

plementary tests, the application of tests for school knowledge and general information; and, finally, the gathering of a life history bearing upon the careers of these individuals.

As one read over these case histories one was impressed with the evidence of marked differences in behavior manifested by these different persons. Some had shown throughout life fairly good social adjustment (taking into consideration the fact that they were all feeble-minded). Others from the very start showed strong determiners for criminal careers, and manifested serious social maladjustment.

Sixteen per cent. were undoubtedly self-supporting, steadily employed, and apparently gave satisfaction where they worked. Thirty-eight per cent., while more or less self-supporting, changed positions frequently, and worked irregularly. Thirty-five per cent. never worked at all; while 11% did housework at home.

Eighteen per cent. never used alcohol or drugs; 82% used alcohol; 5% used drugs as well as alcohol.

Nineteen per cent. were moral, while 81% were undoubtedly immoral women.

Twenty per cent. were first offenders, 80% were repeaters.

In short, we have a group of about 19 individuals who were classed as having shown good or fair social adjustment, while about 81 individuals were considered to have shown poor or bad social adjustment.

The type of behavior manifested by these individuals seemed to correlate less with their age and mental level than with certain fundamental trends of personality.

Those with good or fair social adjustment possessed characteristics—personality traits—that, despite the existence of feeble-mindedness, enabled them to adapt themselves fairly well to the conditions of normal living.

Those with poor or bad social adjustment possessed personality traits that early gave promise of grave difficulties in behavior, and must inevitably have led to complete failure in adjustment.

We do not want to be understood as recommending the handling of feeble-minded girls out in the community; but we do want to call attention to the fact that some feeble-minded persons seem to get along fairly well under outside supervision, and do avoid serious social difficulties, and therefore are not necessarily—because they are feeble-minded—vicious, incor-

rigible and irresponsible. We do want to emphasize the fact that the majority, however, of feeble-minded delinquents seen in court are institutional cases, and are incapable of measuring up to the social standards of the community in which they live.

We want to emphasize strongly the fact that a well-rounded, thorough-going study of the possibilities of each individual delinquent, though he be feeble-minded, is necessary for an adequate adjustment of his case.

Clinical Department.

FRACTURE OF THE LONG BONES: A CLINICAL STUDY.*

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THE clinical deductions chronicled in this paper are gleaned from a case that in every aspect of bone surgery presented a very interesting picture. Before stating the record of events, it must be said, in justice to the surgeons who at different times exercised their skill in the hope of attaining a successful issue, that they were fully cognizant of the serious task which was confronting them.

On June 2, 1912, a female aged 24 years, in excellent health and splendid physical condition, was injured in a street-car collision. She was taken to the City Hospital. Examination at that institution disclosed a simple oblique fracture of the right femur about three inches below the great trochanter, and a compound fracture of the left tibia and fibula. The mandible at both angles was also fractured. Under the direct care of the visiting surgeon, the fracture of the right femur was reduced and the limb suspended in a Hodgen splint. This splint insured both traction and counter-traction. The fracture of the left tibia and fibula was reduced and the leg placed in a wire splint. Three weeks later the satisfactory progress of the wound permitted the application of a plaster-of-Paris cast to the left leg.

August 2, eight weeks after the accident, the Hodgen splint was discarded and a plaster-of-Paris cast substituted. August 9 the patient left the hospital and went home.

October 1, four months after the accident,

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the casts were removed from the right thigh and the left leg. Upon examination it was found that there was union neither of the femur nor of the tibia. The fibula was united. A consultation of two surgeons and an orthopedist was called. An open operation was decided upon. This was performed October 26, 1912. The operation consisted in refreshing the bone ends of the broken femur and securing apposition with silver wire. The wound became infected. This infective process extended over several months and severely taxed the health of the patient. The healing of the wounds left the bones ununited.

Another consultation with two different surgeons was called. After an examination, it was decided to break up the fibrous union that had taken place in the femoral fracture and place the limb in wooden splints, with extension. This was done March 8, 1913, in the patient's home. The splints were removed nine weeks later. No union.

May 19, 1913, at the Lutheran Hospital, a resection of femoral bone ends was undertaken, and the limbs immobilized in a plaster-of-Paris cast with strong abduction. Twelve weeks later no union had taken place. The patient was sent home. Consulting another surgeon, the patient was advised to go to Washington University Hospital. At this institution she was operated on October 13, 1913, sixteen months after receiving the injury. A graft from the right tibia was transplanted into the ununited left tibia. The leg was encased in a plaster-of-Paris cast. December 29, 1913 (ten weeks later) it was removed and union was found to have taken place. A cast was reapplied.

January 14, 1914, a graft from the right tibia was transplanted into the ununited right femur. The graft was of the inlay variety.

At the time of the operation no undue attempt was made to correct the deformity. The surgeon's sole aim was to excite an osteogenetic force sufficient to accomplish a bony union. This accomplished, it was reasoned that the correction of the deformity could be brought about by a subsequent operation. Inasmuch as the adductor group of muscles was very much contracted at the time of the operation, this was a logical procedure, as it would have been impossible, even with the best of fixation, to prevent a possible accident to the graft. This was clearly demonstrated to me in the subse-

quent course of the case. Furthermore, the surgeon, being alert to the defective osteogenetic power of the bone ends, decided not to force the limb into any absolute fixation, but simply to allow it to rest in a comfortable position so that no compression or constriction could exert any inhibitive influence on the callus formation. At times the contractions were sufficiently violent to endanger the graft. The patient begged for slight traction on her limb that the muscle spasms might be to some extent controlled. Traction of about ten pounds was applied. A certain amount of relief was thereby obtained.

When she left the hospital, on March 1, 1914, six weeks later, union with a deformity greater than the original had taken place. May 11, 1914, after being at home a little over nine weeks, she returned to the Washington University Hospital, where the cast from her left leg was removed. The union of the tibia was found firm, but there was a marked posterior bowing. The patient remained at the hospital seven weeks for after-treatment, and was then sent home.

September 1, the patient returned to the hospital for treatment for her stiffened knee and ankle joints and x-ray examinations. She remained three weeks. From Sept. 21, 1914, to July, 1915, the patient was at home. There she was subjected to massage and motion exercises in a most assiduous manner.

July 15, 1915, she returned to Washington University Hospital to have her knees and ankle joints, which were partly ankylosed, manipulated under anesthesia. She remained 15 days. From June 2, 1912, to July 15, 1915, the patient had been subjected to 15 ether, 5 gas-oxygen anesthetics. The time from August, 1915, to February, 1917, was spent by the patient at home, applying the various motion exercises she had learned while in the hospital and having her limbs massaged. She made every endeavor to learn to walk, but did not seem to be able to make any progress, and, as she expressed herself, her muscles absolutely refused to act right. She complained of much pain in her back, principally the lumbar region. The fracture sites, too, were at times very painful.

February 7, 1917, I was asked to interest myself in her behalf. The patient stated that measures which in the past were helpful had

now reached their limitations. She was unable to improve on her present state of walking and the future was beginning to grow dark for her. It was a request that could not be denied. The physical examination revealed the patient

good health. With this expression there was linked an asset, very essential to the sustenance of hope,—willingness and fortitude. When the patient was asked to walk, it was with the greatest effort that her lower extremities were

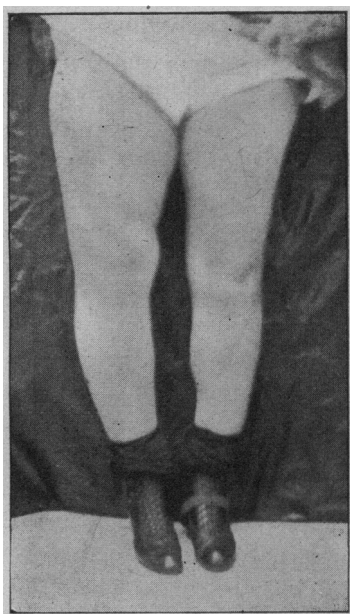


FIG. 1.—Angulation of right femur with firm union following inlay bone graft for ununited fracture. There is about $3\frac{1}{2}$ inches shortening. The valgoid condition of the right leg is the resultant weakening caused by excision of bone used as grafts for right femur and left leg.

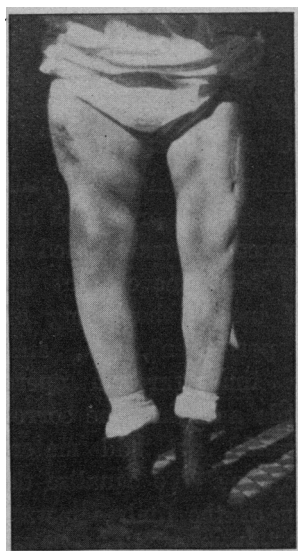


FIG. 2.—Correction of angulation in right femur. Firm union.

in a fairly good condition. This was remarkable when the experience of the past four and a half years of her life was considered. From the want of proper exercise a general anemia was contracted, and this was very apparent. However, she expressed herself as feeling in

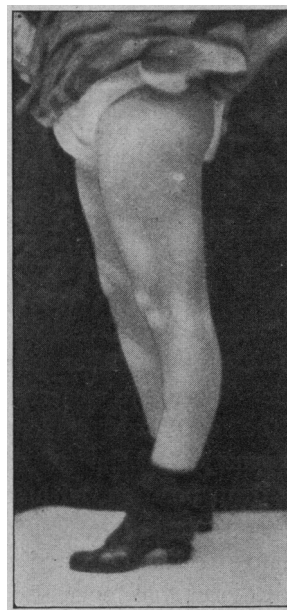


FIG. 3.—Backward bowing of left tibia, with firm union following inlay bone graft for ununited fracture.

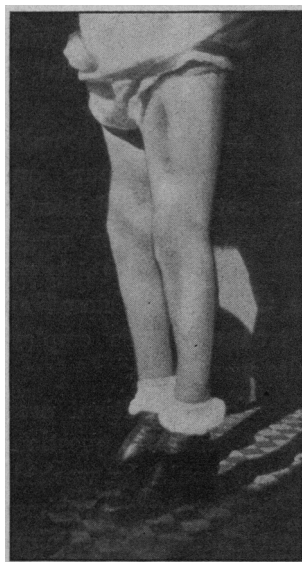


FIG. 4.—Correction of backward bowing of left tibia. Firm union. An excision of 3 inches of the left femur was made to equalize it with its fellow and to relieve the pelvic obliquity and the lateral curvature of the spine.

placed in motion. The contortions of her body resembled those of a tabetic. A heel three inches in height was necessary on her right shoe, while her left leg had to be supported by a brace.

Examination of the right lower extremity re-

vealed a shortening of three and one-half inches, with marked inward rotation. The knee and ankle joints gave about one-fourth normal motion. In the hip joint motion was quite normal. A deformity in upper third of thigh, such as would result from angulation and outward bowing of the femur, was apparent. The amount of callus formation about the fracture site was very large. The union was firm. The group of adductor muscles was contracted. On the outer side of the thigh the skin was adherent to the bone, a marked depression interrupting the normal contour.

Examination of the left leg revealed an extensive bowing of the tibia backward. Callus formation over the site of fracture, which was in the middle third, was rather extensive. The union was firm. From the cicatrix in the middle third of the leg it was evident that there was much destruction of the soft tissues. The foot was in a drop position, with an extremely limited motion of the ankle joint. The knee joint gave about one-third normal motion. Motion of the hip joint was normal.

Examination of the pelvis elicited a marked obliquity, compensatory to the shortening of the right leg. The spine gave evidence of lateral curving to the left. The lumbar muscles on the left side of the spinal column were prominent.

Here was a terminal condition which, after a period of four and one-half years in a patient who had been subjected to the skill of very competent surgeons, proved most disappointing. Everything that was good and effective in both the closed and the open methods of treatment was employed and yet the end-results were poor.

The condition of the patient presented many problems, and it became a question with me to what extent they could be worked out. Why this patient did not have a primary union of the right femur must be explained upon the ground that after the broken bone ends had been brought in good alignment, the proper fixation of the fracture, through some cause or other, was not maintained. In the left tibial fracture, a septic process interfered with union. Later, when the right femur was subjected to the open method of treatment, it was also a septic process which prevented union. Seven months later, when the bone ends of the ununited femur were resected and no union re-

sulted, it must be inferred that the osteogenetic forces were defective or that the fixation of the limb was inefficient, permitting a material amount of movement to take place between the fragments sufficient to interfere with the process of consolidation.

The introduction of the bone graft clearly demonstrated that it was a direct assistance to osteogenesis, both the fractured femur and tibia giving evidence by promptly uniting.

The success of the bone graft lends an interesting chapter in this case. Almost two years after failure of union the introduction of an autogenous bone graft caused the bone cells to respond to the stresses to which the part was subjected. Consolidation took place. That the osteogenetic forces were weak and that the callus produced was not sufficiently strong in its consolidation to permit weight-bearing became apparent through the resulting deformity in both femur and tibia. It would appear that five months (femur) and seven months (tibia) might be sufficient time for the consolidation to support the body weight without disaster. There is no definite time when it can be said that a bone, whose continuity had been re-established through the stimulus of a bone graft, will be sufficiently strong to bear the body weight without dire consequences. It is fairly safe, however, to assume that a grafted bone will require at least three times as long for firm consolidation as a broken bone which has responded to primary union.

Having fully acquainted myself with the clinical manifestations presented in this case, a method of procedure was decided upon. From the skiagraph it became evident that the three and one-half inches shortening of the right femur was permanent, *i.e.*, an attempt to lengthen the limb through operative means would be futile and that the correction of the angulation would not add materially to the length of the bone. To equalize the difference in the length of the limbs, it was decided to excise three inches of the left femur. With this procedure it was expected to restore to a certain extent the existing obliquity of the pelvis and to aid in the obliteration of the lateral lumbar curvature. Furthermore, it was expected that this procedure would more readily overcome the unequal strain that had been thrown upon the joints and ligaments through the faulty transmission of the body weight upon

the lower limbs. The correction of the right femur was brought about by removing with a chisel a wedge from the convex side of the angulated bone. This was made imperative because of the hard and extensive callus formation. The callus was found uniform in its density throughout. A piece of the graft, about one inch long by one-half inch in width, having the appearance and characteristics of a sequestrum, was removed. Before the femur could be brought in proper alignment, it became necessary to chisel through its entire thickness. Recalling the various pathological stages this bone had passed through and being fearful that a latent septic condition might be stimulated into activity, the bone and soft tissues were subjected to the least amount of traumatism possible. It is well to remember that organisms remain quiescent for a long time in a fracture which has united firmly and apparently normally after an infection, and that a subsequent trauma or the introduction of foreign matter, such as plates and screws, may stimulate them into active growth and so endanger a junction.

To guard against any displacement the bone ends were secured with a bronze wire. The wire was given preference over a Lane plate because of the fear of inciting a possible infection, and furthermore, because experience has proven that a plate can produce actual delay in efficient osseous union. Inasmuch as it could be assumed that in this extensive callus formation the osteogenetic force was deficient the contraindication to the plate became the more apparent.

Blood bathed the exposed bone freely. Closure was made without drainage. This was done under the assumption that the presence of blood about the traumatized bone might be of direct assistance to osteogenesis. Further to facilitate the bone production, the thigh was subjected to a congestive treatment—the so-called damming, originated by Thomas, which has served me well in several cases of delayed union. The limb was corded with a rubber tube applied above and below the fracture, sufficiently tight to produce considerable swelling and stasis for several hours a day. A Liston splint reaching to the axilla was applied to the extremity. The fixation seemed to be satisfactory. As long as the patient was under the influence of an anesthetic the group of ad-

ductor muscles, which prior to the anesthesia were markedly contracted, remained relaxed, and the splint did not betray its shortcomings. However, after the effect of the anesthetic had subsided the reflex contraction of the muscles manifested itself, disturbing the fracture and causing great pain. A Buck's extension was applied in the hope that gentle traction would overcome these muscle contractions. No difference, however, could be noted. Suspecting that the damming could excite or aggravate the spasms, it was discontinued. It was, however, found that cording of the thigh lessened their severity and the reapplication of the rubber tubing was resorted to for even a longer period of time.

After four weeks, during which time the patient received an opiate almost daily on account of the pain caused by the muscle spasms, it was decided to encase the limb in a plaster-of-Paris cast in the hope of getting more efficient support through a firmer fixation. The cast enveloped the lower part of the trunk and extended up to the thorax. It encased the whole extremity, including the foot.

The change seemed to be conducive of some good, and although the spasms did not subside entirely, they became less severe and of shorter duration, with longer intermissions. On account of atrophic changes in the limb, repeated applications of casts became necessary. Before a new cast was applied the limb was not encumbered with any form of splints for two days, excepting a sandbag support. During this time the whole extremity was bathed and massaged, and the articulations subjected to passive motion. It was interesting to note how quickly the limb changed from its blanched color to a livid one after the cast was removed, giving distinct expression of how restricted the blood supply must have been to the parts. Such a picture as this strengthens the belief that a plaster-of-Paris cast is not infrequently the cause of a delayed union, but may be a potent factor in non-union.

The application of a plaster-of-Paris cast to a broken bone must be a studied procedure. Its shortcomings must be well understood and its indiscriminate use should be discouraged. A plaster cast must not be applied to be constrictive or to compress the limb, but must be restrictive only, fitting closely to its actual somewhat increased circumference and forbid-

ding further increase of this circumference by muscular effort. At the end of three months the plaster cast was discontinued and a wooden support of posterior and lateral splints was substituted. The muscle spasms had not entirely ceased. At times they were very severe. However, the contractions became less frequent, their favorite time being in the morning, in the evening, or at midnight. During the first week in September, seven months after operation, a test of the limb revealed a firm union and all splints were discarded. Mild muscle spasms still supervened. The patient was not yet permitted to leave her bed.

The operative problem of the left femur presented difficulties entirely different from the right. To equalize its length with its fellow, an excision of three inches was to be made. Could this excision be made without interfering to an appreciable extent with the function of the limb? Would it be possible for the muscles to contract so as to have coördinative utility and be able to accommodate their sense to a degree that would insure an almost normal muscle balance? Taking into consideration that this patient was fully matured, these questions possessed a weighty import. Inasmuch as fractures of the femoral shaft resulting in two inches shortening terminated in satisfactory function, it was reasoned that an additional inch would not prove a serious menace. The excision was made at the time when the deformity in the right femur was corrected (February 19), and the site chosen was that presenting the best mechanical advantage. This seemed to be in the middle third immediately above the nutrient foramen. With a Gigli saw the excision was accomplished with ease. When the bone ends were approximated the muscle structure sagged about the bone in large masses. It was not a promising picture. To retain the bone ends in apposition and prevent a possible displacement, a graft taken from the excised bone was pushed into the medullary canal of the femur. A parting of the bone ends was anticipated by introducing a bronze wire through the upper and lower fragment. This bronze wire was tied in a knot as an ordinary piece of twine. At the conclusion of the operation everything appeared satisfactory and the limb was immobilized with a Liston splint. Four hours after the effects of the anesthetic had passed off, there occurred violent muscle con-

tractions. They were irregularly intermittent and shook the limb. It was necessary to administer an opiate to relieve both muscle spasms and the pain every 10 to 14 hours. On the fifth day after the operation a roentgen photograph revealed that the intramedullary plug was forced out, the wire had given way at the knot and was now an elongated loop and the bone ends had parted to the extent of about two and one-half inches. The damage which the violent muscle contractions had wrought was a great surprise; inasmuch as they were not abating in their severity, the only alternative was the application of a Lane plate.

After removing the wire and the intramedullary plug which was found lying outside of the medullary cavity, a heavy plate with six holes was placed without difficulty. The junction was found strong after four screws, two in the upper and two in the lower fragment, had been introduced; for this reason the remaining two screws were omitted. The limb was encased in a plaster-of-Paris cast in an abducted position. This cast, like the one on the right limb, included the foot and extended up to the thorax. To anticipate muscle spasms after the effects of the anesthetic had passed off, an opiate was administered. As long as this patient was under the influence of an opiate she was free from these painful contractions. Upon withdrawal of the drug the muscles, principally the adductor group, would contract in a violent manner, causing great pain and endangering the junction.

On the 18th day after the plate had been introduced the patient informed me that during the night the muscular contractions had been so violent that she feared the plate had been broken, as she distinctly heard a snap coming from that part of her leg. An x-ray picture taken immediately revealed the plate not broken but the screws in the upper portion forced. They could be plainly seen protruding above the plate. The alignment of the bone was only fair, the lower fragment having been drawn inward, causing a slight angulation at the junction.

The condition was disheartening. Again to open the wound and correct the existing deformity by reapplying the plate would have been a justifiable procedure. However, it was reasoned that the existing condition did not warrant it. Manipulation of the limb gave as-

insurance that the plate was still fixing the bone ends quite securely. It was therefore decided to place both limbs upon a Rainey frame, and when the time came for removing the plate, then to make such corrections of the deformity as were deemed advisable.

June 18 the plate was removed, 114 days after it was introduced. The condition found was about the same as revealed by the x-ray picture taken at the time when the plate was supposed to have been broken. The screws in the upper fragment were out of their holes. The screws in the lower fragment were loose and could be removed with ease. Angulation of the bone was quite marked, the lower fragment having been pulled perceptibly inward. The Rainey frame undoubtedly was of great service in preventing a greater deformity. The behavior of this fracture clearly demonstrated to me how the non-union in the right femur resulted during the early measures that were instituted.

Although the position of the bone ends was fairly good, it was found that after nearly four months the callus was soft and no difficulty was experienced in readjusting the bone into the proper anatomical line. It is a rule in fractures that the worse the position of the bones the longer will the callus take to consolidate. In this case, however, although the apposition was not good, the limited amount and soft condition of the callus cannot be ascribed wholly to the poor apposition, but must be attributed to some extent to the anemic state of the patient. The limb was again encased in a plaster-of-Paris cast and placed in a Rainey frame. Muscular contraction became more mild, and only occasionally was there a marked exacerbation.

July 20, five months after operation, at 2.30 p.m., a muscular spasm of great severity was experienced which lasted three hours. This was the last of the severe contractions. An opiate was now only occasionally necessary. The inference could readily be made that this patient had become a habitué, having received almost daily doses for three months and tri-weekly doses for two months; however, it was with comparative ease that the discontinuance of the drug was effected. This was indeed remarkable. During the last two months of her stay in the hospital no opiates were administered. The muscular contractions continued for seven months, only during the last two

months were they so mild that no notice was taken of them. Antispastic remedies and quite a few mechanical measures to overcome these muscular spasms that so seriously threatened a good end-result did not influence the condition. Morphin was the only remedy that gave relief. It was hoped that the muscles would give up the struggle and acquiesce, as had been my experience in most cases of fracture where such contractions were severe enough to attract attention.

In this case, however, the phenomenon presented itself in such an unusual form that a central lesion was suspected. A neurologist, however, assured me that no such lesion was present. Inasmuch as temperature and pulse remained within a range that would preclude any pathological changes in or about the fracture during the process of consolidation, the persistency of these muscular spasms must be ascribed to an asthenic condition of the patient, inviting a neurological inanition, where a trauma so agitated the nerve centers that the coördinative powers of the muscular apparatus gave evidence of disconcerted action, and continued to do so until more favorable nutritive changes had taken place in the system. At no time did the temperature rise above 100° nor the pulse rate exceed 90, excepting on August 2, when the temperature registered 102° with a pulse rate of 118. The sudden change in the temperature and pulse picture was caused by an acute attack of appendicitis. The appendix was removed the following day. It showed evidence of marked thrombotic changes. Five days later the temperature and pulse were again within the normal range.

September 4, when the plaster encasement was removed from the left limb, muscle atrophy was marked. The contour of the thigh, however, was good and the firmness of the muscles presaged a good functional result. In this I was not disappointed as the patient is not experiencing the difficulty in walking that had been expected. The greatest hindrance to overcome now is the partly ankylosed condition of both knee and ankle joints. These articulations, although close attention was given them, suffered much during five years of confinement.

How nearly these articulations can be restored to their normal action is problematic. At present it is a serious handicap to the patient's

walking exercises. Too much stress cannot be placed upon the care of the articulations in fracture of the long bones. It does not matter much whether the fracture is in the immediate vicinity of the joint or not. The neglect of extending the needed attention to a joint of a limb that has been immobilized is almost a surgical sin. No matter how serious the bone injury there is always an opportunity at some time when the proper consideration given a joint, may avert much that is aggravating and frequently very troublesome. Especially is this true in fractures involving the long bones of the lower extremities.

The remaining deformity that necessitated correction was the bowing backward of the left tibia. The amount of callus about the middle third of the tibia, the site of the fracture, was abundant. Consolidation was strong. It will be remembered this was a compound fracture, the infective process covering nearly three months. A non-union resulted. This ununited fracture was subsequently stimulated into union with the assistance of a bone graft taken from the right tibia. The deformity was undoubtedly caused by too early weight-bearing, when the callus was the seat of active changes and consolidation was far from complete.

In correcting this deformity, which was undertaken the same time the right and the left femur were operated on, an oblique osteotomy was done through the callus between the original fragments of the shaft. The tibia was not severed in its entirety, enough of the bone being kept intact to act as a splint for fixation to prevent any overriding and subsequent shortening. After the chisel had penetrated the tibia to about four-fifths of its thickness the lower fragment was forced backward, the action being similar to the correction of a green-stick fracture, until the posterior bowing had been overcome. The result of this manipulation left a gap about an inch wide upon the anterior aspect of the tibia. This gap was allowed to fill with blood and the skin closed over it. No trace of the bone graft was found. With posterior and lateral splints, the leg was securely fixed and bandaged to the Liston splint, which was used to immobilize the thigh. Subsequently, when the Liston splint had to be changed on account of the muscular contractions, the entire extremity was encased in a plaster-of-Paris cast.

The anatomical line of the tibial shaft remained as it was placed at the time of operation and a good consolidation resulted at the end of three months.

This patient is at present able to stand erect and is making satisfactory progress in walking. Muscle fatigue and joint pains necessitate that the exercises be of short duration.

The long confinement caused ligamentous relaxation in nearly all the large joints of her body. This was exemplified in the frequent subluxations of her shoulder joints by some trivial movement.

In summarizing it may be said that the dominant facts in this case were:

The successful bone grafting 16 and 19 months, respectively, after the fractures had been incurred.

The successful bone grafting following a septic process.

The successful bone grafting after non-union following resection of the bone ends.

Excision of three inches from the femoral shaft, without causing any apparent damage to the mechanics of the thigh muscles.

The violent and long-continued (seven weeks) muscular contractions.

Failure to anticipate these muscular contractions.

Failure to judge the violence of these contractions.

Failure to secure properly the bone ends of the left femur after excision.

Failure to immobilize properly the extremities from the start.

The successful moulding of the callus of the left femur four months after excision.

The length of time it required for the consolidation of the callus to permit weight-bearing.

The promptness with which the patient was able to discontinue the morphin.

Book Reviews.

Pharmaceutical Botany. By HEBER W. YOUNGKEN, Ph.G., A.M., M.S., Ph.D. Second Edition. Philadelphia: P. Blakiston's Son & Co. 1918.

This book deals with the pharmaceutical aspect of botany. It is divided into two parts: the first is devoted to the morphology and physiology of Angiosperms; it gives the history of