomiting and diarrhea, and the temperature rose to 103°. The urine, however, became clear almost immediately. After four days a second dose of 25,000,000 organisms was given with little constitutional disturbance. The general condition begun to improve. Within a week the stomach and bowels were in a good condition. A third dose was given on the thirty-eighth day of the disease. The urine had remained clear with no pus or sediment.

There is now after only three injections of the vaccine no evidence of cystitis, and the general condition is greatly improved.

These cases illustrate in many instances the value of the bacterial vaccine in treatment. Our experience has not been limited to those summarized, but we have also seen marked benefit in a number of other cases of osteomyelitis, empyema, in old appendical sinuses and other affections. The cases of epidemic cerebrospinal meningitis treated gave indifferent results, and the series of cases reported by Rotch were not encouraging. Nevertheless, in earlier cases with the use of specific vaccines, the results might be improved. It seems from our use of the vaccine treatment it is of considerable benefit in a large majority of suitable cases when treated intelligently. Some cases will give brilliant results, others a safe cure, and still others only some improvement. We feel that this method of treatment may be made of great service to the physician and the surgeon.

CONCLUSIONS.

1. Each new method in medicine should have a thorough trial before it is rejected.
2. A non-attenuated specific vaccine, given in proper doses, is essential to success in the treatment of cases with vaccines.
3. To control the amount and frequency of the dose of a vaccine, either the opsonic index or general clinical symptoms may be the guide.
4. Localized infections of moderate duration offer the best field for treatment.
5. The vaccine treatment, when used in conjunction with medicine or surgery, may lessen suffering and deformity and frequently save life.

SOME PERSONAL EXPERIENCES WITH SPECIFIC VACCINES IN THE TREATMENT OF BACTERIAL DISEASE.*

BY MARK W. RICHARDSON, M.D., BOSTON.

In June of this year, I read before The Massachusetts Medical Society a paper¹ on the "Treatment of Typhoid Fever with Specific Sera, Filtrates and Residues (Vaughan)," and, from observation upon 130 cases, I concluded in part, that

(a) The course of typhoid fever, if treatment be instituted early enough, can be favorably influenced by inoculation of specific bacterial products.

(b) Inability to make an absolute diagnosis in the early days of the disease has been a severe handicap to specific treatment.

*Read before the Boston Society for Medical Improvement, Nov. 25, 1907.

¹ See this JOURNAL, Oct. 3, 1907.