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THE TRUE NECK OF THE FEMUR: ITS STRUCTURE AND PATHOLOGY.¹

BY HENRY J. BIGELOW, M. D.

II. — PATHOLOGY.

IMPACTED FRACTURES.

POSTERIOR IMPACTED FRACTURE OF THE BASE OF THE CERVIX.²

THE posterior impacted fracture of the base of the cervix often occurs in old people. I have met with it also in middle life, and do not hesitate to express the belief that it is the most common of the fractures of the neck of the thigh bone. That it has not been so considered may be explained by the following considerations: —

1. It has been generally recognized only of late years.
2. The injury may be a comparatively slight one.
3. Its signs are in some cases a shortening and eversion hardly perceptible.
4. When it unites, there may be no lameness to attract subsequent attention.
5. When it proves fatal before union, the impaction may have been disengaged by manipulation or otherwise, during life or after death, — especially by macerating the specimen for preservation.
6. On the other hand, unimpacted fracture of the small part of the neck, usually supposed to be most common, is marked by prominent symptoms: it entails great and persistent lameness, inviting attention and examination after death, however remote, and the specimen when obtained is unmistakable.

The displacement varies greatly in degree. One wall only — the posterior one — is impacted at the intertrochanteric line, where the bone is a mere shell, driving the true neck, or the remains of it, farther beneath the trochanters, and sometimes detaching the latter. The firm anterior wall resists impaction, but bends at the line of fracture as a hinge. If this hinge were vertical, the shaft would be only everted; while if it were transverse, the neck would be only bent and the leg shortened. But as the hinge stands at an angle of about 45°, shorten-

¹ Concluded from page 5.

² Figs. 7, 8, and 9.

ing and eversion are nearly equal. Impaction, when slight, is detected by a difficulty of inverting the foot rather than by actual eversion; and the shortening may seem doubtful.

It is needless to say that the rotated trochanter still sweeps through an arc of which the head of the femur is the centre, and that there is no crepitation. Shortening and eversion, however inconsiderable, point directly to this lesion. A large number both of cases and of specimens are referrible to this type, — impaction behind, with a hinge in front, each at its respective intertrochanteric line. In some of these specimens the neck is bent down nearly to a right angle with the shaft.

The remaining varieties of fracture of the femoral neck are susceptible of classification, and deserve, for the purpose of comparison, to be mentioned in this connection.

IMPACTED FRACTURE OF THE HEAD OF THE FEMUR.¹

The impacted fracture of the head of the femur is rare, and I do not believe it possible to distinguish it from that just described, even if it were desirable to do so. In three cases I have known, there was the same shortening and eversion, and the same comparative ability to move the limb. A woman who has just died of the injury was able to get into and out of bed with but little assistance, and the trochanter, when rotated, swept through its arc. There was no union. The small extremity of the cervix was rather "rebated" than impacted with the head of the femur, and the fracture was "within the capsular ligament."²

The firmness of the fragments in such a case is chiefly due to the dense central cone of spongy tissue which projects from the head of the bone and impacts itself in the friable cavity of the cervix. If the cylinder of the cervical portion is simultaneously impacted into the head of the femur, around the base of the cone, immobility is doubly insured.

I have elsewhere expressed the opinion that these conditions are essential to the very exceptional occurrence of bony union of the small part of the cervix. In default of ankylosis, the neck is doubtless absorbed, presenting, after a time, the familiar conditions of an old "united fracture." So that permanent lameness may result from a fracture which, by simulating impaction of the base, promises, at first, bony union, with comparatively little deformity.

IMPACTED FRACTURE OF THE WHOLE BASE OF THE CERVIX WITH INVERSION.³

The very rare impacted fracture of the neck with inversion, instead

¹ Fig. 10.

² See extracts from the Proceedings of the Society for Medical Improvement, this JOURNAL, No. 1, 1875, p. 20.

³ Figs. 11 and 12.

of eversion which is the rule, occurs when the neck in front slips off its hinge into the cavity of the shaft. This is hardly possible, as I have elsewhere shown, unless the whole posterior intertrochanteric mass, including the trochanters, is fairly detached.

UNIMPACTED FRACTURES.

FRACTURE OF THE SMALL PART OF THE CERVIX OF THE FEMUR.

The fracture of the small part of the cervix of the femur, which has been usually described as the most common fracture of elderly people, and erroneously as deriving importance from being within the capsular ligament, is a loose fracture, with no interlocking to maintain the immobility of the small extremities, even were they disposed to bony union. Familiarly characterized by increased motion, great pain and disability, much shortening, marked eversion, and the rotation of the shaft upon its axis instead of through an arc, it is not likely to be mistaken even at first sight. But its relations to the capsular ligament are probably uncertain, owing to differences in the size and insertions of the latter.

COMMUNED FRACTURE OF THE TROCHANTERS AND SHAFT.

Lastly, when the trochanteric portion of the femur is comminuted, the detached neck and head of the bone may be very variously placed in bony union, both as to angle and as to the part which becomes subsequently attached to the shaft.

In completing the list of injuries to be borne in mind while examining a hip with reference to impacted fracture, we may enumerate dislocation, sprain, crack, the rare separation of the epiphyses, and the fracture of the acetabulum into the pelvis.

TREATMENT.

A few words of a practical character may be added here. Apart from dislocation, the main object of examination is to decide, with reference to treatment, whether a fracture is loose or impacted. I have demonstrated here and elsewhere the following points, illustrating the difficulty of further diagnosis:—

1. The common impacted fracture of the base of the neck and the rare one of the head may be indistinguishable from each other.
2. A fracture seemingly impacted and promising bony union may yet result in ligamentous union with corresponding lameness.
3. In loose fractures with great shortening, it may be sometimes difficult to distinguish a fracture of the small part of the neck, which does not promise bony union, from that of the trochanters, which does.

But while an accurate diagnosis of such cases is sometimes absolutely impossible, no embarrassment need be felt in the treatment of these injuries. Their treatment is simple.

If to extend a limb means to draw it down, impacted fracture and whatever resembles it should never be extended; but only steadied by weight or splint. On the other hand, a loose fracture with decided shortening should be first drawn down to something like its normal length. Or, more briefly, treatment consists in immobility, with the previous extension of a loose fracture.

A careful review of these injuries thus leads back to a practical rule already usually adopted. But it leads further, and demonstrates conclusively that prolonged and active flexion and rotation of the hip, in search of positive signs, is more than superfluous. Without anæsthesia it entails needless suffering, and with or without it, by loosening impaction or lacerating tissues, it may be disastrous.

The question of dislocation settled, a very brief and gentle examination is alone admissible; chiefly to determine (1) the degree of shortening, (2) whether the shaft rotates through an arc or on its axis. The most useless and damaging examination is that by quick and persistent rotation, and by flexion of the thigh as far as a right angle.

The prognosis, if the patient lives, is favorable for bony union, except in the case of loose fracture of the small part of the cervix, which, if not readily distinguished, had better be disturbed as little as possible.

Familiarity with the posterior impacted fracture of the base of the neck will remove the most frequent source of doubt in the diagnosis of injuries of this region; and the sooner the old classification "intra and extra capsular fracture" is abandoned, the better it will be for science, for diagnosis, and for treatment. In the interest of the patient and of treatment the question should be, "Is the fracture loose or impacted?" and science is often compelled to rest satisfied when this is settled.

EXPLANATION OF FIGURES.

Fig. 7. Front view of right femur showing the fractured cervix bending like a hinge at the anterior intertrochanteric line, to allow the posterior impaction. The head of the bone leans more distinctly from the observer than the perspective indicates.

Fig. 8. Rear view of same, showing the cervix impacted beneath the posterior intertrochanteric line. The head of the bone leans towards the observer.

Fig. 9. Horizontal section of the same, showing the anterior hinge and the posterior impaction. The dotted line shows the normal position of the head. The patient who furnished the specimen from which these figures were taken was seventy-two years of age. It will be seen that the prolongation of the true neck has disappeared by senile atrophy, leaving only a few radiating lamellæ. The specimen is of exceptional interest as showing this form of impaction with little comminution or other injury of the bone.

Fig. 10. Impacted fracture of the head of the femur. The patient who furnished this specimen died of pneumonia in two weeks.

Figs. 11 and 12. Impacted fracture of the base with inversion. The anterior view (Fig. 11) shows the neck slipped off its thick hinge, into the cavity of the shaft. To allow this, the whole trochanteric mass must have been detached, as seen in the rear view. (Fig. 12.)

Fig. 13. (See first half of this paper.) Diagram of a section of the head of the femur of a sheep, showing a deep trochanteric fossa. If this fossa were filled with spongy tissue (as seen beneath the dotted line), the posterior neck would be partially concealed, as in the human femur. The analogy, whether true or not, is too striking to be overlooked. A

deeper fossa exists in certain animals, especially South African ruminants, of which I examined sections in the Hunterian Museum in 1868. In this specimen the tendon inserted at the bottom of the fossa is prolonged into the spongy tissue by radiating lamellæ which intersect concentric arches as represented in the diagram, and resist traction to great advantage.

In examining a number of preparations lately made by my friend Dr. Dwight, I am satisfied that the tendency of what I have called the true neck is to attach itself below, where it becomes thin, as a tangent to the inside of the cylinder of the shaft; and also that it may be tolerably well pronounced in a subject six or eight years of age.

A CASE OF IMMEDIATE TRANSFUSION.

BY JAMES R. CHADWICK, M. D., OF BOSTON.

Mrs. M. N., thirty-two years of age, entered the Massachusetts General Hospital on May 27th, 1874, eleven weeks after the delivery of her second child. The labor had been short, but attended by profuse hæmorrhage; this hæmorrhage had recurred frequently until two weeks before her entrance to the hospital, when it ceased. The convalescence had been satisfactory in other respects, so that she was able to be out at the end of the third week. The repeated losses of blood, however, soon began to undermine her health, previously robust, until she was completely blanched, had a persistent headache, and frequent attacks of syncope; she was in this condition on entering the hospital. Bowels constipated, pulse 108, urine dark-colored.

May 28th. Iron, eggs, broth, and two ounces of sherry three times daily were ordered. Dr. F. Minot, in whose ward the patient lay, invited me to perform transfusion, if I thought advisable. On learning her history, I declined to operate until the ordinary methods of treatment had been tried and found inefficient, not deeming the case a favorable one for transfusion.

On June 2d she was failing, had had nausea and vomiting all night.

June 3d. Less vomiting. Dr. Minot notified me that she was sinking. In view of this I agreed to operate on the following morning. At 6 o'clock P. M. I took these notes of her condition: Great emaciation, sallow waxy complexion, extreme prostration; pulse 118, respiration 30, temperature, 102.8°. A loud souffle with the first sound of the heart was considered to be anæmic. No bruit du diable over the jugular veins. Areas of hepatic and splenic dullness were not enlarged. A drop of blood from her finger was seen to be very deficient in color; under the microscope, the number of both red and white corpuscles was found to be greatly diminished when compared directly with healthy blood. Urine normal, no albumen by nitric acid test; urophæin increased, uroxanthin normal. With microscope no casts, but very few and doubtful disintegrated blood corpuscles.

June 4th. *Operation*, with the assistance of Drs. Minot, Ellis, Lyman,

C. P. Putnam and J. J. Putnam, of Boston, E. J. Forster of Charlestown, L. Wheeler of Worcester, and a number of house-officers and students. Dr. J. J. Putnam furnished the blood. Aveling's instrument for immediate transfusion was used. Dr. Putnam, having seated himself upon a stool beside the bed, extended his left arm by the side of the patient's right arm. A fold of skin over the median basilic vein of the patient was then raised and a transverse incision made: the wound gaped so as to expose the vein to view. The anterior wall of the latter was raised by the forceps, and a V-shaped cut made with the scissors. The afferent nozzle was next taken from the basin, with the fore-finger closely applied to its external end to prevent the escape of the warm water; it was inserted into the vessel without difficulty, and intrusted to an assistant. A direct longitudinal incision was then made into Dr. Putnam's median cephalic vein, but the attempt to introduce the efferent nozzle failed, despite persistent efforts, owing, I believe, to the bifurcation of the vessel just below the opening. Dr. C. P. Putnam now offered his arm, and a similar cut was made directly into the left radial vein; the nozzle, however, could not be inserted until a slight transverse incision had been made in the integument. The afferent nozzle had by this time become filled with blood, so that it had to be withdrawn from the patient's vein, cleared of the clots, refilled with water and reinserted. The rubber tube, likewise filled with warm water, was then affixed to the nozzles, and the process of transfusion inaugurated by the injection of the syringeful of water into the vein, and prosecuted by the repeated filling and emptying of the bulb.

According to the printed directions, sold with the instrument by Messrs. Krohne and Sesemann, of London, the bulb should hold two drachms; on this assumption I based my calculation as to the amount of blood transfused, but a recent measurement of my bulb reveals its capacity to be precisely four drachms, a discrepancy of most vital importance, and one which, in my opinion, contributed largely to bring about the fatal result hereinafter recorded.

The following notes were taken during the operation:—

After sixth evacuation of bulb, pulse 118, some nausea, patient complains of heart-beat and backache. More color in lips and cheeks.

After eleventh, pulse fuller, now 108.

After thirteenth, pulse fuller, now 104; bulb empties less freely.

After nineteenth, pulse 104.

After twentieth, bulb does not fill readily.

After twenty-second, operation terminated.

Some retching after withdrawal of nozzle.

During the operation, Dr. Ellis applied the stethoscope to the chest several times, but failed to detect any change in the character of the respiration or of the heart-sounds. The anæmic souffle was unaffected.

Some difficulty was experienced in stanching the flow of blood from the incised vein. Before I left, the patient expressed herself as feeling much better and stronger than before the operation; she was free from headache or backache.

For the subsequent notes I am indebted to Mr. W. F. Whitney, medical house-officer of the hospital.

10 A. M. Severe rigor, lasting nearly an hour. Extra blankets, brandy, heater to feet, and sulphate of morphia, one fifth of a grain subcutaneously, afforded relief. Brandy punch (3j.) was ordered to be given every hour.

10.30 A. M. Temperature 106.3°.

11 A. M. Temperature 106.4°.

11.30 A. M. All oozing from wound has ceased. Pulse 134; temperature 105.3°.

12 M. Has been vomiting constantly for the last hour. The bandage about the wound is found to have become loosened and at least four or five ounces of blood to have escaped into the bed. A ligature is put around the vein. Some vomiting.

1 P. M. Temperature 104.2°.

3.30 P. M. Vomiting ceased at 3 P. M. Patient is now delirious.

4.30 P. M. Comatose; temperature 103°.

June 5. 8 A. M. Comatose during night; now conscious, recognizing husband. Stimulants. Failed during the day, and died at 7.30 P. M.

Autopsy by Dr. Fitz, twenty-six hours after death; the following are his notes:—

Skin very pale. A watery blood is pressed from the proximal portion of the incised vein. Right hand moderately oedematous.

Acute Internal Pachymeningitis.—Inner surface of the dura mater on both sides shows patches of a thin, delicate, translucent false membrane, very readily detached and containing numerous minute hæmorrhagic spots.

Increased Fluid in Pericardium.—About two ounces of clear yellow fluid in pericardium.

Anæmia.—The heart, in common with all the other organs of the body, except the spleen, is extremely anæmic. The valves and cavities are healthy; no thrombi in the latter, nor are any found in the pulmonary arteries after careful search.

Spotted Fatty Degeneration of the Heart.—Almost the entire inner surface of the left ventricle is spotted with minute yellowish-white opaque points. A section through the walls reveals a similar appearance, but the spots are more thickly clustered and extend into the substance for at least two thirds of its thickness. The right ventricle is in a like condition but to a considerably less extent. The microscope shows these spots to be due to fatty degeneration.

Edema of Lungs. — Lungs extensively œdematous. Kidneys pale. Tubules of cortex indistinctly separated. About one third of right kidney is atrophied; the surface is depressed, granular, dirty red, and tough. The veins leading from this part are filled with a firm, decolorized, adherent thrombus, similar to that found in one of the uterine veins, both being unmistakably of long standing.

Retrogression of Uterus. — Uterus of normal size. Walls cut with greater ease than usual; surface of section opaque. The membrane lining the cavity presents a tripe-like aspect from the intersection of slightly elevated red ridges.

The urine taken from the bladder at the autopsy was analyzed by Professor Wood with the following result: Color slightly smoky. Reaction slightly acid. Specific gravity, 1012°. Much sediment. Uro-phæin diminished. Uroxanthin increased. Urea, chlorides, and uric acid diminished. Sulphates, earthy and alkaline phosphates normal. Albumen about one per cent. Sediment is chiefly bladder epithelium. Considerable pus. Few renal epithelial cells. A few brown, coarsely granular, and hyaline casts. One blood corpuscle seen in six specimens. The casts were chiefly large, but some were of medium and small size. Hæmatin was present, as shown by brown coagulum of albumen on heating, and also by brown precipitate with sodic tungstate.

Remarks. — Neither the train of symptoms presented by this patient, nor the pathological changes found post mortem give a clew to any serious malady other than universal fatty degeneration. The atrophy of one kidney was clearly connected with the thrombosis of the renal and uterine veins, and may unquestionably be referred to the early days of childbed; there was no indication that the functions of the kidneys were impaired. At the autopsy, the most careful search throughout the whole vascular system failed to discover any clot that could awaken a suspicion of embolism such as might be caused by coagulation of blood in transit through the tube. No froth or air-bubbles were found in the vessels.

The fatty degeneration of all the internal organs, and especially of the heart, was the direct result of imperfect nutrition, due to the frequent losses of blood. The diminution in the volume of the circulation, which is the first effect of a hæmorrhage, is soon corrected by the osmotic extraction of serum from all the tissues of the body, but a corresponding deterioration in the quality of the blood results. This poverty of the blood, nature can rectify, if she is given time. Multiply the large losses of blood at short intervals, however, and she succumbs in the effort to make good the extraordinary waste; not only does nutriment fail, but the circulating medium, by means of which it is distributed throughout the economy, is wanting. No wonder, then, that the system is poorly nourished, and soon becomes too far reduced to carry on the functions of

life. This dependence of fatty degeneration upon frequent losses of blood has been recently pointed out by Gusserow,¹ Ponfick,² Perl,³ and others. Ponfick describes the identical spotted fatty heart — of normal size and sound valves — found at our autopsy, as occurring particularly in women who have lost much blood in childbed. According to him, it is associated with a marked reduction in the number of the red blood corpuscles and in the amount of fibrine. Dropsy is almost constant. Perl succeeded in developing this fatty degeneration of the heart in dogs, by bleeding them a few times to a great extent. When small amounts of blood were abstracted quite frequently, no such result was obtained.

The direct practical bearing of these remarks becomes apparent when we realize that the introduction of blood into the vascular system, when it is already filled to about its natural capacity, is quite a different matter from infusing blood when the vessels are empty and collapsed. In the former case, the vascular tension is increased far beyond the normal; the cavities of the heart are obliged to dilate far beyond their natural limits, and must then contract with more than their habitual force in order to propel the augmented volume of the circulation through the comparatively narrow channels. In short, a severe task is imposed upon the heart, for which, in such instances as the present, it is incapacitated by disease. By transfusion we seek to better the quality of the blood, but this end may generally be compassed by other means, so that we have no right to employ transfusion, with its attendant risks, until the other remedies have failed.

The fatal termination in this case was certainly inevitable, but was in all probability hastened by the shock of the operation and the subsequent hæmorrhage, with the attendant mental perturbations, but more particularly by the direct strain to which the heart was subjected by increasing the volume of the circulation.

These views had not taken so definite a shape in my mind before the operation; yet for these very reasons I had designed to restrict the amount transfused to six ounces. In this I was foiled by the erroneous statement of the description bought with my instrument. I transfused eleven ounces instead of six as I supposed, an error — as may be inferred from what has gone before — most prejudicial to the chances of the patient. Recent reflection has convinced me that transfusion is attended by great risk in chronic cases associated with fatty degeneration of the heart, and that this state of the heart is to be suspected in all patients who have been subject to repeated losses of blood. If we decide to employ transfusion, in spite of this unfavorable element, the danger must be as far as possible averted by the introduction of a very small amount of blood at one time, and repeating the process later it

¹ Archiv für Gynaekologie, 1871, page 218.

² Berliner Klinische Wochenschrift, 1873, No. 1.

³ Virchow's Archiv, 1874, page 39.

required; or the poor blood of the patient must be allowed to escape from one arm, while the healthy blood is being injected into the other.

Acting upon these convictions I have advised against the operation in several consultations to which I have been summoned during the past summer. On one occasion I was persuaded to go sixty miles to transfuse lamb's blood into the veins of a consumptive. I went after repeated solicitations and a distinct disavowal—on my part—of any belief in the curative agency of transfusion in such diseases. On examining the patient I found, in addition to extensive disease of both lungs, very labored action of the heart, and obtained the history of much pain and distress in the cardiac region, and a number of fainting turns during the previous month; the patient was likewise greatly emaciated. I represented to the man the peculiar danger which would attend the transfusion of blood into his veins, and finally persuaded him to renounce the project. A month later, however, a more daring surgeon from New York, a German, successfully transfused six ounces of lamb's blood into the patient. My prognostications of the exceptional risk were fully verified by the unusual symptoms subsequent to the operation. There were "sharp pains throughout the back, chest, and limbs" immediately after the operation; on the next day, again "acute pains in the back;" on the following morning, "two fainting spells in quick succession," and a pulse of 130; on the fourth morning, "palpitation of the heart" for half an hour, and again in the afternoon lasting two hours. Since that date no untoward symptoms have occurred, but the patient has recently published a card in the local journals announcing that his condition has not been improved by the operation, and warning others from trying the experiment.

Aveling's instrument worked well. The slight obstacle to the emptying of the bulb after the thirteenth evacuation I attributed at the time to a tilting upwards of the external end of the afferent nozzle in the hands of my assistant, whereby the oblique internal opening was forced against the wall of the vein and thus closed as by a valve. To this view I still hold. The tardy filling of the bulb after the twentieth evacuation may fairly be set down to the anæmic condition produced in the blood-donor after the loss of eleven ounces of blood. The difficulty of obtaining a steady flow from an incised vessel was, I am told, often experienced in the days of frequent blood-letting. I can quite understand, however, that these explanations may not seem satisfactory to those who look with disfavor upon immediate transfusion.

In conclusion let me ask whether the fact that eleven ounces of blood were infused without sensibly modifying the anæmic soufflé, taken in connection with the fatty degeneration of the heart, does not throw a little discredit upon the theory that this soufflé is due to the impoverished condition of the blood? May not further investigations demonstrate that it is symptomatic of a fatty heart?

RECENT PROGRESS IN MEDICAL CHEMISTRY.¹

BY E. S. WOOD, M. D.

Phosphorus.— On account of the powerful attraction which phosphorus has for oxygen, when the former is in a state of minute subdivision, as is frequently the case in substances suspected to contain it as a poison, and on account of the fact that that property of phosphorus which is chiefly relied upon in Mitscherlich's test (its phosphorescence) can be prevented by the presence of many substances, such as turpentine, the generally accepted antidote, it is extremely desirable to have a good method by which phosphorus can be effectually isolated from organic mixtures without danger of becoming oxidized during the process. In addition to the method of D. A. Van Bastelaer,² L. Dusart contributes another³ which has the advantage of enabling us to preserve for any desired length of time the phosphorus in the form of a stable compound; with this compound one of the characteristic reactions of phosphorus can be obtained, and its non-oxidation is insured. This process depends first, upon the ready solubility of phosphorus in a mixture of equal parts of bisulphide of carbon, ether and alcohol; secondly, upon the easy formation of a compound of sulphur and phosphorus, which is oxidized much less easily than free phosphorus; and thirdly, upon the precipitation of the sulphide of phosphorus thus formed by metallic copper, a compound resulting which can be preserved for an indefinite period, and which, when subjected to the action of nascent hydrogen, disengages phosphoretted hydrogen, an inflammable gas which burns with a green flame.

The process is as follows: To the liquids to be examined is added the mixture of alcohol, ether, and bisulphide of carbon, in which one half per cent. of sulphur has been previously dissolved, in successive portions. This solution is added until it forms an emulsion with the organic liquids. The solids to be examined are finely divided, covered with the solution, and repeatedly shaken. After twenty-four hours' contact, the bisulphide of carbon solution is removed, and the residues treated in the same manner a second and a third time. The mixed bisulphide solutions are filtered rapidly into a retort, and metallic copper freshly reduced by hydrogen is added. Sufficient copper has been added when the last portions remain brilliant after warming a few minutes on a water-bath. This liquid, after standing twenty-four hours, should be distilled over a water-bath. After the distillation, there remains in the retort a little water, fatty matters which float on the surface of the water, a certain amount of extractive matter, and

¹ Concluded from page 12.

² See this JOURNAL, January 1, 1874.

³ Journal de Chimie Médicale, September, 1874.

the compound of copper with the sulphur and phosphorus. These collected on a filter should be washed with alcohol and then with ether; this process removes the fat and leaves the copper compound as a black, brilliant substance which undergoes no perceptible alteration when exposed to the air. When this substance is placed in a Marsh's apparatus in which hydrogen is being generated, phosphoretted hydrogen is given off, which burns with a green flame. Sulphuretted hydrogen is also formed, and must be separated by passing the mixed gases through a tube filled with pumice-stone saturated with a strong alkaline hydrate. By this method, the phosphorus was detected in the paste made by mixing the ends of two matches with sixty grammes of bread, fatty matters, and like substances.

The following question arose in France in consequence of a report of chemical experts who, finding in the organs of a cadaver, after death under suspicious circumstances, free phosphoric acid and an excess of crystals of triple phosphate, stated as their opinion that the probable cause of death was phosphorus poisoning: "In the absence of the slightest trace of free phosphorus in the suspected matters, and also in the absence of all characteristic post-mortem appearances, such as fatty degeneration of the liver, can experts conclude that phosphorus poisoning has taken place, because they have observed an abnormal amount of phosphoric acid and ammonio-magnesian phosphate in the substances submitted to chemical analysis?" This question was referred to a commission consisting of MM. Gaillard, Grassi, Roucher, and Jules Lefort, who reported as follows:¹ "The proportion of phosphoric acid found in the suspected matters submitted to chemical analysis is no convincing proof that poisoning by phosphorus has taken place." And, further, that "neither the presence nor the quantity of phosphoric acid and crystals of ammonio-magnesian phosphate in the suspected matters can be considered as proofs of poisoning by phosphorus."

Analogy between Phosphorus, Arsenic, and Antimony. — Dr. Ch. Roucher refers² to a case of mild arsenic poisoning reported by Dr. Gaillard which has several points of interest. Fowler's solution was prescribed for a patient, twenty-two years of age, for an obstinate eczema. Fifteen drops were ordered morning and night for fifteen days, fifteen drops three times a day for the next fifteen days, and after that twenty drops three times a day. This corresponds to about one quarter of a grain of white arsenic for the first fifteen days, one third of a grain for the second fifteen days, and one half a grain daily after the first month. The result was that the first doses were tolerably well borne, there being only slight disturbance of the stomach. The forty-five drops daily caused vomiting and more intense pain in the stomach. The sixty drops daily could not be

¹ Journal de Pharmacie et de Chimie, July and August, 1874.

² Annales d'Hygiène, October, 1874.

borne, and as the skin disease was not cured, the patient gave up the treatment. A short time afterwards, however, the eczema disappeared. The arsenic caused some pain in the limbs with symptoms of paralysis. After omitting the Fowler's solution, the paraplegia increased instead of diminished. This being attributed by Dr. Gaillard (who first saw the patient five weeks after the omission of the Fowler's solution) to the continued presence of arsenic in the system, an examination of the urine was made and arsenic detected. Its elimination by the kidneys continued for six and one half weeks after discontinuing the medicine. Seven and one half weeks after its omission, no arsenic could be detected in the urine. After this period the paralysis rapidly disappeared.

This case is remarkable, first, for the tolerance of such large doses by one unaccustomed to its use; and, secondly, for the slowness of the elimination of the poison. Different authors give the time for the elimination of arsenic as from twelve days to a month, and many consider that the opinion can be given that, if arsenic is detected in the organs, it must have been ingested within a month before death. The above case, however, shows that it may require about fifty days for its complete elimination. Whether the elimination after chronic poisoning is slower than after acute remains to be decided.

In connection with this case the author cites experiments with tartar emetic, and shows that the action upon the digestive organs, upon nutrition, and upon the nervous system are the same for both arsenic and antimony. In several cases of phosphorus poisoning reported by Andante, M. Roucher finds similar symptoms produced as in chronic arsenic and antimony poisoning, and he is led to believe that the analogy which marks the chemical properties of these three closely allied elements will be found to exist in regard to their physiological action also.

On the Physiological Test for Poisons. — MM. Albertoni and Lusana¹ find that the extractive matters obtained from the various animal fluids and tissues produce death in animals when injected subcutaneously or into the veins. The symptoms produced by such injections are first an increase and then a diminution in the frequency of the pulse, soon a lowering of the temperature, slow respiration, diarrhœa, and certain convulsive and paralytic phenomena, most frequently paraplegia. Ordinary extract of meat, like Liebig's extract, has precisely the same effect; also the substances extracted in the ordinary way from the organs of two sisters who died under suspicious circumstances proved fatal to animals when injected subcutaneously, the symptoms which were produced being the same as those caused by the extract of meat. They conclude, therefore, that it is impossible to affirm that certain organs contain a substance foreign to the organism and capable of producing death, because the extract from those organs has been found to cause the death of an animal when injected subcutaneously.

¹ *Annales d'Hygiène, July, 1874.*

MAREY ON ANIMAL MECHANISM.¹

Of late years several works have appeared treating of a greater or less part of this subject of Animal Mechanism. Though referring only to the human skeleton, the work of Meyer stands far in advance of all others. The views are correct, and, though hard reading, the book is intelligible. Haughton's Animal Mechanics is for the most part incomprehensible to those of us who are not advanced mathematicians, but the looseness of the work in the parts we can understand enables us to bear our exclusion from the rest with philosophy. In Pettigrew's Animal Locomotion² similar defects are to be observed, with the difference that as the author conceals his ideas in mazes of words instead of labyrinths of figures, it is more easily criticised. With these works in our mind, we have looked forward with much interest to the work now before us. In certain respects we are much disappointed; in others as much pleased. The work is divided into three books: the first treats of Forces and Organs, the second of Functions: Terrestrial Locomotion, and the third of Aerial Locomotion. As may be inferred from the title, the first book embraces a pretty extensive field. We think it a mistake to devote so much space to the correlation of forces and such general principles, for the space does not admit of their receiving justice, and a superficial discussion is unprofitable. The whole of the first book is open to a similar criticism, as it treats of a great number of topics not essential to the plan of the work. Animal heat and electricity might, we think, be dispensed with. The discussion of the evolution theory is interesting and able. The author shows very well how the shape of the bones depends upon the arrangement of the muscles, vessels, etc., though we have doubts if the rule be absolutely true that "there is not a single depression or projection in the skeleton the cause of which cannot be found in an external force, which has acted on the bony matter either to indent it or to draw it forward." There is a good deal about the muscular system that is inaccurate, and a little that we think is quite wrong. The author follows Borelli with a blind confidence that accounts for some of these defects. He quotes this author's comparison of a primitive muscular fibre with a chain composed of minute circular elastic rings, and speaks of the laws governing the manner in which it will recover itself after being stretched, apparently thinking this a parallel case to contraction from a state of repose. The author gives it as a law that "the work done by a muscle will be in proportion to its length and its transverse section; that is to say, to its volume or to its weight." To make this true, it is of course, necessary to assume that the "substance of the muscles, that is to say, of red flesh, presents the same density in the different parts of the animal frame;" but he states this not as an assumption but as an acknowledged fact. We are unable to say this is not true, but we should like to have some proof of its truth before accepting it. Considering the great difference of coarseness of fibre in different parts of the body, and the different kinds of work required by different muscles,

¹ *Animal Mechanism: A Treatise on Terrestrial and Aerial Locomotion.* By E. J. MAREY, Professor at the College of France. (International Scientific Series.) New York: D. Appleton & Co. 1874. Pp. 283.

² See this JOURNAL, May 14, 1874.

we should think it very improbable that an ounce of muscle represented always the same potential force. Some muscles, like those of the orbit, are incessantly employed during the waking hours in moving a light unresisting body hither and thither; some, like the muscles of the back, must be kept for a great part of the time in partial contraction; and again others have usually but little to do, and are occasionally called upon for a violent effort. It is hard to believe that the power of all these is the same. Ranvier a year ago showed that there were marked differences both in structure and manner of contracting between the red and the white muscles of the rabbit, and it is not impossible that analogous distinctions can be drawn between different muscles of animals in which all are red. It is surely a serious error to speak of the *rectus abdominis* as a long muscle. By way of putting all our fault-finding together, we must say here that the translator appears to be quite ignorant of anatomy, for he makes utter nonsense of two passages (pp. 75 and 88) by translating the French for *fibula* (*péroné*) into "perinæum."

Leaving general principles, the author turns to the discussion of the phenomena of locomotion on land, as shown by man and the horse; and through air, as shown by insects and birds. We shall limit our discussion to the movements of man. We regret that the mechanism by which movements are effected is not more considered, the author giving us merely the results but not all the steps by which the results are obtained. Thus, while showing the length of contact of each foot with the ground in walking, the rise and oscillation of the pubes, etc., he says little of the muscular action by which this is accomplished. He ignores entirely the bending of the knee. But in spite of these defects, it is impossible to praise too highly the ingenuity displayed in contriving apparatus to record the results, and the accuracy with which it is accomplished. The following is a short summary of the movements in walking. One foot is always on the ground, the one which has completed a step reaching the ground just before the other leaves it. The raising of the latter of course causes the former to bear all the weight, and to make the pressure necessary to start the body. The pressure is not equal throughout, but increases gradually during the greater part of the step and rapidly toward its end, at which moment the forward movement of the body is most rapid. The pubes (and consequently the head) is highest at the middle of the step; for then the supporting leg is nearly straight. At the same moment the pelvis is thrown towards the side of the supporting leg, so that the foot may be nearly under the median line of the body. The variations in the step in running, going up and down stairs, and in the galloping of children are freely discussed. Most ingenious modifications of this apparatus are made for the horse; and that for birds is especially complicated.

If the scientific part were equal to the mechanical, the work would be perfect.

T. D., JR.

PROCEEDINGS OF THE ROXBURY SOCIETY FOR MEDICAL
IMPROVEMENT.

[REPORTED FOR THE JOURNAL.]

A SPECIAL meeting of the society was held on the evening of November 24, 1874, at the house of Dr. F. W. Goss.

DR. R. T. EDES occupied the chair.

Veratrum Viride. — DR. P. O'M. EDSON presented the regular paper for the evening, on the uses of *veratrum viride*, illustrating the same by reports of cases.

The first case was one of croup, in which the symptoms were severe, with high fever and all the indications of a grave case, and one in which exudation was to be expected; but the symptoms abated soon after the exhibition of the *veratrum viride*. No membrane was thrown off, and there was no muco-purulent expectoration. It was believed that the case ended by resolution before exudation had time to take place, a result due, probably, to the prompt action of the drug. In this case he gave a two-ounce mixture containing half a drachm of Norwood's tincture; and of this he ordered a teaspoonful every two hours. The age of the patient was four and a half years.

The second case was that of a stout, plethoric young man, with clonic spasms; his face was injected, his eyes were bright, and his carotids throbbing. He had been similarly affected before, and on former occasions the convulsions had continued for some time after the use of emetics and other treatment. As a result of these former seizures he had been left weak and depressed for several days afterwards. But on this occasion Dr. Edson gave him at once half a drachm of the tincture with the effect of reducing the pulse in one hour from one hundred to seventy. In two hours he was perfectly rational and went to sleep; and in two days he was well.

The third case was one of acute mania from the excessive use of alcoholic stimulants. There was furious delirium. Fifteen drops of the tincture of *veratrum* were given, to be repeated in an hour; but the patient slept and there was no further trouble.

Dr. Edson then spoke of the good effect of the *veratrum viride* in meningitis of children; it is safer than other depressants, as its effect can easily be checked by the exhibition of opium and stimulants, thus differing from aconite and antimony. It is a sedative, reducing the action of the heart and causing general relaxation, and its best results are obtained from small doses often repeated.

In answer to questions Dr. Edson said that he had never given the drug to a child under two and a half years old. In one case he gave on one occasion two drops every two hours, for twelve hours, with no bad effect. One drop would be a dose for a child one year old. The effect should be carefully watched, the patient being visited often while the drug is being administered. *Veratrum* is indicated in cases of rapid pulse due to too great power of the heart, but not in the rapid pulse of debility.

Croup. — DR. EDES asked if any member had ever seen a non-membranous case of croup prove fatal.

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