Leech, who suffered from symptoms pointing to phthisis (dulness and slight retraction of left apex, diminished breathing, with moist rales, and diminished chest movements on that side, cough with considerable amount of mucopurulent expectoration, loss of flesh, but no hæmoptysis); repeated examination of the sputa showed absence of the tubercle-bacilli, and the further progress of the case now shows that the symptoms were due to some growth or mass obstructing the left bronchus.

The other case is a patient now under my care, suffering from diabetes, with excessive, though not fetid expectoration and symptoms of phthisis. The sputa show no tubercle-bacilli, but contain large masses of a mycelium fungus (even if examined immediately after they are coughed up), which stains well with gentian-violet, but which can be easily distinguished from Koch's bacillus, by the size, form, and arrangement of its several parts. The chest symptoms are most probably due to some form of necrosis, a pathological condition often formed in cases of diabetes; possibly we have here some peculiar form of mycosis, for which the bronchial secretion in diabetes would form a favourable soil. The further progress of the case may give the solution of this question.

In all the above given observations, the sputa only were examined for bacilli, and I need not again draw attention to the valuable diagnostic aid we derived from the presence or absence of the bacilli in the different forms of obscure lung disease. But as the bacilli seem to occur wherever we have the tubercular process going on with any amount of intensity, the bacilli will aid us in the diagnosis of tubercular disease in other organs, if those organs themselves either are so situated as to be accessible to inspection (mouth, larynx), or form secretory organs whose secretions pass out of the body (intestines, urogenital tract). Already we possess a few observations on this subject. Fränkel (*Berl. Klin. Wochenschr.*, 1883, No. 4) found tubercle-bacilli in the secretion covering laryngeal ulcers in fifteen out of sixteen cases of laryngeal phthisis, by simply brushing the ulcers and examining the secretion covering the brush. Lewin (*ibid.*) could confirm this observation, though Guttman (*ibid.*) could not detect the bacilli in two cases of laryngeal phthisis examined similarly. The tubercle-bacillus would thus be of great diagnostic value to distinguish between syphilitic and tubercular laryngeal ulcers. Lichtheim (*loc. cit.*) found the tubercle-bacilli in cases of tubercular enteritis in the diarrhoeic stools; they were not found in very large quantities, but they were found in every specimen examined.

Rosenstein (*Centralbl. für die Med. Wissensch.*, 1883, February 3rd) detected the bacilli in the urine of a patient who had symptoms of tubercular disease of the epididymis, the lungs being perfectly free. Lichtheim detected the bacilli *post mortem* in the contents of the pelvis of the kidney in a case of tuberculosis of the kidneys; and hence it is only reasonable to suppose that, in cases of tuberculosis of the urinary tract, the bacilli would be found in the urine.

Lastly, Ransome having detected the bacilli in the expired air of phthisical patients, and C. R. Smith having given, in a recent number of this JOURNAL, a ready method of detecting them in the expired air, it behoves us now to see whether, in cases of acute miliary tuberculosis, especially in children, where there is no expectoration, the bacilli are present in the expired air.

I may also mention that Fränkel (*loc. cit.*) found numerous tubercle-bacilli in the pus aspirated from a scrofulous or tuberculous joint, and I can confirm this observation, as, in a marked and advanced case of phthisis under the care of my colleague Mr. Jones, with tuberculous arthritis of the ankle-joint, numerous tubercle-bacilli were found in the pus evacuated from that joint.

We come now to the last point of our inquiry, as to the prognostic value of tubercle-bacilli in the sputum.

Balmer and Fränkel (*loc. cit.*) believe, as the result of their numerous observations, that the prognosis of a given case depends on the number of the bacilli, and their full development. In the rapid cases, with pyrexia, sweats, etc., the bacilli were very numerous, large, and spore-bearing; they also found that the quantity increased with the advance in the destructive process of the disease; in phthisical persons where the process is very chronic, or where the disease is arrested, or where there is no pyrexia, the bacilli very few in number, small, and badly developed. D'Espine on the other hand, found no such relations between the bacilli and the process of the disease. Lichtheim believes that the bacilli are only found in the profuse puriform sputum of phthisical patients; that they depend on the existence of an ulcerative or rather destructive process in the lungs, communicating with the air-passages; and they are found wanting when, in spite of an existing tuberculosis, the destructive process is absent. They would, according to him, therefore, not

occur in the acute miliary tuberculosis. Heron, on the other hand, seems on the whole to agree with Fränkel.

From the results of my own observations, I feel compelled to differ from Fränkel. I found very numerous fully developed bacilli in cases of phthisis, where there was little pyrexia, and where the process was slow and chronic; and I found but a scanty quantity in some cases of acute phthisis with profuse expectoration; thus, in a case which has just terminated fatally, and where *post mortem* examination showed dilated bronchi, small cavities, and marked tubercular infiltration of both lungs, and where the illness only extended over a little more than three months, repeated examination of the profuse and purulent sputum showed the bacilli in very sparing numbers. In several cases where the disease seemed to remain in *statu quo*, or where there were marked signs of amendment, the sputa continued to contain the bacilli in very much the same proportion as before. On the other hand, I cannot agree with Lichtheim, but rather believe, from the observations on the three cases of very incipient phthisis, that the bacilli occur very early in the sputum, before there are any signs of ulcerations, and when the sputum is by no means purulent. The presence of the bacilli in acute miliary tuberculosis I have as yet had no opportunity of examining into.

As the result of these observations, I think I am justified in saying that, though the bacilli in the sputum are of the greatest diagnostic importance in pulmonary phthisis, and though they occur in cases where there are as yet no physical symptoms whatever, we are not as yet justified in making the prognosis dependent either on their quantity or their fully developed state as found in the sputa.

Since the above was written, we have had two further additions to our knowledge on this subject. Licht (*Deutsche Med. Wochenschr.*, 1883, No. 5), observed 72 cases of phthisis, and found the bacilli present in all; and Dettweizen and Meissen (*Berlin Klin. Wochenschr.*, No. 7, February 12th, 1883), found them in 85 out of 87 cases of typical phthisis. As regards the prognostic value, both observers come to conclusions similar to those arrived at by me.

ON THE TREATMENT OF CERTAIN FRACTURES OF THE LOWER END OF THE FEMUR.*

By FREDERICK TREVES, F.R.C.S.,

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THERE are certain fractures, through the lower end of the shaft of the femur, that are apt to be associated with a peculiar deformity, and to require, in consequence, a special treatment. These fractures are generally, either just above the condyles, or are directed through the shaft within a few inches of that spot. The fracture may be either transverse or oblique. It is more usually of the latter variety; the obliquity is often extreme, and its general inclination is from behind downwards and forwards. The more transverse fractures are probably due to direct violence; the more oblique, to a force indirectly applied. The position of the upper fragment is practically unaffected, while the upper end of the lower fragment is drawn forcibly backwards into the ham by the action of the gastrocnemii muscles. The lower fragment is, of course, always drawn upwards, and from the twofold displacement, it follows that it may cross the axes of the upper fragment at a considerable angle, while it will lie behind that portion of the bone. These fractures are very often associated with a secondary vertical fracture, that extends into the knee-joint, between the two condyles, and that thus produces what is known as the T-shaped fracture. It is not implied that all fractures, through the femur above the condyles, are associated with this displacement; probably the majority are not. There are, indeed, many circumstances that would oppose such a displacement. There is, for instance, no reason why the obliquity of the fracture should not be such that this particular deformity would—after shortenings had occurred—be impossible. Many muscular and tendinous fibres are attached along the bone across the fracture line, and the deformity mentioned would not be possible, without a considerable laceration of these fibres. If the fracture takes place when the knee is bent, the condition of the gastrocnemii would be such that it would hardly be capable of forcibly dragging the lower fragment backwards at the time of injury. This is of consequence, since it would appear that, not a few of the fractures about this part, that are due to indirect violence, are caused by falls upon the bent knees. It is common, in museum specimens, to find the two fragments overlapping (the upper in front of the lower), and the upper end of the

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lower piece of bone directed a little backwards, so that the whole fragment is slightly oblique to the long axis of the upper portion of the femur. This trifling deviation may be due solely to the overlapping of the bones, the lower fragment being unavoidably directed backwards, as it passes up behind the upper fragment. The cases, however, to which reference is made in this paper, are those in which the lower fragment is drawn very conspicuously into the popliteal space, and where this displacement is, without much question, due to the gastrocnemii muscles.

It is obvious that these cases cannot be treated in the ordinary way. Extension in the long axis of the limb merely increases the deformity by dragging upon the gastrocnemius, and so upon the lower fragment. Thus, if the long splint were to be applied in the ordinary way, it would be possible for the limb to be put up apparently straight, while the knee-joint was all the time considerably flexed.

In one or two preserved specimens where the bones have united at a conspicuous angle, it is not improbable that this treatment had been carried out. It would be useless to attempt to act upon the little lower fragments by pads or pressure, and therefore the long splint being abandoned, the only available treatment is by some form of the double inclined plane. By the double inclined plane the knee is bent, and the large upper fragment is brought to the lower one; the parts can be well fixed to the splints, and the weight of the trunk can be made use of as an extending force. In applying this treatment, the actual double inclined plane is seldom made use of. It is cumbersome, difficult to maintain in a rigid posture calculated to produce bedsores, and extremely uncomfortable. The principle, however, of the double inclined plane can be applied in many less objectionable forms: as, for example, by a MacIntyre's splint bent considerably at the knee and slung from a cradle, by Nathan Smith's anterior wire splint, by Hodgkin's suspension splint, and the like. In all these appliances the knee is bent, the parts below the fracture are practically fixed, and the weight of the body—the limb being suspended—acts as the extending force. Even to these ingenious forms of apparatus, a good deal of exception may be taken. The patient's body and the joint above the fracture are not fixed, and a somewhat undesirable degree of movement in the upper fragment is possible. The comparative freedom allowed by suspension increases this possibility. Moreover it is a question, when dealing with a fracture close about the joint, whether it be well to fix that joint in a flexed position, unless it be intended that it should always retain that posture. It must be remembered that some of these fractures are so near the joint, as to render unavoidable some damage to its soft parts, while many others actually enter the articulation. The prospect of ankylosis after the latter form of injury is not a slight one, and is well illustrated in those fractures of the humerus that involve the elbow joint.

Although, therefore, the treatment by the principle of the inclined plane may serve to remedy the immediate deformity, it is not without somewhat grave disadvantages when applied to these particular lesions. The treatment, on the other hand, that appears to most commend itself is that alluded to by Mr. Bryant (*Practice of Surgery*) in the following terms: "In fractures of the lower third above the condyles where the gastrocnemii muscles tend to draw the lower fragments backwards into the popliteal space, some surgeons prefer the use of the inclined plane, and where the bones cannot be otherwise kept in apposition, it is, probably, a sound practice. But what I believe will turn out to be a better one, is the division of the tendo Achillis, and the use of the long splint..... I have taught this for the last twelve years, but have had only one opportunity of testing its value." By the method here advocated, any deformity produced by the gastrocnemii muscles can be entirely remedied, and the fracture treated with all those advantages that pertain to the use of the long splint. The treatment, indeed, recommends itself as a good surgical procedure on many grounds, and enables the surgeon to carry out those essential principles that, since the days of Pott, have been recognised as important in the treatment of fractures. Inasmuch as no details have, so far as I am aware, been given of this mode of dealing with the fractures described, I venture to record three cases in which I applied this treatment, and which appear to substantiate the advantages ascribed to it. The patients were all males; the fractures differed in each instance both as to their nature and mode of causation; and in two of the cases the local result was rendered more evident by *post mortem* examinations.

CASE I.—R. P., a drayman, aged 33, was admitted into the London Hospital under my care on November 13th, 1879. He had fallen from his dray, and, while lying upon the ground, the wheel of the dray, which was heavily laden, had passed over his right thigh.

The femur was fractured about two inches above the condyles; the fracture was slightly oblique from behind downwards, forwards, and outwards. There was some effusion into the knee-joint; the patella was a little displaced to the right; and the tibia, with the lower fragments, appeared to be so much displaced backwards as to give rise to an appearance not unlike that seen in dislocation. The lower end of the upper fragment projected forwards, and could be readily felt under the skin; the lower fragment was forcibly dragged backwards into the popliteal space. The vessels were uninjured. On applying extension, the deformity was much increased, although the shortening that existed could be almost entirely overcome. The limb was at first put up on a double inclined plane. This proceeding brought the fragments at once into good apposition, and removed the outward evidences of the deformity. The man, however, was very stout, his weight being about sixteen stone; and it was soon found that, even with the greatest care, the parts would not be retained in position. He complained, moreover, a good deal of the pain occasioned by the apparatus. The limb was then placed in a MacIntyre's splint, so that the knee should be considerably flexed; and the splint was slung from a cradle made for the purpose. The unwieldy size of the limb and the frequent movements of the patient (that the apparatus did not restrain) soon brought about a disturbance of the fragments; while the treatment, in addition, caused much inconvenience. On November 16th, I divided the tendo Achillis, and applied a long side-splint with a forty-pound weight attached; the lower end of the bed being raised to resist this extending force. The fragments were almost immediately brought into excellent position, and the whole extremity from the pelvis to the foot was firmly secured. The integument over the seat of fracture was so severely contused on admission, that I feared the skin would slough, and so make the fracture a compound one. I therefore dressed the part antiseptically as a precaution. A slough did form; but it remained for weeks dry and hard, and firmly attached. Not a drop of pus was produced. By January 10th, union appeared to be firm, and the shortening was one inch. The antiseptic dressings were discontinued; and in a short while afterwards the scab-like slough came away, leaving a granulating wound. The patient was kept in until this little surface healed. He left the hospital on March 1st, with the fracture firmly united, and able to walk without assistance of any kind. The knee-joint, however, was perfectly stiff. In this case, the great size of the limb seriously interfered with the suspension treatment; and, since the knee-joint became ankylosed, it is as well that it was allowed to become rigid in the straight position. Passive movement of the joint was attempted as soon as it was deemed safe, but with no result.

CASE II. J. E., engineer, aged 46, admitted under my care May 26th, 1880. The patient was said to have fallen forty feet, alighting upon his feet. There was a compound fracture of the right thigh! its lower part. The skin wound easily admitted the finger, and was situated about two inches above the patella; it had been caused by the penetration of the sharp lower end of the upper fragment. The fracture was very oblique, from behind, downwards and forwards, and was situated about two inches and a quarter from the condyles. There was also a vertical fracture extending between the two condyles into the knee-joint. The upper ends of the two lower fragments were pointed, and were drawn forcibly into the ham. There were many loose fragments of bone embedded in the adjacent muscles, and in the tissues of the popliteal space. The great vessels were uninjured. The sharp lower end of the upper fragment had been driven through the quadriceps, so that the whole thickness of that muscle intervened between it and the lower fragments. This mass of muscle was detached from its contact with the upper piece of bone with the greatest difficulty, and had it not been possible to manipulate the parts through the wound, this detachment would have been quite out of the question. From many various manoeuvres with the limb, I am convinced that, had the fracture been a simple one, no manipulation would have dislodged the piece of muscle between the fragments. With the finger in the wound, the exact position of the broken bones could be well made out and easily studied. Before chloroform was given, I was surprised to find to what an extent the lower fragments had been dragged back into the ham. When the knee was fully bent, the two lower fragments could be readily moved, but when it was extended they became quite fixed. The two lower fragments were separated by a finger's breadth alone, but were in contact below. Keeping my finger upon the lower fragments, I tried the effects of various positions of the limb upon their movements. When the limb was extended in the straight line, the fragments were drawn forcibly into the ham, and the more the extension the more the displacement. Flexion

over an inclined plane enabled the three fragments to come well together, but their mutual relations were considerably disturbed by comparatively slight movement of the body. The tendo Achillis was then divided, and the long splint applied, with an extra dress weight of thirty pounds. The parts fell into excellent position, and could be firmly and evenly maintained there. The wound was dressed antiseptically. The patient was greatly shaken by the accident, and had received, in addition to the above injury, a very severe laceration of the arm, and a compound fracture of the left leg into the ankle-joint. He never rallied from the shock, but, in a few days, became delirious, and died eight days after his admission. At the *post mortem* examination the observations above made were verified at leisure.

CASE III.—R. B., basket-maker, aged 51, admitted January 4th, 1881. While under the influence of drink, the patient had slipped over a stone, and had fallen upon his hands and knees, striking the left knee against the kerbstone. There was a very oblique fracture of the lower third of the shaft, with a second fracture into the knee-joint that separated the two condyles. Both the lower fragments were found, on admission, to be drawn forcibly into the ham; and this deformity was exaggerated greatly by extension. The displacement had probably been effected by the patient's drunken attempt to rise. The limb was adjusted as above described. Shortly after admission, the patient had an attack of delirium tremens. During the attack, the value of the large splint, in allowing of the body being kept fixed, was well demonstrated. Had any suspension splint been applied, it would have probably proved useless, as the patient was extremely restless. The section of the tendo Achillis at least prevented the gastrocnemius from taking any part in promoting displacement. The patient never recovered from the delirium, but gradually sank into a state of dementia, lost all control over his sphincters, became comatose, and died exactly thirty days after his admission. The *post mortem* examination revealed a somewhat remarkable fracture. It was oblique from behind downwards and forwards, and, commencing six inches above the condyles, ran down to the trochlear surface in front. In some part of the course, it was nearly vertical. The two corner fragments were made up of the two condyles, with a sharp spicule of the shaft attached to each. The fragment of the shaft remaining with the inner condyle was six inches in length; that remaining with the outer condyle, four inches. There were but slight inflammatory changes in the synovial membrane. The fragments were already united by a good deal of sound callus, especially at their upper parts, and were in very good position. The specimen is now in the Museum of the Royal College of Surgeons.

FERROCYANIC TEST PELLETS AS A CLINICAL TEST FOR ALBUMEN.*

By F. W. PAVY, M.D., F.R.S.,

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MOST who have stopped to give consideration to the matter, have, I think, felt that it would be exceedingly desirable if something more convenient than the method of procedure with heat and nitric acid which has been in use so long, were placed at our command as a reliable test for albumen. At least, such is the expression which has from time to time fallen from those I have met; and I have been so strongly impressed myself in this way, as to have been induced to turn my attention towards endeavouring to meet the want. The convenience of the cupric test pellet for sugar inclined me to look for something that could be kept and employed in a solid form; and I started with the view that, to be suitable for the purpose, it must be freely and quickly soluble, devoid of objectionable physical properties, and a sharply marked and reliable precipitant of albumen.

During the last two or three years, I have carried metaphosphoric acid in my urinary pocket-case, and have frequently been in the habit of otherwise employing it. It is known to constitute an excellent test for albumen, and I tried for some time to bring it into a convenient form for use. In a pure state, it is a glacial body, which, although deliquescent, does not quickly dissolve. Kept in fragments, these stick together in such a manner as to prove troublesome at the time of use. I mixed the acid with other agents, as citric acid, sulphate of soda, chloride of sodium, and cane sugar, but I failed to obtain a satisfactory product. Thus, finding that I could not succeed in getting what was wanted with metaphosphoric acid, I looked around for another suitable agent.

Yellow prussiate of potash and acetic acid, employed together, have long been known to furnish a valuable test for albumen. There may be other tests as good, but I think it may be said that there are none that can be spoken of as actually better. Citric acid may be made to take the place of acetic acid, and thus a test capable of being kept and used in a solid form is supplied. The precipitant of the albumen is ferrocyanic acid, and this is liberated just as effectually by citric as by acetic acid.

I, at first, thought that it would suffice simply to mix the yellow prussiate of potash, and citric acid, in the proper proportions, and compress into a pellet to obtain the test in the form I wanted. Experience, however, soon showed me that the matter was not so easily to be disposed of. Difficulties presented themselves which have taken time and consideration to overcome. With the willing and able assistance, however, which Mr. Cooper has rendered in carrying out the mechanical operations I have suggested, a pellet has been produced which seems, as far as I can at present judge, to supply all that can be desired. Its components are the sodic ferrocyanide, and citric acid. Grounds exist for the employment of the sodic instead of the potassic ferrocyanide.

All that is necessary in using the pellet is to crush it to a powdered state, within a folded piece of paper, with a silver or other coin from the pocket, or in any other way that may suggest itself, and to run the powder into an ordinary sized test-tube, and pour in the urine to be examined to the height of about an inch. On simply agitating freely, without the application of heat, a precipitate will immediately, or almost immediately, appear when albumen is present. The test is so delicate, that the smallest amount of albumen gives rise to a distinctly recognisable opalescence, and, with a larger quantity, a dense white precipitate is produced. Instead of crushing the pellet, it may be broken in half, or placed in a whole state in the urine. Used in this way, it takes a minute or so for it to be dissolved, and the reaction to be produced.

An estimate may be formed of the amount of albumen present by allowing the precipitate to settle, and reading off its height in proportion to the contents of the tube, in the same way as is done after the application of heat. As no employment of heat is required in the application of the test, it is not necessary that a test-tube should be used. A wine-glass or medicine-bottle will answer instead, and the quantity of urine should be kept down to about that recommended when a test-tube is used. Enough acid exists in the pellet not only for liberating the ferrocyanic acid from the ferrocyanide, but for more than neutralising the alkalinity that is likely to belong to a specimen of urine limited to the quantity which has been recommended to be taken. Through this circumstance, the test acts equally well with alkaline as with acid specimens of urine.

Phosphates do not interfere with the validity of the reaction given by the test. They not only are not liable to be precipitated by it, but the acid present will promote the solution of phosphates already deposited.

Should the urine be turbid from lithates, it must be cleared by warming before the test is employed. A number of ways in which this can be done will readily suggest themselves, without recourse to the use of a spirit-lamp where no spirit-lamp happens to be at hand. If thought proper, the test may be used in the same manner as some persons are in the habit of employing strong nitric acid: viz., by bringing the specimen and the test into contact with each other without admixture, and looking at the line of junction for the precipitate. Thus used, the pellet should be dissolved in a little more than sufficient water to cover it, and the urine then allowed to flow gently down the side of the test-tube until a stratum of about half an inch in height has collected. The lamina of precipitate which is formed from specimens containing a minute amount of albumen comes out denser and more sharply defined than with nitric acid. Further, if the contents of the tube be afterwards shaken together, a diffused precipitate is visible; whilst in the case of the strong nitric acid the precipitate disappears.

With urine containing oleo-resinous matter consequent upon the administration of an oleo-resin medicinally, it is known that nitric and other acids occasion a precipitate. The same will naturally occur with the ferrocyanic pellets, and this is the only fallacious indication that I am at present aware belongs to the test. Error from this cause, whenever the conditions permit it to be presented, must be guarded against in the same way as has been hitherto done under the employment of nitric acid.

Since this communication was written I have seen the albumen precipitant test papers introduced by Dr. Oliver, of Harrogate. They certainly form a very neat and elegant adaptation. Whilst encountering the difficulties that presented themselves with the pro-

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