

THE INFLUENCE OF POSITION IN FRACTURES AND DISLOCATIONS AS SHOWN BY A COMPARISON OF THESE INJURIES IN MAN AND ANIMALS.¹

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THE various adaptations which have occurred through man adopting the erect attitude are extensively dealt with in the large text-books of anatomy. The effects of position on the soft parts have to some extent been worked out, but so far as I know no work has been done upon the effects of the quadrupedal and bipedal positions upon injuries to the bony parts. These I have tried to work out in their principal directions. The subject matter therefore consists largely of what may be called surgical mechanics, and to this I have added the data drawn from veterinary surgery.

The mechanics of the injuries to the bones and joints in man can be easily studied as there is abundant material, but it is difficult to obtain the accurate data of fractures and dislocations in animals because an attempt is rarely made to rectify these, the animals being destroyed as they have no longer their full working value. This part of veterinary surgery has never been worked up to anything like the extent that it has been in man. The differential diagnosis and treatment are very shortly treated and the etiology of fractures and dislocations is almost untouched. In order to remedy this defect to some extent I have consulted all the cases which I could find reported in British and some American literature. Upon such material it is naturally impossible to build up reliable statistics as to the relative frequency of these injuries. Still, as fractures and dislocations are rare in animals and their study apparently of little practical use, the cases are recorded even when they do not necessarily present only usual features. Again, in consequence of the procedure after injuries in animals being usually to kill and not to cure the reports generally contain, besides an account of the injuries as made out in the living, descriptions of the post-mortem conditions found. These cases which are complete are of the greatest value, and I have neglected as too indefinite most of those in which such an examination was not made. In this way I have examined the records of more than 350 cases. I propose dealing only with those injuries which occur both in man and animals under conditions that are comparable. For example, I have omitted the fractures and dislocations which are peculiar to man owing to his fore-limb being specialised into an arm. Similarly some very interesting fractures in animals have been omitted, as that of the navicular bone in the horse, on account of the fact that there is no corresponding bone in man. Because the horse is the quadruped that is most frequently damaged and has been in consequence most fully studied I have selected it as the type to compare with man.

Broadly speaking, fractures are of rare occurrence in the horse in comparison with man and dislocations are still rarer. Animals agree with man in so far that they suffer less often from dislocations than fractures. The principal mechanical reasons for the fact that dislocations are less frequent in animals than in man are twofold—namely, the very strong muscles and tendons which surround the joints and the simple, limited movements allowed in them. In quadrupeds the presence of four supports to the trunk gives great stability to the animal, but these supports, which are disposed in pairs, are differently arranged with respect to their several segments. The ways in which the different segments of the limbs are placed give rise to the principal differences in the fractures and dislocations which occur in man and animals. It will add to the clearness of the following account if I first briefly state what these arrangements are. The long axes of the ilium and scapula both make angles with the long axis of the body of about 45°, that of the former directed downwards and backwards and the latter downwards and forwards (Fig. 1). From this point the angles in both limbs differ. The ilio-femoral angle is just

about 90° and the humero-scapular 105°; the femoro-tibial (knee) 90°, the humero-radial (elbow) 150°; the tibio-tarsal 135° and the radio-carpal is practically 180°, the radius, tarsus, and metatarsal bone being almost in one straight line and the metatarso-phalangeal angle is about 165° and the corresponding carpal angle 135°. Speaking generally the bones of the fore-limb approximate in some degree towards a straight line, which accords with their predominant function of weight-bearing. The hind-limb, which is eminently propulsive, has its several segments set at more

FIG. 1.

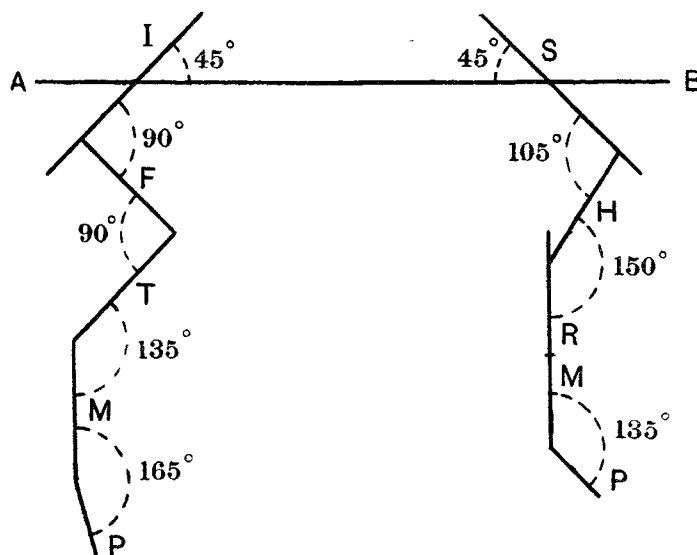


Diagram showing the relations of the segments of the fore- and hind-leg of a horse to each other. A, B, Longitudinal axis of body. Fore-limb: S, Scapula; H, Humerus; R, Radius; M, Metacarpal; P, Phalanges. Hind-limb: I, Ilium; F, Femur; T, Tibia; M, Metatarsal; P, Phalanges.

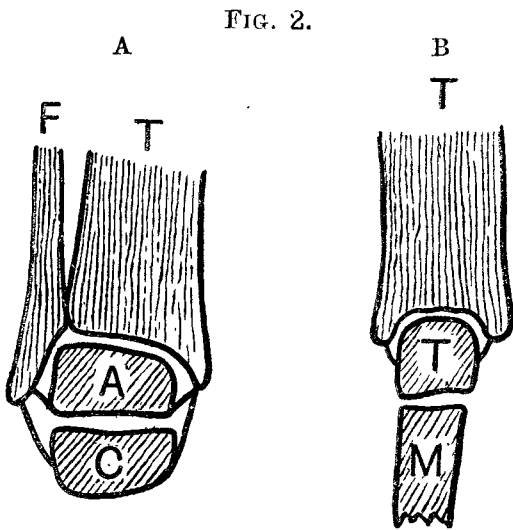
acute angles and is therefore bent in a zigzag manner like a spring. As the body-weight acts vertically at all these joints a constant strain will be thrown upon the muscles and tendons passing over them. If the ligaments bore this strain, movement in the same direction as the natural condition would be prevented. For example, the knee is naturally flexed to about 90°, and if the tendency of the body-weight to flex it further was prevented by ligaments the animal would be unable to bend its knee beyond this angle. These points will be severally dealt with in respect to their influence in the accounts of the various injuries.

FRACTURES AND DISLOCATIONS IN DIGITIGRADE AND PLANTIGRADE ANIMALS.

The first problem to be considered is the influence of digitigrade and plantigrade progression upon injuries. To make this clear the mechanical conditions must first be considered. The distance from the ground to the ankle-joint represents the length of the lever which acts on this joint. This lever, or foot-lever as it may be called, in man consists only of the astragalus and calcaneum, the total length of the perpendicular being not more than 3 in. In the horse, however, the foot-lever consists of three phalanges, the metatarsal bone of the tarsus, its length being about 18 in., the corresponding carpal lever being about 18 in. The mechanical value of this lever is, then, six or seven times greater than that in man. Besides the length of the lever its intrinsic strength must also be considered. In man it is short and thick, consisting of only two segments, which are firmly united by an inter-osseous ligament, whereas in the horse it is very long, many-jointed, and comparatively thin. In the latter, therefore, although the foot-lever has from six to seven times the mechanical value that it has in man, it is relatively weaker. The socket in which this lever works will materially influence dislocation in two ways, by its size and depth. Both these conditions must be gauged relatively to the length of the foot-lever, the absolute size and depth being of no value in comparisons. The ankle-joint is relatively larger in man and it is also deeper inasmuch as the malleoli are relatively longer. As in the horse the mechanical advantage of the foot-lever is much greater and it plays upon a relatively small and shallow socket it might be expected that dislocation would occur more commonly than in man. This, however, is not so; Müller says he knows of no cases of such a luxation. The

¹ Thesis for the degree of M.B. in the University of Cambridge.

explanation therefore must undeniably lie in the weakness of the foot-lever. This, as has been said, consists of many parts which are bound together by very strong ligaments. Instead of these dislocations of the ankle it is found that the foot-lever breaks and the records show that the bones break before the ligaments. The metatarsal and metacarpal bones form just over half the length of each foot-lever and, as might be expected, are the bones most frequently broken. The metacarpal bone is broken more frequently than the metatarsal, probably in consequence of its being more exposed to injuries, such as in stumbles, turning, &c. I examined the records of 15 cases of the former and 5 of the latter. The bone next commonly broken is the long (first) phalanx, 10 cases; then the middle phalanx, 6; and finally the os pedis, 5. It is of interest to note that the order of frequency of fracture decreases with the length of the individual bones. Accordingly these considerations show that fractures of these bones are of greater frequency among those in the horse than they are in the case of man. In man, with his relatively short, broad foot-lever and large ankle-socket produced by the long malleoli, it is to be expected that these latter processes are more likely to be broken off than in the horse (Fig. 2 A). Such is certainly the case, for



A, Diagram of bones about the ankle-joint of man. T, Tibia. F, Fibula. A, Astragalus. C, Calcaneum. B, Diagram of bones about the ankle-joint of the horse. T, Tibia. T (on the small bone), Tarsus. M, Metatarsus.

dislocation in man at the ankle is extremely rare without such a fracture. In the horse Leisering records such a fracture found post mortem and Müller suggests that Louchard's case may have been another. These are the only two cases I could find. Besides the dislocation of the ankle-joint with fracture of the malleoli, plantigrade animals differ from digitigrade animals in having the calcaneum fixed by contact with the ground. By virtue of this they are liable to astragaloid and subastragaloid dislocation. Digitigrade animals are exempt from these injuries as the calcaneum is never so fixed. Owing to the plantar arch in man the calcaneum is directed backwards and downwards and is fixed by contact with the ground only at its hindmost part. In consequence, the whole length of the calcaneum acts as a lever to break the inter-osseous ligament between it and the astragalus. There is a similar lever from the heads of the metatarsal bones to the tarsus.

Another point in connexion with dislocation at the ankle-joint is that in man the movements permitted there are more extensive. This certainly gives an additional liability to dislocation but may also save him from injury. For instance, violence applied to the outer side of the foot in man may result in nothing more than a sprain of the ligaments, but in the horse in which the movements at the ankle-joint are limited such violence is very liable to lead to fracture. The ankle-joint in the horse forms anteriorly an angle of 135°, whilst the wrist is practically in one straight line with the arm. There will be a constant strain upon the calcaneum, which is very rarely broken in the horse; it is then usually broken by muscular violence. Such an accident occurs very rarely in man, as for instance when he adopts digitigrade progression, as in running, jumping, &c.

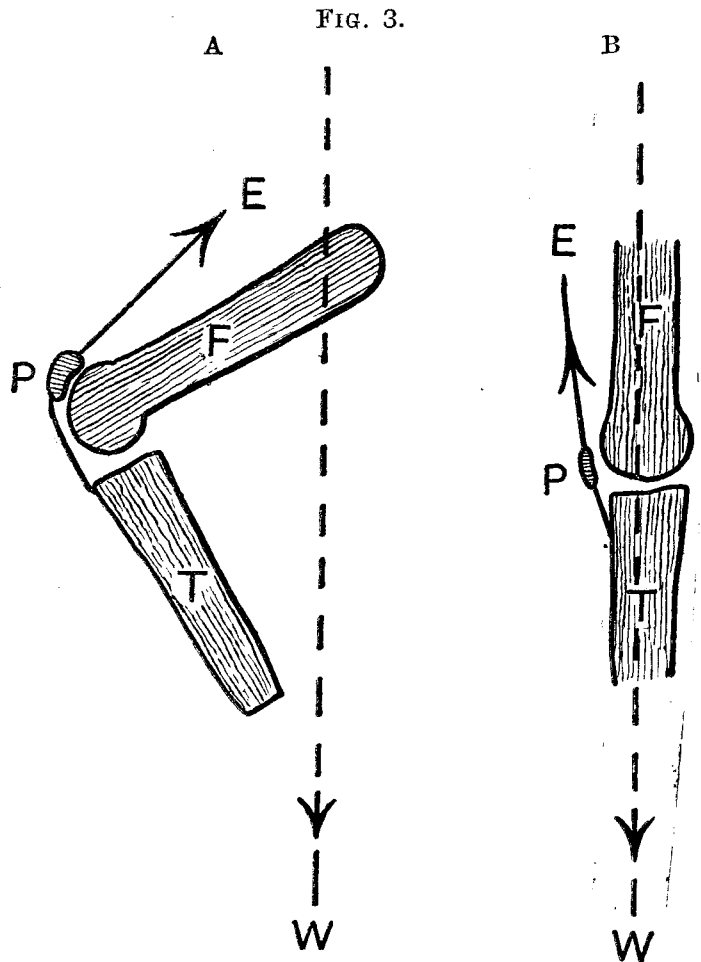
FRACTURES OF THE FOREARM AND LEG.

The tibia is the most commonly broken bone in animals. In its causation it differs from that in man by being almost

invariably caused by direct violence, whilst in man such a cause is uncommon. As a result of this transverse fractures are commoner in the horse than in man and in transverse fractures the ends of the bones are not unlikely to remain in apposition. It is not therefore surprising to find cases recorded in veterinary literature in which displacement did not occur for some days after the receipt of the injury. This period is of very variable length, as from five to thirty days or more. Williams asserts that in such cases the damage is probably subperiosteal and that this membrane being very strong is sufficient to retain the two fragments together. Nowhere have I found the possibility of impaction considered, though it is not so likely to occur with direct violence. Cases in which displacement does not occur early, as when the bone is broken transversely, do occasionally occur in man. This cannot occur often, for the most common fracture of this bone is produced by indirect violence and the line of fracture is in consequence more or less oblique. Fractures of the fibula are very common in man, whilst in animals with well-developed fibula it as a rule only occurs as the result of direct violence. In the horse the fibula is defective and only exists in the upper third of the leg; Müller asserts that it is never broken. The tibia of the horse has an outer malleolus as well as an inner supplying the wants of the lower end of the fibula (Fig. 2 B). I have shown above that neither malleolus is at all likely to be broken. The radius in the horse is similarly placed to the tibia and suffers, as would be expected, similar fractures. The ulna is only a fine splint-like bone in the horse in its lower part and is very rarely broken. Like the fibula it is sometimes broken by direct violence in cats, &c. The olecranon will be considered after the patella.

FRACTURE OF THE PATELLA.

Gurlt's statistics give the frequency of the fracture of the patella in man as 1·4 per cent. of all fractures. The veterinary text-books state that this fracture is very rare and that when it occurs it results from direct violence; the more



A, Diagram of knee of horse. B, Diagram of knee of man. F, Femur. T, Tibia. P, Patella. E, Line of action of quadriceps. W, Line of action of body-weight.

recent works add muscular violence. In a search through American and British literature I have been unable to find a single case. In the horse the knee is naturally flexed to an angle of about 90°, and as the line of action of the body-weight is vertical there will be a continuous strain on the

patella. This strain cannot be resisted by the ligaments, as then further flexion would be prevented, and this is certainly not the case. The strain must therefore be borne by the quadriceps extensor, the patella, and its ligament. With the assumption of the upright position such continuous strain will be lost, as the body-weight is transmitted directly from the femur to the tibia. Both Humphry and Goodsir, later also Meyer, obviate muscular action in their theories of the mechanism of the knee in standing. The patella has therefore lost in man a great deal of its function and may therefore be said to be atrophic. A limit is placed to this atrophy by the value of the patella in walking, running, &c.—i.e., when the knee is flexed. Besides this, in the flexed knee of the horse the patella has to transmit the force through an angle (Fig. 3), and consequently must be a much stronger bone than if it had merely to withstand a nearly pure traction force, as in the straight knee. In adopting the erect attitude the ligamentum patellæ has been shortened, so to speak, in order to take in the slack. Man's patella, therefore, rides relatively lower on the femoral condyles than in the horse. This enables it to be in contact with the femoral condyles near its middle and not at the ends. The area between the two horizontal lines on the articular surface indicates this area of contact. The bone is consequently snapped by the contraction of the quadriceps muscle. This is the usual method given to explain the fracture by muscular violence, but a most important factor is not considered. The knee is flexed at the time and in consequence the body-weight will work hand in hand with contractions of the quadriceps.

In the horse, then, we have a stronger patella which by means of a longer ligamentum patellæ rides higher on the femoral condyles. Nearly the whole of it is in contact with the femur at the same time. Therefore it differs from man's in being almost entirely out of harm's way. Considering these points and the extreme rarity of the fracture it is very improbable that it is ever broken by muscular violence. The statement to this effect in the veterinary works in all probability arose from the observations in the treatises on the surgery of man. Mr. Anderson shows that this injury is more common in people of feeble habit of body from the St. Thomas's Hospital returns of 1880-1890. This frequency, he says, "points to the predominant influence of a second factor, a diminished textural resistance in the bone." To this may be added other clinical facts. It is by no means infrequent to find refracture in a different place after wiring has been done. May it not be that here a new piece of cloth has been put in an old garment? Again, one often sees cases of fractured patella in whom the other patella has been broken before or which breaks subsequently. Mr. Anderson has on clinical grounds pointed out an atrophic condition of the patella related to the age and condition of the subject. This is a condition of the individual and differs from the suggestion I have made from our ancestry. To these must be added Poirier's evidence of the great diminution of the compact bone with increase of age.

Comparing the patella of man with that of a typical quadruped it is seen that the former is relatively shorter and broader, its breadth equalling and usually exceeding its length. It is thinner also, as is shown by calculating its thickness even in terms of the relatively shorter length. Thus it may be said to be the weaker, and this is supported by comparing sections of the bones. In man there is less compact tissue round it and the cancellous tissue has wider meshes and weaker trabeculae. The structure of the patella on all points bears out the weaker condition found in that of man which had been suggested above from *a priori* reasoning.

FRACTURE OF THE SESAMOID BONES.

One of the most interesting fractures in the horse has no counterpart in man, but as the bones are placed under somewhat similar circumstances as in the patella I will give a brief account of them. The sesamoid bones are strong masses in the flexor tendons situated on the metatarsophalangeal and corresponding carpal joint (Fig. 4). The joint is hyper-extended to an angle of about 135° and in consequence of the vertical line of action of the body weight a constant strain is borne by these bones. As they are situated over the joint they are more similarly situated to the human patella, but they agree with the quadruped's in that they are in contact with the overlying bones in almost their entire length. They are therefore not liable to be broken across the lower end of the metatarsal bone. Fracture occurs by muscular violence and differs from the common results so

produced in the extraordinary comminution which takes place. The bones are broken in as many as from 5 to 30 pieces; the fracture may also occur in all the fore-limbs simultaneously. I have analysed eight papers upon this subject. Hart of Calcutta says that it was the commonest fracture which he had to deal with, and that it occurred chiefly in young horses from Australia after a voyage of from 60 to 70

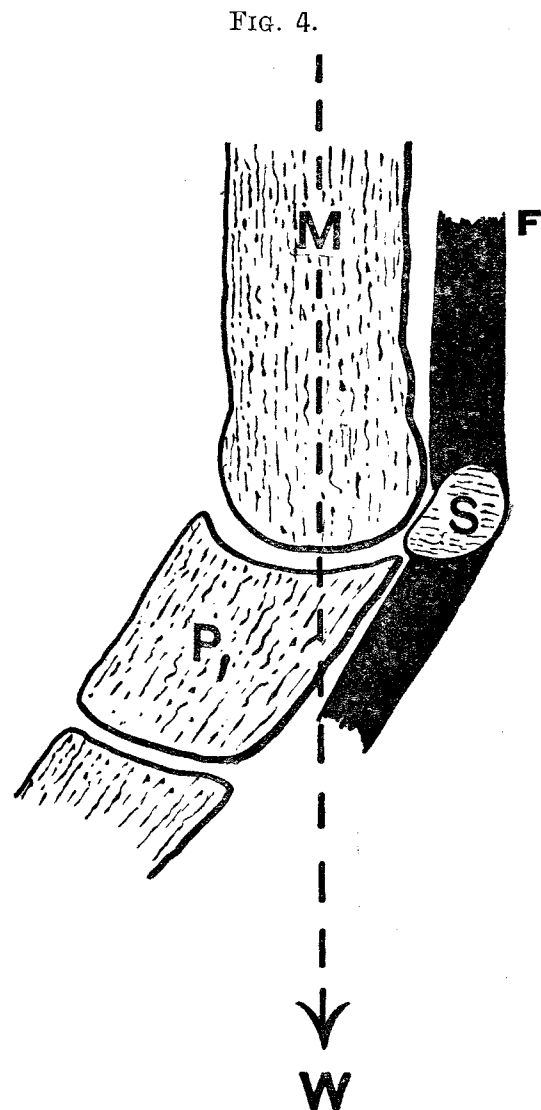


Diagram of metacarpophalangeal joint of horse. M, Metacarpal bone. P, Proximal phalanx. S, Sesamoid bone in flexor tendon F. W, Line of action of body-weight.

days, during which they stood continuously and suffered the greatest privations. When landed they bolt maniacally and after going a short way collapse. Post mortem he demonstrated that the sesamoid bones were lighter and more cancellous than normal. Professor Varnell previously had also described the same morbid condition as predisposing to the fracture, but offered no suggestion as to the cause of it. Hart also showed that if care was taken in landing and for some time afterwards this predisposing condition could be recovered from. Both the above authorities have shown the predisposition, but have not worked out the mechanism of the fracture. The bones are situated over the metatarsophalangeal and metacarpophalangeal joints and also lie in contact with the bones; the joint is hyper-extended to 135° from the vertical. As the animal gallops, each time its legs touch the ground, a violent strain will be thrown on the flexor tendons and the sesamoids. Also, as the bones lie directly over the joint, the lower end of the metatarsal bone will be driven violently upon them. This action will be somewhat like that of a hammer, and considering the great tension on the bones the resulting comminution may be explained. In Hart's cases besides the predisposing condition of the bones there is the excessively violent muscular action from the excitement of landing after the long voyage.

A point which may deserve explanation is that in from 60 to 70 days of standing could atrophy be induced in the bones? Such conditions should normally produce an hypertrophy, but continuous strain with the malnutrition and greatly impoverished health might produce the atrophy. Leisinger records a case of transverse fracture, the bones being probably broken across the lower

end of the metatarsal bones. The sesamoid bones, therefore, present an intermediate condition to the patellæ of man and quadrupeds. They agree with those of man in being broken by indirect violence, but by virtue of being completely in contact with the underlying bones and bearing a continuous strain, differ from it in being broken into several pieces and not into two by a transverse break; they are also placed over the joint, and, though very rarely, are broken transversely by muscular violence. They agree with the horse's patella in being subjected to the continuous strain and being in almost complete contact with the underlying bone, but the horse's patella differs, as shown above, in being situated so as to be practically out of harm's way with respect to indirect violence. They also illustrate the influence of the individual's condition as predisposing to fracture. The joints over which they are placed are set at different angles, the foot 165° and the hand 135° (Fig. 1), and it might therefore be expected that the fore leg sesamoids would be more frequently broken than those of the hind leg. This will certainly to some degree be balanced by the fact that in the legs greater muscular action will be experienced.

FRACTURE OF THE OLECRANON.

The olecranon in the arm corresponds in some degree to the patella in the leg. Owing to the specialisation of man's arm the conditions cannot be compared with advantage; in the horse the condition of the fore-limb is to some extent the same as the hind-limb and a comparison may here be made. Though the olecranon is suitably placed for being broken across the trochlea of the humerus it is hardly ever so fractured. Pernaud records such a case in the horse. Cases are occasionally recorded in which fracture has occurred on a level with the upper end of the radius, but they are scarcely cases of fracture by muscular violence. The reason why it is not more frequently broken probably lies in the fact that the fore leg is mainly of use for weight-bearing and the hind leg mainly for propulsion. In this way the olecranon to a great extent is saved from the violent intermittent contractions of the extensor muscles; should the patella have been continuous with the tibia it must inevitably have been broken off. That the fore leg is of less value in violent movements is indicated by the fact that the shoulder-girdle is nowhere in bony connexion with the trunk, the clavicle of course being absent. As the humero-radial angle is only 150° and not 90° (Fig. 1), as in the knee, the olecranon is not so well situated for fracture as a like structure would be at the knee.

FRACTURES OF THE HUMERUS AND FEMUR.

Fractures of the humerus and femur may be dismissed in a few words. They usually result from direct violence. In the case of the femur of animals the neck is not usually so marked as in man, and, as Müller has pointed out, it is probably less commonly broken. When compared with man both these bones form an angle of 45° to the long axis of the body. In consequence a continuous strain is thrown on the glutei, supraspinatus, infraspinatus, &c., which has led to the enormous development of the tuberosities of the humerus and of the trochanters. The presence of the third trochanter in animals is probably accounted for in this way. Steel records a case in which this was torn off by muscular violence. Besides the third trochanter being present and the large size of the other trochanters the constant strain may account for the shorter neck to the femur, for the longer the neck the greater the mechanical disadvantage of the glutei.

FRACTURES OF THE TRUNK.

The scapula is uncommonly broken in the horse on account of its sheltered position and of its mobility due to absence of the clavicle. Excluding chipping of the glenoid cavity I analysed only 6 cases, none of which presented any features of interest. The pelvis in the horse is far more frequently broken than the shoulder girdle, as might be expected. I collected 25 cases of this fracture, 11 of which were multiple, 6 of the ilium only, 4 of the acetabulum only, and 4 of the ischium only. A favourite situation for fracture is at the narrow neck of the ilium. The ratio of the breadth of the neck to that of the expanded part of the ilium is in the horse 1 in 6, in man 1 in 3. The neck of the horse is relatively less broad and is not thicker. Force applied to the crest of the ilium has the length of the bone for a lever and this lever is longer in man and also possesses a relatively weaker point in the neck, and it is here that the

fracture occurs most commonly in the horse. This constitutes a most important distinction to the fractures in man. A similar remark would apply, though with considerably less weight, to the fractures of the ischium in the horse. The position of the pelvis in man and in animals seems to exercise little influence upon its liability to fracture.

The ribs in the horse are occasionally broken by muscular violence, but far more commonly by direct violence. Gabriel records a case of fracture of the first rib by muscular violence during turning. In man the clavicle protects the upper ribs; in the horse this bone is absent, but the position of the fore legs protects them. Müller quotes the returns of the Prussian army for 1891 and gives the fractures of the vertebral column as 30 cervical, 6 dorsal, and 3 lumbar. Of the 22 cases I examined 11 were cervical, 4 were dorsal, and 7 were lumbar. Pure dislocation as in man is very rare and occurs only in the cervical region; a partial dislocation or subluxation occurs more frequently in the horse. The cervical vertebrae most commonly involved were the second, third, and fourth. Fracture alone was commonest in the lumbar region and here the first lumbar vertebra was the usual one broken. The twelfth dorsal was the one most frequently broken of this set. So far they agree with the conditions of man's injuries. But owing to the vertebral bodies articulating with each other by means of a kind of ball-and-socket joint the vertebra in front may be split by that behind. Such a case is recorded by Smith, where the fourth cervical vertebra split the body of the third. The coccygeal or caudal vertebrae are for obvious reasons broken more often in animals than in man. The sacrum is quite as true to its name in animals as in man, being rarely if ever broken.

Of 21 cases of fractured jaws in animals 3 were of the upper and 18 of the lower. Of the latter 5 occurred in the symphysis, which is probably a higher percentage than in man and probably due to the weak union found at the symphysis in animals. The squarer jaw in man allows more easily of fractures to occur other than at the symphysis. Of fractured skull there is little to be said, except that I found recorded 10 cases of the vault (2 frontal, 4 parietal, 2 occipital, and 2 general) and 3 of the base.

DISLOCATION OF THE PATELLA.

Though fracture of the patella is one of the rarest fractures in the horse yet dislocation is the commonest luxation. Around this luxation has cropped up a considerable literature. Certain papers illustrate the interesting evolution of the knowledge of this condition and its mechanical causation. I give a short epitome of them. Spooner says that these cases were taken for cramp; Duboisin describes cases of femoro-popliteal neuralgia. In these last papers Professor Youatt adds an editorial note that the cases are those of dislocation outwards of the patella. "An old practitioner" next frankly narrates the trouble he had with a case and Professor Youatt again enlightens us. The luxation was attributed to mechanical causes such as uneven ground relaxing the extensors; similarly fracture of the neck of the ilium was found to cause it. It was then said that ill-health relaxed the ligaments and led to the absorption of the fat behind the patella and its ligaments and so allowed the luxation. This condition disappeared on return to health. With Golding begins a period of inquiry; he asserted that ill-health and non-development of the femoral condyles caused it. Professor Axe wrote a paper on Adynamic Luxation, giving conditions like those mentioned above. Professor McCall then put forward the various mechanical conditions which might lead to luxation. He added several new ones, as vertical position of the femur, hydrops articulari, &c., to the list. Dollar, in a paper written a little later quotes Chuchu, who says that the luxation is only partial and that the patella gets engaged with the knob of the internal femoral condyle. He also quotes M. Violet, who regards spasm of the internal vastus or paralysis of its antagonistic muscles as a factor. Dollar himself advocates Chuchu's views. Tweedley gives a careful account of dissections he did on these subjects. He supports Chuchu in asserting that the luxation is partial and due to the patella's "temporary arrest on the superior entablature of the femoral condyle." This hooking with the internal condyle he says is aided by the various conditions mentioned above and he gives the muscular spasm after galloping as the occasional cause. Müller now divides the luxation into two classes, dislocation upwards and dislocation to the side, nearly always to the outer side. I have come across only one

notice of the inward luxation of the patella in a horse and that is recorded by Pernaud.

As has been said, in the horse the patella lies relatively higher on the condyles as the ligamentum patellæ is longer and so is thus allowed greater amplitude of lateral movement. In the partial dislocation the flexed knee with the constant strain on the extensors, &c., aids considerably in the locking of the bones. The very large internal condyle prevents the inward dislocations. The continuous strain will also tend to prevent the displacement of the patella round its long axis. I have found no reference to such a displacement in veterinary literature. In man, as in the horse, dislocation outwards is by far the commonest. It also agrees in being most frequently only partial, but owing to the erect position the partially dislocated bone is not fixed by the weight of the body as in the horse. The lower end of the femur in man differs from that in the horse in the external condyle and its articular surface extending higher up the front of the femur than the internal, where it is also more prominent. In the horse precisely the opposite condition exists, yet in both cases outward dislocation is the commonest. The explanation probably is that in assuming the erect attitude the extensor muscles have acquired a more outward pull; the pelvis is broader and the knees are closer together under the body. The same explanation is also a factor in the condition of the external condyle in man mentioned above. The inward pull of the extensors, the knees being widely separated, in the horse will also aid the upward extension and prominence of the internal condyle. The existence of complete inward dislocations of the patella in man has been questioned by Malgaigne and denied by Nélaton and Streubel; Hamilton quotes one case of partial luxation reported by Key. Pernaud's case is the only one which I have found in animals, and this was probably only partial. Many of the mechanical points mentioned in the history of dislocation of the patella in the horse apply equally to man's. The non-development of the femoral condyles may explain some of the cases of congenital luxation in man.

DISLOCATIONS OF THE SHOULDER.

Dislocations of the shoulder are rare on account of the absence of the clavicle allowing more mobility of the scapula besides other general reasons. It shows especially well how simple movements affect the liability to dislocation. In man force transmitted up the humerus, as in falling, is not directed to the glenoid cavity but to the side of it, and so the bone is easily dislocated; in the horse the simple movements practically only allow of the direct transmission to the glenoid cavity. The accident mainly occurs in the hunting field, as when landing from a jump with the fore legs thrust forward. The line of the humerus is then about vertical, as it is normally directed backwards, making an angle of 45° with the long axis of the body. In this position the head of the bone may escape in almost any direction. As the tuberosities are very large from the continuous strain on the supraspinatus, &c., the head of the humerus is more likely to escape inwards—i.e., subcoracoid. Still it is to be expected that subspinous dislocations should be relatively more common than in man. The veterinary text-books unanimously state that subcoracoid dislocation is the commonest and do not mention subspinous at all. Dr. Phineas Abraham questioned this and recorded a case of his own and two under the care of Professor Robertson in which post mortem the humeral head was found on the dorsum scapulæ. In the veterinary literature I found records of 4 other cases, but not one of these can be surely put into any class. In man, as is well known, subcoracoid dislocation is frequent whilst subspinous is rare. Dislocation of the shoulder in the horse is almost invariably associated with chipping of the glenoid cavity, probably due to the very large tuberosities of the humerus or the difficulty that the head of the bone has in escaping owing to the simple and not extensive movements allowed. In man for the very reverse reasons the edge of the glenoid cavity is uncommonly chipped. In him also fracture of the humerus with dislocation is more common, and this is especially true of separation of the epiphysis.

DISLOCATION OF THE HIP.

I collected three instances dealing with dislocations of the hip in animals. Two were certainly on to the dorsum ilii and one into the obturator foramen; in the others no post-mortem examinations were made as reduction was accomplished. Cattle have a shallower acetabulum and are more liable to this dislocation. From *a priori* reasons it might be expected

that dislocations into the sciatic notch should occur more frequently than in man, and with the head of the femur escaping inferiorly thyroid also. In the skeleton the cotyloid notch in the acetabulum of the horse is extremely large and, though spanned by the transverse ligament, might well aid to a greater frequency of thyroid dislocations in them. In conclusion, it may be noted that in looking through the fractures in animals there appears to be a marked absence of cases in which impaction occurs and again of separation of the epiphyses as compared with man.

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SIX CASES OF MALIGNANT DISEASE OF THE CERVIX UTERI TREATED BY VAGINAL HYSTERECTOMY.

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CASE 1.—A married woman, aged fifty-four years, was admitted into the Samaritan Free Hospital on July 13th, 1896. Her previous history was as follows. At the end of February she had noticed a discharge of blood from the vagina. This continued daily until her admission into the hospital. The discharge was never offensive. She did not complain of any pain and was always able to work. For two months previously to her attendance at the hospital the quantity of the discharge had increased. She stated that she was losing flesh. The menopause had occurred seven years previously. She never had any vaginal discharge until the present trouble commenced. She had had five children (twins twice) and two miscarriages. The last child was stillborn. On examination she was found to be fairly well nourished, with no cachexia. Her appetite, she said, was good and she slept well. On bimanual examination the uterus was found to be freely moveable. There was no infiltration of the broad ligaments. A nodular growth was felt, involving chiefly the posterior lip of the cervix and extending upwards into the cervical canal. The appearance of the growth *per speculum* suggested malignant disease, the surface bleeding readily when touched. On July 17th I performed vaginal hysterectomy. The method adopted was that of ligaturing the broad ligaments with silk from below upwards and separating the uterus with scissors after the application of each ligature. The operation occupied 35 minutes. The convalescence was uninterruptedly good, the patient getting up on the fifteenth day and leaving the hospital three weeks after the operation. Sections made from the growth showed that it was a columnar-celled epithelioma. I saw this patient on May 11th, 1898. There was no trace of recurrence.

CASE 2.—A married woman, aged thirty-one years, was admitted into the Samaritan Free Hospital on Dec. 14th, 1896. For a period of five months she had suffered from loss of blood from the vagina after sexual intercourse. During this period also a profuse, foul-smelling discharge had been flowing from the vagina. Her menstrual periods were regular, lasting from three to four days, until five months previously. She had had two children and no miscarriages. The youngest child was six and a half years old. (It may be mentioned