The New England
Journal of Medicine

Volume 242 MAY 18, 1950 Number 20

ANNUAL ORATION

SAFE MANAGEMENT OF FRACTURES*

JOHN W. O'MEARA, M.D.†

WORCESTER, MASSACHUSETTS

A REVIEW of the titles of previous orations indicates that fractures were first discussed by an orator of this society in 1840. The speaker was A. L. Pierson, M.D. His must have been a sturdy audience if he read all that was printed, amounting to seventy-three pages of narrative and twenty-four additional pages combining case reports and fracture statistics of the period 1821 to 1840 from the Massachusetts General Hospital.

Referring to treatment, the speaker made the following remarks:

> It is the duty of every good surgeon at all times to wait upon nature. But more especially is this true of the treatment of fracture, where all that art can do is to effect the coaptation of divided parts and guard against accidents. The rest is purely a natural process, which receives no aid from art.

(The late Dr. Nathaniel Allison, of Boston, discussing a very lengthy paper along similar lines, confined his remarks to the single phrase "Ain't Nature grand?")

For intracapsular fracture of the hip Dr. Pierson recommended following the advice of Sir Astley Cooper that "the patient be made as comfortable as can be and the fracture left to its fate." The speaker concluded "I have thus completed a practical sketch of the subject of fractures, the difficulty of compressing which into a moderate space I did not at first appreciate; and I should much regret if, in laboring to be brief, I have become obscure."

Five years later, Orator William J. Walker, M.D., presented an address entitled "On the Treatment of Compound and Complicated Fractures." This material also was published, the narrative filling forty-four pages supplemented by fifty-six pages of finely printed case histories, a total of one hundred pages, or more than three hours' reading time.

*Presented at the annual meeting of the Massachusetts Medical Society, Boston, May 16, 1950.

†Orthopedic surgeon-in-chief, Worcester City Hospital; orthopedic surgeon, St. Vincent Hospital.

In the fifth century before Christ, Greek physicians, among them "that astonishing old genius Hippocrates," were using rest, reduction by traction and external splinting in the management of fractures.

In the course of a sojourn in Asia Minor some thirty years ago, I heard several times of a curious method used by desert Arabs for treatment of fractures of the lower extremity. I have not seen it recorded. The patient remains where he fell. A hole of proper dimensions is dug in the sand beneath his buttocks, and clothing between it and the excretory apertures is removed. The injured extremity is cradled comfortably. If the digger has made a nice estimate, the fracture should be healed and the hole filled at about the same time.

There was nothing in either of the orations of a century ago to suggest remarkable improvement over much older technics.

A CENTURY OF PROGRESS

For a hundred and five years nothing more has been heard about fractures from an orator of this society. I do not propose to fill the gap in detail but shall mention a few facts, names and dates for orientation.

Ether was first used in public as an anesthetic for an operation on October 16, 1846, at the Massachusetts General Hospital. Between 1850 and 1860 skin traction in the form of Buck's extension, and plaster of Paris for splinting, came into fairly common use. In 1867 Lister's monograph on antisepsis, much of it based on study of compound fractures, was published. In 1888 surgical instruments were sterilized by boiling, and the era of aseptic surgery had opened. Hugh Owen Thomas (1843 to 1891) devised the splint that bears his name, and many others. Roentgen described x-rays in 1896. Great improvement in equipment has been made in recent years. That boon to cartoonists, the frame

over the bed, to support balanced traction, is called the Balkan frame because it appeared during the Balkan War of 1903. Skeletal traction by means of the Steinmann pin or Kirschner wire dates from 1909. In 1910 Sir Arbuthnot Lane came to this country to talk about open reduction and internal fixation of fractured long bones by means of the Lane plate. F. H. Albee, who devised a bone-grafting operation for Pott's disease in 1911, found hand tool methods crude, requiring too much time, tiring the surgeon and unnecessarily shocking the patient. He devised an electric operating set, run by a small universal motor. "Splint 'em where they lie" was a slogan of World War I. Thereafter, to the present day, the Committee on Fractures of the American College of Surgeons has worked unceasingly to improve the transportation of injured persons, particularly of those with fractures. During and after World War I surgical shock was studied intensively. Means to combat it were developed and improved in World War II. The Carrell–Dakin method of managing compound fracture had a brief vogue, followed shortly by the Orr method, popularized later by Trueta in the Spanish Civil War and used widely everywhere between the two world wars. In the ten years following War I, Böhler, of Vienna, had a good bit to say about management of fractures, recommending, among other changes, the unpadded cast. In 1924 Russell described his widely used system of traction. Effective chemotherapy began with sulfonamides in 1935. Penicillin, streptomycin and aureomycin followed. Great strides in the art and science of anesthesia have been made. Spinal anesthesia, attempted sporadically since the turn of the century, has finally attained a secure place.

Twenty-five or thirty years ago much of the metal used for internal fixation of fractures came from the hardware store. Broken plates, loose and broken screws and unfortunate consequences were common. From that unhappy day we have come far. Before he left the Massachusetts General Hospital about fifteen years ago for an assignment in New York, Philip D. Wilson had enlisted the interest of the National Bureau of Standards in our hardware problems. Venable and Stuck soon afterward reported that electrolysis was "the controlling factor in the use of metals in treating fractures."

A paper by Leonard T. Peterson entitled "Fixation of Bones by Plates and Screws" in the *Journal of Bone and Joint Surgery* for April, 1947, summarized knowledge and practice up to date.

To me personally, the most stimulating paper of this period was that of Smith-Petersen, Cave and Van Gorder, published in 1931 in the *Archives of Surgery*, on the treatment of intracapsular fractures of the hip by internal fixation. Each winter before that since I had been in practice, I had looked with dismay at a ward full of about thirty old women with broken hips, buried in plaster spicas. They were a miserable, unhappy lot. Any measure to improve their condition was welcome. Dealing, as we did, largely with patients from the lowest economic and social levels, in the wards of a municipal hospital, the operation as proposed was too formidable for safety. It soon occurred to me, as it did to others, that if the operation could be made simpler and safer, much suffering might be eliminated. My contribution was "Blind Nailing," presented in 1934 to the New England Surgical Society and in 1935 to the American Academy of Orthopaedic Surgeons. Several other surgeons had previously described methods simpler and safer than the original. Open reduction, with its attendant hazards, was quickly supplanted by blind nailing, by that and other names. Internal fixation of the fractured femoral neck by one instrument or another, without open reduction in nearly all cases, is now standard procedure among fracture surgeons.

External skeletal fixation in the treatment of fractures was tried and discredited for the first time nearly a hundred years ago.

In 1921, here in Boston, where he was guest of honor at a meeting of the American Orthopaedic Association, Vittorio Putti, of Bologna, one of the world's great orthopedic surgeons, described informally the apparatus he was using for leg lengthening. It was a modification of the method previously employed by his chief, Codivilla. In the same year a paper by Putti, reporting 10 cases, appeared in the *Journal of the American Medical Association*. Not many years afterward, Abbott modified Putti's apparatus, increasing the number of transfixion pins from two to four. Anderson, Stader (a veterinarian) and Haynes, still later, applied the Putti and Abbott principles to the treatment of fractures, each devising modifications of the Abbott leg-lengthening apparatus. All these have appeared in the last fifteen or sixteen years. Stader's splint, devised for animals, particularly dogs, was adapted to human beings and used in a considerable series of well managed fractures at Bellevue Hospital shortly before the United States entered World War II. The war provided a tremendous opportunity to try again on a large scale the methods of external skeletal fixation. Its scope and particularly the Navy's participation in it required that fractures, especially those occurring at sea, be treated under unusual conditions and, unfortunately, often by physicians with little previous experience. In the unusual circumstances of naval warfare external skeletal-fixation splints were widely used where simpler and safer methods might have been chosen under different conditions.

Intramedullary fixation in the treatment of long-bone fractures came to public attention in this country through a somewhat dramatic story in a national magazine about 1942. An American soldier, released from a German prison camp after

having sustained a fracture of the femur, came home with the fixation instrument in the bone. He had been treated without a cast or other external splint and had been walking since the operation. Küntscher had described the method in Germany in 1940 and devised the rod that bears his name. The medical literature reveals that intramedullary fixation of the clavicle had been carried out in France as long as forty years before. After the war the method was taken up in this country. MacAusland reported 7 cases in *Surgery, Gynecology and Obstetrics* in January, 1947, and further reports have appeared in abundance.

Among the technical exhibits at medical meetings, the tools are displayed and attract maximum attention. At the moment, this is the spectacular way of treating a fracture.

Management Today

The methods of fracture management a century ago have been referred to and compared briefly with primitive practice. Differences are not remarkable. Some of the enormous contributions of the last century have been mentioned. No doubt many others equally deserving have been omitted.

Here now is our overflowing kit of tools. How shall we use them in the best interest of the patient? Do we need less knowledge of the basic sciences — less skill, judgment and experience? Do our newly acquired diagnostic aids of the laboratory and the x-ray department make history, physical examination and the use of our senses unnecessary? Does each new surgical gadget render its predecessor obsolete? Does the gun replace the man behind it?

The treatment of fractures has become more exacting and complex than ever. With new tools have come new standards. Our end results are seen and critically examined not only in the hospital and by the attending surgeon but also by his professional associates and, in cases involving workmen's compensation or tort, by other physicians, lawyers, the court and often the patient himself. The management of fractures now involves so much responsibility and perhaps risk of malpractice suit that many physicians prefer not to become involved.

It is clear that the trend is toward more and more surgical management. Is that good? Surely it should never be said, paraphrasing Bick, that the only excuse for surgery is the surgeon's enthusiastic desire to practice his craft. I recently heard a young surgeon's mother say of her son "he is only happy when his hands are in someone's belly." Also, recently, I heard of a resident, nearly ready to start practice after many years of training in surgery, who upon reporting to his superior on a child with fractures of both bones of the forearm and being asked what he would do about it, replied that the only treatment he would be competent to carry out would be open reduction and internal fixation of each bone. Sir Robert Jones said that of many thousands of fractures of both forearm bones, he could remember not more than a dozen on which he had to operate.

Is it not a responsibility of those who teach fracture management to resist eager surgeons, reckless enthusiasts and the pressure of instrument salesmen?

The treatment of fractures is not limited to a few experts. It has been estimated that the number of fractures occurring in this country annually now is between 1,000,000 and 1,500,000. If the patient will permit it, any physician with a license to practice may treat a fracture, any fracture, and by any method he sees fit to use.

Let us not forget that open management of any type is more hazardous than closed and that the consequences of error may be tragic.

Who knows how many patients with simple fractures of the leg, treated by open reduction and internal fixation, have or have had chronic osteomyelitis, delayed or absent union, stiff or partially stiff and painful ankles? The large clinics report some figures, but everybody is doing it. What are the average man's statistics?

Nor are infection and osteomyelitis the only hazards. Multiple wires in the foot or hand may produce exceedingly painful and disabling osteoporosis, without infection. Nonunion may result from distraction, easily accomplished by direct traction on bone.

Treatment of a fractured neck of the femur by internal fixation is well established and without doubt represents one of the striking advances in the field of fracture management. Before the discovery of this method and under the most favorable conditions, fracture of the neck of the femur healed in approximately 3 cases out of 10 — under average conditions, in probably not more than 1 in 10 cases. Internal fixation, well done, improved the incidence of union to 75 per cent.

This, then, is a method of operative treatment that is justified in capable hands. It is the safest method for handling this particular injury. The penalty for error averages less than that for closed methods.

Does that hold true, however, for intertrochanteric fractures? I mean the fragmented type, not the fracture close to the base of the neck with a solid trochanteric mass that can be nailed in the way that a fracture of the femoral neck can be nailed. By any method of treatment nonunion is practically unknown. The difficulty here is to avoid shortening.

Open reduction and internal fixation of this fracture represent much more of an undertaking for patient and doctor than the same treatment of a fracture of the femoral neck. The patient averages nearly ten years older, his degenerative processes are farther advanced, his activities were probably restricted before the fracture occurred, his bones are brittle and his fracture is in multiple fragments,

some of which may not have been demonstrated on the preoperative x-ray examination.

To reassemble this jigsaw puzzle of broken bones in a field of blood requires a large incision, liberal instrumentation and a formidable mass of hardware. Statistics have appeared from a few large fracture clinics claiming that it is the best method. It may be, in some circumstances, but what of the cases not reported? Let us not forget that many an excellent result has been obtained in the past by carefully tended skin traction and good nursing. That method is as good now as it ever was. The management of an elderly patient in traction is not spectacular but it is fairly safe.

Let this not be a decision in which the excuse for surgery is the enthusiastic desire on the part of the surgeon to practice his craft.

Delayed Reduction

The average patient thinks of a fracture as an emergency. He heads straight for the nearest hospital and often prefers the resident on the job to the visiting man who will be there in the morning.

The method of delayed reduction practiced by J. R. Moore at Temple University Hospital for eight years and in more than 7000 cases should be better known. His plan for handling fractures is as follows:

> In the first place, all patients are examined immediately for nerve and vessel injury and for such complications as head, spinal-cord and internal injuries. The treatment of these major problems is instituted immediately by the department concerned.
>
> Secondly, all fractures of the long bones are immobilized immediately in plaster-of-Paris splints that routinely include the joint above and the joint below.
>
> Thirdly, roentgenograms are taken at the convenience of the roentgenographic department, either immediately or on the following day.
>
> Finally, one day a week is set aside for the reduction of fractures.

In reporting upon this method Moore concluded as follows:

> The reduction of fractures may be delayed. The ideal time for delayed reduction is between the fourth and eleventh day. Complete immobilization in plaster should precede delayed reduction. Compound fractures [with exceptions which he noted], simple dislocations, compound dislocations and fractures complicated by nerve or vessel injury should be regarded as emergencies. The time required for repair in the group of delayed reductions would seem to date from the time of fracture, rather than from the time of reduction, since additional delay was not observed. Union and function appear to be unhampered. Delayed reduction provides the opportunity for excellent teamwork. The best trained individuals are readily available for all purposes. The patient is adequately prepared for anesthesia. . . . If teams which provide well-trained supervision are available for immediate reduction, immediate reduction should be done. In localities where well-trained supervision is not at hand, it would appear that delayed reduction is by far the better procedure. . . A well-supervised delayed reduction is better than a poorly supervised immediate reduction.

Intramedullary Fixation

At a medical meeting here five months ago a well informed and very enthusiastic young man spoke about intramedullary fixation. He described many patients he had managed by this method. He had treated each long bone, including phalanx, metacarpal, radius, ulna, humerus, clavicle, femur, tibia, fibula and metatarsal. The nails were introduced by open operation. He stated that intramedullary canals vary in diameter from patient to patient, from bone to bone and in different segments of the same bone. He also said that the nails often become incarcerated so that they can neither be driven in farther nor extracted, without special equipment and great difficulty. He added that at least $600 worth of nails of various sizes and shapes should be in any beginner's kit.

Three months ago, among the technical exhibits at the meeting of the American Academy of Orthopaedic Surgeons in New York, were several instruments for intramedullary fixation and tools ancillary thereto. An "intramedullary outfit" was shown.

The immediate future looks ominous. The havoc wrought among servicemen of World War II with instruments for external skeletal fixation may be the lot of civilians with intramedullary fixation.

The method may have some merit. The Fracture Committee of the American Academy of Orthopaedic Surgeons reported upon it in February, 1950. Dr. Herman F. Johnson, committee chairman, was kind enough to lend me a copy of the report, as yet unpublished. The following is quoted:

> For those who may be on the fence about proceeding with this technique for fresh fractures of the femur, we offer the following statement: given the proper indication, intramedullary fixation is the most effective form of therapy for many fractures of the shaft of the femur. That statement must now be diluted a bit. This technique if applied to improperly selected cases, or if inefficiently or unskillfully carried out, offers more intriguing possibilities of trouble than any other. Most of us have had at least one unhappy, though not necessarily catastrophic experience.
>
> Probably the most common error consists of inserting a pin that is either too long, too short, too big or too small. A pin tightly lodged or impinged in an intramedullary canal may develop into a very chastening experience. A short or loose pin provides inadequate fixation. For these reasons, intramedullary fixation of the femur necessitates considerable planning, pre-operatively. There is no formula for the size of a canal in relation to the length of the bone.
>
> Local complications are bound to occur in this technique, particularly bent pins, migration of pins, distraction of fragments, insecure or incomplete fixation, and the complications that may be attendant upon any technique that requires exposure of bone.

The entire report is too long for quotation here. No bone but the femur was reported upon. In

general, the authors, expert orthopedic surgeons, appear to view the method with some favor. For me, their recital of errors and complications dilutes this "most effective form of therapy for many fractures of the shaft of the femur" considerably more than "a bit."

If it can be safely used to ease the pain and assure a comfortable outcome in injuries hitherto difficult to manage, such as pathologic fracture of the femur, and by surgeons who are willing to learn in detail and in advance the anatomic vagaries of the intramedullary canal in old and young, long and short, knock-kneed and bowlegged; and who will report in detail and with complete candor, something may eventually come of the method. It should not be regarded as an opportunity for reckless enthusiasts who like to practice their craft.

Conclusion

In conclusion, the increasing trend toward surgical management of fractures is recognized. Three major surgical means are available to all. Best established is open reduction and internal fixation or, in occasional situations such as the femoral neck, closed reduction and internal fixation. External skeletal fixation has been mentioned. Last and presently most glamorous is the method of intramedullary fixation.

In a presidential address to the American Academy of Orthopaedic Surgeons, Dr. A. B. Gill, of Philadelphia, remarked, in substance, that to treat all fractures by any special apparatus as though that supplanted use of head and hands is both ridiculous and futile. He also advised the study of principles rather than methods and added "a mind that grasps principles will devise its own methods." In Campbell's *Textbook of Operative Orthopedics* is the statement that "the majority of fractures may be reduced by closed methods; surgery should never be recommended unless definitely warranted."

Sir Robert Jones, the most revered teacher and practitioner of orthopedic surgery of this century, stated that nonoperative methods give a high percentage of good results even when exact reposition is not obtained. He said also that nonoperative treatment by a surgeon who understands body mechanics is always more successful than operative treatment by a surgeon who neither knows nor cares much about the functions of a limb. Advice such as this is too good to be forgotten.

To the patient the major calamity associated with a broken bone is that he has lost its function. The major job of the doctor is to restore that function quickly and completely if he can but, by all means, safely.

In writing the foregoing, I have no doubt employed phrases or even sentences, some recently seen, others long remembered, the sources of which are forgotten. Obligation to the authors is acknowledged.

For the honor and privilege of delivering the one hundred and forty-sixth oration, I am deeply grateful.