

process itself may be at fault, since the callus thrown out about the fractured ends may be so proliferative that it softens and dissolves before it has performed its part in the repair, or it may become so brittle as to be useless. Old age, cancer, paralysis, rheumatism and syphilis are passive and *not* active constitutional causes, although the contrary is strongly asserted. As local causes we enumerate: the interposition of a foreign body between the ends, such as a piece of muscle, tendon or clothing, the destruction of the blood supply of the bone, improper adjustment of fragments, defectively applied fixation apparatus, where the fragments are not held in a proper position, but are movable. More cases occur in hospital practice than formerly, as the hospital internes are allowed greater liberty in the treatment of fractures to-day than they were accorded some years ago.

There should be no difficulty in the diagnosis of cases of non-union after fractures. The condition, as a rule, is apparent.

The treatment of cases of ununited fracture must be in accord with the cause of the delay. Iron for the anæmic, iodide of potash and the salicylates for the rheumatic, mercury for the syphilitic constitute our remedies for those cases which depend upon some fault of the system. But even with this course, many patients become tired and discouraged at the delay, and demand that more active measures be adopted. It is then that rubbing the ends together, injections of irritants, introduction of setons, caustics and pins, resection of the ends of the bone, bone grafting, wiring, and finally amputation of the member must be considered. One or more of these methods may be adopted; of course it is to be understood, any faulty position must be corrected. The history of these various procedures is entirely out of place in a practical paper, and then, again, you are all familiar with them. The best method, so

far as my limited experience goes to show, is that of resection, resection with wiring of the freshened ends of the bone. After the operation I encourage free suppuration, believing the bone which results will be firmer and more permanent, since, as Wyeth has written: "If the broken ends do not come in contact with the air—that is, if the fracture is not *compound*—the process of repair in bone after an injury is similar to the physiological process of development of this tissue—namely, the embryonic tissue is developed into cartilage-cells, and these, undergoing proliferation, develop into a secondary embryonic tissue, which is formed directly into bone. If, however air is admitted to a wound in bone, the process of ossification in the embryonic tissue is more rapid and direct, since the intermediate stage of cartilage-cell formation does not occur."

Repair begins in adult subjects generally about the tenth day, the callus is solid from the fifteenth to the thirtieth days, and is absorbed by the sixtieth day.

I have seen four cases of ununited fracture during the last twenty years; in two success followed resecting the ends and wiring, one died from shock following amputation of the thigh, and the fourth would not consent to any operative treatment, and has a perfect pseudarthrosis of the lower third of the thigh, without disability, but a shortening of about two inches.

CASE I. B. S. P.—White, adult. Was first seen and treated for secondary syphilis. Further examination revealed the presence of a pseudarthrosis of the right humerus at the upper-third, of several years duration. The arm was perfectly useless to him, hanging flail-like by his side, so when an operation, looking to its improvement, was proposed to him, it was gladly accepted. Under a mixed anæsthesia of chloroform and ether, an incision three inches long was made along the outer aspect of the arm, the bone exposed, and the ends found to