

the pneumococcus and Morax-Axenfeld bacillus, while the former will succumb to a ten minute exposure at 56 C. (132.8 F.), the latter to a five minute exposure at 55 C. (131 F.). In his experiments on rabbits the essayist was still capable of obtaining a positive culture from a pneumococcus corneal lesion after a ten minute exposure to a temperature of 53.9 C. (120 F.) and states that a temperature of 54.4 C. (130 F.) was of no value. We will watch with interest the future experiments of Dr. Shahan when he uses a high temperature and shorter exposure, conditions that would seem to bring his heat effects in closer relation to that obtained by Weekers, Bourgeois and others. In the presence of severe cornea ulceration after the failure of such cauterizing agents as phenol and iodine thoroughly applied, I rely on the actual cautery, but we must not lose sight of other adjuvants such as the vaccines.

DR. JOHN GREEN, St. Louis: Dr. Shahan's experience with this method in experimentally produced pneumococcus ulcer in rabbits was not encouraging. Recently an opportunity presented itself to try the thermophor on a patient with hypopyon keratitis. The applications were made under the supervision of Dr. Shahan so that the conditions were favorable for a fair test. A worker in a chemical factory presented himself May 28 with a 4 mm., nearly round ulcer near the center of the cornea. There was hypopyon rising to a little less than one-quarter the height of the anterior chamber. Smear and culture showed pneumococci in abundance. The thermophor was brought to a constant temperature of 115 F. and gently but firmly held in contact with the ulcer for ten minutes. The contact was practically continuous, except for momentary withdrawals, due to sudden shifts in the position of the eye. At the end of the seance it was found that the epithelium had been denuded to a total diameter of 5 mm., the ulcer proper measuring 4 mm. Atropin, 1 per cent. three times a day, and boric acid irrigations were ordered. May 29 there was only slight change in the ulcer; the hypopyon was either stationary or had increased a trifle. Thermophor applied for ten minutes at 121 F. May 30, the hypopyon was appreciably higher and the ulcer measured 5.5 mm. in diameter. Thermophor applied at 122 F. for ten minutes. May 31, hypopyon increased, ulcer spreading superficially as indicated by nasal and temporal subepithelial yellowish exudates. Thermophor applied at 124 F. for five minutes to the nasal side of the ulcer and for five minutes to the temporal side. June 1, there was positive increase in the size of the ulcer but no tendency to penetrate deeply. It was deemed inadvisable to pursue this line of treatment further. The edges of the ulcer were touched with 20 per cent. zinc sulphate solution and the ulcer itself buried in a mass of methylene blue powder. The following day the inflammatory signs were less marked and the hypopyon had diminished. A continuance of the methylene blue treatment was effective in checking the further spread of the ulcer and the hypopyon gradually diminished. The patient is now making satisfactory progress.

DR. L. HOWE, Buffalo: We are very much indebted to the author for the way in which he has presented the negative phases of the effects of heat on the eye. We must keep clearly in mind the factors involved; that is, the resistance of the eye and the resistance of the bacteria if we expect to kill them. We now know definitely what the lethal point of the eye is. Bacteriologists are not so well agreed as to the lethal point of bacteria. When I prepared the paper three years ago which described for the first time this method of measuring the temperature of the eye by means of thermal junctions, I was rather surprised to find such a difference of opinion on this point among bacteriologists. At that time I asked Professor Ernst of the Harvard Laboratory concerning the lethal point of the gonococcus. He gave figures which made it quite sure that that form of bacteria could stand heat better than the eye. It is true we use heat when we cauterize, but over only a very small surface. The value of the measurement of heat does not relate to the higher temperatures. But as we find moderate heat of advantage clinically the practical point is to deter-

mine with delicate tests, like the galvanometer, what the exact temperature is of the applications we make. When that is done we can decide what class of cases are affected by increased temperature and in what way.

DR. WILLIAM E. SHAHAN, St. Louis: This method should not be confused with any electric method where the electric current heats the tissues by passing through them. In this method all unknown factors, except heat, have been eliminated, and the effects of this agent alone studied. Neither should it be confused with any application of heat approaching cauterization. Dr. Howe's remarks on the practical impossibility of getting accurate results with the use of the mercury thermometer alone are fully concurred in and indebtedness to him for his paper on the thermocouple at Minneapolis in 1913 ought to be fully acknowledged.

ORTHOPEDIC SURGERY IN WAR TIME *

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We are of the opinion that efficiency as it is generally understood should not be the goal of life. But we are also of the opinion that once a goal is set, it should be attained by the least expenditure of any energy which is worth saving, and we believe that this is what efficiency ought to mean.

In a physical conflict such as war, the goal of both sides is set. To attain it each must conserve the physical energy of its soldiers in order to increase their strength in battle. Each must strive for the complete recovery of its wounded in order that the ranks may be kept as full as possible. Finally, but perhaps most important of all in any long conflict, each must see to it that those large numbers who do not lose their lives, but who by reason of their mutilating wounds lose their fighting power, do not become a burden on the industrial community already depleted and vastly overburdened by the necessity of support of the armies in the field. The few left at home are doing intensive work, and the wounded heroes, if the national strength is to be conserved, must have a still further test of their heroism and be made to contribute their remaining energy to help maintain their still efficient comrades.

Our thesis is to be that orthopedic surgery has a very large part to play in (1) assuring physical efficiency in the ranks; (2) in conserving and restoring the function of the locomotive apparatus of the wounded; (3) in providing the physical possibility and perhaps reorganizing the means by which the war cripples may become happy, productive, wage earning citizens, instead of boastful, consuming, idle derelicts.

ORTHOPEDIC EXAMINATION OF RECRUITS AND SOLDIERS IN TRAINING

Posture.—It has not been, we believe, solely because of the better appearance presented by erect, full chested men, that all recruits are compelled to go through "setting up" exercises, and that good carriage is so strongly emphasized. Life insurance figures suggest that the number of inches of chest expansion up to certain limits is in direct ratio to the quality of the risk.

This important part of preventive work, namely, the acquisition and maintenance of a good posture, is surely essentially an orthopedic concern. It is well

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looked after at present by the trainers of recruits. It is possible if orthopedic help were sought that still more might be accomplished in the direction of simplification and more rapid attainment of the desired end.

Feet and Shoeing.—We are perhaps tempted to forget in these days of trench warfare that the feet of the soldiers are of supreme importance. The front must be reached often by forced marches. Railroads may supply men and provisions, but do not fight battles or push on as victory is gained. At the Battle of the Marne, an English surgeon, in charge of a hospital near the front by which the armies surged in haste, told me that in the early days there were constantly large numbers of footsore men in every company, sometimes 25 or 30 per cent. These men were inefficient, if not an actual burden.

Being impressed with the large numbers of nurses who had to be temporarily relieved of duty in the course of their training in a large general hospital on account of foot strain, the writer began many years ago to examine the feet of all probationers as a routine when the classes entered. Suggestions as to shoeing and any necessary immediate treatment, etc., were made on the basis of this examination, and on the basis of the muscle balance tests, by which potential trouble may be discovered. By this method it was possible to actually eliminate foot strain from the causes of disability among the nurses who followed instructions. In armies the soldiers *must* follow instructions.

We believe that careful tests of this sort would more than compensate for the time consumed by the discovery of potential but correctable faulty weight bearing and the assurance of more constant and continuous efficiency when severe tests came.

The American army shoes, as far as we have been able to ascertain, are vastly better than those of many other nations, and several of the so-called army shapes leave little to be desired. It was most satisfactory to pick out an unusually good shoe from among hosts of bad ones which the patients in a French hospital were wearing, and to find that this was an American shoe and was being supplied to certain of the French soldiers.

No care can be too detailed as to the fit, shape and quality of soldiers' shoes. Battles may be lost or won by shoes alone. In a questionnaire conducted by Dr. Smith Peterson and the writer at the American Ambulance in Paris, many more than half of the 200 soldiers under investigation had suffered from blisters and other more serious foot troubles caused by faulty fitting and faulty fashioned shoes. A man may not fight at his best with a blister on his heel.

ORTHOPEDIC SURGERY IN A BASE HOSPITAL

The opportunities for preventive orthopedic surgery have not ceased when the base hospital is reached. They have hardly begun. The wounds of the war are nearly all infected. Healing is delayed, and contractures and adhesions are almost certain to occur, unless these dangers are appreciated and future function striven for quite as strenuously as the healing of the wound.

Ankylosis, after joint injuries with their accompanying infections, is a very common and unfortunate sequela, but the degree of this misfortune depends on attention to the position in which the joint stiffens, and every joint may be said to have its position of

choice. For example, a stiff shoulder in 45 degrees of abduction, an elbow in 90 to 100 degrees of flexion, a knee in 20 to 30 degrees of flexion, are often not serious handicaps, whereas an arm glued to the side, a fully extended elbow, a knee flexed to a right angle, represent actual crippling and require an operation or a forcible manipulation, which, because of the previously septic nature of the wound, may not be without serious risk.

I shall not discuss at length the problems of immobilization of joints and compound fractures of bones. These matters have been considered in some detail in a previous paper; but I would remind you that no surgeon should be as well qualified to deal successfully with these problems as an orthopedic surgeon. Mr. Robert Jones has his great orthopedic base hospital at Alder Hey near Liverpool, Professor Lange his German orthopedic base at Munich. Both these masters make trips to the front and instruct the surgeons in the orthopedic technic of splints and plaster, but unless we are much mistaken, in the other base hospitals of both these countries, and surely in the base hospitals which we observed in France, there is still very great opportunity for orthopedic endeavor, and this endeavor is sure to yield full compensation for labor.

In our own experience we found plaster of Paris most adaptable for immobilizing even the septic compound fractures requiring constant irrigation. Wide reinforcing bridges must, of course, span the open wound, and nice application must be had; but in hands familiar with its use it serves its purpose well. The ingenious splints of Mr. Jones, Dr. Joseph Blake and other surgeons are also most useful, and the overhead suspension, or so-called Balkan splint, often used in combination with metal splints, adds greatly to the comfort of the patient and often facilitates drainage.

Problems of Restoration of Function.—The return of function in wounded and infected joints depends on many things: first, of course, on the extent of the injury, and second, on the seriousness of the infection. We have been impressed by the power of repair which the ends of bones possess and also by the considerable amount of resistance which the synovial membrane displays.

It seems to us that conservatism should be practiced in regard to early excision of joints, and that multiple incisions and absolutely free drainage should be reserved for those cases which actually *do* need it. We do not believe in making these incisions and providing this drainage in cases which *may* need it. We are aware that occasionally we shall be sorry that we did not thus widely open and drain, but we are sure we shall many more times be glad when we simply wash out the joint thoroughly and leave only a tiny rubber tissue drain running into or down to the joint opening. Joint function returns very quickly and perfectly if the latter procedure is successful, very slowly, or not at all, after the former.

We need not emphasize the importance of massage and early gentle, active and passive motion to prevent the formation of permanent adhesions.

Brisement forcé, which is usually resorted to if these early movements have not been carried out, is a most unsurgical procedure, and only rarely successful.

There are now several very excellent universal mechanotherapeutic machines, both French and German, which, working on the principle of the pendulum, afford excellent opportunity for the slow but safe limbering out of joints and stretching out of muscular

contractures. The results which they accomplish are slowly gained, but they may be expected to be permanent and we know no shorter road.

Operative Orthopedic Surgery.—As the war progresses there will be no limit to the field of what may properly be called orthopedic operative surgery. There is ample opportunity for its practice now, but with septic compound fractures, in which wide gaps of bone exist, grafts are obviously not advisable until the sepsis has thoroughly disappeared, and in stiff joints all experience teaches that no attempt should be made to perform arthroplastic operations until long after the septic process has been quiescent, how long may be found to vary with different germs. Perhaps a year is not too long as a working rule.

Many limbs are saved now that formerly would have been amputated, both because it is more possible to save them and save life as well, and also because the supply of artificial limbs bids fair to be so inadequate for some time to come. In these limbs, position has often been sacrificed to life, and realinement will be necessary. A further task and opportunity for orthopedic surgery is thus presented. These are only a few of the tasks and opportunities.

ORTHOPEDIC WORK WITH CRIPPLES

Apparatus.—The cripple has a right to look to the orthopedic surgeon for an amelioration of his condition. Much may be done by preventive and restorative surgery alone; much more may be accomplished by the added use of apparatus of one sort or another, supportive, retentive or corrective.

The little book of Spitzzy and Hartwich gives us an idea of the care with which these matters are being considered in Germany. Not only adaptations of the standard types familiar to all orthopedic surgeons are required, but also various forms of inexpensive prostheses are in constant demand for both upper and lower limbs. It would be hard to conceive of a more ample opportunity for exercise of mechanical ingenuity than that presented by the maimed limbs of the returning soldiers. Even if funds were at hand, which they are far from being, there is apparently a completely inadequate supply of the modern expensive and complicated and not always durable forms of artificial limbs. Once given the occupation, an inexpensive and adaptable makeshift can usually be planned and can be easily obtained.

Occupational Training.—This brings us to the consideration of the occupational training of cripples. It is fitting that orthopedic surgeons should take the lead in organizing this work, as they have done in the past and are doing now in Europe.

Here in America, although much has been accomplished, most of the cripples throughout the country are cripples still, and idlers instead of special wage earners. There can be no question as to which state of being is of greater use to the nation, or as to which state is the happier state for the individual. We should surely appreciate the importance of devoting much energy in our several communities to a rounding up of these interesting people and providing them, probably by state legislation, with vocational training. This is a form of preparedness of which every pacifist must approve.

We point with much satisfaction to a recent bill introduced into the Massachusetts legislature by Representative John L. Monahan and just signed by Governor McCall, the provisions of which are as follows:

Resolved, That the board of education is hereby directed to investigate and report to the next general court, on or before the second Tuesday of January, 1917, what facilities exist in this commonwealth and what provisions have been made to give special training and instruction to persons who have suffered the loss of sight or loss or injury of limb or member and whose earning capacity has been destroyed or impaired by such injury, for the purpose of reestablishing of increasing the ability of such persons to earn a livelihood, and also to investigate and report what provision has been made or opportunity furnished for such purposes of training or instruction in other states and in foreign countries, and to include in its report a statement of the opinion of said board on the advisability of action on the part of the commonwealth to establish or extend means for such training and instruction, and also to submit drafts of such legislation as they deem necessary to carry into effect their recommendations.

The American Orthopedic Association at its last executive session appointed a special committee, of which Dr. J. E. Goldthwait is chairman, to consider ways and means by which the orthopedic surgeons of the country may organize a national orthopedic reserve. Detailed plans of an orthopedic base hospital are being worked out and sources of supply assured. We urge most strongly the cooperation of this section, both officially and individually, with this committee. It seems to us of great national importance—how great it may be, we trust we shall never know. At the executive session it was recommended that a committee be appointed by the Chair, and Dr. Goldthwait was appointed chairman of this committee also.

We believe orthopedic surgery in times of peace is a most comprehensive specialty; in war time the possibilities of its helpfulness are still greater. The fact that these possibilities are not always recognized should make orthopedic surgeons seek opportunities to demonstrate them. If this opportunity is accepted it may well mark an epoch in the history of the specialty.

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ABSTRACT OF DISCUSSION

DR. NATHANIEL ALLISON, St. Louis: I succeeded Dr. Osgood at the American Ambulance last summer. In the early months of the war in Europe, I speak particularly of the French and Belgian sides, the hospitals were not adequately prepared, and the surgeons comprehended little of what they had to do. Supplies were not forthcoming. General surgeons, medical practitioners—all the leading men in France, were called to the colors, to serve in such ways as they could in inadequately prepared hospitals with no supplies. The American Ambulance was in a fortunate position, having an excellent building, unlimited supplies, and being able to spend on the care of the patient about five francs a day from the donations that were made for the hospitals. This is much more than can ordinarily be afforded in France. Mr. Frederick Villars, a war correspondent who has followed all the wars that have occurred in the last thirty years, said that the American Ambulance was the best military hospital that the world had yet seen.

The thought this brings up to us is what we would do for the care of tremendous numbers of wounded, if war should come suddenly on us. The more or less of a catch word we all are using, "preparedness," is apt to be only a catch word, unless things are taken quite seriously. These men come in in hundreds and thousands, and they must be taken care of, and their wounds are of the most severe character. The American Ambulance, in its first year, treated three thousand patients, with a death rate of 8.8 per cent. This compares very favorably with any municipal hospital. In the first year they did only eighty amputations. That shows what orthopedic surgery—the hospital was practically an

orthopedic hospital—has done. No one thought of anything but conserving the limbs to the best function that could be obtained for them. Everyone tried to devise means to conserve them, and in that way, these very original and valuable appliances that Dr. Osgood has shown you have come into use.

Some provision should be made in this country for taking care of tremendous numbers of wounded. I hope that we shall never have need to have such measures put into effect; but if we should, the need will come suddenly and not after months of preparation. The American Orthopedic Association, to this end, appointed at its meeting in Washington, D. C., a committee to standardize some notion of what orthopedic surgery could do in case such a condition should arise with us, and I would suggest that this section might also appoint such a committee.

DR. EBEN W. FISKE, Boston: My experience was, perhaps, a little different from that of Drs. Osgood and Allison. Dr. Osgood said that preventive orthopedics had hardly begun when the base hospital was reached, and this is very true. But on the other hand, orthopedic surgery is as essentially prophylactic as it is reconstructive, and nowhere is this truer than in its application to the surgery of war. How large a proportion of the cases in Europe which are today requiring late treatment for deformities were preventable no one can say. Of course, lack of time and material, and the presence of wide-spread infection, make it very difficult to carry out these measures; yet even with the first dressings certain knowledge of the mechanics of fractures must be employed, and all the way back, long before the base hospital is reached, there are innumerable opportunities for the application of orthopedic principles toward the prevention of deformity and the preservation of function. Naturally in the most severe injuries we must first preserve the limb, if not the life, with the establishment of full drainage. Second in importance is immobilization, and lastly, alignment and orthopedic principles. In the moderate injuries, however, which furnish the largest proportion of cripples, we can do a great deal. It is as easy, for example, to put up a wrist in dorsiflexion as in any other way, yet it is not always done. Again, among the minor injuries, the necessary rest and relaxation of the exact structure damaged, to be obtained by orthopedic measures, is greatly neglected, although this would often prevent the patients' transfer back to the base, a matter of extreme importance in keeping the maximum number of men in active service. Dr. Osgood advised the use of plaster-of-Paris and I think from his experience he is fully justified. But in many of these early purulent conditions, it has been the experience of many good observers that splints are superior to plaster because, provided the immobilization is perfect, the splint is usually cleaner and gives more chance for drainage and dressing; it allows observation of the limb for spread of infection or gangrene and control of the secondary hemorrhage, and for early massage and manipulation. But the choice of the splint is very important. Traction and coaptation together are undoubtedly the ideal method of putting up fractures of the extremities, but traction with the body weight as a counterforce is not ideal, because every movement of the body creates spasm, so prejudicial to the comfort and safety of the patient. Pull and counterpull within the splint is ideal and is so used throughout the English army, after the Thomas method. It is also adapted to the arm, with the counter-pressure by a padded ring against the chest wall. A material now generally used is an aluminum alloy rod, which can be easily bent, cut or spliced, and can take the place of any splint, even the Thomas. I want to call this splinting to your attention, because I feel that orthopedic surgeons in this country should be familiar with a material that is so universally applicable and valuable in war surgery.

DR. J. D. GRIFFITH, Kansas City, Mo.: I want to second the suggestion Dr. Allison made that we should have a committee appointed from this section, such as was appointed from the American Orthopedic Association, for the purpose of helping us in being prepared for an emergency. To one who has been along the line the absolute unpreparedness of this country is apparent. We ought to be prepared thoroughly.

DR. JOEL E. GOLDTHWAITE, Boston: The committee of the American Orthopedic Association was appointed with the idea of trying to standardize, or decide what is the best equipment for an orthopedic base hospital, or what material should be used in any hospital unit which might be established, whether a general or special orthopedic unit. It was also thought possible to have the members of the Orthopedic Association and all the men in the country who are interested in orthopedics get together, so as to be made available for service in case of need. The committee consists of Drs. Allison, Henderson, Forbes, Erving and myself. Already General Gorgas has been written to, and the plan put before him, and he is most cordial in his wish to have the thing go on. It is a part of the committee's expectation after they have worked out what is necessary for an equipment of a unit, to have such collections of material stored in different parts of the country ready for use, these storage places to be known to the National Academy, and also to the army. All of us must feel that the great need is for our doing something that will put us in a position very different from what most of the nations abroad were in when the war began. Then too, it is not only in the time of war that opportunities of this kind are available. When the war is over there will be an opportunity to get orthopedic experience, for hospitals are being established to help those who have been crippled. It is the hope of the committee that any of the men here wishing to join an orthopedic unit will communicate with the committee. The committee will send letters to all those doing work in our specialty; but in case they should not hear on account of error in the mails we should like them to send a statement of their age, experience, whether married or not, etc., to the committee. We can have the names classified so that the government will have men fitted for different kinds of service. Some could go to the front, others could go to the base units. It will help the committee if you will do this.

A PLAN OF TREATMENT IN INFANTILE PARALYSIS *

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The successful treatment of infantile paralysis requires that the surgeon should have in his mind a definite plan covering all the phases of the disease, a plan based on the pathology in its various phases. We have at the outset a virulent acute affection with a high mortality, then comes a period of two years during which we try to restore to their highest efficiency the affected muscles, and finally we meet in the later and so-called stationary stage of the affection the question of correcting deformity and restoring or improving function by operative measures. Few affections offer a wider range of requirements from a therapeutic point of view, and if when we are treating the first stage we bear in mind what may happen to the patient in the third stage, we shall treat the early stages better.

The muscle test spoken of in the paper is a means of quantitatively estimating the strength of muscles by means of their pull against a spring balance, and is not only useful in locating the existence of weakness in different muscular groups, but offers a means of estimating the gain or loss in muscular strength under given conditions.¹

The stages of the disease are as follows:

1. The stage of onset begins with the acute attack, and may be assumed to end when the tenderness has

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1. Martin, E. G., and Lovett, R. W.: A Method of Testing Muscular Strength in Infantile Paralysis, *THE JOURNAL A. M. A.*, Oct. 30, 1915, p. 1512.