

1839 Williamson

On Fractures.

The subject of Fractures is perhaps the most unfortunate that can be selected for the subject of a Thesis, seeing in the first place, that from the nature and extent of its application it can hardly be handled, if at all, in the limits assigned to one; and in the second place that it is thought to be so easily and universally understood, as scarcely to receive even an ordinary share of attention. The first of these being admitted, it will be sufficient, in addition to what is seen in every-day life both in and out of the Profession, to illustrate the second by an observation of Mr. Pott, who is justly looked upon as having been one of the best and most experienced judges of Surgical practice. "Every" he remarks, "the most inexperienced and least instructed practitioner, deems himself perfectly qualified to fulfil this part of the Chirurgical art; and the majority even of these are affronted by an offer of instruction, on a subject with which they think themselves already so well acquainted. This is also the opinion of

of a considerable part of the people.

They regard Bone-setting (as it is called) as no matter of Science; as a thing which the most ignorant farmer may, with the utmost ease, become soon and perfectly Master of; nay, that he may receive it from his father and family as a kind of heritage. These various identifying reflections may have induced this great Surgeon (as they are followed by it) to have given to the world that excellent production, which, though faulty in some respects, has been looked upon as constituting the first Scientific enquiry of this branch of the ~~subject~~ healing art, and as laying the foundation of those more successful and Scientific views now entertained regarding it. It is not easy to see why such a feeling should still exist with many regarding this subject, fraught as it is with so much interest and importance; for to use the words of an able Medical writer, "Whether is this branch of Surgery simply mechanical, nor restricted to the consideration
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of bandages, Splints and other apparatus; but comprises questions and investigations not impeded in respect to their scientific character, by any others in the whole range of surgery."

It is hoped that the following pages will contribute somewhat to the corroboration of this statement. And here let the caution be repeated against the supposition that the treatment of fractures is simply a mechanical business, and the advice - that whoever is intent on treating the accidents giving rise to fractures either of a simple or complicated nature, must have an intimate acquaintance with the principles on which that is to be conducted; and they will be found to comprise from the frequency and variety of these accidents, by far the greater number of the principles of the Profession in general. In the following essay I do not intend, neither would my limits allow me, to give a succinct account of the several fractures occurring in individual parts of the body. It will
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be my endeavour to narrate in detail the principles on which a correct knowledge of this class of affections has been founded, and on which our efforts at cure are employed; and to point out the several accidental circumstances, originating in different causes, which are capable of swaying these efforts and those principles.

The English word Fracture is from the Latin frangere Fractum, and is meant in professional language to convey the idea of a sudden breach formed in the continuity of one or more bones, attended by a set of corresponding changes from the normal state of the part in which it has occurred. This breach of continuity as it is effected by a variety of means, and influenced by a variety of circumstances, is made to assume a variety of conditions; whence the necessity and importance of drawing definite distinctions between them, and accordingly a judicious classification of Fractures has been found of essential service in practice, in elucidating them

their pathology and contributing in no small degree to success in their treatment. The important distinction which first presents itself, and it is of primary consequence in practice, is founded on the condition of the neighbouring soft parts, and is well expressed by the terms Simple and Compound.

The Simple Fracture exists in a break in the continuity of a bone without any external wound communicating with it. The circumstance of a wound exposing the fracture renders it compound, whether this wound has resulted from the cause inflicting the injury from without, or from the fractured end of the bone itself. This great distinction being premised, it is necessary, in order to understand the subject, to consider its two departments separately and in detail.

Simple Fractures. The remarks which were offered concerning the distinction of fractures in general, do also hold good with regard to this by far the most

most frequently met with division of the subject. For if we consider more definitely the causes and manner of its production; modified by the particular bone, and the particular portion of the bone, injured, and the state of the part when injured; acted upon too, both by the circumstances inducing the injury and those individually inherent in the part of the frame subject to the injury, we shall not be at any loss in discovering the grounds on which the distinctions of this class of fractures are framed. From such considerations Fractures are divided into 1. Single - transverse - oblique and longitudinal. 2. Comminuted - double fracture. 3. Complicated. These distinctions are not to be looked upon as "mere scholastic refinements," as in practice they severally maintain an important influence over the Prognosis and Treatment. 1. The term Single is applied to a Fracture existing at one part of the bone, and may be, from the direction of the breach, transverse, oblique or longitudinal: of these, the transverse

is in the shafts of the long bones, the simplest and most susceptible of a favourable result in the treatment. When it occurs in the Patella, or Calcis or Olecranon Elbow, in which it is the most usual form of fracture, it is apt to induce inflammation of the contiguous joints, and lead to diminution of their functions, from the union taking place by means of ligamentous substance. The oblique fracture is difficult of being retained in situ and is generally attended with effusion and considerable laceration of the soft parts. I have known two extreme instances of this form becoming compound during the treatment. The longitudinal form is seldom met with in simple fractures, it is however seen in fractures of the Patella, or Radius and Os Femoris; ^{as Ladyford the} it is a fragment attendant on gunshot-wounds implicating the bones. 2. The Comminuted variety occurs in the shattering of a portion of a bone and is generally the result of great force operating on the part. The double fracture is a

Modification

Modification of this and implies the existence of a break in two or more parts, distinct of the Bone at once. 3. The Complicated form is illustrated by the fracture occurring near joints, by the laceration of an artery &c. and may comprise all the above varieties.

The Diagnosis of fractures is frequently attended with difficulty, and can only be arrived at by a due consideration of their Symptoms and Causes.

The Symptoms attendant on a Simple Fracture are Deformity, and Shortening of the limb, (when seated there) / consequent on the surrounding Muscles, and weight of the limb itself, exerting their displacing tendency on the broken ends - inability, partial or complete, to move the injured part - unnatural motion, and Crepitus, or rubbing grating of the broken ends, on applying external force: - Swelling, from blood effused from the injured vessels, and displaced fragments - pain and spasmodic action of the Muscles, from irritation of the sharp extremities of the Bone & speedy follow: - there

is generally more or less collapse from the shock, and I have seen a stout healthy man faint on setting a fracture of his radius. In fracture of the extremities, extrication of air, difficult to be accounted for, sometimes takes place around the broken ends, and induces a feeling of crepitus, quite distinct however from that afforded by the rubbing of the ends themselves. These symptoms, though usually met with, do not always mark solution of continuity in bone. Thus there is little or no deformity, and certainly no shortening, in fractures occurring in only one of the bones of the forearm or leg; for the uninjured bone has acted as a splint and prevented any such thing from taking place: and in some cases of fractured Fibula related by the late Mr. Allan, the patients were able to walk about. ^{but} Again pain and inability of motion with swelling, result from dislocations and even bruises; while the most diagnostic symptom, Crepitus, is sometimes attendant likewise on dislocations

in which it is produced from attrition in the quality of the Synovia, as Sir A. Cooper has pointed out. ⁽⁶⁾ Fractures are rendered difficult of detection from the bone being deep-seated & from great ecchymosis having occurred; but above all, when from the severity of the injury or subsequent neglect, inflammatory swelling and tension have been allowed to take place. Now if a fracture be immediately reduced, and the broken ends be kept in accurate contact, and the other measures to be mentioned afterwards be employed for assisting Nature to repair the breach, for the process of re-union is entirely her handiwork in this as in other parts of the frame / caeteris paribus, the immediate result of the injury & the extravasated blood - will be quickly removed, and a series of changes take place. That, in the end, will induce this happy return to the normal state. But if the symptoms marking the recent occurrence of fracture be not attended to, and the broken ends be allowed to re-

(6) or Dislocations & Fractures of the joints. In vain

-Main unaided and the other proper
 means be not at once resorted to for
 the safety and cure of the patient and not once
 the injury, the spasms ~~will~~ become more
 violent, "Keep pulling about the bones",
 produce extensive laceration of the
 muscles, bloodvessels, nerves and whatever
 else comes in their way, with continued
 effusion and swelling; and this state of
 matters is either followed by the conversion
 of the simple into a compound fracture,
 or by the occurrence of violent inflammatory
 action, inducing great constitutional dis-
 -turbance and delirium; Gangrene or ^{In the latter case}
 at least Sloughing of the cellular tissue
 with extensive suppuration among the mus-
 -cles, is inevitable, and, if survived, leave
 the limb deformed and useless. With this
 frightful anticipation before them, is it not
 matter of surprise & regret, that empirics and
 others, unacquainted with the pathology of
 this branch of the healing art - in intimate re-
 -lation with the general pathology of that art
 itself - should undertake the management
 of this important class of affections? And

that

that there are to be found those who are foolhardy enough to risk "limb & life" in their hands?

The Causes of Fractures.

Bones are broken in three ways. 1. From external violence operating directly on the injured part. 2. From external violence operating on a part of the Bone distant from the resulting injury, and inducing it by causing a strain to be on upon it. 3 From violence in some predisposed cases, - ordinary action of the Muscles attached to the bones. The first of these is the most frequent, and is exemplified in the case of a fracture of the Skull, resulting from a blow. The second is more frequently met with in fractures of the tibia, caused by a twist of the foot - generally inwards - in a person falling. The last is very rare in a healthy condition of the Bones, and has been supposed by some to be entirely confined to the smaller Bones, as the Patella, Os Cubi and Metacarpus Minus, into which powerful external Muscles are inserted. There are sufficient cases on record however to

prove

prove that the long bones are liable to be broken in this way. I have known two instances of it treated in this Hospital. The first occurred in a stout young man in whom the right Os brachii was fractured immediately below the insertion of the Deltoid, during the sudden and forcible extension of his arm while yawning. The second happened in a man addicted to the use of Opium: a beam of wood suddenly struck him on the lower part of the thigh, as he was in the act of climbing, his leg was instantly forcibly extended, he felt the bones of his leg give way, and he fell down; on being taken up, it was found, that the Tibia & Fibula of the left leg had suffered simple transverse fractures, the former at the junction of its upper & middle third, the latter at its middle. Both of these men were free from any constitutional affections, and in both the fractures did well.

Sometimes two of these causes act simultaneously in inducing fracture, but when such has been the case, it is generally of the nature of double fracture.

Bones are predisposed to Fracture from various causes, as, from their situation, the Ribs and ribs; from their functions, the Radius and Clavicle, which give support to the hand and arm, and are connected with their general motions, ~~of the joints~~ and exposed to fracture from falls upon them; from the changes, which take place in them as age advances, inducing fragility; and lastly, from their diseased condition, either arising in connection with diseases affecting the System generally, or originating in the bones themselves. Syphilis, Cancer, Rickets, Scurvy and Scrophula are the diseases inducing a liability to Fracture in bones. Fragilitas osium, Medullary Sarcoma of Bone and Necrosis are those, which, existing in the osseous tissue, lead to a breach in its continuity. An interesting example of fracture from the latter of these viz. Necrosis, occurred lately in this Hospital under Mr. Lyne. The patient, a boy 8 years old, was admitted with acute Necrosis of the Left Femur. From the simple effort of rising from stool the bone snapped; & from the several cir-

- circumstances

-Circumstances connected with the case that need not be mentioned here, the limb was amputated, and on dissection the fracture was distinctly found to be nothing more or less than the separation of the dead from the healthy portions of the bone.

The History of Fractures is interesting and important, as in general leading to a knowledge of the exact cause of their infliction, and may, by declaring a priori the nature of the Fracture, be made to influence cases of medico-legal enquiry.

The Prognosis of Fractures perhaps constitutes the most important branch of their pathology, and is intimately connected with the principles of pathology in general, and accordingly can be only correctly drawn from a due consideration of these and of their several relations with Anatomy and Physiology. It varies 1. according to the patient's age and Constitution 2. according to the bone and part & Condition of the bone injured. 3. According to the Nature, extent & complication of the injury. 4. According to accidental circumstances

Running

occurring during the treatment.

The subject being young and healthy, the seat of the fracture existing in bones and portions of them not connected with the more important parts of the frame, and not influenced by the agency of formidable displacing powers, as in the middle of the Os Brachii, the transverse direction (in most cases) and single and not complicated nature of the fracture, together with the absence of those influences inducing accidental disease during the period required for a cure, as improper management, Epidemics &c., are the circumstances conducing to a favourable termination. While the reverse of these, Old age, diseased states of the constitution or Bone, (as those mentioned above⁽⁴⁾) the circumstance of the injury being seated in bones containing important organs, as the Skull, the Spine, the Thorax and the Pelvis, or subject to continued displacement &c. &c. fractures of the Clavicle and oblique fracture of the Os Femoris, and the comminuted and complicated nature

of the fracture, must be looked upon in general as indications of ^{an} ~~an~~ favourable prognosis, in the first place with regard to the reunion of the fractured bones, and in the second place, the recovery of the patient.

An important condition connected with the pathology of fractures is Displacement of the broken ends, and a due consideration of the causes influencing this gives rise to one of the leading objects in their treatment. It is obvious that Displacement results from the operation of agents external to the passive condition of the bones themselves; and by far the most powerful and common of them is to be found in the action of the surrounding muscles, though this effect is modified by the nature of the bone injured. Thus in fracture of the ~~Pa.~~ transverse tibia, and though more rarely, of the Scapulae and os calcis, the muscles attached to them cause the fragments to recede from each other or in more correct language draw the upper one from the lower, while in most other cases they cause them to overlap in

various

various degrees of extent; and in these it is generally the lower portion which is acted upon, and being pulled upwards behind the other, gives it that projection which led the older surgeons to call it ~~upper~~ the rising end of the bone. This latter form of displacement takes place either from the muscles acting upon the lower portion from being inserted into it, or into a part to which the lower portion is attached and whose motions it follows. Fracture of the humerus immediately above the insertion of the Pectoralis Major, where this muscle is assisted by the tendons of the Latissimus Dorsi and Teres Major, draws the lower end of the bone upwards and inwards, and the displacement causes an apparent projection of the upper portion, which is however generally in its place. A similar displacement, but vice versa with regard to the position of the broken ends, occurs in fracture of this bone above the insertion of the Deltoid. Again this form of displacement takes place when the os femoris is fractured at its neck, exterior to the Capsula Ligament, for here the external

is an example
of the first of these,

rotator

Extensors and abductors pull the lower end upwards and backwards, the neck & head remaining in their place. Examples of the second form are met with in Fractures of the Tibia and Fibula, in which the more powerful muscles seated on the posterior aspect of the limb, acting upon the heel, draw the lower portions of these bones upwards & backwards; and in fracture of the middle & lower portions of the Thigh where it is induced by the action of the hamstring muscles on the leg. Displacement of the ends of a fractured bone is likewise produced by the natural weight ^{of the} attached to one of them, as in cases of fracture of the Tibia & Cervix femoris, where the weight of the foot & limb if ~~unopposed~~ unresisted cause the fragments attached to them to be displaced. The injury too causing the fracture, as a blow or rough and ^{and subsequent} improper handling, may have caused the ^{accidental circumstances} form of the displacement.

Treatment of Fractures.

Before entering upon the consideration of the principles regulating the treatment of Fractures, it will be proper to enter
into

into an examination of the manner in
 which reunion takes place after a breach
 occurs, has ~~taken place~~ as it is only on a correct
 knowledge of this that these principles
 are founded. The reproduction of bone,
 of such important consequence to frac-
 tures and many diseases of the bones, seems
 to be dependent on a difference of the
 physiological state of the species of bone and
 that of most others of the economy, though
 we are not aware of what this difference
 consists. The question is not yet settled
 with regard to the manner in which
 the reproduction of bone takes place,
 though it has from time to time received
 the unequalled attention of most able
 physiologists and Surgeons. The following
 facts seem however to be universally ad-
 mitted regarding that branch of the subject
 relating to reunion after fractures: they
 show most beautifully the uniformity of that
 system of design, which is seen to obtain ^{everywhere}
 in Nature's operations on the Animal economy;
 In the method of repair, though conducing
 to different results, pursued in injuries of
 the

The bone, is regulated by the same laws that influence the process in the other textures of the frame. When fracture of a bone has taken place there is found the following state of parts: Effusion of blood from the torn vessels around the fractured ends, partly in the form of distinct surrounding clots extending up the ends of the medullary canal in the cylindrical bones, and partly infiltrated into the periosteum and the surrounding and intermuscular tissue - there is ^{cellular} generally more or less laceration of the periosteum at the broken points, and of the surrounding muscles in which these have come or lie in contact. This extravasation renders the parts stiff and thus at once conduces to the production of rest, an object of the first importance to a cure. Now if the salutary changes are allowed to take place for the repair of the breach, the serum and red particles of the clot become speedily absorbed, leaving the fibrine in a state capable of being organized, for it is found firmly adhering

adhering to the surrounding textures or
 rather to the lymph effused upon them,
 from the irritation consequent on the
 injury. This coagulable lymph continues
 to be deposited, between the fractured ends,
 in the form of a gelatinous reddish sub-
 stance, in the periosteum, rendering it
 softened and swollen, in the medullary
 membrane, and this becomes likewise swollen
 and of firmer consistence, its two portions
 combining and obliterating the canal,
 adjacent and in the interstices of the cellular tissue,
 and of the surrounding muscular fibres.
 This free effusion of lymph renders the
 distinction of the several tissues a matter
 of difficulty or even impossibility, and
 gives them the appearance of a homogeneous
 mass. The lymph is of course effused in
 greater quantity where the most irritation
 exists, and that is immediately around the
 broken part of the bone, confining the ends
 in their situation and protecting the soft
 parts from their irritating influence.
 Shortly afterwards the extremities undergo
 a process of absorption by which they are
 reduced.

rounded soft, granular and even, and in intimate connection with the surrounding lymph. Then there are observed indications of this mass becoming organized from the appearance of bloodvessels shooting through it and finally anastomosing freely with each other, though derived from the several types of bone, periosteum and cellular membrane. This organized mass or callus, as it is termed, becomes more dense and compact and approximates the ends of the bone, apparently from interstitial absorption of its substance. The muscles again assume their natural appearance and the "tumour of the callus" becomes more defined, separated in size and quite distinct from the neighboring parts; its fibres are parallel with the long direction of the bone. The fibro-cartilaginous structure of the callus (for it has assumed this appearance) now presents an appearance of vascularity and has specks of osseous matter deposited in it, and in larger quantity where it is next the bone & periosteum - these increase in size - coalesce - and finally the ends of the bone are included in the centre of

a solid Spous Case or femur covered with
 Periosteum continuous with that on the sound
 parts of the old Bone. The substance between
 the immediate portions of the broken ends has
 become much denser and closely adherent
 to the walls of this femur, but has not yet
 assumed the appearance of Bone. The thick-
 ened and vascular Medullary Membrane which
 is in intimate connection with substance ^{in the} the
 intervening between the fragments, has also
 assumed a firmer consistence - it under-
 goes a fibro-cartilaginous change similar
 to that mentioned above, and lastly forms
 a solid spous cylinder, which may be
 termed the internal ring or femur. Thus
 the ends of the broken Bone are enclosed be-
 two - two spous cases, being connected with each
 other by a tough fibro-cartilaginous sub-
 stance in the centre, and the spous femur
 at their circumference. In this state
 the union is far from being complete
 though Surgeons usually discontinue the
 retentive apparatus at this stage; for
 this Callus is not persistent, but only serves
 as a temporary means of union till the
 substance

substance between the extremities themselves shall have acquired the consistence and qualities of Bone. As this seems to be principally derived from the Bone itself it is of course slow in being formed and generally takes on 8 months to 20. Dr. Cruveilhier named it the retentive Callus (Cal retentif) while to the former he gave the term of Provisional Callus (Cal provisoire).^(C) As soon as the retentive Callus has been formed, the provisional Callus becomes more compact both in the external and internal rings - is gradually lessened in thickness, and at length entirely disappears, leaving the medullary canal again continuous, and the Bone in the form & condition of its normal state, with the exception of a greater vascularity, degree of and firmness existing at the part that had been broken.

The circumstances tending to retard or even prevent the process of repair after fractures, and which of course ought to be obviated as far as possible, are, the permanent separation of the fractured extremities, occasional separation of

(C) Leçons orales de Clin. Chirurg. Tome IV. Thème

them from want of perfect and un-
 interrupted rest - Complications in-
 ducing an over degree of action, want
 of vascularity in one of the fragments,
 as in cases of fracture of the neck of
 the thigh-bone, the existence of some con-
 stituting influence, as that of Ulcers,
 Sinuses &c. in the neighbourhood of the
 fracture, and certain diseased states and
 peculiarities of the Constitution and the
 Bones themselves. Among the diseased
 states of the Constitution found to counter-
 act the uniting process, the most is
 Sea-Scurvy, which has been likewise re-
 lated as inducing absorption of the Callus
 of fractures of old standing. In Lord Anson's
 Voyage this phenomenon is particularly
 recorded. (d) Syphilitic and Mercurial
 taints of the Constitution are likewise
 opposed to the speedy reunion of broken
 bones. Pregnancy is still considered an
 unfavourable condition for the repair
 of fractures, on the premises, that two
 excited actions cannot be maintained in the
 body at the same time; it is however

(d) Voyage round the world.

denied

denied by the highest authorities as being so. Though in general diseases of the bones themselves are adverse to the healthy process of repair after breaches in them, yet contrary to what might be expected, they are not always so. Sir Charles Bell mentions the case of a patient affected with Rickets, who suffered fourteen fractures in succession. all of them united. "(c)"

Sir Benjamin Brodie has related some cases of fracture occurring in diseased bones, in which contrary to his expectation union took place as well as under ordinary circumstances. (f)

The indications of the treatment to be pursued are of course with a view to the favouring of the process by which union takes place: and to fulfil them, 1. The broken portions must be immediately returned to their natural position. 2. They must be retained in that state. 3. Unfavourable symptoms must be prevented from taking place or relieved if they do arise. The first indication viz. the reduction of the fracture is in most cases effected

(c) Institutes of Surgery -

(f) London Medical Gazette for 1833-34.

by means of Extension and Counterextension
with Coaptation of the broken surfaces.

In doing this due attention must be paid
to the influences opposing it, and of
these the action of the muscles is by far
the most formidable. It must be over-
come by relaxing them, and then in
general those measures will be found to
succeed. In some cases, as fractures of the
Patella & Humerus, there is no occasion
for the adoption of these measures, and
all that is necessary is to place the limb
in a position suited to the relaxation of
the muscles attached to the upper fragment,
and then to push it into close contact
as possible with the lower.

Should the fracture be complicated with
a dislocation, if possible, the luxation
should invariably be reduced before the
fracture is set. This complication hap-
pens most frequently at the ankle, where
it is not very difficult to bring back
to right. But should it occur in any
of the articular joints, when the fracture
is near the articulation and situated close
to

the luxation, the reduction of it will be found to be a matter of ~~great~~ difficulty. Some Boyer states that the attempt would be inspirious and unavailing, because the necessary extension could not act upon the upper fragment, and were it to operate on the lower it could only have the effect of painfully stretching the muscles and perhaps lacerating them. (1) He directs therefore, that the fracture should be first attended to, and when it has become firmly united, that an endeavour should be made to rectify the displacement. He confesses however that the attempt rarely succeeds after the perfect union of the fracture; and expresses himself as being unacquainted with any case, in which the luxation, complicated with fracture, has ever been reduced, when the nature of the joint and the circumstances of the case, prevented the treatment from beginning with the reduction of the dislocation. (2)

This observation coming from such an experienced authority, added to the circum-

(1) Traité des Maladies Chirurgicales Tome III. p. 115.

(2) See citato.

stances of the following case, must serve to shield me from the imputation of presumption in advocating the practice he himself deprecates, of endeavouring to reduce the luxation before setting the fracture. A man, 45 years of age fell while intoxicated; on his applying for relief some hours afterwards, that while still tipsy, it was detected that the right humerus was fractured at the neck, and that the head of the bone was displaced into the axilla; extension & Coaptation were immediately used, and the head of the bone returned to its place without difficulty. In six weeks' time he was able to use the arm.

The second indication viz. the keeping of the fragments in situ, requires the employment of means for fixing the limb so effectually, that it may continue perfectly motionless during the whole time requisite for the union of the fracture. These are, the placing the limb in the posture suited to the relaxation of the muscles, and the use of Splints, Bandages,

and other apparatus. That there are
 necessary must be obvious to every one who
 is impressed with the importance of the
 broken surfaces being kept in a state of
 uninterrupted repose - a state certainly far
 from being likely to be produced, for the length
 of time requisite for the union, by the patient
 himself; seeing that in all cases of
 fracture the involuntary spasmodic action
 of the muscles, and the unavoidable sub-
 jection of the limb to frequent motions, by
 the patient coughing, sneezing or other-
 wise performing necessary acts, must nat-
 urally disturb or retard the process by which
 alone that union can take place. The splints
 that are employed in the surgical practice
 of this Hospital, in fractures, are few in
 number; and as they are extremely simple
 in their application, and equally success-
 ful in their employment with others of
 a more complicated nature, I shall
 here take the liberty of enumerating them,
 while at the same time they are those
 which I wish to be considered the most
 proper for the effecting this the second and
 the

the subsequent or third indications of cure. In all cases they are framed so as to extend considerably beyond the broken ends (generally as far as the joints including the fracture).

Those made of pasteboard are in most general use, and when accurately applied, afford most comfort to the patient, and admit of observation of the part and necessary adjustment, without the incurrence of any risk of moving the broken ends.

Usually one for each side of the limb is employed, and being softened ⁱⁿ warm water, and padded with curled tow or cotton, is retained by the loose Bandage. These Splints are used in all simple cases free from displacement, or where the displacement has been readily overcome and only requires some means to prevent its again taking place. In the several fractures of the Bones of the upper extremity, with the exception of the Olecranon process; in those of the feet, and in individual fractures of the Tibia & Fibula at a some distance from the ankle joint, the pasteboard Splints are found to be perfectly effectual.

Th.

Mr. Dupuytren's Splint is always used in
 treating the individual fractures of those
 bones occurring immediately above the
 ankle-joint - It consists of a piece of
 plain strong deal-wood about 3 inches broad,
 and should be long enough to reach from the
 head of the tibia or Fibula, respectively, to
 three or four inches beyond the heel - It
 is perforated at the upper end by two holes,
 and has two deep notches at its other ex-
 tremity. A pad of corresponding breadth is
 attached, by a few pieces of Bandage, and to it
 should be thicker or doubled, at its lower or up
 end. The Splint thus adjusted is applied
 on the side of the limb opposite the fracture;
 the displaced foot is inclined, ~~also to the~~ to it
~~opposite side~~ over the fulcrum formed by
 the pad, and retained in that position by
 the passing the Roller through the notches,
 and over the distals, previously covered with
 tow or Cotton, and then carrying a few
 turns up the leg. Sometimes the foot is
 displaced backwards in the fractures of
 the Mallus; in this case a modification
 of the above Splint is very successfully
 employed

Employed by Mr. Lyne who directs it to be placed on the front of the leg & ankle and not behind as Mr. Dupuytren proposed. It is scooped out at its lower extremity to fit the instep, and a few turns of a bandage being passed around the heel, draw the foot forward and maintain it in its position.

In fractures occurring simultaneously in both the bones of the leg, the modified Splint of Mr. J. C. Boyer, or the simpler and better modification of it by Mr. Liston, is of excellent service in fulfilling the several indications sought after in treating this difficult and important fracture. The open spaces left for the ham and the heel have proved a most valuable improvement in the latter of these Splints. A modification of Beaumont's Splint is that which is employed with uniform success in all cases of fractured Femur. It precisely resembles that used in fractures of the humeri & should extend from the breast to 5 inches below the heel. A shawl or towel is placed under the perineum & affixed to the two holes at the upper part of the Splint. &c.

- tension

Tension is then made at the heel by the passing of a roller through the rollers at the inner end, and over the dorsum of the foot. A roller may either serve to affix the Splint to the limb or what is better a sheet. One attention must be paid to the padding of the ankle where the pressure chiefly falls. The inclined Splint of Mr. Dutger is quite fallen into disuse in the treatment of fractures of the thigh bone in this Hospital, and the only cases of it I have seen treated upon it (3 in No) went wrong; at least one was followed by inflammation of the thigh & death. The other two were "turned out of bed" with crooked thighs and shortened legs: and one of these prayed for a trial of the "long Splint" after five weeks' Discomfort on the other and was extremely grateful for the indulgence!

In some situations Splints are inapplicable, and properly superseded by other apparatus. Thus in Fractures of the Clavicle, the pad in the Axilla, and Bandaging of the Arm to the Chest, as employed by Desault, or the Shoulder straps used by many Surgeons of the

the present day, are found to be perfectly
 sufficient to keep the fragments together,
 and prevent their separation by the motions
 of the patient's body. Bandaging is
 used alone in fractures of the ribs & scapulae,
 in those of the bones of the Pelvis and other
 parts of the trunk, and, by restraining
 the actions of the muscles, retains the frag-
 ments in situ. In fractures of the lower
 jaw a broad bandage or what is better
 a Handkerchief, applied under the chin
 and tied at the vertex, so as to keep the
 teeth in close apposition, is quite suf-
 ficient to prevent any motion of the
 parts; a piece of pasteboard, however, fash-
 ioned so as to fit the body of this bone, and
 then to pass at right angles upward along
 the ramus to the temples, with the application
 of bandages to keep it in its place,
 is more generally employed in fractures of it.
 I need scarcely add the patient is obliged
 to lie upon slops. The chief circumstance
 in fractures of the Patella & Peroneus above,
 as mentioned above, is relaxation of the
 triceps muscle by extension of the limb, and
 the

the subsequent application of a figure of 8 bandage round the joint, so as to press the upper portion to the lower.

In the employment of these several means for the cure of fractures, attention must be paid to some circumstances which otherwise are apt to lead to unpleasant results: thus the broken limb must be supported equally throughout its whole length on the surface on which it lies, otherwise displacement of the fragments is sure to take place⁽⁺⁾, and suffering from continued & painful pressure; the former of these is seen in fractures of the thigh - the latter in those of the leg & thigh when the heel and knee are often injured: the application of the bandages too, must be uniformly firm, and in every case the patient's own feelings must be consulted as far as possible.

The third set of indications necessary to be attended to in conducting the treatment consists in the adoption of means for obviating the accession of unfavourable symptoms or the removal of them if already present. The first of these considerations will be found to

to be for the most part attained by the means already described as fulfilling the first two indications of the treatment, and it only remains to say that the patient's health should be maintained throughout; for this purpose measures ought to be taken to restrain the inflammatory action that is apt to follow the receipt of the injury, and in general it will be sufficient if the case has been treated from the commencement as above described / to restrict the diet for the first week or so and to regulate the bowels; if the patient is of full habit and apprehensions are entertained of the action proving immoderate, antiphlogistic measures ought ^{to} be had recourse to. The diet ~~ought~~ ^{must} however, after the febrile symptoms have subsided, as a necessary degree of action is requisite to be kept up for the purpose of union. With regard to the second consideration viz. the removal of Unfavorable Symptoms if present, it will be proper to state that these may have arisen either from the nature and complication of the injury, or the peculiarities of the patient.

patient's constitution, notwithstanding that
 proper measures may have been taken; or they
 may have been the result of neglect or im-
 proper management. Inflammation of the
 neighboring joints in fractures of the bones
 entering into their construction is sometimes
 met with, and is the result of the blood effused
 into the Synovial Cavity. It is to be treated
 on general principles and the apparatus,
 if any, must be very slackly applied or
 not made use of during its continuance.
 It is most frequently met with in the Ankle,
 Knee and Elbow; in the former from fractures
 of the Malleoli into the joint or disruption
 of its ligaments in displacement of the Tibia
 with fracture of the Fibula; in the two
 latter either from fractures of the Patella
 and Osseum or of the Condyles of the Os sa-
 femoris and Radius. The inflammatory Symp-
 toms attendant on Contusions must be similarly
 treated. Abscesses are sometimes induced to such
 an extent as even to prevent the immediate
 reduction of the fracture, and are not unfre-
 quently perceived in a slight form after it
 has been accurately set; in the first of these
 subjects

Perfect relaxation of the muscles with confinement of them by a moderately firm bandage, and rest, must be tried, and if these means fail Bleeding - Tartar Emetic and Opium, with the placing the limb as accurately as possible, will be generally found sufficient, after a few days, to allay it. When it takes place from irritability of the patient or some unusual species of bone, after the limb has been set, it must be obviated by opiates and the re-adjustment of the fracture.

Non-Union of fracture

The extremities of a fractured bone sometimes do not unite together, and then they remain either quite detached or, as is more frequently the case, are connected by a fibrous or ligamentous looking substance, and ~~this state of parts~~ from the motion permitted between them, this state of parts receives the appellation of false-joint.

The condition of this false joint has been differently described but it seems to be now the general opinion that the connecting medium of the fragments (which are either sharp or rounded at their extremities) consists of a fibrous substance resembling ligament - extended

over

over and between them, and that when it exists in the form of a Capsule its inner surface is smooth and capable of secreting fluid resembling Synovia. Professor Hays considers the Capsular form to be dependent on "the existence of cavities, more or less extensive, between the fibres of this substance." (c)

The chief cause of this condition of matters resulting from fractures is the want of perfect and uninterrupted rest, so often insisted upon in this paper, as being one of the most important considerations in their treatment. Next to this come the sexual peculiarities and diseased states of the Constitution mentioned above.

The treatment of this unhappy result of these accidents consists in the withdrawal of those constitutional causes tending to maintain it, as also the local ones of motion, foreign irritation &c; and in producing an excited action in the part so as to induce a deposition of organic matter; and then to treat the case de novo.

The first of these means is to be attained by the internal exhibition of medicines suited to the particular variety of the affection, and the placing the limb in Splints & bandages as

Recommended above⁽⁺⁾. The second is induced in three ways. 1. By rubbing the ends of the bone forcibly one each other: 2. by passing a seton through the space between them: 3. by cutting down upon them and sawing or ripping them off. After each of these three modes the fractured limb is to be kept perfectly quiet and treated as an ordinary case.

The first of these methods for procuring united action ought to have a fair trial in every case, and if after this it prove insufficient, the seton may be introduced and retained, till evidence is given of the new bone having effused, when it is to be withdrawn. The third measure, the cutting down upon the bone &c., is not to be attempted without warning the patient of the danger he is to undergo from it, and must only be undertaken in cases where such a severe proceeding is warranted, from the inconveniences resulting to him from the want of rigidity in the bone, and after the failure of the milder means. The treatment after the operation is the same as in Compound fractures. This measure it must be stated is not always successful.

(+). Page 32 et infra

Compound Fractures.

The first object of consideration to the Surgeon, on being called to see a fracture complicated with a wound exposing the bones, is, whether an attempt is to be made to save the limb; and will require all his judgment and experience to determine; the same so, as it must be done at once, as a few hours' delay may place his patient beyond the reach of even the severe remedy of amputation. The circumstances which lead to this question are the certainty of violent inflammation & fever, arising in proportion to the extent of the wound, or suppuration or gangrene, or death without any material local change, from the effects of violent constitutional disturbance. The state of the various systems ~~is~~ connected with the injury must be carefully ascertained, and as a general rule it may be safely stated, that if this is manifestly so bad as to render recovery (as well of the limb as of the patient) impossible, amputation ought to be immediately had recourse to. - If not so, i.e. if there is a probability of the ultimate recovery of the patient's limb, he ought

to be allowed the benefit of the chance, seeing that ~~even~~ in the end reputation is as successful as now so, at least in civil practice, as ~~then~~ if performed at first: - and in persons of a healthy constitution no little reliance is to be placed on the adoption of those measures called antiphlogistic, to allay the immediate effects of the injury. - The state of the soft parts, the condition of the blood-vessels and nerves and of the bones themselves, the contiguity of important parts or joints &c. and the patient's constitution, must be all taken into consideration in determining the surgeon in the step he is to take, and may individually, though in general, collectively to, ~~assist~~ ^{assist} him in his decision.

as they are

Being determined on to make the attempt of saving the limb, if practicable the wound should be encouraged to unite by the first intention, as by this means it will become of the nature of a simple fracture. For this purpose the fracture is to be set as soon as possible, and the edges of the wound having been brought together are to be retained by strips of plaster, or may be covered with lint

and

and allowed to adhere by the blood drying around it; while at the same time the patient is to be kept very quiet, and purgative and diaphoretic medicines, administered, ^{as to be} If the bone project through the wound and cannot be easily replaced, the protruded portions should be removed by the saw or pliers as far as may be sufficient to allow this to be done, and then they should be set as accurately as possible, and the position retained in a splint. The inclined Splint of Mr. Lister will be found a most serviceable one in this kind of fracture, as the dressings can be changed as frequently as necessary, without moving the position of the limb. - To restrain the inflammatory action which, in by far the majority of cases, is sure to set in, cloths very thin to allow free evaporation / must be applied wet with cold water, and must be frequently changed, or what is better, may be kept constantly moistened and cool, by allowing a few threads of wadding to fall down from them from a jug full of cold water placed beside the bed. The patient must be depleted according to his strength, and Saline & Nervous purgatives with antimonials

only

only exhibited. When inflammation has come
 on fomentations and frictions must be
 substituted for the cold applications. as
 soon as the inflammation shall have begun
 to subside the relaxing measures must be ~~and~~ changed
 for those of a stimulating kind - and either
 of Sulphate of Zinc, Acetate of Lead &c. with
 generous diet must be made use of: free
 rest must be allowed for the escape of matter,
 and incisions and counterpunctures are to be
 made for this purpose, if required: while
 by pressure and bandaging, and strict attention
 to the maintenance of perfect rest and the
 proper position, the cure will be very much
 expedited. Should the fracture have been com-
 minuted, the several detached pieces of bone
 ought to have been extracted, as they delay
 very much the cure. In other leading points
 the treatment is precisely the same as in
 simple fractures.

R. W. Mearns
 Royal Infirmary Edinburgh
 13th July 1839