TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting Held March 2, 1925

The President, Dr. Edward B. Hodge, in the Chair

FRACTURE OF FIBULA WITH SEPARATION OF LOWER TIBIAL EPIPHYSIS

Dr. Hubley R. Owen presented a boy who, September last, fell and injured his left ankle. A plaster case was applied by his family physician and left without removal for two months. When it was taken off a marked deformity was apparent, for the relief of which he applied to the Orthopædic Hospital, where he came under Doctor Owen's care. By an osteotomy a good alignment was secured with good joint function. He was surprised to find how difficult it was to cut through the epiphysis.

Dr. A. P. C. Ashhurst said that of 300 cases of ankle fracture studied by him some years ago there was but one found of the type described by Doctor Owen. He had had another case recently.

FRACTURE OF A BONE GRAFT

Dr. George P. Muller remarked that the problem of bone regeneration has been the source of much discussion for over fifty years and even now is open to further study. Ollier, in 1867, announced that the transplantation of living autogenous periosteum-covered bone would result in a living transplant and he considered the periosteum as the most important factor in maintaining the life of the transplanted bone. Barth, in 1893, reported the results of some experiments which showed that the bone transplant dies and only acts as a sort of scaffold to be gradually replaced by new bone formed from the surrounding bony tissue or fragment ends. This was also the opinion of J. B. Murphy (1913). As a result of this opinion surgeons began using boiled bones as transplants. In 1902, Axhausen stated that while much of the transplanted bony tissue died, a few cells persisted *in the periosteum* which survived and produced the new bone. In 1912, MacEwen claimed that the periosteum is merely a limiting membrane, and that all osteogenetic activity resides in the bone cells. His theory has attained rather wide acceptance, notably by Gallie (1918).

Mayer and Wehner (1914), Phemister (1914) and a number of other writers now believe that there are specific osteoplastic cells, probably in all of the elements of the transplant, which persists and regenerate new bone by a process of absorption and substitution. The graft receives nutrition both from serous permeation and an ingrowth of capillaries from the surrounding tissues. He had been attracted by the statement of Mayer (Annals of

SURGERY, 1919, vol. lxix, p. 360) when he says: "Neither the scaffolding theory, nor the opposing view is entirely correct, but a double process is at work; to a certain extent the graft acts as a scaffold for the ingrowth of osteoblasts derived from the adjacent bone, but it also contributes to its own life, first by the persistence of bone cells, second by the activity of the transplanted periosteum."

In one of his papers, Phemister (1914) reports on the results of five experiments in which a long transplant was fractured in the middle. In three specimens the periosteum was removed and in two others it was left on. When periosteum was left on there was callus formation at the seat of fracture in the transplant which underwent ossification before that which united the fractures at the ends. In one case there was bony union in forty-five days, while the two fractures at the ends were freely movable. On the other hand, where periosteum was removed, union was by a fibrous intermediary callus which showed only a small amount of ossification at the end of eighty-seven days.

He concluded that "a fracture through a transplant unites by callus formed from the surviving cells of the transplant in the vicinity of the fracture." The speaker thought it worth while to report the following case, particularly as he was able to observe the course of events over a long period of time.

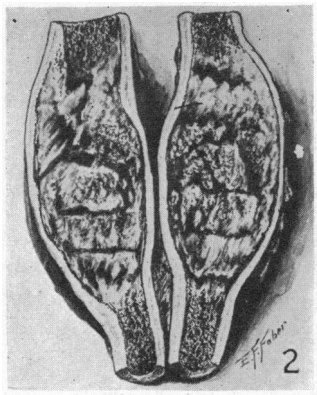
DOCTOR MULLER then presented a young woman, twenty-two years of age, who was admitted to the University Hospital, January 28, 1921, on account of a slowly growing tumor at the upper third of left tibia. No trauma. Duration five years. Pain past three weeks. The growth involved the entire circumference of the tibia, without "crackling" of cortex. X-ray (Fig. 1) showed this to be a bone cyst or enchondroma (Baetjer) or giant-cell sarcoma (Pancoast).

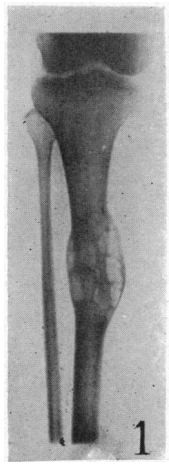
Operation.—(January 29.) Longitudinal incision. Cortex found exceedingly hard. Section of tibia isolated and six inches resected by Gigli saw. A bone graft 7½ inches long was removed from the right tibia with a sharp chisel and implanted into the wound with ends pushed into medullary cavity. The graft included periosteum as well as endosteum and cortex. Wounds closed without drainage. Plaster case applied. Graft in perfect position. (Fig. 3.) *Pathological Report.*—Benign bone cysts (obsteitis fibrosa cystica). (Fig. 2.)

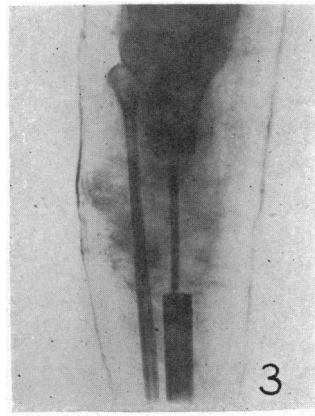
Discharged February 17, 1921, on crutches. X-ray examinations were made at frequent intervals and about one-half of these are reproduced. About five months after the operation it will be noted (Fig. 4) that the graft is united at both ends and particularly at the upper. Bearing on this point is the statement of Gallie, "the transplants must be imbedded in the fragments for a considerable distance in order that the bone-forming qualities of the periosteal and endosteal surfaces of both transplants and fragments may be enlisted to make certain of solid bony union." There is evidence of new bone formation all along the graft, very faintly traced, however.

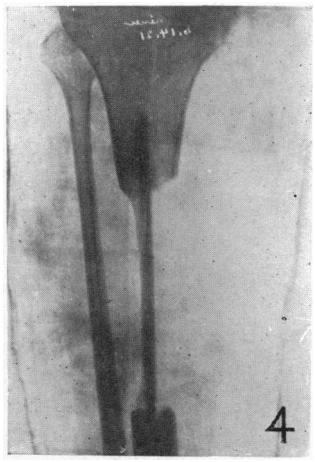
Early in September, 1921, the patient fractured the graft. A brace had been worn since July, but was immediately replaced by a plaster case. Callus began early at the seat of fracture and is perceptible by October

(Fig. 5), and better in November. (Fig. 6.) In April, 1922, the fracture was united but the bony union was apparently not perfect. (Fig. 7.) By this time the lower fragment as well as the upper had become pointed. The brace was resumed. In March, 1923 (Fig. 8), and January, 1924, the graft had perceptibly thickened and the callus at the seat of fracture had begun









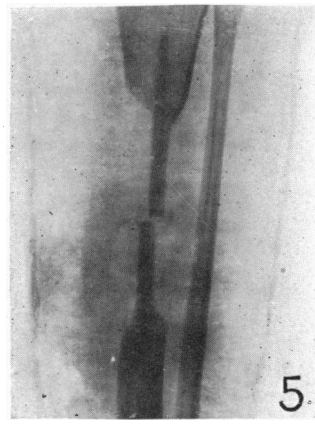


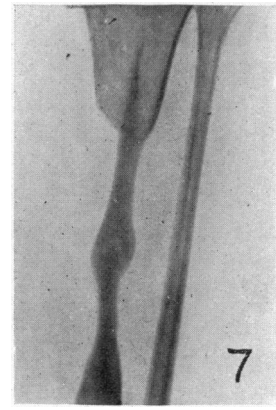
FIG. 1.—X-ray appearance of cyst.
FIG. 2.—Drawing showing the nearly solid cyst after removal.
FIG. 3.—Appearance of the bone one week after introduction of graft (1-29-21.)
FIG. 4.—Five months after operation. Note the callus reaching from the host bone ends.
FIG. 5.—After fracture. Note suggestion of callus.

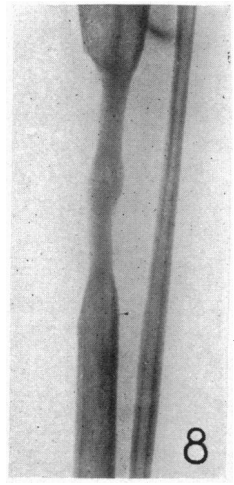
to disappear. The brace was discarded. In March, 1925, four years after the operation, the graft is nearly as thick as the lower part of the tibia, but has not blended as well with the upper fragment. (Fig. 10.) Note that the graft end is still visible in the upper end of the tibia.

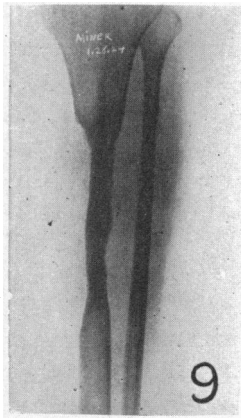
The patient has ¼ inch shortening and walks without limp.

He adopted the medullary graft because it seemed as though there would be more immediate stability, although he was aware that generally speaking an inlay graft is more satisfactory theoretically and particularly

in the case of non-union after fracture. McWilliams (ANNALS OF SURGERY, 1921, vol. lxxiv, p. 286) believes that the intramedullary method of grafting should be discarded, and while Doctor Muller agreed with this argument in the matter of using the graft as an intramedullary peg in ununited fracture,







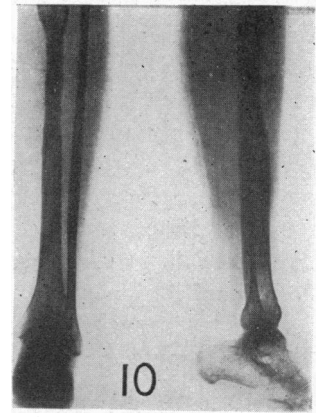


FIG. 6.—Three months after fracture. Note increase of callus, firm union of fragments to bone ends.
FIG. 7.—Fifteen months after operation. Note pointing of lower tibial fragment.
FIG. 8.—Two years after operation. Thickening of graft proceeds slowly. Callus less prominent than in previous years.
FIG. 9.—Three years after operation. Little evidence of the fracture. Graft larger than fibula.
FIG. 10.—Four years after operation (3-3-25). Except at the junction at the upper end, the graft appears as a normal tibia.

yet he thought the method has a use in long transplants such as the case herein reported.

Fracture of a bone graft has, no doubt, been noted by many surgeons, but there is little specific mention of the subject in the literature. In reporting a large series of cases from the Mayo Clinic, Henderson (*Jour. A. M. A.*, 1921, vol. lxxvii, p. 165) states that in a certain percentage the graft broke, usually about the fifth to the eighth week. He thinks that massive grafts

firmly held to the fragments with beef-bone screws afford greater safety against fracture. McWilliams (ANNALS OF SURGERY, 1921, vol. lxxiv, p. 286), in his collection of 1390 reported cases, found 17.6 per cent. of failure but only states that fracture or dislocation of the graft may be a cause of failure and are due to insufficient immobilization. Eloesser (*Archives of Surg.*, 1920, vol. i, p. 428) reported a series of twenty-two patients, personally operated on, and of these refracture occurred in seven. The graft always broke near the middle, the ends remaining firmly welded to the matrix bone. In two cases the refracture united, in one with considerable callus. Smith (*Jour. Orthoped. Surg.*, 1921, vol. iii, p. 270), in 1921, describes two varieties: (1) Disintegration fracture, occurring six to eight weeks after operation and resulting, as a rule, because absorption outstrips restitution; the graft becoming soft and porous at the ends, and if rigid, immobilization has not been carried out, the connection between graft and lost bones becomes loosened. He reports an example in the case of a bone graft for a defect in the upper third of the ulna, which reunited with a large amount of callus. (2) Clay-pipe stem fractures, occurring several months after the bone grafting, and which results because for a prolonged period the graft may depend almost entirely on its mineral constituents for its strength, especially at the centre. Smith thinks they unite, but a prolonged period of immobilization is necessary. It would seem as though the repair of the fractured graft reported in this paper was an evidence of persistence of the living graft, but Mamourian (*Brit. Med. J.*, 1921, vol. ii, p. 934) believes that the appearance of callus about the ends of a broken graft is not proof of the survival of the graft but only an evidence of greater local stimulation. But Haas (*Surg., Gyn. Obst.*, 1923, vol. xxxvi, p. 749) showed by experiment that there is an inherent power of regeneration in a transplanted piece of bone, even if the transplanted fractured graft was implanted into a muscle removed from any possibility of osseous ingrowth from other bones. If the graft was boiled and implanted no signs of bone proliferation occurred.

DR. DEFOREST P. WILLARD said that three or four years ago he saw at Toronto a number of the war cases which had been treated with bone graft bridging large defects in the tibia. A large series was shown; about 50 per cent. had had fracture of the bone graft, nearly always at the juncture of the middle and lower third of the graft. The upper new bone coming down had covered about two-thirds of the graft, but the bone from the bottom had been a little slower and the fracture had taken place at that position in the lower third and practically always at the end of seven months from the time the bone graft had been put in. They emphasized the need for extra support of the bone graft between the sixth and the eighth month because that is the dangerous time. They were especially careful during that period with their later cases and have had less trouble with the grafts.

DR. A. P. C. ASHHURST said that he had a bone graft fracture after eight years. It was a case of giant-cell tumor of the lower end of the radius. It is interesting on account of the question of the blood supply. The tumor

was at the lower end of the radius and he excised the lower third, including the joint surface, putting in a bone transplant shaped as nearly as possible like the lower end of the radius, and fastened it to the remaining shaft with a plate, screws and wires. This bone came in contact with other bone only at one end of the graft, the other end being free in the wrist-joint. At the end of eight years, the patient struck it against a table and the graft fractured about its middle. He kept the forearm in a plaster splint for a long time, but at the end of one year she still had non-union. He then operated on her again, nine years after the first operation, took out the plate and screws and cut a slot into the transplant across the line of fracture, with a circular saw, and inlaid in the original bone transplant another bone transplant and secured firm union within a few weeks. On examining specimens of bone removed from the fracture line, the bone was found to be dead, so far as the pathologist could tell; there were no live bone cells in it. The question now arises whether, if the circulation gets into the transplant only from the bone to which it is attached, how does it happen that the part of the bone not connected with other bone, but entering the wrist-joint, was living? The circulation must have come in from the periphery on all sides.

The longest transplant he had used was about 18 cm. long. He used this to supplant the upper half of a tibia which was being excavated by a parosteal sarcoma. He cut out the tibia from the knee-joint down; placed the remaining fibula in a hole in the external condyle of the femur, and took a transplant from the other tibia for the inner condyle; this was nearly ten years ago and the graft has not broken as yet. He sees no reason why the one graft should remain and the other fracture. Neither graft was an inlay graft: that in the forearm was in contact with bone only at its proximal end, while that in the leg was implanted at one end in the narrow cavity of the remaining tibia, and at the other in a hole drilled into the internal condyle of the femur. The periosteum was left intact on both transplants, so far as possible, since he regards it as a protective membrane and desirable whenever a transplant is to lie exposed to extraosseous tissues. When an inlay-transplant is used, he regards the periosteum as detrimental.

BONE GRAFT OF THE TIBIA FOLLOWING REMOVAL OF A GIANT-CELL TUMOR

Dr. Isidor S. Ravdin presented a negro girl, six years of age, who was admitted to the University Hospital, June 27, 1924, with the history that about eight months previously she had sustained a fracture of the lower end of the right tibia for which she was operated on. The leg never recovered its normal size and at a later operation the bone was "scraped." Following this there was a gradual enlargement at the ankle for which she was admitted at the University Hospital. Examination of the lower end of the right tibia showed a fusiform swelling of the lower third. The swelling was firm, prominent, tender and painful. There was present the scar of a previous operation. The X-ray diagnosis by Doctor Pancoast was giant-cell tumor. The cortex is intact except possibly a small area on the inner aspect of the tibia.

July 3, 1924, the patient was operated on by Dr. George P. Muller. A

tourniquet was applied. An incision was made over the lower end of the right tibia on its inner surface. The periosteum was opened and the tumor was dissected free from its periosteal enclosure. A Gigli saw was then passed around the tibia above the tumor and the bone was divided. The same procedure was practised on the lower end of the tibia after the epiphysis had been carefully dissected free from the growth. The cavity was then irrigated with McDonald's solution. The tourniquet was removed, bleeding points were caught and the wound closed with tier suture, without drainage.

July 26, under ether anæsthesia, Doctor Ravdin removed a graft about five inches long from the left fibula and inserted it into the medullary cavity of the right tibia. The entire circumference of the fibula on the left side was used, leaving only a small portion of the periosteum behind it. No attempt was made to fix the graft into the tibial epiphysis. The wound was closed without drainage. A plaster bandage was applied to both legs.

August 3—X-ray report: Right leg: The bone graft is in very good position in the tibia. The upper end of the bone graft is in the medullary canal of tibia. The lower end is located over the epiphysis of the tibia. Left leg: Negative, except the fibula shows absence of piece of bone used for bone graft in right leg.

August 19—X-ray report: There is no definite evidence of bone disease, but the distal end of the upper fragment of the tibia is slightly rarefied. The periosteum is forming new bone over the portion of the shaft that was excised.

November 10—X-ray report: Good regeneration of the tibia and fibula, but there is still inversion of the right foot.

Pathological report of the tumor removed: a benign giant-cell tumor.

The giant-cell tumor was formerly considered malignant, but has gradually been placed in the group of benign lesions. It is regarded by many surgeons and pathologists as a normal attempt at repair following traumatic or low-grade infectious processes. It is therefore called by some pathologists chronic hemorrhagic osteomyelitis.

Coley has reported a group of giant-cell tumors in which metastasis occurred. Stone and Ewing in their last paper, however, stress the fact that a true giant-cell tumor does not metastasize. The tumor may undergo malignant change, or the pathologist may fail to recognize the malignant character of the tumor primarily.

Henderson and Meyerding, of the Mayo Clinic, have used the fibula as an intermedullary bone graft in cases such as the one reported. Henderson believes that the approximation of endosteal with periosteal tissue does not offer the same chances of success as the direct approximation of cancellous or endosteal tissue. Furthermore, he does not believe that the intermedullary bone graft gives a sufficient margin of safety against fracture.

However, the reporter believes that if the periosteum can be saved, so that regeneration of new bone can take place from this, the results should be nearly as good as those obtained from the inlay graft.

DR. GEORGE P. MULLER said that in this case the questions of diagnosis and primary treatment were decided entirely by the X-ray. At the time of operation after he sawed through the tibia, he found the tumor with a shell about it which could be enucleated from the periosteum, so it was scooped out to the end of the epiphyseal line where it was detached with forceps. At the lower base of the cavity it came away by simple enucleation. The periosteum was left because in three or four cases where he had removed a large

portion of bone, as for osteomyelitis in children, and left the periosteum, there has been complete regeneration of the shaft. He had no definite intention of applying a bone graft in this case, but while he was away on vacation, Doctor Ravdin thought it best to do the graft, and it may be that the child is getting the result from both the original operation and the graft. Doctor Muller then exhibited a set of lantern slides from a man who had had fifteen operations for chronic osteomyelitis performed in various hospitals. The reporter himself removed a section of the tibia and did a Huntingdon operation by removing a portion of the fibula, shifting it together with the muscular tissue, and jamming it into the tibia at either end. The patient developed infection, necessitating the use of drainage, but as the new slides show, thirty months after operation, there was practically a new tibia. It is generally known that the fibula when transplanted will enlarge rapidly and take the place of the new bone, and this case shows better bone formation than in the case reported by him in which the graft was done.

PROSTATIC ABSCESS

DR. LEON HERMAN read a paper with the above title, for which see p. 1115.

DR. ALEXANDER RANDALL commented upon the remarkable diversity of pictures which these cases of prostatic abscess show. The literature contains some unique examples, such as the interesting case of Lydston, where it was clinically thought to be an hypertrophied prostate, and even at supra-pubic cystotomy it was unsuspected and spontaneous rupture took place during the period of bladder drainage; or that of Harlow Brooks, which clinically so simulated enteric fever, that for four weeks the true condition was completely masked. He himself had seen a case in which for three weeks it gave every symptom suggestive of malaria except the absence of the plasmodia and then only incision for a prostatectomy uncovered the true condition. Doctor Herman has accentuated three things of the greatest importance: First, that a great many of these cases are non-specific in their origin and due to infective organisms. In a short series, which he reported six years ago, of sixteen cases, exactly one-half were proven to be non-Neisserian infections. The second point which he brought out possibly too lightly, is the question of the leucocyte count. It is of the utmost value and is frequently exceedingly high. And the third point which must be continually accentuated is the proper mode for treating these cases. The old practice of rupturing an abscess on a sound in the urethra is an operation so blind, hemorrhagic, destructive and particularly mutilating, that he did not hesitate to call it absolutely unsurgical. The post-operative morbidity in these cases is frequently hideous and many of them are made prostatic cripples for the remainder of their lives. Drainage by rectal puncture is equally unsurgical, and because of the likelihood of urethral rectal fistula, should never even be considered.

A perineal extra-urethral incision is the method of choice. With clean-cut surgical approach, pendant and copious drainage without damage to the

urethra or rectum, it gives man a promise of a complete resolution and repair. There is no method to be considered other than this.

DR. DAMON PFEIFFER detailed the history of two cases from his experience, one about three years ago; a man who was seized while on a trip to Washington, with very severe pain in the perineum and great difficulty in urination. He came back home and soon observed a slight urethral discharge and then an epididymitis. He absolutely denied venereals. A few days later, he discharged a large amount of pus from the urethra and went on to recovery. The culture showed staphylococcus aureus.

Recently he saw a case of abscess of the prostate which had existed at least five weeks before it was recognized. The man was being treated for continued fever without diagnosis. On rectal examination a large fluctuating mass was found in the region of the right lobe of the prostate which was opened without difficulty.

DOCTOR HERMAN (closing discussion on his paper) described a case recently met with in an old man presenting all of the cardinal symptoms of benign prostatic enlargement. This individual had a leucocyte count of 36,000 in the absence of fever. Following supra-pubic drainage large quantities of pus came through the tube, which in all probability was due to a chronic abscess of the prostate which had ruptured spontaneously into the bladder.

All of the cases in the series reported by him, with one exception, had gross prostatic pus varying in amount from one-half drachm to one quart. The exception referred to was a man in whom, while there was a leucocyte count of 18,000 present and the temperature of 100, no gross abscess was found at operation.

POST-OPERATIVE COMPLICATIONS

DR. J. BERNHARD MENCKE read a paper with the above title, for which see p. 1160.