

ART. VIII.

Traité des Fractures et des Luxations. Par J. F. MALGAIGNE, Chevalier de la Légion-d'Honneur et du Mérite Militaire de Pologne, Membre de l'Académie Royale de Médecine, Chirurgien de l'Hôpital Saint-Louis.—Paris, 1847. Tomes II.

A Treatise on Fractures and Dislocations. By J. F. MALGAIGNE, Member of the Royal Academy of Medicine, and Surgeon to the Hospital Saint-Louis. Paris, 1847. 2 vols. 8vo. Vol. I (*On Fractures*), pp. 842.

THE prolific pen of M. Malgaigne has again been at work, and we have before us the First Part—and a goodly instalment it is,—of a systematic treatise on 'Fractures and Dislocations.' The present volume is accompanied (as its fellow is intended to be) by an Atlas, containing a series of drawings, very well executed on stone, and illustrative of the letter-press. Altogether, this division, which we propose reviewing, and which comprises fractures only, is very complete; and is a good specimen of the style of work in which our continental neighbours excel us.

On turning to the preface of our author, for the purpose of ascertaining whether he had any especial object in the present publication, we were surprised to find that he purposed to fill up a void in the surgical literature of his country;—France not possessing, as do England and Germany, even one systematic treatise on the injuries of bones. We were certainly startled by this announcement; but, on consideration, we could not gainsay it. This branch of surgery has, indeed, received contributions, and not unimportant ones, from the pens of many French authors, both in the form of monographs, and in their comprehensive systems of surgery; but we are unacquainted with any work in the French language, of compass equal to the present, which is exclusively devoted to the consideration of fractures and dislocations.

M. Malgaigne by no means professes to limit himself to the product of his own observation and experience, in the compilation of the present work. On the contrary, it is destined to present to the reader an historical assemblage of "doctrines and ideas," on the subject of which it treats, from the earliest period to the present day; and the Museums of the Hospitals, Val de Grace, and Dupuytren, have been severally laid under contribution, to assist in supplying the materials for nearly one hundred figures, which are contained in the sixteen plates of his Atlas. Further, a general and arranged bibliography is promised at the close of the second volume.

The volume before us is divided into two parts, of which the first, occupying nearly half the work, is devoted to "Fractures in general." The divisions and subdivisions of this section are numerous, and comprise, under various headings, the causes, varieties, diagnosis, treatment, progress, &c., of fractures generally. The second part treats of "Particular fractures,"—that is, the fractures of particular bones.

It is scarcely necessary to observe, that it would be entirely beyond the compass of a review, to present to our readers a complete, or even an imperfect, analysis of *all* that the volume contains. We shall content ourselves with merely a brief notice of many parts, whilst we select others for more careful consideration; trusting thus to put those who may honour

us by the perusal of our article, in a fair way of judging for themselves of the excellencies or deficiencies of our author.

Our author's definition of fracture is,—“a sudden or violent division of bone or cartilage;” though he admits that the vulgar interpretation of the word, or rather its synonym in common language, conveys so appropriately a just and correct impression of the nature of the injury inflicted, that a risk is incurred of complicating, instead of simplifying, the technical term, by attempting to define it. Under the head of “Etiology,” our author considers the following subjects: certain general predisposing causes apart from disease; morbid affections which act in this way; and determining causes. The influence of age, sex, and seasons, are combined under the first of these subdivisions.

The materials from which M. Malgaigne's conclusions have been drawn, in relation to the influence of age as a predisposing cause to fracture, are derived from the records of the Hôtel Dieu, during a period of eleven years. The number thus afforded for this statistical purpose is 2377. As such tables as this are valuable, we give the general conclusions derived from them: they are as follows. Fractures are most frequent between the ages of 25 and 60 years, and become more rare as the age recedes in either direction from these extremes: fractures, therefore, are least frequent in the very young and very old, the number being identical (in the tables of the text) as regards the annual average, between the ages, severally, of from 5 to 15 years, and from 75 to 80; but the average of these injuries between 2 and 5 years, rather exceeds that of the period of life above 80. The present, however, is an instructive exemplification of the caution which is required in drawing conclusions from apparently sound statistical data; and the source of error here is pointed out by our author, who remarks that, by referring to the census, he discovered that individuals between the ages of 5 and 15 constitute one fifth of the whole population; whereas, the returns prove that only one twenty-third part of the total amount of fractures occur between these ages, &c. Another table represents the relative frequency of fractures in young children, the materials being supplied by the records of the Hospital for Children. This shows that fracture is most frequent between the ages of 2 and 4, and least frequent between 4 and 5; but again increasing, though in a diminished ratio, up to 7. The final conclusion from these investigations is, that, taking the age of the population into account, fracture is most rare between 4 and 5 years of age, and of most frequent occurrence between 55 and 80. The following are M. Malgaigne's suggestions as to the causes of these results:

“In searching for an explanation of these facts, one may suppose that, between the ages of 2 and 4, falls are more frequent, from the tottering gait of the infant, and more serious, from the skeleton possessing as yet but feeble powers of resistance. After 4 years of age these causes diminish, but are replaced by others, such as games, running, fighting, &c. At puberty, the various employments of the mechanic and labourer are superadded, man being in the full exercise of his physical powers from 25 to 40; and after 40, the degeneration of the osseous system. If this last and influential predisposing cause of fractures does not augment the number of these injuries between 55 and 80, and even permits of a diminution of the average after that period, it is because the infirmities of age become an exemption, by withdrawing individuals from many occasional causes of fracture, such as heavy work, personal encounters, &c.” (p. 4.)

We are scarcely disposed to admit, with our author, that the skeleton begins to degenerate so soon as forty; and we think he has overlooked some of the true causes why fracture becomes more frequent, up to a certain point, with advancing years. We allude to the diminishing activity of the muscular system, together with the frequently increasing bulk of the frame generally. Thus, the young and active often extricate themselves from the risks to which they are subjected, and which are frequently attended with serious results to the less agile. Moreover, there is a resiliency in the youthful frame, which is much impaired in middle life, and gradually lost as age encroaches, so that the body falls more as a dead weight; and, if we superadd to this, the fact of the frame augmenting very often in bulk and weight, so that increased momentum is given to a fall, we have altogether an important class of causes in operation, which are not noticed by M. Malgaigne.

In speaking of the obsolete opinion of Boyer and other surgeons, that a preponderance of the earthy constituents of bone renders fracture more frequent in the old than young, our author combats this notion, which was founded on hypothesis and not on experiment. He adds that, so far from this supposition being correct, it has been ascertained that, in those bones where the *animal* matter predominates, fracture is more frequent, the compact bones of adults being possessed of the greatest power of resistance to external force. He seems to have devoted considerable attention to this subject; and the views published in his '*Anatomic Chirurgicale*,' are stated to have been confirmed by subsequent researches at the Hospital Bicêtre. Some skeletons, he remarks, become even more dense, and therefore resisting, with advancing years; but, more commonly, the texture of the bone is thinned by absorption, which, we think with him, is the true cause of fracture, especially of the ribs and neck of the femur, in the aged. The extreme thinness of the bones of some persons in advanced years is rare, and is regarded by M. Malgaigne as an abnormal condition, and treated of elsewhere.

As regards the influence of season on the production of fracture, our author denies that winter is more prolific than summer. He admits that falls are more frequent, but they are less severe; and the slippery state of the pavement is more than counterbalanced by the operation of other causes that are productive of severe falls, such as building, &c., which are more particularly confined to the summer season. In these remarks, reference appears to be made exclusively to a town-population. Again, fractures have been found by our author to be decidedly more rare in winter, amongst children, than in summer; which he accounts for by supposing that they are kept at home by their parents, instead of being allowed, as in fine weather, to wander about and play.

Some useful and interesting tables follow, exhibiting the relative liability of different parts of the skeleton to fracture: these, however, we pass by, merely noticing that the right side of the body is shown to be more obnoxious to these injuries than the left; and that fractures of the extremities, especially the inferior, are more common than those of the trunk.

The following is a summary of our author's opinions on the subject of certain affections, which have been regarded as predisposing to fracture. In the first place, he divides these causes into two classes,—those which

render the bones more friable, and those which inordinately augment the power of muscles acting on the bones. In speaking of scorbutic affections, M. Malgaigne states that the Bicêtre has an annual visit, in the spring, from this disease; but that he has never been able to trace a single fracture to its influence. Of gout he has been able to discover but two instances, and those not very satisfactory. He admits the influence of cancer, but regards the cases as rare, and the conditions associated with the disease, in its operation upon the osseous system, as but little understood. Where spontaneous fracture occurs in cancerous subjects, he regards this effect as due, in the majority of cases, to cancerous degeneration of the bones themselves; exceptional cases sometimes occur, however, in which there is a species of atrophy, similar to that of old age. Scrofula, in our author's opinion, is rarely influential in determining fracture; but rickets he regards as the most rife cause, and that not in childhood only. In addition to the above, many other casual affections are enumerated, such as necrosis, hydatids, osteo-sarcoma, the neighbourhood of an aneurism, &c. But there is still one predisposing cause, which our author considers has been much overlooked, and which assists in explaining why long bones are sometimes fractured by muscular action; and this is a local inflammation of the osseous tissue itself, signalised by dull pains, usually set down as rheumatism. Of this form of disease, as predisposing to fracture, M. Malgaigne cites some instances.

In the next section, which treats of the immediate or determining causes of fractures, we meet with some very good remarks; but shall be able only to cull one here and there for the benefit of our readers. The two great heads under which our author includes these causes are, "External Violence, and Muscular Action." He remarks, indeed, that a case is reported of a rib being fractured by the shock of the heart's action (therefore an *internal* cause), but very properly adds, that it was a presumed, rather than a satisfactorily proved, cause; and therefore not worthy of constituting an exception to the above classification. The subdivision adopted is that which is usually recognised as distinguishing the causes of fracture which operate from without, viz. into direct and indirect; but M. Malgaigne adds, a little further on, an opinion, in which we entirely concur, that the momentum of a fall requires (usually) the superadded influence of muscular action in fixing the bony levers, in order to the production of fracture; and this is especially apparent in indirect fractures, as proved by the difficulty of breaking a bone in this way in the dead body. As a further corroboration of this opinion, he cites the proverbial immunity of drunkards from the severer effects of falls,—a proverb, by the way, the truth of which our own hospital experience scarcely confirms.

At the close of the present section, on the causes of fracture, violent explosions of gas are mentioned; and a strange instance is cited, as having occurred at the catastrophe on the Versailles railway. It is that of a circular fracture of the skull, which was shivered by the disengagement of steam, consequent on the action of heat on the brain (*ébullition du cerveau!*)—a horrible example, indeed, as M. Malgaigne observes, of the "power of these new agents set going by the hands of man."

One curious branch of this division of our subject remains to be noticed,

viz. the occurrence of fractures before birth. Apart from the clumsiness of the accoucheur or midwife, or from disproportionate development of the head, and of the pelvis through which it has to pass, there appears no reason to question the fact, that fracture may occur during uterine life. Devergie relates an instance of a woman having struck her abdomen violently against the angle of a table, when six months advanced in pregnancy; and, on being delivered at her full period, she produced a child whose clavicle had been fractured, and firmly, though not very accurately, united, as was proved by a post-mortem examination, the infant dying shortly after birth. A similar case occurred to Carus; but in this instance the fracture was compound, and of the leg. The protruding bone was necrosed, and the infant died of mortification of the limb. But the most remarkable example of fracture occurring within the womb, and related by our author, is one in which no external injury was received by the mother; but she heard, during a movement of the child, a noise like the breaking of a stick. She was delivered, six weeks afterwards, of male twins, one of which had a broken thigh. The speculators on the mode in which this fracture was produced have surmised, that it was either caused by muscular action or by the entanglement of the limbs of one *factus* with those of the other. We think, with M. Malgaigne, that it is wiser to await the occurrence of similar cases before we decide that such a lesion can only occur where there are twins; in truth, we are at a loss to comprehend what value is to be attached to the determination of the case either way, except as a matter of simple curiosity.

Want of space obliges us to pass by the greater part of the ensuing chapter, on the "Varieties of fractures;" and this we do with the less regret, as we shall have casually to allude to the subject in our notice of the second division of the volume. Under the head of "Incomplete fractures," we observe that some notice is taken of the possibility of bones being bent,—an explanation which some have preferred to the supposition that a bone may be partially or incompletely fractured. We believe in the possibility of either of these forms of injury, though they certainly are not of common occurrence. M. Jurine, of Geneva, seems to be of a contrary opinion; for he says that accidental curvature of the bones of the fore-arm is not very rare, and speaks of having seen as many as a score of cases. He has also seen an instance of curvature of the humerus, and another, in which the bones of the leg were similarly affected. His treatment is based on the simple principle of gradually unbending the curve by pressure. He places a splint on the palmar aspect of the hand and fore-arm (when the bones of the latter are the seat of the injury), and applies a roller firmly, from the fingers upwards. The experience of most authors is decidedly in favour of the rarity of this form of injury; one case, in which we judged the forearm to be thus affected, has come within our own sphere of observation; and we also remember to have seen an instance, in which the parietal bone was "dented in" by pressure, in a young child, without any apparent fracture of the bone. The absence of head symptoms added to the interest of this case. We apprehend that firm but cautious pressure with the thumbs on the salient part of the curve should be made, before applying the splint and bandage as recommended by M. Jurine. The treatment of these accidental curvatures

and incomplete fractures should be conducted on the same principle ; therefore the question of diagnosis between them resolves itself into a matter of pathological curiosity.

M. Malgaigne's division of "Complete fractures" is into *transverse*, *jagged* (*dentelées*), and *oblique* ; to which he adds, separation of the epiphyses of bones. In speaking of denticulated or jagged fractures, he states that he has conducted a series of experiments on the dead body, to render this division of his subject more complete. He found, when he broke a bone with a heavy iron bar, that, in the immense majority of cases, this form of fracture was produced, and in such a way that there was most frequently neither displacement nor crepitus, in consequence of the angular points dovetailing into the corresponding depressions of the fractured surfaces. If the force employed in the production of these artificial fractures was sufficient to occasion partial displacement of the broken ends of the bone, this effect our author found due to the breaking asunder of some of these tooth-like processes, which thus became so many isolated fragments or spicula ; whilst others, retaining their attachments to the main fragments, sufficed to prevent the displacement from becoming complete ; and the same cause operated in rendering reduction difficult.

The foregoing experiments, and the marked uniformity in most instances of the result, induced M. Malgaigne to direct his attention especially to the subject in cases of fracture which came under his notice ; and he found his conclusions entirely verified.

"I think, therefore," says he, "that I may lay it down as a general law, that the greater number of simple fractures, produced by direct force, are denticulated fractures, presenting the same phenomena in the living as in the dead : that is to say, either unattended by any displacement, or accompanied by either partial or complete displacement ; but, in the latter two alternatives, the difficulty of reduction is greatly augmented by muscular action. I shall notice further on that oblique fractures themselves very often present these denticulations, and that certain comminuted (*multiplés*) fractures are only denticulated fractures, in which a large tooth has become isolated by the same shock which broke the bone." (p. 63.)

This is an interesting generalization, and one worthy to be remembered by the practitioner.

Accidental separation of the epiphyses of long bones is classed by our author amongst fractures ; and, for all practical purposes, there can be no objection to the classification. He attributes the first distinct and satisfactory notice of this form of injury to Bertrandi, towards the close of the last century ; and cites some authenticated instances, in which it was produced, from rough and careless treatment, in bringing children into the world. The bones which suffered were the femur, tibia and humerus. These accidents may ensue from analogous causes after birth, and up to the time of puberty. They are, however, of rare occurrence, and require the same treatment as fractures in the same situations,—a fortunate circumstance, inasmuch as we are acquainted with no satisfactory diagnostic by which to distinguish between the two forms of injury.

The section on "Comminuted fractures" (*fractures multiplés*) follows, and is treated of under four distinct heads, viz. fractures with splinters ; cases in which the same bone is fractured at several points ; those in which the bone is crushed ; and lastly, fractures which involve several bones at the same time.

It will be perceived that the French and English terms do not exactly correspond,—the former being more inclusive than the latter. Our *compound* fractures, again, are included under the more generic head of “*fractures compliquées*” in the French treatise; this term comprising, in addition to what we mean by a compound fracture, all concomitant lesions in the neighbourhood of the seat of primary mischief. The coexistence of fracture and dislocation M. Malgaigne admits to be very rare, as, indeed, his table of the cases, already referred to, shows. Of the 2358 fractures which constitute his chief statistical resource, four only were complicated with dislocation. In the first, the neck of the humerus was fractured and its head dislocated; in the second, the same form of dislocation coexisted with fracture of the shaft of the bone; and in the other two, the double injury affected different bones, and therefore belonged, in reality, to a distinct class of cases.

The general symptoms attendant on fractures form an interesting and important section, which includes the ordinary signs by which these injuries are characterised and identified, such as the cracking sound at the time of the accident, and the subsequent pain, loss of power, swelling, abnormal mobility, &c. We shall limit our observations to the last-mentioned of these diagnostic indications, as it will afford us an opportunity of allowing our author to speak for himself, in giving directions how to elicit this important sign. After complaining of the careless manner in which this source of diagnosis has been treated of by most systematic writers, and making some general remarks upon the subject, he proceeds in the following strain:

“The different means to be had recourse to for detecting mobility in a broken bone must be varied according to the seat and nature of the fracture. When the humerus or femur is the seat of injury, it is necessary to fix the upper fragment, and to carry the knee or elbow forwards or laterally; an angular yielding of the limb will then be perceived where the fracture exists. In fracture of the clavicle, the weight of the shoulder is sufficient to produce this angle; and, if it should not be apparent when the patient is lying down, it may be readily rendered so by drawing the shoulder downwards and inwards. In fractures of the fibula, Dupuytren recommended that the fingers of either hand should be placed along the tibia, whilst the two thumbs rested on the fibula at some distance apart from each other; pressure was then to be made by each thumb alternately, so as to force inwards the broken extremities of the fibula at the seat of fracture. A similar plan may be adopted where the tibia or one of the bones of the fore-arm is the seat of injury. But when the fracture is near to a joint, it is necessary to resort to other methods; and it is essential to ascertain by what alteration in position the fragments move most readily on each other. Thus, Desault suggested, in doubtful fractures of the cervix femoris, that the thigh should be rotated; and the arc of the circle described by the great trochanter ought, according to its extent, to indicate whether this apophysis is still supported by the uninjured neck of the femur, or whether it turns upon its own axis. M. Maisonneuve considers the following to be valuable tests in some fractures of the lower extremity of the radius or fibula. In the former, mobility is often rendered very apparent by forcibly bending the hand backwards; and, in the latter, the fragments are separated by directing the point of the foot outwards,—results which no other plan of proceeding can elicit.” (p. 91.)

We are subsequently warned against certain sources of error in forming a diagnosis from this sign; such as diseased softening of bone; and the

natural flexibility of the fibula (pointed out by Dupuytren), which is very apparent towards its centre, and when deprived of support. The same remark is applicable to the ribs. Again, the mobility of a neighbouring joint, when the supposed fracture is near to it, may be mistaken for the abnormal mobility of a broken bone.

Lastly, our author notices one source of error which has misled or left him in doubt, viz. a condition of integument, in which that structure has been deprived, by age or inflammation, of its natural suppleness; so that, in flexing a limb, to ascertain the presence of any abnormal mobility, the skin has been thrown into transverse folds, simulating the appearance which would be presented if the limb had really lost the continuous support of the bone or bones. We need scarcely remark, that this and the other sources of deception can scarcely mislead a surgeon who has had even a moderate share of experience; but it is important that the young practitioner should be made acquainted with them and bear them in mind. To distinguish between indistinct crepitus in the neighbourhood of an articulation, and that which is proper to the joint itself where the synovial membrane is affected, is much less easy, and may perplex or deceive even experienced practitioners. But it is quite unavailing to lay down any rules or to give any directions, upon which the inexperienced can depend in this difficulty. Personal observation is the only sure guide, and even that, as we have remarked, is sometimes insufficient. We cannot say we have ever derived much assistance from the use of the stethoscope in the detection of crepitus, though M. Lisfranc speaks highly of it. An educated hand and delicate touch are more discriminating than even the practised ear, under the circumstances we are considering.

The next section, on the "Progress and terminations" of fracture, includes several subdivisions of importance, which it behoves us to glance at as we proceed. M. Malgaigne divides the period required for the reparatory process into three stages of equal extent. The first is occupied by the preparatory steps of dispersion of the extravasated blood, subsidence of the inflammation, and the secretion of the materials necessary for reunion. During the second section of the entire period, these materials become organized, and assume increasing consistence around the seat of fracture; whilst the third is dedicated exclusively to the process of ossification. "After this," says our author, "I admit no further stage; and this remark will find its application when I discuss the theories which have been broached in reference to the progress of the formation of callus."

A passing allusion is made to an observation of Guenther, on the arrested growth of the nails during the period occupied by the reunion of a fractured bone of one of the limbs,—the doctor thinking he had made the discovery, that this condition is constant in such cases, and that the growth does not again commence until reunion is completed. M. Malgaigne has put these observations to the test, and has arrived at the conclusion, that the Saxon doctor was the dupe of his own imagination or of his patient.

The origin of callus—a much disputed point,—deserves some notice. A brief retrospective view of all the hypotheses propounded regarding this interesting subject is first taken by our author, who, however, limits his

observations to two theories, which he traces severally to Galen and John Hunter. Respecting these he makes the following remarks :

“The most remarkable point associated with these theories is, that they are not deduced from actual and particular observations, like most of the others, but that they are propounded more in the form of *à priori* assumptions, or rather, as flowing from the general notions which their authors put forth regarding the restoration of divided parts,—Galen teaching that all solution of continuity (in organized parts) is reunited through the medium of the nutritious juices proper to each part, and Hunter attributing the same function to the extravasated blood. If one thing in this history is calculated to excite one’s wonder more than another, it is the contemplation of modern genius succumbing to ancient,—John Hunter bowing to Galen.” (pp. 114-15.)

It is not our intention to discuss the merits of these hypotheses, or of M. Malgaigne’s comments upon them. We shall confine ourselves to a brief abstract of the account given by him of the process under consideration.

The first phenomenon, as admitted at all hands, which presents itself on dissection, is the extravasation of blood, in varying quantities, around the seat of fracture. This is a necessary effect of the rupture of vessels, consequent on the injury sustained; and at the same time it appears to be made subservient to the subsequent steps which are essential to the reparation of the lesion.

The second stage consists in the outpouring of coagulable lymph, which gradually replaces the effused blood. This usually takes place in the course of twenty-four hours after the occurrence of the accident. This plastic lymph, our author considers to be produced conjointly by the medullary tissue and periosteum; “perhaps also,” he adds, “by the fractured surfaces of the bone,”—an opinion in which we concur. Though this lymph is poured out into the neighbouring tissues surrounding the seat of fracture, it is more especially met with in the periosteum and interior of the bone. The succeeding step is the organization of this new deposit by the penetration of vessels into its interior, the extravasated blood disappearing *pari passu*. As to the organization of the clot itself, our author considers that, as a fact, it rests on no foundation or proof which can support it. Thus much concerning simple fractures. With respect to those which are in communication with the external air, M. Malgaigne remarks :

“As far as my means of observation have enabled me to judge, in man, the outpouring of coagulable lymph takes place in every part where the air does not penetrate, and fills even the intervals between the fractured extremities of the bone, when they are so placed in relation to each other, as to be preserved from the contact of the air. Granulations spring only from the suppurating parts; and, instead of aiding in the reunion of the fracture, they are produced at the expense of the bone, which they excavate, or cause the absorption of, wherever they are developed. So that, if, in the most complicated cases, a process of suppuration should have denuded the extremities of the fragments, which have thus become eroded and covered by fleshy granulations, it is necessary, in order to reunion, that lymph should be specially deposited between the opposing surfaces of granulations; and it is in this lymph that the ossific deposit takes place, by which the loss of substance is compensated for. On the contrary, when an osseous surface continues isolated, without relation or possible chance of union to another surface, then no fresh bone is deposited, and the loss of substance produced in the manner above noticed is permanent.” (p. 118.)

This organization of the callus is, however, but the completion of the first great stage in the reunion of a fractured bone; or, more correctly speaking, the preparatory process which necessarily precedes that of ossification, and is, therefore, in itself transitory, and but a means to an end. It is not our intention to accompany our author through his discussion of the various and contradictory opinions which have been entertained and promulgated on this subject. As the theory of Dupuytren, so complete and apparently satisfactory and conclusive in itself, has been so much in vogue, especially in France, M. Malgaigne has devoted a considerable space to analysing its correctness. We may remind our readers, that the eminent surgeon to whom we refer, divided the process of reunion of a fracture into five distinct stages; to wit,—1, the vascular distension of the soft parts, which extends over a period from the first to the eighth or tenth day; 2, the epoch in which cartilage is formed, reaching from the tenth to the twenty-fifth day; 3, that in which spongy ossification ensues, including a period from the last date to the fortieth or even to the sixtieth day, according to the age, constitution, and health of the patient; 4, in the fourth period compact ossification takes place, and this is not completed until the expiration of the fifth or sixth month; and lastly, 5, the epoch of definitive or permanent callus, which is accomplished by the eighth, tenth, or twelfth month. The main objection which M. Malgaigne considers to attach to this theory, as, indeed, to many others, is, that it cannot be proved that any transformation to cartilage ever takes place in man. He does not deny that such a stage may have been observed in the lower animals, though the identity of this temporary deposit with the true and permanent texture of the same name, may fairly be questioned; but he agrees with André Bonn in stating that he has never observed such transformation, where he has had the opportunity of examining a fractured limb at this period. He admits, however, that his observations in the human subject have been limited to the adult and aged; and suggests that, probably, the period of cartilagification (if we may be allowed the word) may occur in the young,—or, in other words, that the plastic lymph in children assumes the appearance of cartilage before ossification ensues; whereas, in the adult, the corresponding tissue has a reddish hue, and presents more of a fibrous character; and in this the ossific deposit takes place.

Our author takes objection likewise to the fourth period of Dupuytren. He considers that the hypothesis of the conversion of spongy into compact callus is founded on too few observations and experiments to be of any value; and cites examples (some, indeed, from Dupuytren's own lectures) to support his objection. In many instances, he asserts (and we think correctly), that the spongy union is the permanent condition of the reunited bone after fracture. The conversion into compact tissue he regards as the exception to the rule; and even where such conversion ensues, he considers that Dupuytren has no grounds whatever for limiting the period to the interval between the third and sixth month.

We must not, however, pursue this interesting problem any further, but refer our readers to the original for the opinions of our author in detail. We may, nevertheless, remark, in dismissing this section of the work, that we consider its subject anything but exhausted, and as offering more fruits to the laborious and patient cultivator of pathology.

We pass by the succeeding articles on the "diagnosis, prognosis, and treatment" of fractures generally; as well as the greater part of those on the "reduction of fractures," and the relative merits of various forms of apparatus employed for retaining the injured parts in proper relation; confining our notice to a few interesting details which occur towards the close of the first division of the work. First, respecting the influence which the movement of the trunk has upon fractures of the lower limbs, especially the thigh. M. Bonnet instituted a series of experiments, in which he proved, and probably exaggerated, the ill-effects of raising the pelvis to place the bed-pan beneath it, and such-like movements. Without underrating this serious inconvenience, M. Malgaigne attaches less importance to it than M. Bonnet, but gives directions how the patient should be raised. By far the best and most effectual remedy is to avoid the cause of such mischief, by having a trap to open beneath the patient. As to the lateral and rotatory movements, there can be no reasonable apology for them, except in unusual circumstances, such as a protracted confinement, &c., when they are not likely to be as injurious, if at all so.

As opposed to the entirely immoveable forms of apparatus, we have the "swing-box," in which the limb is suspended, and which we have employed with advantage in some instances of fracture of the leg; but it is entirely inappropriate in fractures of the thigh; and we would remind those who draw inferences on such a subject as this from experiments on the dead body, that one, if not the most, important element in the consideration of the subject, is lost sight of, viz., muscular action.

The section devoted to the treatment of compound and comminuted fractures, generally, contains many valuable hints, with which, in the main, we concur. With respect to the most serious injuries to the bones of the face, we can bear testimony, from frequent observation, to the extraordinary power of reparation,—dependent, doubtless, on their high vitality,—possessed by this division of the osseous system; with the exception of the lower jaw, which seems to come into the same category, in this respect, with the long bones. As regards the removal of spicula or detached fragments of bone, where the fracture is both compound and comminuted, we regard it as sound practice to remove all such as are entirely isolated, or nearly so, and to enlarge the external wound for that purpose. Where still firmly attached, the size, form and position of such fragments, together with other casual circumstances associated with the case, must guide the surgeon as to the proper course to pursue. Paré's simple but practical recommendation should always be followed, viz. to explore with the finger, and not to trust to the questionable information obtained through the medium of probes or other instruments. On the proper and careful dressing of the wound in compound fractures, our author justly lays considerable stress: whatever apparatus be employed, this part of the limb must be left exposed, and within reach of the surgeon, that it may be daily looked to, and, if necessary, dressed: all constriction should be avoided, and warmth and moisture substituted for other dressing, where an angry and suppurative action exhibits itself. These principles leave no hesitation in the mind of the practical surgeon as to the propriety of selecting that form of apparatus which at once secures entire immobility of the limb, at the same time that the superficial injury can be readily exposed, without such disturbance of the splints, as will risk displacement of the fractured bone

or bones. We therefore do not hesitate to enter our protest, in common with M. Malgaigne, against any form of apparatus which requires readjustment every time the wound is dressed; as well as against the mischievous practice of dressing the wound for once, and then inclosing it in whatever mechanical contrivance may be selected for keeping the limb at rest, and leaving the remainder to Nature.

Under the head of "accidental complications" of fractures, the subject of vascular lesions is considered. There are not many points of practice which call for more cautious discrimination, as well as promptitude of action, than those which involve the question regarding amputation in fractures. It has been our lot, and we believe every conscientious surgeon will make the same confession, occasionally to witness recovery after we have counselled amputation and it has been resisted by the patient; and to see death ensue when we had determined on attempting to save a limb, where the complicated nature of the injury had raised the question of its removal. Of all these complications, probably injury to blood-vessels is that which calls for the most calm and serious consideration in the treatment of these injuries. Frequently extravasation of blood may take place into the whole soft parts of a limb, without external bleeding, or positive means of ascertaining the source of the hemorrhage; thus endangering the immediate vitality of the limb from mechanical pressure. This is, however, only one of the causes of risk where a blood-vessel of importance is wounded. All must be reflected on, and carefully weighed; and the age, constitution, temper, and especially the previous habits, of the patient, must constitute elements in the consideration of the question, and data on which to found a judicious opinion. This interesting subject is fairly discussed by our author, and we agree with him in opinion as to the proper course to pursue as a general rule; though we must qualify that opinion by stating that there are cases which admit of no alternative but that of amputation. In simple fracture, complicated with a pulsating tumour, M. Malgaigne prefers placing a ligature on the main trunk of the wounded artery to the alternative of amputation, a practice which is justified by the successful cases recorded by Dupuytren, Delpech, and B. Cooper. Further, he considers the same practice preferable to the condemnation of a limb in cases of compound fracture, *where the lesion is not of that character which otherwise renders the sacrifice imperative*,—a qualification which must be accepted unreservedly before we can subscribe to the opinion.

Tetanus is a complicating sequence of a very serious nature; and the question of amputation is not unworthy of consideration, though we fear we must add the results of our own experience to that of M. Malgaigne, in sad confirmation of the general futility of an operation where this dire disease has been once fairly established. The only instance which we can recall to memory of decided relief, *apparently* consequent on removal of the injured part, was a case of contusion of the foot, involving mischief to the phalanges of several of the toes. In this instance the nervous affection existed in a subacute form; and the case therefore seems to confirm the statement of Larrey, derived from his own experience, that more success might be expected where amputation is resorted to in chronic than in the acute form of tetanus,—a conclusion, indeed, which our knowledge of the disease would have led us to anticipate. "*Sublatâ causâ tollitur*

effectus” is an aphorism which is unfortunately inapplicable to the subject under consideration.

The causes and treatment of non-union of fractures have a section appropriated to them by our author. The remedial measures at our command are classed by him under the four following heads: “1, To secure for a sufficiently protracted period entire fixedness of the limb; 2, to procure approximation of the fragments by compression; 3, to excite the vital energy of the seat of injury by local means; and 4, to act, according to the particular circumstances of the case, through the medium of the system generally.” We shall not dwell at length on this subject, as we shall devote a short space, in another part of our present Number, to its consideration.* We may, however, remark, in passing, that we coincide with Mr. Liston and other surgeons of experience, who have recommended the seton in long-standing cases of non-union, in deprecating the practice of leaving the threads in for more than ten days or a fortnight; if this do not induce the desired effect, we have little faith in a more protracted trial, to say nothing of the mischief which is likely to ensue on the adoption of such practice. The results which are brought out by a statistical review of cases thus treated, are confirmatory of this opinion. Excision of the fractured ends of a broken bone we regard as a much more serious operation,—one, in fact, which, except in the fore-arm, is scarcely to be recommended: in the case of the humerus the operation is tedious and not free from risk, and by no means certain in its effects,—an observation which possesses still more force when the femur is the seat of injury. We shall conclude our notice of this subject, and, indeed, of the first division of our author’s work, by a quotation of his own opinions on the treatment of false joints, resulting from ununited fracture; premising that these opinions are founded on the assumption that it is on the soft parts we have to rely for the production of callus. We shall not wait to discuss whether his data are correct; in practice his conclusions, we think, are on the whole sound.

“It is my opinion that we ought to act upon the soft parts especially; and, in following the example of Nature, we must, above all, strive to excite inflammation of an adhesive kind. Stimulating lotions are too insignificant; blisters are more active; but sinapisms, which produce an irritation at once more prompt, intense, and deep, without a suppurative action, which is undesirable, appear to me to merit preference. Rubbing together of the fractured ends of the bone acts only by irritating the soft parts; and the same effect is produced by sudden and violent movements of a fracture, with a view to burst asunder the fibrous bands which connect the fragments together, as well as by direct and transient compression, by which the surrounding muscles are contused. Lastly, acupuncture is a resource without risk, the efficacy of which is enhanced by the aid of electricity, of which the needles may be made the conductors.

“Thus, then, the primary object should be to excite adhesive inflammation; and, when all the means at our command of producing it have failed, then, and not till then, we must endeavour to promote suppuration. Here, however, the first question which presents itself is, whether we ought, as some partisans of the method by seton have recommended, to persevere in the employment of this irritating agent for months together, or to limit its use, as advised by Liston, to eight or ten days? To attempt to establish as a general rule such long persistence in the

* In our review of the Transactions of the Medical and Chirurgical Society.

use of the seton, is an absurdity ; for what is more likely to delay and interfere with the consolidation of a compound fracture, than protracted suppuration? But, on the other hand, the limit fixed by Liston is likewise too arbitrary : the true rule is, to persevere until vascular fulness (engorgement) of the soft parts is established. Eight days will suffice to produce this effect in some instances; whereas, in others, fifteen or twenty days, or even a longer time, are necessary. The study of facts, as presented to us in practice, has already led us to the same conclusion ; and we have seen the seton miscarry both from too early removal, and from its presence being tolerated too long." (p. 321-2.)

It is not without premeditation that we have devoted so much space to the first division of M. Malgaigne's work ; for the general principles which should guide the surgeon in the treatment of disease or injury, seem naturally to afford a fairer scope for judging of an author's merits, and of the degree of reliance we may place on his recommendations in the treatment of individual cases. We have, therefore, the smaller space to devote to the second great section of the work, which comprises the nature and treatment of the fractures to which the different bones are liable. We cannot, however, in justice to our author, entirely pass by, without notice, this essential part of his volume ; but we must content ourselves with the selection of two or three chapters, which will afford us material for illustrating the practice of M. Malgaigne in the treatment of fractures. Those on injuries of the sternum, clavicle, and fore-arm will suffice for this purpose.

The rarity of fractures of the *Sternum* has induced us to select the chapter which treats of them, to observe if our author can throw any fresh light on their causes, nature, and treatment. He states that but one instance has presented itself in the course of eleven years at the Hôtel-Dieu ; which, considering the vast number of injuries admitted into this institution, appears remarkable. These fractures are usually transverse, and not by any means necessarily attended with deformity. M. Malgaigne refers to but one case of longitudinal fracture of this bone, recorded by Barrau, and which was cured, though it is not stated whether any deformity remained. Our author relates another case of singular comminuted fracture which terminated fatally, the nature of the injury being masked during life by the amount of consequent swelling and the complicated nature of the injury. Direct or indirect causes may produce this injury : our author adds muscular action as a third agent in the production of fracture of the sternum : we must say we think this very questionable, save in diseased, and consequently friable, bones. Two cases have come under our own notice and care, illustrative of the more ordinary causes. In one, the subject of the injury fell from a considerable height, and fractured several ribs, as well as the sternum transversely. In the other case, the fracture was produced by the patient falling a short distance with a sack of flour on his back, by which the trunk was bowed suddenly and violently forwards. In the former of these, the age of the patient, and the complicated nature of the injury (involving internal lesion), caused death ; in the latter, the patient recovered without a bad symptom, though the fracture allowed of the distinct movement of one fragment on the other ; there was no displacement productive of deformity in either case. M. Malgaigne narrates several cases, recorded by different authors, of transverse fractures produced by falls on the back. Chaussier, he adds, has seen two instances in which fracture of the sternum occurred during labour, the patients

bending themselves forcibly backwards during the labour pains, and resting on the arms and heels. A similar effect followed a similar act (as regards position) in a mountebank, who was exhibiting the feat of curving the body backwards, whilst he raised a heavy weight with his teeth and arms. These, however, cannot fairly be placed in the category of fractures by muscular action, though, indirectly, they were thus produced. The only genuine case of this last-mentioned form of fracture, noticed by M. Malgaigne, is one recorded in the 'Gazette des Hôpitaux' for 1830. The subject of it was the victim of scirrhus of the stomach, which occasioned frequent and violent fits of vomiting. After death the sternum was found to be fractured in its upper third; the presumed agent was the diaphragm; and the reporter states, that though "the bone appeared to be diseased an inch below the lesion, it was healthy at the seat of fracture itself." (?) The prognosis in cases of fracture of the sternum is usually favorable, save where this injury is accompanied by other complications, or the bone is driven in, so as to press upon or mutilate the viscera beneath it. Where the latter occurrence is met with, it may be imperatively necessary to raise the depressed fragment, for which M. Malgaigne considers it justifiable to make an incision through the integuments, and introduce an elevator; but, he adds, "two circumstances ought to put the surgeon much on his guard, not only with respect to operations of this kind, but even in pressing too far the attempts at reduction by ordinary methods; the first is the danger of suppuration, and the second, the difficulty of retaining the fragments in their proper relation when reduced." (p. 459.) Fortunately these serious cases are of extreme rarity; and certainly we ought not to subject our patients to so serious an operation as that first noticed, for the replacement of the depressed fragment, unless other accessory symptoms render it imperative. Petit and Boyer recommended that the sternum should be trepanned where blood is extravasated beneath it; but, as our author observes, this practice scarcely requires a serious refutation; though he admits the propriety of such an operation, where pus in any quantity has collected behind the bone, and the latter is carious.

Fractures of the *Clavicle* are as frequent, as those of its neighbour, the sternum, are rare. The statistical materials at the command of M. Malgaigne show that not more than one fourth of the cases which came under his observation, during eleven years, at the Hôtel Dieu, occurred in females; at least this proportion continued valid between the ages of fifteen and sixty-five, after which period the preponderance was in favour of the female sex. The classification of fractures of the clavicle, adopted by our author, is that which is usually employed, viz. those which affect the shaft of the bone, or either extremity. We turn to the treatment of these fractures to notice whether there is anything particular in the methods he recommends. When the body of the clavicle is broken, M. Malgaigne considers that the following indications should be fulfilled, and in the following ways: First, to elevate the external fragment; this he thinks is best accomplished by an ordinary sling, including the fore-arm and the elbow. Secondly, to carry backwards the external fragment. For this purpose various forms of apparatus have been constructed and recommended, and these are all noticed by our author without particular preference being given to any. A most important indication it certainly is, and may be fulfilled by the employment of the ring pads and straps

attached to them, which buckle between the shoulders. If this apparatus cannot be obtained, a broad bandage carefully and properly applied answers the purpose, in our experience, remarkably well; it should also be made subservient to keeping the arm of the affected side fixed to the trunk. The third indication is to carry the external fragment outwards; a pad in the axilla and the approximation of the elbow to the side, are the means to be resorted to. Our author speaks of various forms of pads for this purpose, but does not give the preference to any particular one; we have never seen the air-cushion employed, as suggested by M. A. Ricord, but should be disposed to think it applicable to some cases, where the patients are moderately tractable. The fourth and fifth requirements are to depress the sternal fragment, and to keep the parts at rest. Of the former of these indications we do not recognise the importance, save in exceptional cases, and then we have little faith in the contrivances proposed to accomplish it; we should place more reliance on relaxing the sterno-mastoid muscle, where such deformity existed, after the adoption and failure of the measures recommended, to fulfil the other requirements.

As to rest, that is of course imperative; and we do not consider with M. Malgaigne, that any especial apparatus is essential for this purpose; but we do know, from experience, that constant observation even of the most tractable patients is requisite, in order to the readjustment of whatever mechanical arrangements are resorted to in the treatment of these fractures.

The rarity of fractures of the sternal extremity of the clavicle, and the comparative frequency of those of its acromial end, are admitted by M. Malgaigne. Of fractures of both clavicles together, he says he has seen but one example, and been able to collect but four more in the records of surgery. We can add a fifth, which occurred under our own observation a few years since. The subject of the injury was standing against a wall on the approach of a waggon; the space was so narrow that the wheel caught his shoulder, and he was thus rolled round between the vehicle and the wall. Both of the clavicles suffered comminuted fracture, and one was broken into many fragments. The deformity was naturally considerable from the loss of support to the scapulæ; but, the patient being particularly docile, the cure was by no means protracted, and in every respect satisfactory. It has appeared to us, in the treatment of comminuted fractures of the clavicle, that its power of reparation exceeds that of most of the long bones, small spicula becoming more readily united to the main fragments during the process of consolidation: compound fracture, and exfoliation after comminuted fracture, are certainly very rare.

Of the fractures to which the *Fore-arm* is subject, our author states, as the result of his experience, that those of the radius are the most common, and those of the ulna, alone, more rare than such as involve both bones: we believe that most surgeons would agree with him in this statement; and further, that a large proportion of all of these accidents occur in the male sex. After the age of forty-five, however, the disparity disappears in cases in which both bones are involved in the injury; and M. Malgaigne's tables further show a remarkable preponderance on the part of the female sex, where the radius alone is broken, the relative numbers being twenty in men and forty-one in women. We do not stop to speculate on this curious phenomenon.

Fracture of both bones is usually the consequence of direct injury, though a fall on the hand may, and sometimes does, produce this lesion. Our author has met with one instance in which the double fracture in question was caused by muscular action: a robust man, of thirty-eight, was in the act of raising a spade loaded with earth, when he heard two distinct snaps in the fore-arm, and both bones were found to be broken, though not opposite the same spot. This, we apprehend, is a unique case.

We turn to that subdivision of the present chapter which treats of fracture of the lower extremity of the radius, to notice what plan of treatment our author recommends; but we may remark, in passing, that he attributes the usual tumefaction observed on the anterior aspect of the radius, when broken low down, to extravasation of blood in the first instance, and to the product or inflammatory action which subsequently ensues in the cellular tissue, and in the sheaths of the tendons around the wrist. Sir A. Cooper was disposed to ascribe it rather to the displacement of the fractured ends of the bone; but we think there is much truth in M. Malgaigne's suggestion. Our author further speaks of the extreme facility of detecting these fractures close to the wrist; we must acknowledge we have been occasionally a little puzzled when the cases have not come under our observation at an early period, for the consequent swelling is generally very considerable.

But respecting the treatment; the indications to be here fulfilled, are enumerated under three heads, viz., "to preserve the interosseous space, to correct the displacement of the lower fragment backwards (or forwards where such is the case), and to prevent the abduction of the hand, by keeping the styloid process of the radius on its proper level." The first of these requirements M. Malgaigne admits is rather imaginary than real, inasmuch as the interosseous space can scarcely be said to exist so close to the wrist, and the displacement inwards is, under any circumstances, so trifling as to be undeserving of any especial attention. To accomplish the second object, our author employs the following plan; we quote his words—

"I prepare two pads of three fingers' length, and in breadth equivalent to that of the fore-arm; I dispose one across the anterior fragment, beyond which it must not extend, and the other on the posterior fragment, taking care that it does not descend so far as to interfere with the usual flexure of the hand backwards. I then apply a splint on either surface of the fore-arm, which presses firmly on its pads, but without reaching below the wrist, the front one alone being allowed to extend a little way below the corresponding pad, which latter keeps it sufficiently removed from the wrist to prevent its doing any mischief; and this trifling prolongation is essential to ensure the pressure of the back splint. The whole is kept in position by a roller, which must extend all along the splints, and this may be stiffened with albumen if necessary, or a few strips of adhesive plaster may be substituted. Lastly, the arm is to be supported in a sling in an intermediate position,* that is, resting on its ulnar border." (pp. 613-14.)

The third indication is the most important, as well as generally the most difficult to achieve. Mr. Cline first proposed a method which has been largely and successfully adopted, viz., by the arrangement of the splints so as to allow the hand to drop towards the ulna, by which means the ten-

* Between pronation and supination.

deney to abduction is counteracted, and the upper extremity of the lower fragment is tilted outwards, and kept separate from the ulna.

Dupuytren employed a curved steel splint, which he applied on the ulnar side of the fore-arm, so as to act by its elasticity on the hand and lower extremity of the radius, and thus produce a state of forced adduction by which the tendency to deformity is corrected; but this and similar forms of apparatus must be irksome, if not distressing, to the patient. Our author prefers the employment of two lateral splints, acting in the same way and on the same principle as those placed anteriorly and posteriorly; that on the radial side pressing the inferior fragment (through the medium of a pad) inwards, the ulnar splint at the same time pressing this bone outwards, whilst the hand is permitted to drop according to the practice suggested by Cline, and adopted by Sir A. Cooper. M. Malgaigne examines the seat of fracture and reapplies his apparatus about the eighteenth or twentieth day, and then leaves it till the thirtieth day, after which time the limb is set at liberty. This plan of treatment he has found both successful and unattended by any drawback during the progress of the cure, or by subsequent deformity.

We do not find that any notice is taken of the simple but ingenious method recommended by Professor Fenger of Copenhagen, who keeps his patients recumbent, and with the injured member resting on a plane which is inclined upwards from the elbow to the wrist, whilst the hand is allowed to drop over the most elevated part of this inclined plane, the arm being only so far confined as to prevent its being shifted from its position,—a precaution which is unnecessary if the patient will keep entirely at rest. The Professor appears to have been peculiarly happy in the treatment of these troublesome fractures of the radius close to the wrist, by pursuing this simple method.

We trust it is unnecessary to pursue our analysis of this the second part of our author's work further, to satisfy our readers of its systematic and eminently practical features. We have but few words to say in conclusion. M. Malgaigne has availed himself largely and judiciously of the labours of others in the accomplishment of his task, at the same time that he has brought the results of his own experience and observations to bear on every part of his subject. We are fain to place reliance on what he states, and to have confidence in his inferences; for he is eminently cautious in weighing and analysing the opinions and statements of others; and frequently exposes the illogical conclusions drawn from false or insufficient data. The accompanying Atlas contains a number of illustrative lithographs, which are very nicely executed, and are calculated to enhance greatly the value of the letter-press.

In fine, we feel that we can with pleasure and satisfaction recommend the volume before us as a safe guide to the surgical student and young practitioner; at the same time that it merits to be classed with those systematic and practical works, which enable us to form a just estimate of the existing state of those branches of operative medicine which they profess to discuss.