

I think would describe the appearance of the hollow shells far more concisely.

Before closing, I take great pleasure in extending my sincerest thanks to Dr. Henry Kreuder of New York, for his help in preparing the microphotographs and histologic examinations.

42 West Ninety-First Street.

ABSTRACT OF DISCUSSION

DR. JOSEPH ZEISLER, Chicago: As having a possible relationship to the case described by Dr. Weiss, I would refer to the frontispiece of McCull Anderson's book on skin diseases, which illustrates a case of psoriasis with oyster-shell-like formation of the scales.

DR. WILLIAM S. GOTTHEIL, New York: I saw the case reported by Dr. Weiss and gave it some little study. It was unusual, and perhaps deserves the separate classification that Unna has given it, but by doing so we may lay ourselves open to the criticism of hyperrefinement of diagnosis based on objective conditions and without any knowledge of the underlying changes. When we recall how a case of psoriasis may change its characteristics during the course of different attacks, we should be less inclined to lay too much stress on small objective differences. We have the lupoid type of psoriasis, and we have seen examples of the oyster-shell-like type referred to by Dr. Zeisler in connection with the picture in Anderson's book. The microscopic changes in psoriatic lesions are not very marked, and while we may call a case of the kind described by Dr. Weiss parakeratosis scutularis, it may after all belong to the great class of psoriasis-like affections, simply differing a little in its external appearances.

DR. W. B. TRIMBLE, New York: I have never seen psoriasis with cup-shaped crusts coming on in this way and showing this oyster-shell formation. This desquamation *en masse*, with the crusts markedly concave on one side and convex on the other, is a very peculiar feature. In these and other respects the case seems distinct from psoriasis.

DR. A. RAVOGLI, Cincinnati: I can recall two cases which in many respects were similar to the one described by Dr. Weiss, but which I regarded as cases of giant or rupiform psoriasis. In these cases there were thick crusts, not unlike oyster-shells, and under the microscope a piece of the affected skin gave the characteristic picture of psoriasis. The picture given by Dr. Weiss consists also in a hypertrophic condition of the papillae, with infiltration of the papillary layer and corium, with the hair follicles showing a great proliferation of the epithelial cells; the whole picture is not very different from that seen in psoriasis.

DR. L. DUNCAN BULKLEY, New York: I have seen cases similar to the one reported by Dr. Weiss, and I recall the illustration in Anderson's book. By careful study of cases like this we may in time prove that we have to deal with a distinct disease, just as eczema seborrhoicum was found to be distinct from ordinary eczema and psoriasis. I think the time has come when we should cut off from psoriasis some of its supposed belongings, and I quite agree with Dr. Weiss that the case he has described is in many respects different from what we have hitherto recognized as psoriasis.

DR. LUDWIG WEISS, New York: In studying this case, I was well aware of the fact that in many respects it was very similar to psoriasis, and while I do not feel inclined to augment the nomenclature of dermatology, I am by no means convinced that the case described in my paper should be classed among the psoriatic affections. I have seen the rupoid form of psoriasis which is illustrated in the frontispiece of Anderson's book, but in those cases we do not find the hairy plugs that were present in my case. In this case, too, the oyster-shell formation of the horny epithelium, the involvement of the hair follicles, and the absence of moisture when the crusts were removed served to differentiate it very sharply from psoriasis, eczema or eczema seborrhoicum, nor could it be mistaken for the impetiginous forms of eruption in which the crusts covered pus and effete material, and until further studies elucidate the nature of the lesions, I shall be inclined to regard this case as different from psoriasis, and call it parakeratosis scutularis.

FURTHER EXPERIMENTAL AND CLINICAL WORK BEARING ON THE VALUE OF LANE BONE-PLATES*

WILLARD BARTLETT, A.M., M.D.

ST. LOUIS

There are still many finer details regarding the results of treatment of fractures by means of the Lane plate which we have overlooked. There are still many questions, and questions of great significance, which are as yet unanswered. Ever since Mr. Lane first demonstrated to us that here, at last, was a means of treating a fracture more accurately than external splint or cast could ever do, ever since he first showed us results which had existed previously mainly in the ideal, we have been so engaged in skepticism, or in trying to grasp the larger more important points of treatment and result, that we have left unsolved those less easily discernible. There are questions pertaining to the infection of these wounds which we have not answered. The riddle of the after-treatment nags at us constantly. There are many interesting histologic factors in the process of healing which the microscope, as yet, has not revealed.

Up to the present time, I have had seventy-two opportunities to treat the human being by means of the Lane bone-plate. Of these thirteen were on the tibia, fifteen were on the femur, fifteen were on the humerus, six were on the clavicle, three were on the fibula, nine involved both the tibia and fibula (of which one was on the fibula, seven on the tibia and in one instance the plate was applied to both the tibia and fibula), two were on the olecranon, four were on the ulna, one was on the radius, and three involved both the ulna and the radius (in one instance the plate was applied to the ulna; in another instance to the radius and in the third to both ulna and radius). Moreover fifteen of these seventy-two cases were compound fractures, and in four of the open fractures the plate was implanted in a suppurating wound. I do not go more fully into my clinical results here, since this is a purely experimental article, and since the clinical data can be found, at least in part, in two papers.¹

In the paper which I read before the meeting of the American Medical Association in Los Angeles last year, I gave my conclusions on a series of experiments performed to determine the force needed to dislodge thirty-four screws, half of them infected, from the long pipe-bones of dogs, at intervals varying from one hour to seventy-one days. My conclusions were that it requires but 41 7/9 pounds to dislodge an infected No. 3 screw from a dog bone, with a cortex of 2 mm. On the other hand a pull of more than 95 pounds was required to draw the average clean screw of No. 3 gauge from bones of about 2 mm. cortex. The corresponding human bones have a much thicker cortex; moreover, No. 5 and No. 7 screws are used, which are much larger in every dimension, to say nothing of the fact that as many as ten of them are embedded at one time. It does not

* Read in the Section on Surgery of the American Medical Association, at the Sixty-Third Annual Session, held at Atlantic City, June, 1912.

* From the Surgical Laboratory of Washington University.

* Because of lack of space this article is abbreviated in THE JOURNAL. The complete article appears in the Transactions of the Section and in the author's reprints. A copy of the latter will be sent by the author on receipt of a stamped addressed envelope.

1. Bartlett and Hewitt: Experimental and Clinical Work to Determine the Value of Lane's Bone Plating, THE JOURNAL A. M. A., Oct. 21, 1911, p. 1347; A Discussion of the Operative Treatment of Fractures Based on the Operation of Eighty Patients, Am. Jour. Surg., January, 1912.

require much mental effort to picture the great amount of force needed to tear such a plate out of an aseptic wound when freshly applied, provided only it has been correctly applied, that is, by means of a drill the size of the screw-barrel with the screw threaded to its head. Moreover, it was pointed out that, while there is a constant absorption of bone cortex around infected screws and a thickening around this area, on the other hand a clean screw and the bone in which it is embedded present no macroscopic reaction whether viewed when inserted or seventy-one

iments with the Lane plate. His efforts were practically futile. Dr. Edward Martin,² however, gives a hint that some experiments have been performed. It is possible, of course, that experimental articles along this line may have been overlooked owing to their having been published under an unusual caption. No doubt, there are surgeons who are performing animal experiments with a determination to solve the same questions that I am trying to solve. My point is that I do not know of them.

The plate used in these experiments was a four-screw Lane plate, made of Jessup tool steel. It is 4.1 mm. long, 0.8 mm. wide at its widest part, narrowing down to 0.3 mm. between the middle screw-holes. The distance between the middle screw-holes is greater than between the middle screw-hole and its corresponding end screw-hole. It is 0.1 mm. thick. The screws used are No. 3 ($\frac{3}{8}$ inch) wood screws. These plates are cut

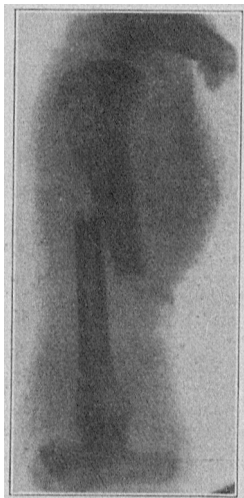
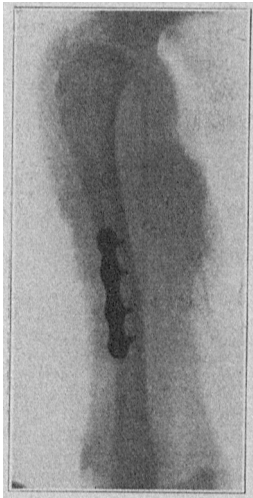


Fig. 1.—Experiment 4. Union of left tibia. Nine days after operation.

Fig. 2.—Experiment 4.—Nine days after operation. Right tibia left unsupported as a control.

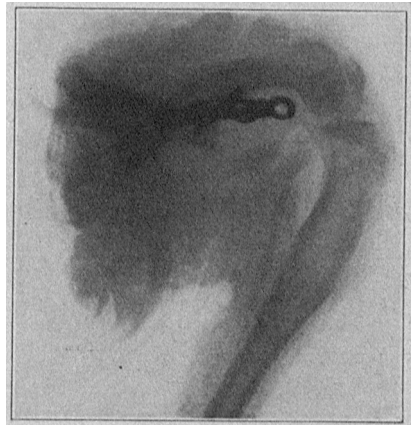
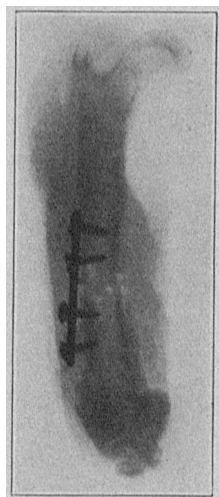
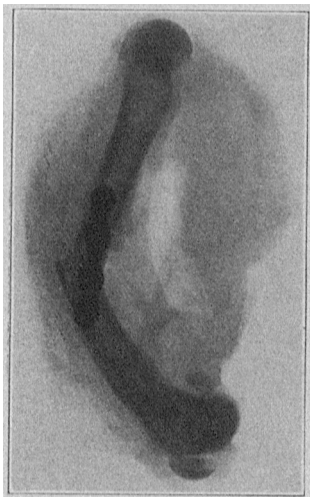
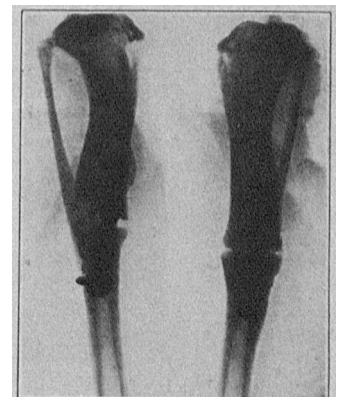
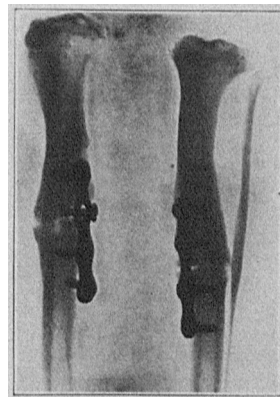


Fig. 5.—Experiment 8. Twenty-seven days after operation. Malunion of the femur.



Figs. 3 and 4.—Experiment 7. Seventeen days after operation. Left femur. No attempt at union.



Figs. 6 and 7.—Experiment 9. Thirty-two days after operation. Union in case in which both tibias were plated.

days later, unless infection takes place. In the experiments here described the screws were not observed under actual working conditions, since there was no pull or other external force acting on them during the healing process, as is the case when the Lane plate is used in the human being.

The primary object of this paper is to determine what happens when plates are screwed to fractured dog bones and the animals are allowed full freedom, without splint or bandage. The secondary object is to make a microscopic study of the process of healing under such circumstances.

The librarian of the St. Louis Medical Library worked for half a day hunting for some account of animal exper-

with file and emery wheel, and the holes are drilled and reamed. As a matter of course, full morphin and ether anesthesia was used in every instance.

No dressing was used on any of these wounds, and in no instance was a splint of any kind used to support the legs. It was, as already stated, the primary object of these experiments to observe what happens when the leg is left unsupported without splint or bandage. Great care was exercised when using the tibia that the fibula might remain intact to operate in very much the same manner as does the external splint when the Lane plate is used in the human body. In four of the animals, the

2. Martin: The Open Treatment of Transverse Fracture of the Femoral Shaft, *Tr. Am. Surg. Assn.*, 1911, xxix, 62.

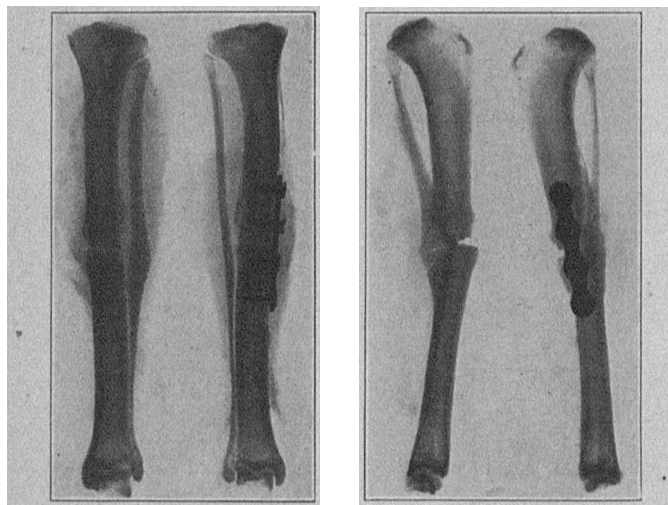
tibia of the opposite leg was broken in exactly the same manner, but left untreated with a plate for the sake of comparison; while in a third series, in four dogs, the femur was fractured and plated in order to ascertain the absolute value of screws and plates when no support of any kind is at hand.

In each instance the leg was amputated at the joint above the site of operation, extreme care being observed in the handling in order that no artificial dislodgment of screws might take place. The extremity was then placed in 4 per cent. dilution of liquor formaldehydi

SUMMARY

Fifteen dogs were operated on. One died of ether. From a second no specimen was saved on account of failure to plate it satisfactorily. A third animal was lost, after five weeks observation.

Proceeding now to a more detailed study of final results of these operations, there is a record of thirteen plates to follow, even though there were only twelve dogs, for in one dog a plate was screwed to both tibias. The plate remained fastened to both fragments in twelve cases, in spite of infection and in spite of the fact that



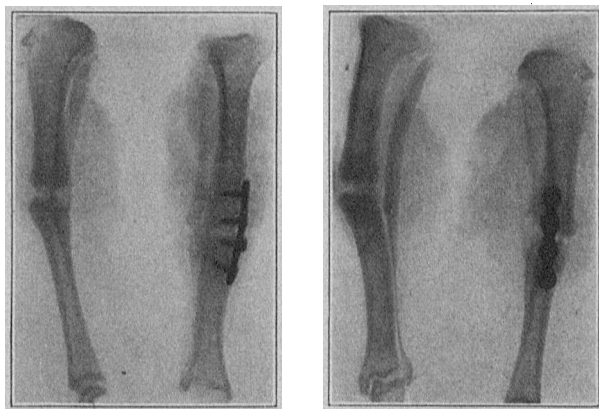
Figs. 8 and 9.—Experiment 10. Thirty-four days after operation. Left tibia plated. Right unplated.



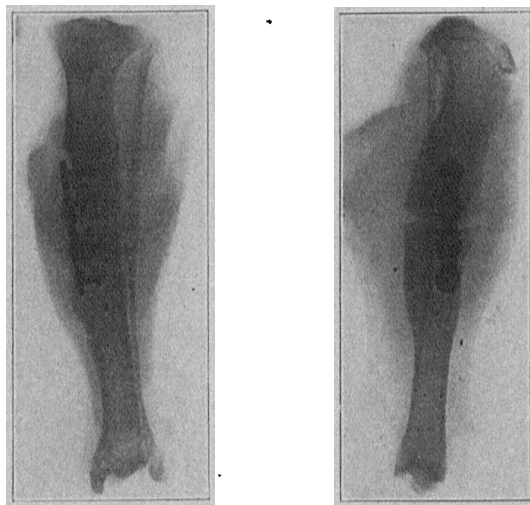
Figs. 10 and 11.—Experiment 12. Thirty-nine days after operation. Left tibia plated, showing necrosis of the shell of the bone. Right unplated.

and x-rayed before being dissected, as a further guarantee against displacement of the fragments. After removal of the soft parts, the segment of bone covered by the plate was excised and the screws carefully unscrewed. The specimen was next decalcified and prepared for histologic examination in the ordinary way, the sections being made in the longitudinal direction.

The most extreme asepsis was used in these experiments. In most of the instances the skin was shaved and treated with soap, alcohol and mercury bichlorid, and was carefully protected with towels clamped to the edge of the incision. Perfect hemostasis was employed, and the wounds were sewed up in two layers, one being in the muscle sheath and the other in the skin.



Figs. 12 and 13.—Experiment 13. Sixty-five days after operation. Left tibia plated, and right tibia unsupported. Fibula, in both cases, intact.



Figs. 14 and 15.—Experiment 14. Seventy-six days after operation. Union of left tibia.

the animal was allowed to go without splint or bandage. Seven of the plates which were found screwed to both fragments were firmly embedded. Five plates were found to have one or more screws loose (one having all four screws loose, three having two screws loose and one having two screws loose and one screw missing). All, however, with the exception of one screw had to be unscrewed in order to get them out. It is of more than passing interest to note that in no case did the plate come out of the wound of its own accord.

Now as regards union of the fragments, I shall consider the femur and tibia separately, in order to get more accurately at results. In four out of thirteen operations I put a plate on the femur. One of these resulted in

mal-union, which, however, when the animal died twenty-seven days later, was firm. In another one of these when, after seventeen days, the dog died there was a soft union, and in the remaining two, after a period of three and seventeen days, respectively, no union had resulted. The remaining nine plates were put on the tibia. In five of these the union was solid; in two there was no union and in two the union was not quite firm. It is significant, however, that three of these tibias which did not show union were in dogs in which the opposite tibia had been broken and then left unsupported, and the other was a case in which the dog died of sepsis after nine days, and, consequently, union had not had time to take place. In other words, in every case in which time enough was given and in which the opposite tibia was intact, so that the animal could walk on it, union of the plated tibia had taken place.

Marked mal-union occurred in only one instance (a femur). In another instance, in which a plated tibia had its opposite tibia broken as a control, both legs were in slight genu valgum.

In four experiments on the tibia, the opposite tibia was broken and then left unsupported as a control. In the first instance, the dog died of sepsis nine days later. Both wounds were open and infected; the plated leg was as perfect as could be expected in so short a time, and the control was fairly movable at the point of fracture. In the second instance, after thirty-four days, the union in the control as well as in the plated leg was solid and both wounds were nicely healed. In the third instance after thirty-nine days, crepitus could be elicited from the plated leg, which also showed signs of pus and little or no callus. The control had a flail joint and the operative wound was healed with no callus to speak of. In the fourth instance, both the plated and unplated leg were in mild genu valgum, sixty-five days after the operation. The position of both, however, was fair. In the plated tibia the union was not quite firm, while the control had healed firmly. There was a large callus on both. These four comparisons admit of no obvious conclusions.

The technic used in Experiment 9 is, to my mind, the most nearly ideal. It will be remembered that, after the holes were drilled, the bone was sawed partly across. In this operation, however, after the first hole was drilled, I drove in one screw to hold the plate as a pattern for the other screw-holes, and later removed the plate to saw the bone. One who is accustomed to handling the instruments in a Lane-plate operation can take this step without any great loss of time, and when, later, one sees how beautifully the plate rests on the bone and how truly the screws are sent home, one feels that this extra precaution has been worth while.

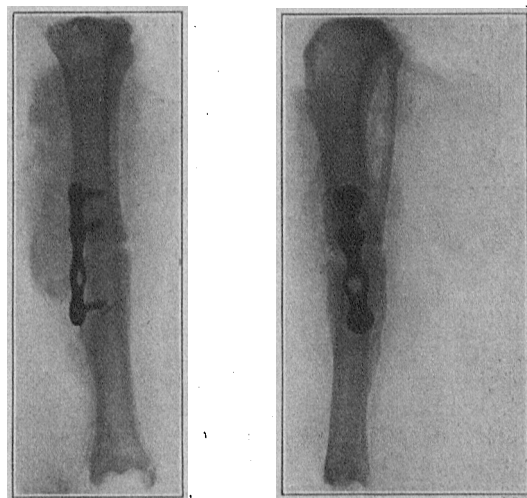
In making a histologic examination of the process of healing, under the conditions to which the bones in these experiments were subjected, it is seen that in most instances union took place by indirect bone formation rather than direct; that is, cartilage was formed in the first stages of healing, which in turn changed to bone. Furthermore, it was observed that in its efforts to accomplish the repair, an internal callus had formed about the point of fracture, until it had completely filled the medulla, to say nothing of an external callus as extensive as one ever sees in the absence of the internal splint.

In no instance was a screw or plate found directly in contact with the bone, there being always much intervening granulation-tissue or fibrous connective tissue around the screws and plate. Hence, one cannot properly say that a screw does or does not hold in a bony socket. In the course of time bone in contact with metal

disappears. In spite of this, as shown by my earlier experiments, screws do hold remarkably well, even in infected wounds in many instances.

In all, fifteen dogs were operated on, and of these one died of ether before the wound was sutured. Three of the remaining fourteen were found perfectly healed when the animals were killed and eleven are known to have become infected as a result of the operation. Then of the last eleven one was lost, having been last seen five weeks after the operation, and another died after six days of post-operative hemorrhage. Five more of the dogs, which are known to have been infected, died of sepsis within twenty-seven days. Nearly all of my experimental wounds are thus seen to have been infected; possibly all of them have been. I did not see the dogs every day, and hence judge this point largely by terminal results.

In my earlier work, I found that infected wounds do heal completely in many instances; hence it is not possible to say that the three healed wounds containing plate and screws have not been infected and healed up completely, in spite of this.



Figs. 16 and 17.—Experiment 15. Union of left tibia, 147 days after operation.

The experiences gained from these experiments naturally apply most directly to infected fractures on the human being. It is of interest, therefore, in this connection to relate that I have put a Lane plate in a suppurating wound on a human being four times. This was done, in each instance, in the treatment of displacement of a compound fracture.

The first patient had the tibia involved; the operation was done a year ago, and he now walks without support of any kind, the plate having been removed a few months since.

The second patient was operated on a little more than three months ago. The humerus was the bone involved and the patient now has a perfectly solid union, with the plate still in place, and is at work as a teamster, in spite of a small granulating wound.

The third patient was operated on three months ago, the ulna being treated. The plate is still in; there is solid union and a fistula persists, which will, no doubt, lead to the removal of the plate. The radius, which was broken at the same time but not plated, is still ununited.

The fourth patient was operated on almost three months ago. Here the fracture was so low down on the tibia that I could not, on account of thin cortex, find

anchorage for the lower screws, and had to give up the attempt.

It speaks well for the future of such cases that I have had three successful results in my only three favorable cases. These patients developed no serious reaction after the operation, which I believe is due, in part, to the fact that the wounds were flooded with tincture of iodine as soon as the very conservative dissection was completed, and packed with gauze after the plate had been applied.

If any clinical conclusions can be drawn from my dog experiments, and from my results on the human subject, I should say that the bugaboo of infection, however undesirable in connection with the use of the Lane plate, would seem to a certain extent to be ill founded. This factor *alone* does not greatly influence the outcome, so far as bony union in a desired position is concerned, granted only that proper wound toilet be employed to prevent a general systematic infection, and that the plate be used with the somewhat trivial proviso that it may have to be removed later.

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THE OPERATIVE TREATMENT OF FRACTURES AND DISLOCATIONS*

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Three years ago, Mr. Lane told us that practically all fractures should be treated by the open method, and that if we did not accept this point of view the courts would drive us to it. At the same session I reported on 200 fractures treated at the Roosevelt Hospital by open operation, the majority of them being handled by the late Dr. Carlton P. Flint. The statement was then made that most fractures were best treated by the closed method, but that there were certain others in which much better results could be obtained by an open operation; and that in order to decide best in any special instance a vast amount of clinical data would be required. We are now in a better position to meet this problem, for the amount of operative fracture work that has been done in this country and abroad, during the last five years especially, has been enormous; and we can now better see our limitations — what we can accomplish by this means and what we cannot and also who should attempt it.

In the last two years 2,100 fracture patients have applied to the Roosevelt Hospital Emergency Ward and of these 104 have been operated on. This, I believe, indicates fairly well the proportion of suitable cases, that is, about 5 per cent.

The question of operation, however, is not limited to whether or not it is wise to cut down on a fracture and put on a plate, but covers a larger field, and operations of this class can be divided into four groups:

1. Open reduction of recent cases.

2. Open reduction of old cases.

3. Operations in which we do not attempt a reduction, but by some other means try to prevent or overcome the deformity or impaired function resulting from fracture or dislocation.

4. A fourth group should be mentioned to include the forms of treatment in which appliances are inserted into the bone at a distance from the site of fracture and allowed to project through the skin — such as the nail extension of Codavilla, Steinemann and Lambret, the clamps of Parkhill, Freeman and others. I have never tried these and shall not refer to them again.

I. OPEN REDUCTION IN RECENT CASES

Of the 107 operations performed by me, fifty-seven came under the group of recent cases. The indication for operating may be stated thus: If a satisfactory reduction cannot be both obtained and maintained by the closed method, the fracture or dislocation should be operated on, there being no further contra-indication.

A "satisfactory reduction" does not necessarily mean a perfect anatomic alignment. A transverse fracture of the femur or humerus, where merely the edges have engaged, if the alignment is good, we know will give a strong, straight, useful arm or thigh without shortening and often will be smoothed out in time, especially in young patients. Why operate? And yet a slight projection forward of the upper fragment in a supracondylar fracture of the humerus will impinge against the coronoid and limit flexion and should be remedied. A rotary deformity in a fracture of the radius above the pronator teres may look straight and true in the x-ray, yet when in our closed attempts by supination the lower fragment merely pursues the upper we should cut down and properly adjust them. Lack of good crepitus always suggests interposition of soft parts and bids us investigate. A satisfactory reduction may be defined then as one in which the increase in the range of motion and the decrease of deformity to be gained by open method do not warrant the risk of operation.

My routine has been never to operate except in self-evident cases, such as patellas and olecranon, until two conscientious attempts have been made to obtain a closed reduction under ether. But some day I hope to be skilful enough to tell in advance by a gentle examination and a good x-ray; whether it is worth while attempting this. For too often we see at operation the ravages in the soft parts our heroic attempts at reduction have made, with the destruction of the precious notching and dentation of the fractured ends.

When is the best time to operate? After the body has had a chance to catch its breath following the original injury, after the bleeding has stopped, the coffer-damming commenced and a good healthy reparative reaction begun; but before the muscles have become set, the exudate around the broken ends begun to harden and our clean cut margins rounded off. Avoid too early operations and spare the body a second trauma too soon. Avoid too late attempts in order to prevent a more difficult operation and bad end-results. Somewhere between the fifth and eighteenth days seems the best time, preferably before the tenth.

The details of the operation have been so frequently and so well described as to need no repetition, but two points must be emphasized. First, unless a man is able and willing to develop by laboratory practice and to follow out the extreme and exaggerated technic of Mr. Lane, he has no right to operate on fractures, and this applies to assistants as well as to operator. It is the only way to guard patients from the calamities which seem to hover nearer bone work than any other field of surgery. Second, after obtaining reduction as simple and as little foreign material should be left in the wound as need be — no appliance if possible, chromic catgut if

* Read in the Section on Surgery of the American Medical Association, at the Sixty-Third Annual Session, held at Atlantic City, June, 1912.

* Because of lack of space this article is abbreviated in THE JOURNAL by the omission of the tables of cases. They appear in full in the Transactions of the Section and in the author's reprints.