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THOUGHTS ON FRACTURES AND OTHER TRAUMA

by

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It is an honor and a pleasure to speak before the American College of Surgeons on the subject of "Fractures and Other Trauma." It is a happy coincidence that this subject be presented this evening here in Boston, for it was in Boston that the "Fracture Committee" of our organization began in 1923. We are paying tribute to such outstanding surgeons as Ashhurst, Blake, Cotton, Darragh, Scudder, Sherman and others who then felt that there was marked need for improvement in the treatment of fractures by all in the medical profession. The intense interest manifested by these men resulted in the establishment by the Board of Regents of this College of the "Fracture Committee". This committee has functioned uninterruptedly since that time with but two minor changes. In 1939 its name was changed to the "Committee on Fractures and Other Trauma" and, in 1949, it was changed again to the "Committee on Trauma." The opinions and the expressions of the various members of this committee have done much to promote a serious study of the subject of trauma and to arouse the profound interest which exists in this subject today.

Since trauma is the most common cause of disability and loss of function, it becomes the one field where the surgeon is most frequently called upon to employ his knowledge and skill. It is our considered opinion, therefore, that more time and consideration should be given to this subject by the various medical schools and hospitals through out the country. All of us recognize that internes, through no fault of their own, have only a fragmentary knowledge of the treatment of fractures. Many of us frequently have been embarrassed by the fact that Boy Scouts and Red Cross first-aid workers (laymen, of course) are better versed in the principles of first-aid, and the application of dressings and splints, than many of our hospital residents or staff associates. Not until medical schools adjust their curricula and allot more time to the teaching of subjects related to trauma will the efforts of the traumatic surgeon achieve the peaks of success already attained by his colleagues in allied medical and surgical fields. The Committee on Trauma is gratified to know that its efforts are "bearing fruit" and that, in time, all traumatic cases will receive material benefit from improved methods of treatment from reduced disability and from increased functional results.

GENERAL DISCUSSION

In order to emphasize properly the importance of an increased knowledge of trauma permit me to review briefly some of the important advances which have been made in this field -- particularly in the treatment of fractures. In so doing I shall try to stress some principles and practices which experience on our own service proves to be sound and not mere theory or hypothecation. Sober reflection brings us to the realization that we often go through life taking too much for granted. We forget that the knowledge of today is but an accumulation of the truths passed down from the experiences of our predecessors, as far back as Hippocrates. Like many of you who still follow the teachings of your preceptors, my own knowledge stems from the writings of Scudder, Stinson and Osgood and my privilege of association with such eminent surgeons as Darragh, Murray, Sherman, Marble, Cotton and the other members of the Fracture Committee. The thought expressed here, today, therefore, are not all new. They represent the precepts of these modern pioneers supplemented by my own personal experience derived from 35 years of industrial surgical practice; including over 3,000 fracture cases, one-sixth of which required open reduction.

Most of you will no doubt agree that there are almost as many methods of caring for wounds as there are doctors rendering the treatment. Every surgeon has his own pet method and routine which, because it has given good results in his hands, he dislikes to discard in favor of that advocated by a colleague. This lack of complete agreement concerning wound care has made it well-nigh impossible to develop a standard technique or even to compare the results obtained by different clinics. This is most marked when one attempts to review the literature relative to the treatment of compound fractures. We cannot help but note that many of the errors present in a large series of cases or leading to poor functional results are due to the dogmatic adherence to one set method of treatment. This dogmatic and over-enthusiastic adherence to a fixed routine in all cases often fails to utilize the basic fundamental principles in the care of a wound, consequently, definite and time-proven scientific principles essential for proper wound healing are often neglected. As proof of this let me speak for a moment on the use of the sulfonamide drugs in the operative site as a prophylactic measure in wound care. Prior to the development of the sulfonamides, surgeons generally were dependent upon the principles first promulgated by Lister and developed to a higher degree of asepsis by those who followed in his footsteps. Aseptic surgery was, and still should be, the main foundation in the treatment and care of wounds. With the introduction of the sulfonamide drugs and the glowing reports in the literature concerning their efficacy, their use in wound care became almost universal. Their bactericidal action was relied upon in many cases to conceal what otherwise would have been revealed as infections due to lack of experience or careless operating technique. Some surgeons even went so far as to state openly that debridement of the wound was no longer necessary since use of these drugs at the operative site would prevent all infection. The unsoundness of their thinking is verified by a report in the literature of 1940 describing 450 open fracture cases with a 20% incidence of infection following the local use of the sulfonamide drugs. In spite of such incidents as this, and the recommendations of your "Committee on Trauma" that these drugs not be used locally, the practice persisted. When this country entered World War II in 1941, Army policy dictated that each soldier carry his own "sulfa" powder and pills to be used by him in the event he was wounded in battle. Experience, however, has subsequently proven the inefficiency of this method of wound care. This inefficiency verified by the report of the Surgical Committee of the National Research Council. Recent experience has confirmed the earlier belief that wounds heal quicker and with fewer complications when they are kept free of irritating material or other foreign bodies. Such substances, while they may be bacteriostatic, do more harm than good to the tissues themselves by causing an increased extravasation of serum and consequent tension on the sutures. This results in increased patient discomfort and delayed healing of the wound. While we are, therefore, opposed to the local use of the sulfonamides or other antibiotics, we do not wish to convey the impression that we disregard them all together. There is no question concerning their effectiveness in the treatment of infection when given systemically, and the sulfonamide drugs together with the more recent antibiotics such as penicillin, streptomycin, aureomycin, and others, have just as definite a place in the armamentarium of the surgeon as they do in that of the internist.

Because of the wide diversity of opinions concerning the proper care of wounds and fractures, this problem was thoroughly discussed at a meeting of the Fracture and Trauma Committee in New Orleans in January, 1941. It was the intention of this group to formulate a uniform practice applicable to the treatment of wounds and fractures which could be universally adopted by our military surgeons in the event we became involved in World War II. The work of this Committee at that time revealed considerable conflict between the reports of Trueta of Spain and Orr of this country when contrasted with those of Coller who showed that "the end-functional results did not justify its continued use." I should like to add also, that such formerly popular

methods as the use of maggots and the employment of a mixture of bismuth, iodoform, and paraffin, known as "Bipp", are now passe. As a result of the discussion by this Committee the following resolution was presented to the army:

> "Resolved: That it is the consensus of this committee that the use of snug-fitting plaster encasements in the initial treatment of acute compound fractures is inadvisable except where the case can be closely and continuously observed.
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> "That early splinting, utilizing fixed traction, should be followed by adequate debridement at the earliest possible time; that such debridement should accomplish removal of all dead and devitalized tissue eliminating all dead spaces and removing all foreign material.
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> "If chemical sterilization is feasible, the use of aqueous sodium hypochlodite is advised.
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> "That the immediate closure of compound fractures is inadvisable.
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> "That wounds of soft parts not involving bone, joint, nerve or tendon, following mechanical and chemical debridement may be closed by secondary suture when the bacteriological check in the wounds proves it permissable.
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> "It is also recommended that the surgical committee of the National Research Council further consider the problem of improving and simplifying practices and procedures after a thorough study of the end results of cases treated to date and a survey of all available literature."

In spite of the foregoing recommendations a number of you will no doubt recall that many of the wounds occurring in World War II were treated by such complicated methods as the vaseline gauze packs and the plaster casts of Trueta, the local installation of sulfonamides, and the use of Stader splints. It is believed that much of this treatment resulted in non-unions and other complications which no doubt could have been avoided, It is the hope of your Committee on Trauma that if there is a World War III, a definite decision will be reached concerning uniform methods and procudures in the treatment of war injuries so that surgical tragedies such as those described in the British Medical Journal of 1944 and 1945 will be prevented. We have the drugs with which to combat infection systemically and with these, together with universal acceptance of sound basic principles in the care of wounds, we should certainly be able to restore a greater number of cases to normal or near-normal functions.

FRACTURES

All of you are thoroughly familiar with the well-established basic aim of the treatment of fractures. We are all of one mind in the belief that the main objective in the treatment of fractures is the restoration of the injured part to a normal, or near-normal function. These concepts are so well established that they need no further discussion here. However, we believe that a review of the various methods of handling fractures, particularly those necessitating open reduction, is in order.

Closed fractures, with no over-lapping or major displacement, may be treated by the credited methods of closed reduction and immobilization. Since there is no open wound through which infection may enter, healing in most cases takes place in the allotted time without complication. Fractures of this type having a minimal amount of over-riding may be successfully treated by Russell Traction or even skeletal traction employing Steinman Pins or Kirschner wires. It is my considered opinion however, that

this latter type of treatment has been over-emphasized and even abused. There is no doubt that the possibility of infection in the wounds may be created by the insertion of these implements of traction. This is well substantiated by a report on the use of skeletal traction in the BostonCity and the Massachusetts General Hospitals, several years ago, in which an 8-10% incidence of infection was noted in cases treated by this method. When two such leading institutions as these report that high an incidence of infection in skeletal traction cases, there is a good reason to suspect that a higher incidence probably occurs in the hands of less ably trained men. Russell Traction, on the other hand, is generally ineffective although it formerly had many strong adherents. For instance, Dr. Robert Kennedy, in 1937, presented 17 cases of fracture of the femur which had been treated by this method. None of these cases, however, had better than 40% end-on reduction, most of them being only corner contacts with overlapping. As a result of this experience, Dr. Kennedy is now a very strong advocate of operative treatment of fractures of the shaft of the femur.

In those fracture cases where over-lapping or shortening is sufficiently great to prevent realignment by closed reduction, operative interference is indicated. The time at which this is performed will, in most cases, depend upon the extent of the trauma to the adjacent soft tissues. When this trauma is extensive, the extremity should be elevated and open reduction delayed for a week or ten days, or until the swelling subsides and the patient's temperature has returned to normal. The necessary operation is then performed, using either stainless steel screws or bone plates to obtain the desired internal fixation should this be necessary.

OPERATIVE TREATMENT

No discussion of the operative treatment of fractures would be complete without some review of the historical background of such treatment, particularly as it relates to the now commonly accepted method of internal fixation. For the past 60 years Lambotte, of Antwerp, has been recognized as probably the first to employ open techniques in the treatment of fractures. Since this was a radical departure from the methods in vogue in the 1890's, he personally made the instruments, plates, and other items necessary for new treatment. Many of their present day counterparts are still associated with his name. Following Lambotte's development, Sir Arbuthnot Lane utilized the new technique and introduced the use of high carbon steel bone plates and ordinary wood screws, together with the so-called non-contact technique. Lane's paper on the "Operative Treatment of Fractures of the Long Bones", which he read at the June, 1909, meeting of the American Medical Association, was the first introduction in America of this approach to the fracture problem. That it met with some opposition may be noted from the discussion of Lane's paper by Dr. Charles Scudder who stated, "we are not ready for the popularization of the operative treatment in this country and we should advise fracture treatment by developing non-operative treatment." It is interesting to note that he reversed his original opinion 20 years later when, in 1929, he admitted, "the operative treatment of fractures has become a firmly established practice."

My predecessor, Dr. William O'Neill Sherman, was probably the first surgeon in this country to employ plates and screws for the open reduction of fractures. Since these items were not yet available in the United States, Sherman imported the necessary armamentaria from England and employed them, in September 1909, in an operation upon an overlapping fracture of the shaft of the femur of 18 months duration. He later admitted that this first case, though far from being creditable, had taught him many important lessons. Chief among these lessons were the necessity of proper equipment, the importance of sharp resection with minimum wound trauma, as stressed by Lane, and the necessity for proper blocking of the skin edges of the wound. Dr. Sherm was not entirely satisfied with the type of bone plates available at that time and,

in 1910, introduced a catenoid type plate, made of vanadium steel, together with a self-tapping bone screw. In the development of these he was assisted by eminent metallurgists and engineers and the results of their combined endeavors received the approval of the United States Bureau of Standards. The vanadium-alloy plates, being softer and more ductile than the high carbon plates of Lane, did not break or become loose as readily as the latter. Then superior quality gained for them wide acceptance.

Some time after the general adoption of this method of fracture treatment, complaints came from various parts of this country relative to breakage of the bone plates employed by the surgeons using the technique that the plates broke. The Presbyterian Hospital in New York reported an exceptionally high incidence of such defects. Since, up to that time, we had treated in our own clinic, over 2,000 fracture cases by open reduction with only 5 or 6 cases of plate breakage, we were unable to account for the difficulty. Investigation disclosed that the plates used at the Presbyterian Hospital had been made by an unlicensed manufacturer who boldly labeled them "as per specifications of the American College of Surgeons and U. S. Bureau of Standards." The hospital purchasing agent, having been misled by the label and probably not realizing the difference in quality, purchased the inferior plates because of their reduced price.

At a meeting of the Fracture Committee in 1938, Venable proposed the use of vitallium plates, since this metal is less subject to electrolysis when in the body. However, since vitallium is a cast metal, it is more brittle than the rolles steel alloys and therefore inferior to them for fracture work. Sherman then investigated the possibilities of employing stainless steel plates containing 18% Chromium and 8% Nickel. These proved to be too soft and ductile for the purpose intended. In the search for a suitable stainless steel Sherman interested the late Dr. James A. Carnes, surgeon to the Republic Steel Corporation at Canton and Massillon, Ohio. As a result of their discussions, Republic Steel Corporation developed an alloy composed of 18% Chromium, 8% Nickel, 2.35% Molybdenum, and the balance iron. This alloy, known as Enduro, proved to have the strength of vanadium steel in addition to being non-corrosive when placed in body tissues. This 18-8 SMO stainless steel has replaced all others as the metal of choice in the treatment of fractures. However, there is still one small dark cloud on an otherwise bright horizon. I refer to the practice of some plate manufacturers who market plates which have been stamped out hot without being subjected to the further annealing which is necessary to restore the normal physical properties of this metal. Manufacturers are still supplying vitallium plates in spite of their brittleness. This subject has been thoroughly reviewed by a sub-committee of your Committee on Trauma and many heated discussions have been held by them in SanAntonio, New York Washington, and Atlantic City. Following their report, which was made with reservations in 1943, the U. S. Bureau of Standards in 1947 refused to approve vitallium as a suitable metal for bone plates because of its brittleness. Since then the government has purchased 4½ million tap screws and 750,000 18-8 SMO stainless steel bone plates for use by the Army as well as for the lend-lease program.

UNUNITED HIP FRACTURES

Thus far we have reviewed the historical development of bone plates for internal fixation. Let us now briefly review the development of some of the methods of internal fixation as applied to special types of fracture. Although screws and nails of various types had, on occasion, been employed in the treatment of fracture of the neck of the femur, it remained for Smith-Petersen to put this technique on a sound, scientific basis. A symposium on fractures of the neck of the femur was held at a joint meeting of the American and British Surgeons, in London, in 1929. At this meeting a confere of Smith-Petersen reported on the treatment in 17 cases of this type of fracture by means of open reduction when a flange nail was used. While he readily admitted that the procedure was still in the experimental stage, and therefore not

subject to definite conclusions, he was violently opposed and strongly condemned by many of those present; this, notwithstanding the fact that most of the opponents of the method possessed little or no actual knowledge of the operation. Among the objections raised were the tendency of the nail to drive the head away from its position of contact with the neck; together with the tendency of this type of nail to back up. Smith-Petersen's ideas bore fruit, however; soon thereafter several other types of nails appeared on the market. Some surgeons less fearful, even venturing to use ordinary, carpenter-type, wood screws.

The screw type of fixation proved to efficient in the cases of fracture of the neck of the femur that it was developed further by Lorenzo. As a result of over 15 years of trial and error Lorenzo developed a lag screw, plate, and lock which has proven to be an excellent adjunct to the treatment of this type of fracture. If properly applied, the absolute immobiliation resulting from this type of fixation has sufficient strength to permit weight bearing. However, experience has shown that early weight bearing should be discouraged until evidence of bony union has been proved on x-ray examination. Early movement of the involved leg and ambulation of the patient is made possible, however, thereby reducing the danger of hypostatic pneumonia, circulatory disturbances, and other complications which beset those suffering this type of injury.

More recently, another type of screw has been developed by Moriari of Brazil. This screw, also intended for fractures of the neck of the femur, has a superior positive thread but lacks the adaptability the Lorenzo screw has, particularly when it is supplemented by the lateral shank plate and lock.

During the period of World War II an intramedullary type of fixation was developed which used Huntscher nails. This is a very adaptable procdure but should be employed only by those who are skilled and experienced in its use. We believe it has practical application but its field of usefulness is certainly limited and the cases in which it is employed should be carefully chosen.

OTHER JOINT FRACTURES

Up to this point we have been talking principally about fractures involving long bones. Fractures in and around joints, however, also present problems of internal fixation and can be treated by one of several methods. In malleolar fractures, with separation of the malleolus, and end-to-end reduction of the fracture must be obtained or non-union will follow. Such non-union results in a painful ankle joint with eventual post-traumatic arthritis. For many years we have successfully employed a stainless steel Kruse nail to immobilize this type of fracture after it has been properly reduced. This nail has a Hagadorn type point and must be so placed that its head can be countersunk below the cortex of the bone or cartilage. This type of fixation is useful also in treating certain fractures of the olecranon. When these latter fractures are more comminuted, good results can be obtained by the insertion of a long, heavy wire, and so using the same principles employed for intramedullary nails.

OPEN FRACTURES

While all of you are no doubt familiar with the basic principles of fracture treatment we should like to review, briefly, what we consider to be some of the more important essentials in the treatment of open fractures. In all cases of open fracture, the involved area is thoroughly cleaned and oompletely debrided. Fixation of the fracture is then obtained by whatever means the surgeon considers proper and adequate. Following this, treatment depends upon the condition of the wound, the elapsed time between the moment of injury and the beginning of treatment, and the experience and

judgment of the surgeon. In those cases where treatment is instituted within 6 to 8 hours from the time of injury, primary closure of the wound can be made. Those cases which are first seen after a longer time interval than 6 to 8 hours are treated in the same manner but the wound is not closed. Instead, fixation of the fracture is followed by Carrel-Dakin irrigation of the wound. Secondary closure is then performed at a later date after the danger of infection is eliminated and it is safe to convert from an open to a closed wound. There is no doubt that, in many of these cases, the use of penicillin, systemically, is of great aid. However, it must always be kept in mind that there is no substitute for a thorough debridement of the wound. Infections are prevented and controlled not by the administration of bacteriostatic or bacteriacidal drugs, but by good, sensible, primary cleaning of the wound, followed by meticulous after-care in the form of close observation and the immediate institution of proper measures at the sign of impending infection. By following this regimen we have found that our incidence of infection in open fractures averages only one percent over a period of many years.

FRACTURE COMPLICATIONS

Up to this point we have discussed various methods of internal fixation of fracture. Let us now consider some of the complications which arise in trauma cases. Probably the most serious complication of fractures is that of non-union. This requires bone-grafting procedures, many variations of which have been developed. It is the practice in our clinic to use either the sliding in-lay or oversized onlay type of bone graft after the manner of Buchanan who, in 1912, was the first in America to report on the transposition of bone in the tibia. The usual technique then involved suturing the graft to the host with kangaroo tendon or catgut. Since this gave questionable fixation, I developed the method of graft fixation by means of vanadium tap screws about 25 years ago. This provided a greater degree of fixation and materially reduced the operating time, and consequently gave increased benefit to the patient. It is now our routine practice to fix all bone grafts with screws, a procedure which is also useful for fixation in step-cut operations on over-lapping fracutres of both bones of the forearm. In addition to this we have, for the past 10 years, also used a sliding inlay graft, from the lateral aspect of the tibia, having a dove-tail-like fitting of the graft into the host at either end. This yields better fixation of the end of the graft into the bone proper and reduces the number of screws necessary to effect complete immobilization of the graft. I might add that it is sometimes found necessary to re-enforce bone grafts by means of a bone plate, in cases where there has been prolonged angulation or marked over-riding for long periods of time. We have observed that bony union has been hastened materially by the institution of metallic fixation. Following the actual bone graft operation, it is our practice to obtain complete immobilization of the involved member by means of external fixation in the form of molded plaster splints rather than solid plaster casts. In the past it was found necessary to remove vanadium screws, in many cases, after bony union has taken place. Following the development of S.M.O. stainless steel, however, the removal of bone screws is no longer necessary and has become the exception rather than the rule.

Another complication of trauma, particularly that involving the joints, is the development of post-traumatic arthritis. This may entail absorption of bone at the fracture site, as in femoral neck fractures, or avascular necrosis of the femoral head. Various forms of treatment for these and other disabling types of hip pathology are being utilized. The Whitman reconstruction operation, in our experience, does not give sufficiently good results to warrant its general use. The McMurray and Schanz type of ostectomy also leave much to be desired, while the Brackett operation, and its modifications, give good results only in certain kinds of cases. Lorenzo has recently developed a molybdenum stainless steel femoral head which is placed in the acetabulum, following removal of the diseased head, and is then fixed to the upper end of the

femur by means of his lag screw, femoral plate, and transfixation screws. This method supplants the more or less discarded osteoplasty which utilized the vitallium and plastic cups. Through the courtesy of Dr. Paul Steele of Pittsburgh, who has performed some 20 of these operations during the past 7 months, I have been privileged to examine 8 patients post-operatively. It was pleasant to find these patients ambulatory in from 10 to 15 days, and walking with a cane with full weight bearing on the involved extremity in about three weeks. It is too early to draw definite conclusions concerning further use of this procedure, but there is reason to believe that this method opens a new era in the treatment of this type of pathological lesions of the hip. Time alone will tell whether this head, which acts as a crutch, will remain fixed in its original position or whether it will act as a movable foreign body with the attendant engendered irritation and foreign body reaction which will necessitate its removal. Generally speaking, however, I am of the opinion that best results in those cases will be obtained by prompt recognition of the impending disaster and early fusion of the hip joint by one of the accepted methods.

VASO-SPASM

A third post-traumatic complication is phlebitis and vaso-spasm of the involved part. The phlebitis may be either thrombo-phlebitis or phlebo-thrombosis. In the acute phase of the injury, however, the irritiation may cause marked reflex vaso-spasm with consequent impairment of the circulation. This condition was able described by Ochsner and DeBakey of New Orleans, who published several papers in 1939 and 1940 on the use of paravertebral sympathetic nerve blocks as a suitable method of treatment in cases of edema of the extremities, thrombophlebitis, and other peripheral vascular disease. These authors showed that the formation of edema in these cases was due to a reflex spasm of the venules of the capillary bed and the consequent exutation of body fluids into the tissues at a greater rate than their removal through normally functioning lymphatic drainage. They further established that a decrease of the edema occurred promptly in these cases when paravertebral blocks were employed. After the reports Ochsner and DeBakey, Dr. JohnHenry of Pittsburgh was one of the first to use this procedure in traumatic cases complicated by vaso-spasm. His first case was that involving an open fracture of the lower leg in which there was marked coldness and ischemia with marked constriction of the blood vessels during and immediately following the operation. Dr. Henry immediately turned the patient on his side, gave him a lumbar block, and observed that the involved leg immediately became warm, took on color, and failed to develop the degree of swelling which usually accompanied an injury of this type. When this treatment was called to our attention we remembered having seen similar reactions in like cases where spinal anesthesia had been employed prior to operation. We then started to use paravertebral lumbar blocks in lower extremity fracture cases and were so gratified with the results that we now employ it, not only in fracture cases but in many types of injuries to both upper and lower extremities where we feel that vaso-spasm might be present, excessive swelling might take place, or where we wish to increase the circulation of the part. We have also noted that edema did not occur in those cases where blocks were administered immediately after removal of casts, and that beginning edema in other cases regressed promptly after one or two paravertebral injections. This is in marked contrast to the prolonged period of disability which formerly was common in those cases which became edematous. We have been gratified, immeasurably, in noting that the patients no longer complain of the injured extremity feeling heavy, numb, or sore but say that it feels more like the uninjured member. The general feeling of well-being noted by the patient would, in itself, appear to constitute justification for the use of this technique. I might add that our technique differs from that of the New Orleans group only in that we combine Sarapin with our procaine hydrochloride.

SUDECKS's ATROPHY

De-mineralization of the bone, or Sudeck's atrophy, is still another post-traumatic complication. This type of complication is seen following prolonged immobilization and

is classified as being equivalent to the disuse atrophy seen in soft tissue. In these cases, likewise, we have obtained excellent results with paravertebral blocks supplemented by the use of physiotherapy and manipulation. We wish to emphasize that, in all cases of injury, the care of the soft parts is as important as the care of the bone. The function of the injured part at the conclusion of treatment is the final yardstick by which results are measured, and our aim should be solely to assure the greatest possible function. This can only be accomplished if adequate attention is given to the care of the associated tendons, nerves, and blood vessels, in addition to the care given to the muscles and bones. Early and constant finger or toe motion in the case of immobilized extremities, together with the maintenance of muscle tone by massage and passive or active motion should be kept in mind and utilized.

MANIPULATIVE SURGERY

Where partial or complete impairment of motion has resulted from prolonged immobilization we have resorted to manipulative therapy or physiotherapy to obtain a restoration of function. Manipulative surgery is a branch of medical science which has been little known and largely neglected by American surgeons, but has been developed to a marked degree by our British colleagues, including Smart, Bankart, and others. This form of treatment has been widely utilized in this country, however, by osteopaths and chiropractors, who have obtained gratifying results in many cases where the medical profession had failed dismally. For physicians to belittle these results and dismiss them with a wave of the hand is unjust and does not reflect the true scientific attitude with which all members of the medical profession should approach every problem. Those who adopt an adamant negative attitude toward the results which have been obtained by practitioners outside the medical profession deny the existence of something solely because he refuses to look at it. The good results thus far obtained from manipulative therapy should urge us to further investigation of the common sense factors found in this type of treatment. The British and Dutch, for many years, have had their manipulative experts who are very skilled within this limited field. This phase of medicine has been neglected too long in America and it is our considered opinion that the time has come for us to cease our unfounded criticism and learn more about manipulative surgery. We frequently encounter patients who have consulted 5 or 10 doctors without relief and often without even being given a diagnosis. These individuals have been told that, in many cases, nothing could be done for them. As a rule these have been cases of joint fixation which resulted from prolonged disuse or immobilization. Our experience has shown that, in most instances, these cases can be helped and even cured by physiotherapy and manipulation under anesthesia. We recall the case of a 24 year old youth who was referred to us with a frozen knee so rigid that radiography was necessary to determine whether the ankylosis was bony or fibrous. He was placed on manipulative therapy and, during the ensuing year, received 16 manipulations under pentothal anesthesia. These were supplemented by physiotherapy and in the end a complete restoration of function was obtained. And yet for using such manipulative therapy we have been severely criticized by many of our colleagues! What is wrong? We have with excellent results manipulated thousands of cases and followed them by physiotherapy including deep moist heat, massage, and Smart machine stimulation of the muscles. This procedure has not only restored and rehabilitated most of these patients but has done much to eliminate the majority of neuroses so common in cases of this type.

PHYSIOTHERAPY

With the institution of the Baruch plan of financial assistance there has been a renewed interest in physiotherapy. The result has been that we have had more progress in the past 10 years, based on sound physical principles, than we have had in the previous 50 years. The rehabilitation center at Bellevue Hospital, New York, is outstanding for the progress it has made in this field and should serve as a model for

others to emulate. We should like to call your attention, specifically, to 2 physiotherapy instruments which have proven highly efficacious in the treatment of numerous conditions seen by the traumatic surgeon. We refer to the induction coil, developed by Sir Morton Smart, for graduated muscle contraction; and to the instrument known as "Moistaire", developed by Dr. Murray B. Ferderber in the Department of Industrial Medicine of the University of Pittsburgh School of Medicine, under the stimulus of Dr. T. Lysle Hazlett through a grant from Westinghouse Electric Corporation. The primary purpose of this latter instrument is to produce hyperemia, eliminate edema, and reduce muscle spasm. In these functions it appears to be superior to other forms of heat therapy. Smart's coil is based on sound physiological principles and materially helps to restore normal function in cases of strain, sprain, loss of muscle tone, and allied ailments. Its operation is readily mastered by technicians; in trained hands it is a valuable aid to patient recovery. It is hoped that the recent progress in physiotherapy will stimulate an increased interest among surgeons in this form of treatment and eliminate much of the condemnation which in the most has attended those employing these methods.

LOW BACK SPRAINS

At this point we come to the realization that the head can absorb only as much as the seat can endure. However, we would like to make some brief comments on several other types of trauma, particularly those frequently seen in a large industrial practice. Let us first consider the broad field of low back pain which, in most instances, is due to either acute or chronic sprain of the lumbo-sacral and sacro-iliac areas. In the acute form there is pain, limitation of motion, serous effusion into the muscles of the involved region, and, at times, edema. Our treatment of these cases varies radically from that followed in most clinics where immobilization and fixation is the rule. When first seen, our acute back cases are treated by the injection of 1% procaine hydrochloride and sarapin into the lumbar muscles; followed immediately by deep moist heat, massage, and Smart machine contraction. The patient is then encouraged to employ active motion so as to keep the back mobile. Strapping, belts, or braces of any kind are avoided in these cases, since we feel that the muscle fixation resulting from these supports eventually leads to the development of a "frozen back." A 15 year survey covering 1500 cases of this type in one of our subsidiary companies disclosed only 2 cases which failed to show prompt recovery under the treatment just described. All of these cases were treated at the plant emergency hospital with no "lost time." Obviously, these were muscle or ligament strains which would have developed a prolonged disability had immobilization been employed.

In the chronic type of low back sprain, or "frozen back", there is marked fixation of the lumbo-sacral area of the spine with limitation of motion, muscle spasm, and movement of the spine as a single unit. It has been our practice to treat these cases by manipulation under deep pentothal anesthesia, followed immediately by physiotherapy as previously described. Our results have been most satisfactory and in several thousand such cases we have not only restored function and obtained earlier rehabilitation but also have prevented the development of a large number of neuroses.

Much has been written about Ruptured Discs in recent years and most surgeons are now in agreement that, where this condition exists, the involved disc should be removed. The entire subject is still debatable and our experience with thousands of low back cases leads us to conclude that the condition is of greater rarity than some of our colleagues would have us believe. Aitken has shown a high incidence of unnecessary operations for this condition with correspondingly unsatisfactory results. Compensation court experience has shown that laborers subjected to this operation were seldom able to return to their former work. The question of whether or not fusion should be

performed often arises in these cases. Personally, I prefer not to fuse the back unless there is a specific indication for doing so, because there is a high incidence of failure in this particular operation.

While on the subject of low back trauma I want to say a few words about the layman's allusion to dislocated sacro-iliac joints. This concept has been popularized by repeated statements on the part of chiropractors and osteopaths that "a vertebra is out of place," "out of line", or "the sacro-iliac joint is out of place or dislocated." Observation of many cases of pelvic injury, however, has shown that the pubic rami, the sacrum, or the ilia, fracture before dislocation of the sacro-iliac joints occurs. In the few instances in which this type of dislocation was seen none of the patients were ambulatory.

POST-CONCUSSION SYNDROME

We cannot leave the subject of trauma without some discussion of head injuries. Much has been written and said about the management of acute concussion, but the general surgeon knows little about the disabling aftermath known as the post-concussion syndrome. My interest in this subject was aroused in 1929, when Penfield reported on a series of cases in which headache disappeared following pneumoencephalograms which had been made on suspicion of possible brain tumor. In the past 20 years we have treated with exceptionally excellent results over 300 cases of post-concussion syndrom with spinal air injection. Only 4 or 5 of these patients required a second or third injection and a great majority of those patients returned to their regular work with no evidence of impairment. Recently, we have resorted to the use of stellate ganglion block in mild or early post-concussion syndrome cases. This was an accidental discovery arising from one of our post-concussion patients complaining of protracted headache and fullness in the head following the spinal air injection. A stellate block which was performed in an attempt to improve cerebral circulation, produced a complete remission of symptoms. This procedure was subsequently tried on eight other cases which were considered too mild to warrant spinal air injection. In each case the patient stated that he "felt fine" shortly after receiving the block and showed complete remission of the syndrome within a week to 10 days thereafter.

ANESTHESIA - PLASTIC SURGERY

In conclusion, we would like to pay tribute to the recent developments in the field of anesthesia and the progress made by anesthesiologists in reducing the incidence of shock. As a result of this progress the surgeon is able to institute definitive treatment earlier, and so materially shortening the period of recovery. We are frequently able, at the time of the original treatment, to convert open into closed wounds, even with the utilization of plastic procedures. In our own clinic we do not hesitate to use skin grafts or skin flaps in carrying out this conversion. We have found that they not only take successfully but, in addition, hasten the convalescence. In cases of open fracture they prevent exposure of the bone with consequent drying and flaking of the exposed cortex. In those cases where closure cannot be carried out immediately, plastic procedures, such as the grafting of skin on granulating areas, are employed, or secondary excision of the wound, with subsequent closure, is performed.

It has been extremely interesting and pleasant to have practiced surgery during a period that is marked by an almost complete disappearance of the objections to the open reduction of fractures. This opposition to open reduction was probably spearheaded by the attitude of Sir Robert Jones, of London, and Dr. Fred Albee of New York,

although neither one had ever used a steel plate or bone screw. There is little doubt that their eminent positions and strenuous objections retarded the acceptance of the operative treatment of fractures for 25 years. I recall my medical student days when we were informed that the treatment of fractures by open reduction would border on mal-practice. How times have changed! Today, we might consider the surgeon who fails to employ this technique where too obviously indicated almost equally guilty of the same charge.

Tonight, I have attempted to review some thoughts and observations on trauma, based on my experience in this field during the past 30 years. Although many of these are truths laid down by my predecessors, they have been correlated largely through the efforts of the Committee on Trauma and have been adopted as standards of procedure in our particular clinic. It is my sincere hope that the observation of these old and proved principles by the new generation of surgeons will stimulate their continued interest over the next 30 years and reveal to them many other obvious truths which we have missed. I trust that they will "take up the torch" and continue the advancement of surgery toward a more adequate treatment of trauma and the complete elimination of infection.

It has been an honor to have had your attention this evening.