

hand in line with the forearm. This, bandaged over the parts, he finds sufficient protection for them. It does not interfere with passive motion of the fingers, and is readily removed and reapplied to permit of passive motion of the wrist joint. It is molded directly over the skin, and requires no padding or compress. In these cases he has carefully caused passive motion of the wrist joint from the fifth day, and discarded the splint on an average of about twenty-one days.

The writer believes that the treatment of Colles' fracture could thus be formulated: 1, Reduction, not always easy; 2, protection by a simple retentive appliance while correct reunion of the bone takes place; 3, passive motion of the fingers from the first day; of the wrist, carefully, from the fifth day.

99 Broadway.

THE PASSING OF PLASTER.

Presented to the Section on Surgery and Anatomy, at the Forty-eighth Annual Meeting of the American Medical Association, held at Philadelphia, Pa., June 1-4, 1897.

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At the Atlanta meeting of the ASSOCIATION, in a discussion before this Section, Prof. Thomas H. Manley of New York made the statement that "plaster-of-paris, as a routine treatment for fractures, should be discarded." The advanced ground taken by that able surgeon is certainly welcomed by the writer, who believes that plaster-of-paris, as a routine means of surgical fixation is doomed, and that its wane will be rapid because of its inherent defects and of the advantages possessed by its rival, wood-fiber splinting.

It will hardly be gainsaid that at present, particularly in the hospitals, plaster-of-paris holds sway as the routine treatment for most fracture cases. Routine, unless perfection has been reached, is baneful to progress in all fields of human endeavor. It can be so in surgery. Happily, however, in this field of activity, there are willing minds and hands to welcome whatever tends toward improvement in their art, and hence the power of routine is weakened; it can not strangle a new method without a trial by honest observers. It may seem an unimportant point whether plaster-of-paris or something better be used in cases requiring surgical fixation, but fractures are frequent and we shall always have them with us; any amelioration in their treatment or results deserves the attention of the profession.

In this brief article the writer proposes to state facts relative to the use of plaster-of-paris as a means of fixation, and of wood-fiber splinting used for the same purpose. A comparison of these facts will render obvious his reasons for believing that plaster, at no distant time, will be relegated to its proper place, a means of fixation to be employed only when more efficient materials can not be had.

1. *Facts of plaster-of-paris treatment of fractures.*—*a.* Plaster-of-paris is dangerous and sometimes deadly to the encased limb. F. H. Hamilton's testimony on that point is sufficient; many living surgeons can verify it.

b. It does not, as generally supposed, immobilize the enclosed parts. A moment's consideration makes one clearly understand how futile it is to expect immobilization of limbs swathed in soft and compressible cotton by a rigid bandage outside the cotton. Supposing the fixation to be efficient at first, it is

soon destroyed by subsidence of swelling and, later, by tissue atrophy that always takes place in an idle limb.

c. It is destructive of the joint functions of injured joints, by preventing the timely application of passive motion to them. The timely application of passive motion to injured joints is an important indication in fracture treatment.

d. Plaster dressing prevents the surgeon's ready inspection of the parts treated, a condition not tolerated in an ordinary wound, and which, for as grave reasons, should not be tolerated in fracture cases.

Addenda—Dangers of plaster.—The dangers of plaster dressings can not be emphasized too much. Limbs have been lost by its use. The loss of a limb from any cause is fearful; from such a cause, horrible and indefensible. It could not occur if the treatment of such cases were to apply accurately molded splints retained by bandages, which should be removed daily as a matter of routine, until every iota of danger from pressure be gone. Such removal of bandages is easily and speedily accomplished, and allows the surgeon to know the condition of the parts he is treating—an impossibility with most plaster-of-paris treatment. Also, such removal of bandages permits of their snug reapplication over the limb and splint, thus producing and maintaining efficient fixation.

The writer recalls the experience narrated by an excellent surgeon at a medical meeting a short time ago, in which he told of a case of simple fracture done up in plaster. Everything apparently went on well, it being particularly noted that the patient's temperature remained normal, and yet, when the plaster was removed, the man's tibia was projecting through the skin and the limb bathed in pus. This could not have occurred if the case had been treated with wood-fiber splinting as above indicated.

The writer has seen a surgeon at a hospital remove a plaster dressing and find considerable bowing of the leg bones, necessitating a rebreaking of the partially united bones with great pain to the patient. In other cases permanent deformities have resulted. Wood-fiber splinting prevents such deformity by the efficiency of its fixation, or permits it to be detected in its incipency, to the comfort of both patient and surgeon.

2. *Wood-fiber splinting.*—Before stating facts relative to the surgical fixation produced by wood-fiber splinting, a short description of the material and the mode of its application may be of interest. The writer described this material (the results of personal experiments, made in a pulp-mill) at the Milwaukee meeting of the ASSOCIATION in 1893. He was first to advocate its use in surgical splinting (at that meeting and again in a paper read at the Pan-American Medical Congress, Washington, 1893).

The material is made in large sheets, of two thicknesses, to serve all cases of splinting. A splint can be made by cutting a suitably shaped splint-blank from a sheet of the material, moistening it with water and bandaging the moistened splint-form over the part to be splinted. The shape of the blank varies with the case treated. The correct shape for the blank is readily gotten by cutting a paper pattern so as to enfold the parts in the manner we wish the completed splint to enfold them, and then, following this pattern for a guide, by cutting the splint from a sheet of the splint material.

In earlier papers, the writer advised the use of stiff-

fening solutions, and several were designated, for moistening the material with. Water, however, is all sufficient, the material being made so rigid as to require no added stiffness. In compound fracture cases, a strong corrosive sublimate solution may be used to moisten the splint-blank.

The splint, having been made and applied correctly, will hold the parts to which it is applied in fixation from the moment of its retention by a roller bandage. It should be allowed to dry upon the limb, and after twelve hours the author's practice is to remove it, and then to reapply it, thus getting ocular testimony as to the condition of the parts.

Facts relative to wood-fiber treatment of fracture.

—*a.* Wood-fiber is adapted to the treatment of fractures of all the limbs, it being moldable directly upon the patient's limb.

b. It produces immobilization of parts, because molded directly on them and retained thereon, without the intervention of cotton batting, which defeats our object if it be fixation. This efficient immobilization is easily maintained by keeping the roller bandage snugly applied over the resilient splint; thus, subsidence of swelling, or tissue atrophy need not interfere with the fixation produced by wood-fiber material.

c. It permits the surgeon to inspect at any time the fracture he is treating, by the simple unwinding of a roller bandage. The reapplication of the splinting is easy, there being no pads or compresses to become disarranged.

d. This ready removal of the splinting permits the timely application of passive motion to an injured joint. The preservation of the functions of neighboring joints should be a most important consideration in the treatment of fractures. When these joints are not involved in the injury which the limb has suffered, this consideration is not so necessary, for normal joints can be immobilized for a long time without serious damage to their functions. When, however, the joints are injured, and this is frequently the case in fractures, it is a serious matter to immobilize them as is done in the plaster-of-paris treatment. Passive motion of the joints involved at the earliest moment consistent with safety is the imperative indication, for both preservation of function, and the earliest return to normal use of the joint.

e. Wood-fiber material is lighter than any other splinting, and no complaint is heard from the patient because of its weight, even in cases where the hip and knee are together immobilized.

f. Wood-fiber material is strong, rigid and durable; splints made from it having been worn in some cases (hip fixation) for eleven months. The material is porous, clean, and does not irritate the skin; in many cases splints having been worn for weeks immediately in contact with the skin, and without excoriation of the skin resulting.

g. No padding is required with splints molded from wood-fiber material; in most cases it is applied directly over the skin. This is important, for how plaster-of-paris or other material can produce immobilization of the bones in a limb swathed in cotton batting it is hard to comprehend.

h. Wood-fiber material permits of rigid antisepsis in the treatment of compound fractures, both of the wound, always accessible by removal of the bandages, and also of the splint material by moistening it with a strong solution of corrosive sublimate. Plaster-of-

paris as ordinarily applied is neither aseptic nor antiseptic.

i. Wood-fiber material is most pervious to X-rays, and does not interfere with fluoroscopy.

j. The mastery of wood-fiber splinting.

This mastery readily comes to one possessing a modicum of mechanical ability and who faithfully follows the simple directions given above. No more skill is required to attain it than is necessary to recognize and manipulate ordinary bone and joint injuries; if the practitioner has not that, he ought to let wood-fiber, plaster-of-paris and such injuries alone.

Besides this modicum of ability, the faithful following of the simple instructions is needful. This is illustrated by the experience of an orthopedist of considerable practice to whom a piece of the splint material was sent to be tried. He soaked the material in a pail of water, though the instructions directed that it "be moistened with water until semiplastic." For a result this gentleman had failure; he frankly acknowledged afterward to the writer, his recognition of the cause of his failure.

Though this mastery of the material were difficult to attain, it would be well worth the effort, for the compensatory complaisance which the practitioner enjoys in the conscious power to be able to splint any case that presents itself, he molding the splint to meet the indications of the individual case. Such splinting is scientific, since it presupposes that the practitioner *knows* the indications that should be met in a given case, and that he knows how to meet them. It contrasts strongly with the employment of manufactured splints, of which there are several varieties on the market, finely formed with beautiful curves and convenient angles; as a rule, however, we find that our patients have not been made to fit these machine made splints. An appreciation of this and of the practicability of employing wood-fiber led H. O. Marcy to state the rule, which it is believed will yet govern this branch of surgery, "The surgeon must make a splint to fit the limb, not the limb to the splint."

A demonstration of the practicability of living up to this rule is furnished in the splints here shown, each of which was molded directly upon the limb of the patient treated, and made of wood-fiber material moistened with water.

(Splints shown were used upon patients for fixation of the toes, ankle, bones of the leg, knee, hip, hip and knee together, thumb, fingers, wrist, bones of the arm and forearm, the elbow and the shoulder.)

In conclusion, the writer does not imagine that his poor efforts can change the general practice in the treatment of fractures much; but he hopes that some day the masters will cease for awhile their labor of climbing the Olympian heights of surgery to consider the facts of this fracture-treatment question. Their teaching, ultimately, he doubts not, will break the sway of the plaster idol, to the comfort and betterment of the injured.

99 Broadway.

DISCUSSION.

Dr. McFARLAND of Pittsburg—I agree with the author in the treatment of Colles' fracture, but I can not coincide with him in so far as plaster-of-paris is concerned. We owe too much to it to discard it. The author laid much stress upon the cotton padding, but so far as my experience goes with fractures of the lower extremities the ordinary Buck's extension apparatus and the sand bag work very well. When the limb is in apposition and there is no disposition to displace-

ment we apply plaster-of-paris. So far as the cotton is concerned, we put it on with an ordinary roller bandage. It is very thin and will apply itself accurately to the contour of the limb just as well as wood fiber. Even in compound fracture it is possible to do very excellent work with plaster. It is inexpensive and to one who is familiar with it, it is not difficult to apply. Its weight does not enter greatly into the matter. With reference to the ambulatory treatment you must use plaster-of-paris, and it gives us good results. Plaster-of-paris has stood the test of time.

Dr. McCONNELL of Pennsylvania—The author objects to plaster-of-paris because it does not immobilize the joint that is injured. I think a number of the bad joints that we have today are due to the too early commencement of passive motion. I think I would be opposed to plaster-of-paris if I used it the way they do in Boston. I do not put cotton batting next to the limb and I believe a very few of us do. We apply a piece of canton flannel first, then four or five folds of plaster-of-paris bandage, placing the soft part of the flannel next to the skin. On the outside of the plaster we place another piece of the flannel. When we want to examine the limb we can take the anterior part off for this purpose. I do not think there is anything against plaster-of-paris, but the fault is the lack of brains of the operator.

Dr. MURRAY of Michigan—I have used plaster considerably, and have also used silicate of soda, especially in compound fractures. I take the injured limb, measure the limb of a well child of about the same size, make my plaster-of-paris bandage over the limb of the healthy child, and after a few hours remove it and apply it to the injured limb. I apply the plaster to the under surface and hold it in place with adhesive plaster. This makes a light plaster and the person can walk around with perfect ease. To my mind the silicate is better than plaster-of-paris. So far as thickness is concerned, from four to six bandages are sufficient. Any old piece of cotton that you can find around the house will answer for the purpose. You can apply it at once in any ordinary fracture, or the second day after you have made your bandage over a healthy limb.

Dr. R. H. SAYRE—I would like to say a word about Dr. Swinburne's method of making extension of the fragments. He would apply plaster upon your arm and make traction upon the hand until he has the bone adjusted. The great point in the treatment of a fracture is to reduce the bone first. He would then reverse the two ends of his adhesive plaster, so as to hold the bone in position. With regard to the question of plaster-of-paris, I think a great deal of unjust blame has been put upon it by the reader. It seems to me the blame should be put upon the surgeons who apply it. Concerning the statement that plaster-of-paris has caused limbs to be lost, the sloughing which has occurred took place before the application of the plaster or the blood supply was suddenly interfered with. If the plaster was not put on too tight there would be no sloughing. A simple string around the finger will stop the circulation and bring on sloughing, and silicate of soda or anything else will do the same thing when improperly applied. It is said that plaster-of-paris does not immobilize the joint, but that depends upon the way in which it is put on. If you have a very fat woman with very small bones and you put on plaster-of-paris, unless you tie it down her bone will certainly wobble. If you put the plaster on outside of the stocking it will often answer perfectly well. Instead of taking six hours to dry, it takes but fifteen minutes. With a jack-knife you can cut it from one end to the other and take it off at your pleasure. If the case is a very fat one you can remove a sufficient slice from each side and thus make it fit admirably. In some cases you want more resistance than this particular kind of splint will give you. I have never seen a leg like these splints seem to have been applied over. This material is excellent and is lighter than plaster-of-paris, which is an advantage, but I think it is unjust to speak against any material that may be used, if the fault is in the mode of applying and not with the material itself. Regarding the advantages claimed for this material, the plaster-of-paris seems to have the same advantages.

Dr. McCLELLAND of Ohio—I have used this material in my practice for many years, but I now use plaster-of-paris more than ever. Other surgeons in my town have used both. I agree with our Chairman that the trouble seems to be more in the way the surgeon handles the case than the material. Sometimes bad results will follow, no matter what the material that is used.

Dr. HILL of Vermont—One of the great advantages in the applying of plaster-of-paris is that you need not handle the broken limb. To persons who are nervous, this is certainly a great advantage. Another good point is that we see our fractures come out of the plaster in good condition. This is due largely to the fact that nature has been left entirely

alone and given an opportunity to complete her work. It is often difficult in the country to hold a limb in exact juxtaposition. We owe a great deal to plaster, for we need not feel anxious after we have properly applied it.

Dr. J. McFADDEN GASTON of Atlanta—If the bone is kept too quiet we sometimes fail to get good results, and this is especially true where the plaster-of-paris is applied under certain conditions. I sometimes rub the ends of the bone together so as to set up an inflammation, and then put on the plaster afterward. I always leave an opening in the plaster so that the limb may be inspected. Pasteboard splints are most admirable substitutes for plaster-of-paris. Silicate of soda is the most admirable dressing. It makes a light splint and is well adapted to all fractures. It can be applied at any time. In discussing the use of splints, we must not forget that the two leading parts in the treatment of fractures is first, to properly reduce them, and second, to keep them reduced.

Dr. G. G. DAVIS of Philadelphia—Silicate of soda bandage is very good, but it must be used in a certain way. I prepare my bandages by means of a bandage roller. I make a V-shaped box with a handle at the top and a ledge near the bottom. This box is filled with silicate. The bandage goes over the edge of the box and is wound on the winch. Bandages made in this way will keep indefinitely and are always ready for use. This is especially advantageous for those who do not have ready access to a drug store. When I take them out I roll them up in wax paper. In applying them I simply put a layer of cotton next to the limb and then put on one of these silicate bandages. I use strips of rubber or something like that to prevent the bandage from wrinkling. I then apply additional silicate but not too much, and after this another bandage is applied. The leg is allowed to remain on the surface of the clothes, and the next morning the bandages are dry and hard. You can readily make openings in this if you wish to remove it. If you wish to reapply one of these dressings as is frequently desirable in the after-treatment you can very easily do so. This method also does very well for a brace for a child. It can also be applied in such a way that it may be laced with a corset string so that it can be taken on or off at will. By applying shellac they are made much more durable. You must adapt your dressing to your case, and I do not think plaster-of-paris is as well adapted for this treatment as the silicate.

Dr. FOWLER—The fact is that about three-quarters of malpractice suits are brought for bad results following the treatment of fractures. It is important to be able to inspect the injured parts after the bandage is applied, but this is not an objection to plaster-of-paris. In many instances bad results are due to carelessness of the patients. Plaster-of-paris and pasteboard might be employed together, or at different stages both may be used alternately. This is a subject too vast to be discussed fully here. The use of silicate of soda is open to the objection that unless there is something to hold it in place it is almost impossible to prevent the distortion of the parts and the occurrence of unsightly and uncomfortable wrinkles. An attempt has been made to make a spinal jacket of silicate of soda and the result was the combining together of silicate of soda and plaster-of-paris. The method is to first apply an ordinary silicate of soda dressing and over this a dry bandage; then the plaster-of-paris is applied. This is allowed to stay until the silicate of soda is hardened, probably some days. At the end of this time the plaster-of-paris is cut away and the silicate of soda then assumes the entire responsibility. It is useful in some cases where the person is weak and broken down by disease. Without the plaster-of-paris it would not have been possible to achieve success in the treatment of fracture, and without this substance and also silicate of soda, pasteboard, etc., it would have been absolutely impossible to have been successful in the ambulatory treatment.

Dr. TRACY—It has been urged against my method of wood-fiber splinting that it could not be used in the ambulatory treatment of fractures. In answer to this objection, I am happy to state that a case of fracture of both leg bones near the ankle treated successfully with wood-fiber, ambulatory treatment was reported by me before the New York Society of Medical Progress, in March last. The use of passive motion to injured joints is advocated at the earliest moment consistent with safety. The surgeon treating a case must be the judge of that time. In this discussion, not indeed anticipated, statements have been attributed to me which will not be found in my paper and I feel that when it is read at leisure by the members that they will be more likely to agree with me in the conclusions arrived therein. Reference has been made to the use of silicate in the treatment of spinal troubles. The spinal jacket which I now exhibit to you was molded directly upon the body of a child—a patient of the Boston Children's Hos-

pital, a case of Pott's disease—and worn by the child during the past year. This was done through the courtesy of Dr. Bradford of Boston. The jacket is made from wood-fiber material and, as has been said, was molded directly upon the child, without the aid of the plaster cast used in the ordinary method. This direct molding was possible with the aid of my machine for the control of the spine, by which traction in any desired degree, together with lordosis of the spine can be produced simultaneously. [The machine is described and pictured in the *Boston Medical and Surgical Journal*, Oct. 1, 1896.]

In conclusion, I would state that no other gentleman present has used the wood-fiber splinting described in the paper, and for that reason more words in its favor are wanting. The material referred to by Dr. McClelland is not the same as that which I have exhibited to you.

RENAL SUPPURATION, CATARRHAL, SPECIFIC AND TRAUMATIC, AND THE VALUE OF MICRO-URANALYSIS OF THE URINARY SEDIMENT AS AN AID TO DEFINITE DIAGNOSIS OF IT.

Presented to the Section on Obstetrics and Diseases of Women, at the Forty-eighth Annual Meeting of the American Medical Association, held at Philadelphia, Pa., June 1-4, 1897.

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(Concluded from page 990.)

The morphologic examination of urinary sediment as an aid of dominant importance in the diagnosis of renal suppuration.—Renal abscess or ulceration of the kidney has only comparatively recently been added to the nosology of serious pathologic lesions. Its ready and definite recognition, with an accurate knowledge of its etiology, with our modern precise and effective treatment of it, makes one of the grandest achievements of the art and science of surgery in the nineteenth century.

For a long time past, for say thirty or thirty-five years, since, in fact, the study of the histologic elements of the human body began to assume the aspect of a science, more or less importance has been attached to the significance of the morphologic elements found in the urinary sediment, as an important though indefinite auxiliary in the diagnosis of renal suppuration.

M. Alberan was among the first to utilize this aid in the diagnosis of tuberculous kidney, and his distinguished master, M. Guyon, has long since admitted the great semiologic value of uranalysis in suspected renal abscess. In the colossal work, however, of systematically arranging, grouping and classifying the different varieties of pyuria, the late Dr. Carl Heitzman was the pioneer and founder. As early as 1879 we find his first contribution on this important subject; but for some years before his death—January, 1897—he had placed it on a solid and enduring basis, and for this alone he has left the medical profession under eternal obligations to him.

Anatomic and pathologic data.—In order that one may intelligently interpret the morphologic atoms found in pyuria, it is essential that we have a familiar acquaintance with the finer anatomic atoms and the structural composition of the genito-urinary tract, besides the difference in function and histologic composition in the two sexes.

Pathology and urinary analysis.—It goes without saying, that, besides a knowledge of the normal structures and secretions, we must be acquainted with the anatomy and histology of the urinary organs before we undertake a microscopic examination of the diseased

elements found in the sediment of the renal excretion. We must have a special training in urinary analysis; as a general knowledge of the microscope will serve us but an indifferent purpose when we come to purulent urine. It is important, then, that there be a clear understanding on this point at the outset, else chagrin and disappointment are quite certain to follow.

The urine in renal suppuration, or purulent catarrh.—In order that we may eliminate error or confusion as far as possible, in all cases, it is well to exclude suppurative conditions along the lower genito-urinary tract; the vagina, the uterus, the Fallopian tubes or the urethra; and in the male, the urethra, the prostate or the seminal vesicles.

Having excluded these, as free, we next approach the bladder. For various reasons we meet with many difficulties here; not in recognizing the presence of cystitis, but its various types.

The urinary sediment.—It has already been stated that the presence or absence of renal pus in the urine, of itself, under many circumstances, is an indefinite quantity in diagnosis.

Thus, in chronic catarrhal nephritis in strumous individuals, epithelial degeneration and morphologic reversion of histologic elements and suppurative discharge, so-called leucocytosis, may go on over a long period without hyaline degeneration, interstitial or organic changes in the renal substance supervening. Neubauer and Vogel record a case bearing on this point, which very well demonstrates the tolerance of the system to pyuria in certain individuals. Their patient was a man who was under treatment for rheumatism, when it was accidentally discovered that he was periodically discharging great quantities of pus in the urine. And yet there was no evidence of any lesion along the uropoetic tract.

Suppurative or ulcerative inflammation of the peripheral type, involving the surface layers of the epithelia or the mucosum of any area of the mucous membrane of the urinary tract up into the tubular structures of the kidney, always gives issue to a purulent admixture of the sediment in the urine.

But when we have an infection involving the interstitial connective tissue elements in the renal tissues, we may have a large purulent collection, without any of it making its way out through the urinary passages. The same absence of pus in the urinary sediment may obtain in cases of calculous impaction of the ureter, or cicatricial stenosis consecutive to ulceration.

The composition of the urinary sediment in purulent urine.—Aside from mineral and nitrogenized elements in pyuria, in the sexes, we have invariably epithelial elements, pus corpuscles, shreds of disintegrated connective tissue, and commonly more or less blood discs, according to the degree and site of inflammatory action.

Large quantities of pus in the urine, of a vesical or renal origin, is always more or less ammoniacal. This decomposing animal matter greatly accelerates fermentation of the healthy secretion, and this in turn imparts an alkaline reaction which, acting on the urine, induces again a saponification, a transformation of pus into a ropy, tenacious mucus. This chemic change is more common in some specimens of urine than in others; its degree depending on extent of urinary stagnation as well as the condition of the mucous membrane of the bladder; and hence there may be discharged from the weakened, anesthetic bladders of old people urine primarily, freely inter-