lesser curvature, amputation necessarily must be made somewhere through the middle zone of the stomach. This greatly alters the technic to follow. Inasmuch as the stomach is considerably shortened and the opening of the cut end very large, the suture line making an anastomotic opening with the jejunum must be above the opening in the mesocolon instead of below it. Here stricture has resulted, Dr. William Mayo having reported two cases. To avoid this contingency, Dr. Charles Mayo has modified the operation as follows: To the cut end of the stomach he attaches the jejunum, 18 inches from the ligament of Treitz, anteriorly. When the union is completed the anastomotic opening adjoins the lesser curvature, and is no larger than 3 to 5 cm. I have carried out this technique only once but from that I can readily appreciate that this method is a step forward in practice.

There are technical difficulties, however, in making the anastomotic opening adjoin the lesser curvature, especially when the stomach is amputated in the prepyloric zone. The process of suturing may be far more difficult than it is when the opening with the jejunum is made at the lower border of the stomach because one may be obliged to work under the shelf made by the costal arch.

The number of clinicians and surgeons who believe that gastroenterostomy as a single procedure should never be the operation of choice is increasing. It is no exaggeration to state that the vast majority of internists are opposed to gastroenterostomy *per se*, yet, some who appear to be conscientious objectors to surgery in general favor radical surgery in dealing with chronic indurated peptic ulcer. For example, Dr. C. J. Johnson of Atlanta, Georgia, in 1917 made the following remarks: "Internists know that ulcers do get well without the knife and that after many years these patients have the appearance of comfort and health. On the other hand, it is true, that there is no successful treatment for some ulcers, or for the complications which they bring about, except operation."

It has been the universal experience that better results have been obtained by gastroenterostomy made in the presence of benign obstruction at the pylorus, and in this limited group of cases simple gastroenterostomy is a most useful and satisfactory therapeutic measure. But, in general, it may be said that operation

for chronic ulcer cannot be applied by rule of thumb, and it is evident that the slowly shifting technique shows the ideal operation not vested in any procedure which leaves the ulcer.

The most satisfactory method of attack aims at excision of the ulcer in a way which does not "alter the complex relations of the alimentary functions and the more complex forces which maintain these functions." One principle of far-reaching importance is the fact that the alimentary tract is a one way passage. This is constituted a law at birth. Infringement upon its claims, either from disease or from the art to cure disease, is a bid for trouble. The multiplicity of short-circuiting operations for the relief of intestinal stasis affords ample proof of this contention. When operation is to be done what surgical and physiological principles are more simple and more rational than removing the disease and leaving the alimentary tract a one way passage? It should not be necessary for nature to put up arrows on the gastrointestinal tract to impress one with the wisdom of so planning his operation as to avoid the collision of food currents. When time and the condition of the patient permit, a technic which removes the lesion and leaves food currents passing in one way out of the stomach will be far less likely to "alter the complex relations of the alimentary functions and the more complex forces which maintain these functions."

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TREATMENT OF BACK INJURIES WITH SPECIAL REFERENCE TO SPINAL FRACTURES THAT ARE NOT ASSOCIATED WITH CORD SYMPTOMS.

BY HEERMAN W. MARSHALL, M.D., BOSTON.

SURGICAL treatments for vertebral fractures without spinal cord symptoms were conceived and have been carried out successfully by different surgeons, so that they have to be considered now together with non-operative measures for fractures.

The data that originally suggested the feasibility of operative interference can be reviewed sufficiently from the following facts:

1. X-rays proved that vertebral fractures occur many more times than was supposed previ-

ously; and that numerous intractable so-called back sprains are in reality compression fractures of vertebrae without cord symptoms.

2. Successful transplantation of bone from one region of the body to another indicated the practicability of converting strips of bone which were taken from tibiae into reinforcing splints for the fractured sections of spines.

3. Accumulated clinical observations had demonstrated that spinal fractures, as they had been recognized, are serious injuries with prolonged or permanent impairment of back functions.

4. Patients testify unanimously that steel braces or jackets of leather and plaster are uncomfortable, restricting, and continually annoying.

Hopes were aroused, therefore, that spines might be strengthened permanently by grafting of bone along spinous vertebral processes, thus bridging over defective sections effectively enough to permit troublesome apparatus being dispensed with entirely. The medical profession owes a debt of gratitude to the surgeons who have had sufficient initiative and courage to prove these surgical methods can be of value in selected cases, and now we are in a position to inquire further into comparative merits of operative and non-operative treatments.

The following questions should be asked and answered as accurately as possible from clinical data and clinical impressions which have accumulated:

1. Are all spinal fractures without cord injury permanently crippling in serious degrees?

2. Precisely how much benefit is derived from spinal grafts? Are there any failures after surgical measures? Does surgery obviate always the subsequent use of mechanical braces?

3. What influences upon results of treatment have varying degrees of compression in the injured vertebrae and slight dislocations of fragments?

4. Can mechanical braces be improved so as to minimize their objectionable features?

Question 1. The first bit of evidence bearing on the first question, namely, whether all spinal fractures without cord injury are permanently crippling to serious degrees is offered in the following case:

A middle-aged laborer in good general health sustained an impacted fracture of a lumbar vertebra by having a bale of hay drop on him

from several stories above, while he was passing along on the sidewalk beneath. The bale hit him squarely on the shoulders and the force of the blow impacted the body of the lumbar vertebra to a degree represented by one-third of its normal thickness, that is, the injured vertebra appeared to be about two-thirds as thick as the adjoining vertebrae immediately above and below it.

There followed a serious disability lasting approximately a year or more with final complete recovery, and the patient was seen first by the writer five years after the accident for a new complaint. The old fracture was identified incidentally at this examination in x-rays which were taken then, but no complaint was made of the fracture and its existence was not known to the patient himself.

This is the only case of such decided degree of crushing with perfect functional recovery, which has been observed by the writer in a series of thirty cases, upon which this paper is based.

The second case is that of a twenty-six-year-old man of rather delicate appearance. He weighed 117 pounds, was 5 feet, 5 inches tall, and he had dropped from the top of a twelve-foot step ladder, striking on the floor in sitting posture. An x-ray taken three weeks after his injury demonstrated a barely perceptible crushing of his eleventh dorsal vertebra; and at this time he had the strength of 50 pounds in a back strength test, which consisted in lifting on a dynamometer as he stood in slightly bent posture.

He refused to stop work wholly, although obliged to give up his regular occupation of electrician. He was the sole support of his family, and, with aid of a steel back brace, with considerable discomfort, he succeeded in continuing a part of each day as travelling agent for an electrical firm. Experiments proved that a steel brace was more comfortable for him than a plaster-of-paris jacket.

He ceased entirely to draw compensation from the insurance company that was paying him at the end of six months; and two years after his injury he had discarded all of his supports. He was made a member of the firm in which he worked and at this latter date he still noticed a little back weakness occasionally when playing with his children at home.

The third case is that of a twenty-four-year-old man, 125 pounds in weight, who was a yarn boy in a cotton mill. He fell onto the top of an ascending elevator and was doubled up against overhead beams when it reached the top as he remained in sitting posture. He fractured his twelfth dorsal vertebra to a very slight degree and was advised by an orthopedic surgeon to have a spinal graft inserted, but this advice was not followed. Three months after the injury, at the writer's examination, he had surprisingly good back function and could lift 320 pounds in a back strength test. A light steel support was made for him then and subsequently he was lost sight of.

If this third patient had received an operation and good results had been obtained, there is little doubt that the latter would have been attributed largely to the surgical treatment by the surgeon in attendance.

To the writer, the injury in this instance as well as in the second case cited, appears to have been more of musculo-ligamentous character than of serious bony nature. It is true these two cases can be classed as fractures of vertebrae and might appear in surgical statistics under certain circumstances as most brilliant results, yet it seems such interpretations should be accepted with reservations when the entire situations are considered.

From these few cases it is possible to say, however, that vertebral fractures are not necessarily permanently crippling always to serious degrees; and that healthy young subjects with slight fractures seem to have fair chances of good or complete recoveries.

Question 2. Precisely how much benefit is derived from spinal grafts? Are there any failures after surgical measures? Does surgery obviate always the subsequent use of mechanical braces?

The first part of this question can never be answered positively; because it is impossible to separate results of normal reparative processes always going on in injured spines from additional results simultaneously occurring that are due to reinforcements simply from inlaid grafts.

The best idea of the value of spinal grafts in the writer's opinion is to be obtained still from theoretical consideration of the situation mechanically, especially in so far as theoretical

principles can be harmonized with dependable clinical results and interpretations.

Clinical evidence indicates that the fate of different spinal grafts is somewhat variable, and that not infrequently they are absorbed or replaced by non-bony tissue. Furthermore, from a mechanical viewpoint it is incomprehensible that strips of bone bridging spinous processes at a distance from crushed vertebral bodies will lessen pressures on these compressed cancellous front parts of the vertebrae very greatly. In subsequent forward bendings of the body crushed vertebral bodies must stand the same squeezing pressures as they did before injury; and possibly persistent pains and disability associated with fractured spines are not dissimilar in part to the pain and disability noted frequently in crushes of the os calcis.

It is well understood that a severely crushed os calcis in a patient past middle age is frequently followed by persistent localized tenderness, also pain on walking for years afterward. Accordingly, it may be well to differentiate, at least two origins of pain in spinal fractures, namely, pain due to crushing of cancellous bone in vertebral bodies and, secondly, pain due to rupture or strains of the posterior group of spinal ligaments.

It is easily conceivable from a theoretical standpoint and also is not contradicted by clinical evidence, that inlaid grafts, whether they remain as bony bridges or fibrous ones, act as reinforcements to the group of posterior spinal ligaments and muscles. It is easy to believe in severe fractures with slight dislocations of fragments and much tearing of ligaments, that closely applied bone grafts at precise sites of injuries will strengthen spines in a manner which steel braces can never do on account of the latter being more remotely situated outside the body with no intimate attachments closely around the damaged areas.

But anterior spinal ligaments, however, which have been abnormally relaxed in severe crushes will remain so regardless of posterior spinal grafts; and presumably anterior ligaments are involved in the pains associated with cancellous bony defects in anterior parts of vertebrae.

The following case is instructive in the present connection:

A middle-aged Italian laborer fractured one of his upper lumbar vertebrae, but was not operated on for several years after his injury.

Soon after the accident, while in a partially disabled state, he was sent to jail for being implicated in the killing of another Italian. After serving a two-year sentence, during which period he was able to work regularly at a sitting occupation, according to jail authorities, he was examined anew. X-rays revealed the fractured vertebrae, and an operation on his back was performed and bone grafts inserted.

He was seen one year after this operation by the writer. At the latter time he wore no support and could lift 90 pounds in a back strength test. The operation wound had healed perfectly, but he claimed that he was weaker after his surgical experience than before it. A steel back support was fitted to him after the writer's examination. The brace made him feel considerably stronger, and he was better able to continue at regular light work in a cigar store.

Presumably somewhat more damage than good was done in this particular operation, although there was perfect healing of the wound. The injured muscles and ligaments had undergone reparative changes, and the damage done to them in clearing the surgical field for insertion of grafts was greater than the benefits derived from additional reinforcement of the inlaid bone. The case serves to emphasize the importance of musculo-ligamentous stays of the spine in contrast to anatomical variations or defects purely. It also illustrates the fact that braces sometimes are needed after operations.

The writer has seen less than a dozen operative results on non-tubercular spines, and cannot give precise statistics regarding the subsequent use of back braces; but all cases after surgical treatment have to wear plaster casts or some kind of support at least for brief periods, and a considerable proportion of them are obliged to wear mechanical appliances for prolonged periods subsequently. Furthermore, some of those who do not, presumably would be benefited by braces as was the patient whose case has just been cited. These facts, however, do not discredit operations in selected instances.

An answer to Question 2 can be made fairly as follows from observations on the whole group of thirty cases. It is impossible to estimate very precisely how much benefit is derived from spinal grafts, but they usually reinforce to a slight degree at least the posterior group of spinal ligaments. They do not pre-

vent further painful pressures on crushed bodies of vertebrae. There is some danger that more damage than benefit will result from surgical operations through unavoidable cutting of posterior muscles and ligamentous attachments.

Mechanical supports are required for long periods after operations in a considerable proportion of cases, and the results of spinal grafting are not sufficiently perfect and complete to make additional benefits negligible which are secured through proper use of braces.

Question 3. What influences on results of treatment have varying degrees of compression in the injured vertebrae and slight dislocations of fragments?

This question has been answered indirectly in the two preceding ones. It is known now that all grades of bony injury occur, from tearing off of tiny particles of bone at ligamentous attachments to severe bony crushes and displacements which are accompanied by the beginning evidences of spinal cord compression and cord injury. The group of cases of spinal fractures without cord involvements therefore really is not a homogeneous one, but includes many different minor degrees of bony ligamentous defects.

The lesser injuries can be recovered from perfectly in healthy young adults in comparatively short time, with or without surgical treatment; and the more severe compressions with displacements of fragments are followed by more or less impairment of back strength permanently, whether operations are done or are not done. The most favorable cases for surgical methods, probably, are those with slight osseous damage and with extensive posterior ligamentous injury.

Question 4. Can mechanical braces be improved or used so as to minimize their objectionable features?

An affirmative answer can be made to this question; and discussions of details of construction of braces naturally merges into principles of their use, so both will be mentioned; and what is said of vertebral fractures is applicable in large measure to apparatus and principles of treatment used for the larger important group of back strains not associated with bony lesions.

An average efficient steel back brace consists essentially of two rods running up along each side of the spine from a pelvic steel base. It is

commonly held in place by various straps and bands which encircle body, arms, and legs. The steel supports help to relieve back muscles and ligaments on the one hand and, secondly, they also prevent motions which may injure the osseous framework itself.

Shoulder straps and leg straps are made frequently in ways that interfere with arm and leg movements sufficiently to be sources of serious annoyance when much activity is attempted. The writer has attempted, therefore, to minimize these inconveniences as follows: In place of usual perineal straps which are required to keep some braces from slipping up, a very thin broad, flexible band of steel is made to encircle the pelvis completely and to conform accurately to its peculiarities. It is made of appropriate rigidity and elasticity to hold down attached upright bars as it grips the pelvis in a comfortable yielding way. In this manner legs are left practically free and unhampered.

At shoulders there is substituted a sternal piece of thin steel or firm inelastic fabric from which, at its upper corners, straps pass upward over shoulders to back steels and outward from its lower corners around sides of the chest under the axillae to the back brace. This arrangement is employed instead of straps closely encircling the shoulders. Pectoral muscles are left wholly unrestricted because the sternal piece covers only the sternum and because its outlines are curved to follow the curved insertions of pectoral muscles on the chest walls. Consequently there can be no irritating sawing action of straps across soft tissues at the shoulders.

Lateral and twisting spinal motions are controlled sufficiently by lateral steel uprights running up from the flexible pelvic steel band below. They terminate at the ends of an upper horizontal flexible steel band, which passes around the back of the chest from side to side and which is attached to all four upright pieces.

A very light steel cradle of considerable firmness and elasticity is thus formed for the flexible lumbar region of the spine and the body is held comfortably in it by anterior sternal straps, broad webbing straps encircling the chest and abdomen as needed and by the pelvic steel band below.

Patients prefer these simple braces to plaster-of-paris jackets or elaborate leather corsets and

they are nearly as efficient as heavier, more rigid appliances.

Other details of seemingly trivial nature which nevertheless determine comfort and effectiveness of apparatus include selection of proper widths and gauges of steel for individual peculiarities of weight and strength. Adjustable features worthy of mention are those which permit easy replacements of heavier supporting rods by lighter ones without destruction of braces as patients become stronger and more normal.

All small improvements that collectively can be described as refinements of design and manufacture contribute to ultimate success of treatments similarly as increased breadth and clarity of conceptions of the medical problems in hand likewise lead to improved results.

There can be very little benefit derived, however, from hanging a finely constructed piece of apparatus on a patient if its possibilities and limitations are not understood, or if the doctor fails to convey adequate instructions and explanations to patients about proper use of their braces.

Some supports are fitted from directions sent out by large commercial concerns which make orthopedic corsets, jackets and other apparatus. Responsibilities for successes or failures in treatment nevertheless rightfully rest with attending physicians, not with makers of apparatus; and it does not appear to be most reputable practice to prescribe appliances without knowing how much harm they can do as well as benefits they are capable of yielding.

Patients with comfortable apparatus are liable to wear the latter until weakness or atrophy of muscles from disuse appears. Or if slight temporary discomforts are experienced there will be unwarranted discarding of supports although these may be the single vital requirements for most speedy recovery of strength and normal function.

Mechanical appliances are prescribed almost wholly from anatomical viewpoints in a considerable number of cases. There seems to be wide recognition of the disadvantages of bad postures and anatomical deformities and much less appreciation that muscles and ligaments possess important physiological peculiarities themselves; that they are designed especially to cope successfully with mechanical disadvantages and marked anatomical variations. An-

atomic results of previously acting causes consequently command attention usually instead of functional causes of symptoms existing at times when treatments are received. Mechanical devices are blamed when the physicians themselves instead are at fault in not understanding the whole situation, and in not knowing precise possibilities and limitations of supports prescribed.

Physiological treatments of simple back strains and strains of ligaments and muscles associated with spinal fractures include use of braces; physical therapeutic measures; internal medical measures and general hygienic regulations that modify the quality of blood circulating through weakened back muscles and ligaments; and of exercises of varying degrees.

Successes or failures depend upon the manner with which these different physiological agents are combined and alternated. One of the commonest mistakes seems to be adherence to any single one kind of treatment. Braces are kept on continuously when instead there should be alternations with periods of graduated exercise; exercises and massage are given to muscles struggling with unfavorable vascular conditions so that under these circumstances these therapeutic measures delay returns to normal state again. Even with use of mechanical supports for low back strains there seems to be much chance for improvement. Numerous strains around lumbo-sacral and sacro-iliac regions are fitted with belts which reënforce the pelvis, yet that are very inefficient in protecting lumbo-sacral junctures from lateral and twisting movements.

There is no single brace or belt which fulfills all requirements completely of any situation very long and accordingly in the writer's opinion mechanical back appliances should be made of easily convertible character, *e.g.*, combination affairs which possess jacket features for restricting lumbar motions, with detachable belts which can be used alone to hold pelvis tightly while allowing free lumbar bending.

Then by keeping in mind certain important physiological principles, namely, the need of alternate activity and rest in all tissues, also the general scheme in most cases which starts with more or less protection for muscles and ligaments followed by gradual diminutions in use of supports and gradual increase in normal functions, it is possible to prescribe belts

or massage, jackets or manipulations or physical therapy, and internal medical regulations with increased efficiency.

CONCLUSIONS.

From study of thirty cases of vertebral fractures without cord symptoms and from a much larger series of simple back strains, the following facts and opinions have been arrived at:

Spinal bone grafts are suited best to well-to-do patients who will be considerably benefited by slight or moderate improvements in their physical conditions. Results of surgical methods are not beneficial enough uniformly; and chances of fair or excellent recoveries are so good in healthy young adults without operation, that spinal bone grafts are not warranted in the majority of workmen's cases.

Spinal grafts reënforce the posterior group of spinal ligaments and usually strengthen spines at least to slight degrees. There are some dangers that unavoidable injuries to muscles and ligaments which result from surgical procedures may weaken backs more than inlaid grafts strengthen them.

Mechanical appliances are required very commonly for considerable periods of time even after successful grafts; and results of this combination are presumably better often than either single method of treatment alone.

Slight degrees of bony fracture in healthy young subjects are fairly well recovered from without operation in six months or less at times; and severer grades of bony impactions occasionally are followed by complete restorations of back functions without operations several years after dates of injuries.

Causes of back symptoms and disability in vertebral fractures should be separated into two groups. The two causes are (1) ruptures or strains of posterior groups of spinal ligaments and muscles; (2) crushes of cancellous bodies of vertebrae with accompanying relaxations of anterior spinal ligaments. Spinal grafts presumably do not influence the symptoms greatly which originate in the second class of causes.

Mechanical braces often can be improved in details of manufacture so as to minimize their objectionable features; and while protecting injured back muscles, ligaments and bones still

permit to a maximum degree usual functions of arms and legs.

Treatments of back injuries, perhaps, should be directed primarily toward restoring strengths in muscular and ligamentous tissues because these are phases of treatment which are usually overlooked and neglected; but pathological conditions in crushed vertebrae should be appropriately treated by immobilization and protection in ways universally approved in treatment of fractures.

The influence of bad postures and of other anatomical peculiarities upon existing symptoms in simple back strains should not be forgotten. Such postural variations usually represent the accumulated results of past musculo-ligamentous changes, but do not indicate functional states of muscular or ligamentous strengths at any specified time. Backs may be comparatively strong with very faulty attitudes or relatively weak with nearly perfect postures, depending on powers of supporting muscles and ligaments at the time to accommodate for anatomic requirements.

Treatments for musculo-ligamentous defects should include use of various therapeutic agents according to physiologic requirements of the tissues in question. There should be use of mechanical braces to reënforce muscles and to offset temporarily the extra mechanical strains due to faulty postures or anatomic deformities. Physical therapeutic agents, massage, manipulations, exercises should be employed as well as internal medical measures. The latter rectify vascular defects and influence muscles and ligaments through the qualities of circulating blood.

Continuous exclusive use of any one of these methods is unjustifiable for very long periods, and they should be alternated and combined with due regard to established physiological principles of alternate rest and activity known to be best for muscles and ligaments.

It is unjustifiable to prescribe mechanical apparatus without knowing accurately harmful as well as beneficial possibilities; and without explaining to patients adequately the functional goals which should be sought and those to be avoided among continually fluctuating states in muscles and ligaments. Use of mechanical apparatus ought to be conceded more generally to be a complicated important matter, which

should not be lightly undertaken, bungled, and finally abandoned with unjust condemnation of these valuable therapeutic agents.

SOME INCIDENTS IN THE LIFE AND MILITARY CAMPAIGNS OF BARON LARREY (1766-1842).

BY WILLIAM PEARCE COUES, M.D., BOSTON.

At the present time a study of the life and accomplishments of the greatest of military surgeons has a peculiar interest. Though the name of Larrey is well known in America, and occasional articles concerning him have appeared in the journals of this country, it is hoped that some new facts of interest will be found in the following pages. Certainly the accomplishments of this great man, with the almost insurmountable obstacles he had to contend with, form a page of medical history which can well be compared with all the wonders of military surgery in the recent war.

A hundred years ago the constant battling with widespread and overwhelming infections which swept through armies like a conflagration, formed a very great part of the military surgeon's work. Larrey coped with many of these successfully, and proved himself a military hygienist of the highest order. This, combined with his great surgical genius, formed a combination of qualities which has never been excelled.

To many men who have arrived at such great distinction in their different callings there is denied the love and devotion of their fellow-beings, through certain defects of character which may be ascribed to the eccentricities of genius. Larrey, besides his great skill and untiring devotion to his work, was happy in possessing the esteem and even the adoration of his patients to a degree seldom equalled. To be sick or wounded, whether friend or foe, was the only qualification necessary to procure his attention and devotion. Indeed, at one period of his campaigns he almost lost his life, while attending English soldiers, ill of typhus. That this was not the only time that his life was in jeopardy will be seen as we follow his career through some of the thrilling incidents through which he passed. Unquestionably his great strength and rugged health enabled him