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Fractures in Children

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William A. O'Brien

I. LAST WEEK

Date: April 29, 1938

Place: Nurses' Hall
Recreation Room

Time: 12:15 to 1:20

Program: Movie: "Popular Science - No. 2."

Obstetrical Report - 1937
C. E. McLennan
M. T. Mitchell

Discussion: C. E. McLennan
J. C. Litzenberg
J. L. Rothrock

Present: 121

Gertrude Gunn,
Record Librarian

II. MOVIE

Title: "Tips for Lazy Husbands"

Released by: The Household Finance Corporation

III. GOSSIP

The annual Medical Technology dinner, held at the Minnesota Union last night, attracted 275 diners. A skit by the students, a song by the trio, including Mary Lohmann's Medical Tech song, written to the tune of "Georgia Tech" - a welcome by Dean Diehl - a reply by "Father" Hovde - intimate views of students and faculty at work and at play by Lillian Willisima - and a tour through Mexico with Parasitologist Thomas B. Magath - made up the program. Tour conductor Magath, with chief emphasis on the non-scientific phases of a scientific exposition into the dense forests of Chapas, delighted his audience with his photography and wit. Some of his stories and experiences will remain favorites for a long time. His travelogue was the climax to another one of those interesting dinners which the Medical Techs always have. As in the past, Orbs sponsored and planned the dinner.....Jennings Crawford Litzenberg appeared mighty pleased with his graduating present in the form of a report of the Obstetric Service for 1937. Drs. McLennan and Mitchell deserve credit for their splendid presentation, and the Service for making it possible.....Radiologist-on-leave Leo George Rigler is now radiologist-at-work following his return from California, where he spent six months on sabbatical leave. Dr. Rigler had time to finish his opus which is now going through final proof correction. When published, it will represent a combination of his famous ourline plus illustrative material.....The Institute on Proctology is in session this week at the Center for Continuation Study. One of the first exclusive affairs, with a rigid enrolment limit of 16, it is being well received. 52 physicians attempted to enroll for the 16 places. The next institute will be from June 6th to 11th, in Diagnostic Radiology. With a fixed limit of 40 students, applications have been rejected for some time. This will be Course No. 14 since the opening of the Center in January 1937. It is planned to offer work this summer in electrocardiography, allergy, a second session in proctology, and another in a medical subject. Through a strange coincidence, many of the courses next year will be held the same week with a good home football game.....It will not be much longer before school activities for the year will be over. We ask for your continued support during May, after which the meetings will recess for the summer months. It is a little early to brag, but it seems as if things have never looked better.

IV. FRACTURES IN CHILDREN

Wallace H. Cole
Edward T. Evans

1. FRACTURES IN CHILDREN
(University of Minnesota Hospitals Cases)

Fractures in children can, in general, be viewed in much the same way as adult fractures but there are certain types and some features which are peculiar to infancy.

The main features which are peculiar to ordinary fractures in infants and children are:

(1) Rapidity of healing

The time for consolidation is much shorter than in adults and in two weeks many fractures are clinically solid, which does not mean, of course, that all protection can be done away with in that time.

(2) Excessive callus formation

Commonly seen in children and probably due to easy stripping of a very active periosteum, may simulate new growth. Always absorbs to normal size bone.

(3) Rapid reaction to the laws of growth and bone architecture

These laws show in brief that in addition to an inherent sense of form in a bone, this tissue also reacts to the strains and stresses placed upon it, and what we call the normal shape of any particular bone is the result of the action of these laws all working together. In children the tendency for a mal-united fracture or deformed bone to assume its normal shape is so active that many fractures can be allowed to heal in far from perfect position rather than resort to the operative reduction which might be necessary in an adult, as the end result will be a normally shaped bone in most cases. Many distressing results have been caused by poor bone surgery because these facts were not recognized and a cabinet-maker's job of reduction was desired.

(4) Fever

A marked symptom at times in children due probably to the rapid absorption of the hematoma.

The fractures which are peculiar to infancy are:

(1) Obstetrical fractures (so-called)

These fractures occur during delivery and affect the clavicle, humerus, and femur more often than other bones. They are due to the maneuvers necessary during delivery and are usually found in mal-positions and disproportions between size of child and pelvis. (None reported in this hospital in review from 1926). These fractures are usually subperiosteal and transverse. Pain, swelling and abnormal motion are present with lack of active movement of the part which must not be confused with paralysis. Fever usually accompanies the lesion.

Treatment

The simpler the better. The fractures heal very rapidly and usually are solid in 10 days to 2 weeks although at times 3 weeks' fixation is necessary in the femur.

Clavicle: Simple figure of eight bandage or adhesive strip to hold shoulder back and up can be used. Results good with no treatment but baby more comfortable with fixation.

Humerus: Card-board splints of coaptation type with the arm bound to chest wall may be sufficient or a triangle may be constructed of the same material. The skin must be carefully watched for irritation, etc.

Femur: The classical treatment is to bind the extremity with knee extended to the abdomen and chest, the

so-called fetal position, not as uncomfortable as it looks and results satisfactory. A miniature Thomas splint can be used with success and a simple gutter splint running up onto the back gives perfect results if properly applied.

(2) Fractures in fragile bones (Osteopsathyrosis, osteogenesis imperfecta, etc.)

Cause of underlying condition not known and importance lies in recognition of basic pathology.

(3) Congenital bowing of tibia and congenital non-union.

A peculiar condition of localized dystrophy in one tibia and fibula, cause unknown, where a bowing is present at birth as a rule but where fracture may already be present. If bowing is corrected non-union occurs. Not to be confused with simple birth fracture.

(4) Greenstick Fractures

A common fracture where a long bone is broken only part way through, the rest being bent to a deformed position. These are easily treated, the only precaution being to prevent complete breaks while reducing.

(5) Subperiosteal Fractures

These are complete fractures, unlike greenstick ones which are incomplete, with no tearing of the periosteum. Occur in rachitic children mainly.

(6) Epiphyseal separations

These are, of course, confined to children up to the age of disappearance of epiphyseal lines. The separation occurs between the cartilagenous disc and the metaphysis and may be accompanied by a fracture of the metaphysis. (Discussed more fully later on).

Analysis of 169 fractures in children up to 15 years of age in this hospital, including epiphyseal separations but not including fractures of the ribs or skull, shows nothing unusual. The results so far as known, but without making an accurate follow-up study, are, in general, excellent. Although many fractures that are sent in to the hospital are those where the local physician has not been able to get a proper reduction or result, it is interesting to note that 68 of our series were seen on the day of the fracture and 27 more the day following the injury.

Fractures of the femoral shaft and lower end of the humerus predominated, there being 41 of each. Of the femoral fractures 3 were operated upon, 1 on account of a solitary cyst underlying the fracture. Only 4 were treated with skeletal traction, the rest with simple adhesive plaster traction. The percentage of skeletal traction cases will undoubtedly increase in the future as we are starting to use it more freely and the above 4 are more recent cases. (See later notes.)

The fractures of the lower end of the humerus which gave the best results are those treated conservatively. Wire traction was used 3 times and open reduction 4 times in the recent cases. It is our impression that open reduction has caused greater limitation of motion than closed even with better anatomical reposition. The excessive stimulation of new bone probably accounts for this. (See later notes.)

There were 23 forearm fractures, of which 9 were operated upon. The results were all good. Routine is open reduction if manipulative treatment is unsatisfactory. Traction with wire or pins has not been used here in children. Of the 12 humeral shaft and 11 radial shaft fractures, 3 of each were operated upon for reduction. The others were treated by traction or fixation in plaster.

Summary

Fractures in children can be treated with more conservatism than in adults for poor immediate and anatomical results are usually corrected by the action of the laws of bone growth. This does not mean that every possible conservative means should not be used to get fragments in good position but it is a reason for not resorting to open reduction unless absolutely necessary. An exception is fracture of both bones of the forearm where cross union can occur and radical measures are frequently needed to prevent it.

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2. ELBOW FRACTURES

(Fractures of the Lower End of the Humerus)

To understand and treat these fractures properly it is absolutely necessary that the anatomy of the parts involved be thoroughly understood.

The lower end of the humerus flattens out in an antero-posterior direction and broadens out toward the 2 sides, the supracondylar ridges on the sides of the lower end of the shaft running down to terminate in the internal and external epicondyles respectively. The extremity of the bone is furnished with 2 articular surfaces, the capitellum and the trochlea, the former being a rounded eminence to articulate with the head of the radius and the trochlea a grooved surface with prominent edges in which the ulna articulates. These, with the epicondyles, form the condyles and are placed at an angle of about 85° with the shaft, thus accounting for about one-half of the carrying angle of the elbow, the other half being, of course, due to obliquity on the ulnar side of the joint. Viewed from the side, the lower end of the humerus is club-shaped and inclined forward so that in adult life about two-thirds of this end lies anterior to a line bisecting the shaft of the bone, while in children up to nine or ten years of age the entire capitellum lies anterior to this line. Just above the capitellum and trochlea anteriorly are the radial and coronoid fossae and posteriorly, opposite to these, is the olecranon fossa. The capsule of the elbow joint is attached anteriorly just above the articular margin but posteriorly it is continued upward so as to envelope the olecranon fossa. On the sides it is attached near the bases of the epicondyles. The external epicondyle is the site of the origin of the common tendon of the extensor muscles of the forearm, while on the internal epicondyle is found the origin of the common tendon of the flexor muscles and the pronator radii teres. The ulnar nerve runs in a groove on the posterior surface of the internal epicondyle and is in close relation to the bone at this point.

Ossification of the lower extremity of the humerus develops from 4 centers, the first to appear being that for the capitellum during the second and third year. Extending upwards this center forms the outer half of the trochlear surface, the center for the inner half not appearing until the tenth to twelfth year. The center for the internal epicondyle appears about the fifth year while that for the external epicondyle is not present until the twelfth or fourteenth year, when it rapidly joins the capitellar center. The internal epicondyle unites as a rule separately to the diaphysis, while the other three centers form the lower epiphysis. This unites to the shaft during the sixteenth to seventeenth years but sometimes earlier.

The fractures of the lower extremity of the humerus may be divided into: Supracondylar, transverse dicondylar, those of the external and internal condyles, "T" or "Y" fractures (the so-called intercondylar), epicondylar and epiphyseal separations.

The supracondylar fractures are the common elbow fractures in children and are due either to: (1) a fall on the outstretched hand; (2) less commonly, a fall on the point of the flexed elbow; (3) more direct injury with the elbow extended. With these fractures there is always more or less displacement of the distal fragment. Following falls on the outstretched hand there occurs the so-called "extension type"

of fractures with the distal fragment displaced backward and the line of fracture oblique, running downwards and forwards. In the less common type due to falls on the flexed elbow we encounter the "flexion type" of fracture with the obliquity in the opposite direction and the fragment displaced forward. This latter fracture is the usual one in adults while the former is the common one in children. In both types of fracture the periosteum is frequently stripped for some distance from the shaft of the bone and the fragment rotated inwardly and displaced to the lateral side. This displacement of the fragment is due to the fracturing force, the direction of the line of fracture, and the pull of the biceps, triceps, and brachialis anticus. Supracondylar fractures are never impacted and usually cause some distortion of the carrying angle. Although nerve injuries are not the rule with this type of fracture, the radial, and, less commonly, the median nerve may be involved and for this reason an examination should always be made for such injuries before any treatment is undertaken. The pulse and circulation should also be investigated on account of the liability to injury of the adjacent blood vessels. Although Volkman's contracture can not be discussed here it is an ever present danger in these cases and must always be kept in mind.

With transverse dicondylar fractures we find that the etiology is practically the same as for the supracondylar type, especially a fall on the extensor surface of the forearm. With this fracture there is a transverse line passing through the olecranon fossa which, of course, makes the fracture intra-articular and causes a hemarthrosis. The displacement of the fragment is usually slight but may be in any direction and the fragment also may become impacted.

Fractures of the external condyle, which are more frequent than those of the internal condyle, are due to a fall on the hand with the force directed upwards through the radius to the capitellum or to a fall on the inner aspect of the olecranon with the elbow flexed and the force transmitted outward to the external condyle. More rarely this fracture may be caused by direct injury to the outer side of the elbow and extended forearm with the pulling off of the external condyle through action of the external lateral ligament. In this fracture the line passes obliquely upward, separating as one piece the capitellum, the outer edge of the trochlea, and the external epicondyle from the rest of the bone. The fracture is rarely impacted and the fragment is usually displaced upward, outward and forward and is frequently rotated. As the result of the displacement there is a distortion of the joint line and an irregularity of the joint surface and therefore a change in the joint axis and carrying angle. Of course, this fracture is also intra-articular.

Fractures of the internal condyle are usually due to direct violence such as a fall on the flexed elbow, the force being transmitted through the olecranon to the internal condyle. This fracture also sometimes accompanies posterior dislocation of the elbow. The line of fracture runs from the center of the trochlea obliquely upward to above the internal epicondyle. The fragment may be displaced in the same general way as the external condyle in its fractures and this displacement leads of course to a loss of the carrying angle.

"T" or "Y" fractures are distinctly an adult injury and are only rarely found in children. The damage is very great as the condyles are broken off and frequently comminuted. There is no typical displacement of the fragments but they may be rotated or twisted out of place in any direction. There is always a marked disruption of the elbow joint and frequently marked involvement of the soft parts.

Fractures of the epicondyles, both internal and external, are due to direct injury or to hyper-abduction or hyper-adduction of the elbow joint.

Fractures of the internal epicondyle are the more common, but, as displacement of the fragments is never great, the lesions are not important. With involvement of the external epicondyle the line of fracture may be intra-articular, as the capsule is inserted well up towards its apex.

Epiphyseal separations may occur up to the time of their union with the shaft but there is no typical displacement and they are relatively unimportant. Etiologically they are due to the direct or indirect forces mentioned under the various fractures. The capitellum may alone become detached at times with marked displacement even up to complete rotation. This latter lesion is one of the common causes of delayed ulnar nerve palsy.

The diagnosis of the various types of fractures of the lower end of the humerus may not be difficult if the cases are seen early before any marked swelling has masked the findings. The distortion of the joint, the change in the carrying angle and the points of tenderness are the important factors. The radiograph, of course gives one the final accurate diagnosis and all cases should be examined with the X-ray taken in at least two planes.

The treatment of fractures of the lower end of the humerus involving the elbow must be directed toward the restoration of the normal anatomy with special attention to the preservation of the clubbing of the lower end of the bone and the carrying angle. To accomplish the proper result the fragments must first be reduced and then a dressing applied which will hold them in the right position while healing is taking place. With the fragment displaced posteriorly the manipulation should consist of traction, hyper-extension of the elbow with angulation at the site of fracture, slipping forward of the fragment by direct pressure, and then acute flexion of the elbow. The degree of supination or pronation may be a factor in holding fragments in alignment. If this procedure can be done under the fluoroscope the replacement of the fragment can be more accurately determined but this fluoroscopic examination is much more important where the fragment has been displaced anteriorly. Rarely open operation with reduction of the fragment and internal fixation is necessary, but this usually results in definite limitation of motion later on. A wire through the olecranon with traction may work better. If the forearm is accurately flexed into such a position that it lies directly on the arm the carrying angle is preserved and no marked deformity of the elbow can result. The position of acute flexion should be the one of choice for all the fractures mentioned unless there is some distinct contra-indication as shown by interference with the circulation or displacement of the fragment. Unfortunately these contra-indications are frequently present and the surgeon can only approximate the ideal. To hold the arm are several types of dressings which can be used. The most common of these are: (1) hyperflexion bandage with the wrist tied to the neck; (2) the lateral hyperflexion plaster of Paris dressing; (3) the posterior moulded plaster of Paris splint with fixation of the shoulder if necessary; (4) the collar and cuff attachment of Jones, and (5) adhesive plaster strapping. These dressings should be kept on for about two and one-half to three weeks after which a simple collar and cuff or ordinary arm sling can be used for from one to two weeks with the elbow carried around a right angle. In simple cases with good reduction careful active motion can be started in ten days to two weeks although with the less satisfactory and comminuted cases this time must be lengthened. Massage and baking can be started when consolidation is sufficient to allow their use. With the transverse dicondylar fractures the period of fixation must be slightly lengthened.

Fractures of the internal and external condyles call for operative interference more often than supracondylar or transverse dicondylar fractures but otherwise their reduction and retention follows along the same lines as those just outlined.

Fractures of the epicondyles need no

reduction as a rule and the simple moulded splint or body swathe with the elbow in acute flexion is all that is necessary for fixation. Gentle motion can usually be started during the first week but the fixation should continue for about three weeks.

To sum up this subject of fractures of the lower end of the humerus, the following points should be re-emphasized:

(1) Accurate knowledge of the anatomy of the parts is essential.

(2) The diagnosis should be made by the clinical findings plus the radiograph taken in at least 2 planes.

(3) Reduction of the fragments should be accomplished conservatively if possible but open operation is necessary if proper alignment is not obtained and wire traction has been unsatisfactory.

(4) Fixation should always be with the elbow joint in as acute flexion as possible, not only for the purpose of retention of the fragments but also to give the joint the best possible chance for maximum function, but frequently this is impossible due to the swelling present. The danger of Volkman's contracture must always be borne in mind and the radial pulse checked frequently.

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3. FRACTURES OF SHAFTS OF LONG BONES IN CHILDREN

Fractures of the Shaft of the Humerus

Anatomy: The shaft extends from the insertion of the pectoralis major to the supra condylar ridges. The soft parts of the arm are divided into anterior and posterior sections by the inter-muscular septum. In the anterior portion are the biceps, coraco-brachialis, brachialis antiens and the neuro vascular bundle. In the posterior the triceps and radial nerve.

Causes of Fractures

(1) Direct blows are common and therefore compound fractures occur frequently.

(2) Indirect violence, as a fall on hand or elbow.

(3) Muscular action.

Complications

(1) Many are compound.

(2) Nerve injury paralysis, complete or partial, of radial, medial or ulnar nerve may occur.

(3) Non-union. This is a common site of non-union but this is exceedingly rare in children.

Treatment

(1) Simple undisplaced fractures: Green stick fractures are common in children and care should be exercised not to complete the fracture when correcting bowing. Even if the fracture is complete and without displacement, immobilization can be satisfactorily carried out by strapping the arm to the body. This can be done over metal coaptation splints and the forearm supported with a sling. Padding should always be used in the axilla in such a dressing to prevent skin irritation.

(2) Simple fractures without displacement but with tendency to angulate: In older children particularly there is a tendency to angulate and the dressing advised is a plaster spica with varying degrees of abduction depending on the angulation present. This dressing is found superior to the various types of mechanical abduction splints which are difficult of adjustment and more uncomfortable to the patient than a plaster dressing.

(3) Fractures with displacement: Where there is displacement the bone fragments usually slip by an inch or so. In cases of transverse fracture the ends can sometimes be locked together by manipulation and a plaster spica applied. It is impossible to immobilize the humerus by a simple

long arm plaster dressing and a body spica should be used. In cases of oblique fracture or where the fragments can not be locked together some type of traction must be used. Traction in recumbency is used at this hospital. Adhesive traction usually suffices in children and a convenient method of applying the weights and pulleys is by means of the Bellevue traction apparatus, a simple wooden frame designed to give lateral pull on the humerus and also support the forearm. It is rarely necessary to use skeletal traction in children but in some older, heavily muscled children a Kirschner wire may be inserted through the olecranon. Care should be taken not to injure the epiphysis. Callous formation is extremely rapid in children, so sufficient correction of length should be obtained at the earliest possible time. When sufficient callous shows in the x-ray a spica may be applied but frequently no dressing is necessary after about three weeks.

Fractures of the Shafts of the Radius and Ulna

Anatomy

It is convenient to consider the ulna as a direct continuation of the humerus and the hand as a similarly continuous appendage of the radius. Thus motion of supination and pronation occurs as the radius rotates about the ulna. The two bones are connected by the tough inelastic interosseous membrane and force received on the hand is transmitted up the radius and transmitted to the ulna through this membrane.

Fractures of the Shaft of Radius Alone

These fractures are not common but may occur from direct or indirect violence. In children they are usually incomplete; those of the shaft proper usually being of the greenstick type and those of the lower end tending to be of the infraction type. The position of the fragments in complete fractures depends to a large extent on muscle pull. In fractures above the insertion of the pronator radii teres the upper fragment is supinated and drawn forward, the lower fragment is pronated and drawn inward. Fractures below the insertion of pronator teres, that is, the lower one-half of the shaft; the upper fragment is displaced forward and inward but does not tend to rotate; the lower fragment is displaced inward and toward the ulna.

Fractures above the pronator teres: Here the proximal fragment can not be controlled and the distal fragment must be brought into line with the upper and dressing applied in ninety degrees flexion and supination.

Fractures below the insertion of pronator should be dressed in the mid-position and flexed ninety degrees. If over-riding is present, traction must be exerted to reduce these fractures. This can be done by immobilizing the elbow - an assistant is usually sufficient in children - and traction exerted on forefinger and thumb. We prefer a plaster dressing at this hospital, extending above the elbow and below to the mid-palmar fold only; thus allowing full flexion of the fingers.

Fractures of the Shaft of the Ulna Alone

These fractures are usually due to direct violence and the displacement is due rather to the blow than to muscle pull. Fractures without displacement should be carefully manipulated to correct bowing. Displacement when it occurs is usually forward and inward, over-riding not usually occurring. Manipulation is usually sufficient to correct displacement, care being taken to force the two bones apart.

Fractures of Both Bones of the Forearm

These are most common in the lower one-half of the shafts and are rare in the upper half. In children they are frequently of the greenstick or infraction type. Care must always be exercised not to create an

incomplete fracture into a complete one when manipulating to correct bowing. Even if complete, traction with elbow immobilized will usually suffice to correct the deformity. Occasionally in older children open operation must be resorted to.

Fractures of the Shaft of the Femur

These fractures occur frequently in children and are usually caused by falls from a height. They may be of any variety but are usually roughly transverse. Oblique and spiral fractures also occur, the majority occurring in the middle one-third of the bone. Displacement and over-riding of the fragments is the rule.

Treatment

The methods of treatment at our command are:

(1) Manipulative
(2) Reduction by continuous traction
(3) Open reduction.

Willis Campbell has particularly stressed the manipulative treatment in which he angulates the femur and hooks the fragments together under a fluoroscope. This, of course, can only be done in cases of transverse fracture. We have attempted this method on several occasions without success. Traction in young children can usually be successfully carried out by means of adhesive tape. In children below the age of six or seven years, the overhead type of traction is used by which the body acts as the traction weight. Both legs are suspended to an overhead frame with the buttocks just off the bed. This facilitates nursing care and the patients are comfortable. In older children a Thomas splint may be used for support of the extremity, the usual meticulous nursing care being observed. In older, more heavily muscled children a Kirschner wire may be inserted in the lower end of the femur. Over-riding should be corrected in approximately the first week and too long delay in placing skeletal traction may result in fixing the fragments in malposition. When sufficient callous has formed, a plaster may be applied. At about three months a walking caliper may be applied in most cases but weight bearing should be delayed until there is x-ray evidence of sufficient union. Occasionally malposition of the fragments occurs, which can not be corrected. In most cases this is probably due to interposition of muscle. In these cases an open operation may be necessary. Internal fixation is not usually necessary.

Fractures of Tibia and Fibula

These fractures do not usually exhibit much displacement. Molding of the fragments under anesthesia is sometimes necessary, a plaster with little or no padding is then applied and the patient allowed to be ambulant. A walking iron aids the patient in walking and protects the plaster. The plaster should be accurately molded to the extremity.

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4. EPIPHYSEAL SEPARATIONS AND FRACTURES

(Juvenile Fracture involving the Epiphysis)

Epiphyseal fractures are peculiar to the child, both as to their occurrence and their treatment. They occur in children rather than adults because the epiphyses are fused only slowly in varying degrees at various ages during the normal development.

The diagnosis depends on the locale and its differentiation from dislocations is obviously an important factor in outling treatment. I would state, however, that while the differentiation from dislocations is obvious, the differentiation from sprains is much more important because of the frequency of greenstick. Fractures and mild impactions at the epiphyseal areas are notorious.

I would commend to you all a thorough familiarity with the chart of epiphyseal fusion.

The treatment of epiphyseal fractures in a report of this type and length must necessarily be rather inclusive rather than specific. Dr. Cole has covered the most serious of epiphyseal fractures, the various condylar fractures of the humerus.

Whereas one may in a child disregard to some extent the alignment and length of shaft fractures on the assumption that adjustment will occur in later growth, such is not the case in epiphyseal fractures.

Trauma to the epiphyseal area is fraught with grave danger of disturbed growth intrinsic to the growth area. Dr. Lipschultz has recently pointed out this fact even showing that perfect reduction carries a certain danger. Apropos of this, there is need for more information in both perfect and malunion end results in respect to growth changes local to the involved part.

Treatment must also take into consideration the adjacent joint structures, their physiology of repair and the ultimate function of the joint.

Soft tissues, especially vessels and nerves are almost invariably close to and relatively unprotected near joints and more subject to injury, thus complicating the picture, the treatment and the prognosis.

Reduction must therefore be gentle but direct, without added trauma but accurate and with due respect to the surrounding soft tissues.

Fixation must be adequate but with consideration for the physiological repair process.

After care must be directed to the restoration of adjacent joint junction forestalling, in its application, the development of secondary joint pathology and growth disturbance.

Failure of a competent initial attempt at reduction either by manipulation or the various methods of traction should in most instances, if feasible, be supplemented by accurate open reduction performed early, not late.

Fixation should be maintained only as long as necessary for the initiation of repair.

Functional rehabilitation should then follow with full understanding of the physiology of normal repair and only within those limits lest pathological repair occurs.

I feel that late open reductions may set up the processes of pathological repair and that it were then better not to touch the case until after normal repair even tho malposition has occurred. The end result may otherwise be no better though the carpentry is perfect. Surgery is an art implying judgment. Surgical carpentry is only the technical application of that art.

And then, unfortunately, despite our best efforts, initially perfect reductions may have bad end results for which reason I feel that every parent should be informed of the seriousness of the fracture and made to understand that the end result is dependent on particular factors of healing and not entirely on the initial reduction. It is hard to explain a poor end result if we have boasted about our initial reduction.