OBSERVATIONS
ON
COMPOUND FRACTURES,

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COMMUNICATED

By MR. SAMUEL COOPER.

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IN the last volume of the Transactions of the Medical and Chirurgical Society, I communicated a case of removal of several of the tarsal and part of two of the middle metatarsal bones, which was followed by complete success, both as to the preservation of the motions and the seemingly appearance of the foot. I now beg leave to transmit two cases of compound fracture, in which the limbs have been saved by a similar removal of large portions from the middle of the cylindrical bones; and one of simple fracture, in which a projecting portion of bone was sawn off with equal success.

On the 17th of March, 1821, John Harper, a fine lad, of fourteen years of age, carelessly riding at a full trot, was thrown from his horse; as

one of his feet hung in the stirrup, the animal took fright, ran away with him at a gallop, till the girth broke, and he fell to the ground. On the arrival of Mr. Hagyard, the surgeon at Hunmanby, where the accident happened, he found the right leg dreadfully fractured; the broken ends of bone projecting from a wound of immense extent, and a portion of the tibia detached, which he removed. After placing the bones in contact, Mr. H. sent for my partner, Mr. Travis, and myself, expressing the greatest doubt "whether the resources of surgery were competent to save the boy's limb." We arrived by candle-light, and found the poor lad in a small and wretched hovel, extended on a couch, with a large wound, and destruction of the skin of the middle of the leg; the upper portion of the tibia projecting like a stick, unconnected with any of the soft parts, and deprived even of its periosteum, to the extent of between two and three inches, and the lower portion denuded of all covering to the length of three-fourths of an inch. The fibula was also fractured near the knee, and in the centre of the leg, so that it was divided into three pieces. It was, however, so connected with the surrounding parts, that the spiculæ of bone could only be discovered by the insertion of the finger into the wound. The teguments on the posterior part of the limb, although much bruised, were not deadened; and the circulation could be distinctly traced along the course of the posterior tibial artery. A considerable hæmorrhage took

place at the moment of the accident, but it was now suppressed. The wound was six inches or more in length, and as many in breadth ; but the boy was comparatively tranquil. On consultation, the grand question was, whether to amputate the whole member ; to put it up in splints as it was ; or to saw off the denuded rough extremities of the tibia, and treat it as an ordinary compound fracture. In this dilemma, which required immediate decision, we determined upon the last expedient. The tourniquet was therefore applied, the broken ends of the bone raised from the wound, and whilst the limb was held steady by one, and a bone knife kept under the exposed portion of the tibia by another of my friends, I successfully amputated the two extremities of the fracture, including about *three* inches of the whole cylinder of the tibia. We were unable to reach the fibula with any instrument, so that the two portions of the tibia could not be brought within an inch and a half or two inches of each other, without projecting the spiculæ of the former into the surrounding muscles. One vessel in the bone bled after the operation, but the hæmorrhage instantly stopped on the application of pressure. Stitches were now passed through the edges of the wound, their sides were drawn as nearly together as convenient, strips of adhesive plaster were applied round the limb, with an eighteen-tailed bandage and splints. The boy was laid in an extended position, with the leg a little elevated upon a pillow.

An opiate was administered, and small doses of Epsom salts prescribed for the morning.

8th.—He passed a good night; pulse about 100; his bowels, after a few spasmodic pains, were relieved; he had a few startings of the limbs in the morning, which soon yielded. A very low diet was enjoined.

On our visit on the 12th we found him so well, and the fever so trifling, that we did not dress the wound. He had used no medicines; his foot was scarcely swelled; the limb was without pain, and steady. A small opening was made through the dressings to liberate any possible accumulation of pus; diet a little improved. When I visited him on the 14th, a week from the accident, the discharge and fetor had so increased that it was judged necessary to remove the dressings. This was a delicate operation, which we performed as seldom as possible; only a few drops of blood, however, escaped from the disturbance; the stitches were beginning to separate, a large dead piece of skin was detaching, and a sinuous ulcer broke out above the wound, which discharged a table spoonful of matter. On account of the trouble of removing the adhesive plaster, strips of lint spread with cerate were now substituted. Our patient went on favourably, with a slight interruption one night, from the alteration of position. 16—Discharge increased, but by no means severe, very

healthy ; the dead parts separated, the stitches removed ; the wound so covered with granulations that the bones were not discernible ; the edges of a fine cream colour, particularly in the lower parts ; pulse not more than 90, tongue clean ; no pain, indeed he has been altogether remarkably exempt from suffering of every kind. Diet generous ; wine and porter allowed. Dry lint to be used without ointment, in the form of strips ; the limb to be dressed daily, to keep it from sucking in the discharge ; an oiled case to be placed under it, and the matter to be well absorbed with a sponge, to preserve cleanliness without disturbance. 26.—The discharge rapidly abated, the wound filling up very much, the bowels regular, aspect of the case highly favourable.

April 6.—The wound healing fast on one side ; but, on the other, the granulations were large, loose, and flabby ; the cuticle polished, and cracking ; occasioned by the effect of the inflammation of yesterday and the day before, which Mr. Haggard had judiciously removed by a cathartic ; as the symptoms were evidently the effect of loaded bowels, produced by the change of diet, and not the consequences of debility. The wine and porter having been discontinued for these two days, the last was again ordered, and a warm spirituous lotion applied through the roller. 10.—The limb much improved. 14.—The wound cicatrizing fast ; several small sinuses broke out on the leg ;

but, to my great satisfaction, on elevating the limb, it felt like a solid bone, without trembling in the centre as formerly. We began now to strap it with the *Emplastrum Plumbi*, spread on linen, from the ankle to the knee.

May 1.—The sinuses diminished; the space between the bones filled up with solid matter; by compressing it on each side I could trace a continued line of bone. The wound being a little fungoid, lunar caustic was applied at each dressing. The limb seemed to have a tendency to sink in the centre, which was prevented as much as possible, by compresses placed underneath. As nothing but time seemed now to be wanting, I discontinued my visits till the second of July, when I found the wound completely healed, and the limb firm. He was ordered to endeavour gradually to walk upon it. On the 26th of October I made a journey to Hunmanby, when, to my great pleasure, I met the boy in the streets, looking remarkably fat and well, able to walk without crutches, with his limb only an inch shorter than the other. I have been the more minute in this case, as I am persuaded the success has been, in a great measure, owing to the varied attentions which have been paid to the circumstances detailed. The portions of the tibia which have been removed are transmitted to the Society, for the inspection of its members; when it will be readily seen that in

a boy of our patient's years, they form one fourth of the length of the bone in its natural state.

In the variety and extent of surgical writings now existing, it is much to be lamented that no elaborate treatise has yet appeared on the management of compound fractures. The finished productions of Sir A. Cooper, and Mr. Lawrence, on Ruptures; and the valuable Essays of the former on Compound Dislocations, form so complete a history of these subjects, that the operations for herniæ are become quite familiar to country surgeons; and I have no doubt that the treatment of compound dislocations will soon be equally decisive. But there are so many interesting cases of fracture, upon which no volume can satisfy the surgeon, and so many circumstances to take into consideration, as to the propriety of the preservation and removal of the limb, that nothing but a large collection of facts can ever establish our practice in these common misfortunes of mankind. The practice of a large hospital may afford its fortunate superintendant some clear rules of action which do not fall to the ordinary lot of surgeons; but with him they rest, and are known no farther. When a man refers to authors, (and how many must he carry about with him, if from home!) besides having to pore over various works for the physiology of the bone, and but few containing what will satisfy him for practical purposes; he must have to

search through others for rules of surgical management, most of which are founded on such sweeping principles, and so little illustrated with cases or experiments, that he is bewildered, and even better without them as they at present exist. Thus, for instance, in the case above cited, Mr. Pott would teach the propriety of removing the limb; some surgeons would advise it directly, and others after trying in vain to preserve it. Mr. John Bell recommends the bringing the parts together, bruised and mutilated as they are, and says they will unite. Mr. Charles Bell very candidly gives a detail of melancholy facts, which although not so expressed by him, are at direct variance with his brother's recommendations*. I am not aware that any experiments have been made to ascertain to what extent of denudation of periosteum, a fractured bone may be capable of uniting by means of its own vessels. I should be inclined to believe that a bone so extensively deprived of all covering and attachment, must be subject to very considerable exfoliations, and perhaps necrosis, which would necessarily prevent osseous union; and, to say the least of it, subject the patient to a long and painful confinement, profuse suppuration, great bodily debility, and even in the end terminate in death, or loss of the member. Dr. J. Thompson's "Observations made in the British Hospitals in Belgium," seem fully to confirm this remark.

* Surgical Observations, Vol. I. page 314, &c.

But one great question is, if the denuded bone be removed to the extent of three inches, will the extremities so far detached from each other ever reunite; and will the leg be afterwards strong enough to support the body in the ordinary pursuits of life? Here Sir A. Cooper's high authority seemed to leave no hope, for we could not put the ends of the bones in contact, or nearer than about two inches of each other, in consequence of the pointed ends of the fibula projecting against the soft parts at every attempt to shorten the limb*. These spiculæ could only be removed by another wound, and perhaps danger to the peronæal artery, which would have rendered the case still more formidable. Hence no rule of practice could be drawn, as a material difference exists between the amputation of a large portion of the humerus or of the

* Surgical Essays, Part II. pag. 30. "The first reason which I should state," (says Sir A. Cooper,) for the want of union in fractures of the neck of the thigh-bone, "is the want of proper apposition of the bones; for if the broken extremities be in any part of the body kept asunder, ossific union is prevented." This opinion is supported by the Baron Larrey. A case is then related of a fracture of the tibia; and another from Mr. Smith of Bristol, of a piece of the tibia sawn off, together with some experiments on the radius and os calcis of rabbits, in confirmation of these remarks.

A similar fact is recorded by Mr. Thomas Sandwith, in his Cases of Surgery, annexed to his brother's works on the Bridlington Epidemic. Might not these instances have occurred, as we sometimes observe them, in particular habits, even when the bones are in coaptation? or they might have been disturbed during the treatment, as would be most probably the case with the rabbits.

femor, or of the head of a bone ; for the divided ends could be brought in contact, or the upper portion of bone, in a joint operation, might still answer its purpose, though imperfectly. Besides, the arm has afterwards no weight to sustain beyond the inclination of the subject. But with respect to the leg, it was necessary that it should be again enabled to support the whole column of the body. Such were the embarrassments that affected our deliberations, and whether the plan adopted should be a guide to future cases, I will not pretend to say ; but since the patient got well without any difficulty, even without pain, and as little deformity as is usual in a common fracture, surely the fact must preponderate a great way over speculative opinion.

I am informed that amputations of the angular portions of fractured bones are not uncommon at the Leeds infirmary. Whether it has been attempted under such circumstances, and to such an extent as has been already detailed, I am not aware ; as important facts are too frequently buried within the walls of an hospital. I must acknowledge, however, that on speaking to the venerable Mr. Hey, on the bad consequences of compound fractures in London, he assured me that he was persuaded it was not so much from the foul air, as from not removing the sharp ends of bone, which irritated the muscles, and became a constant source of tetanus, or of those extensive suppurations so

often followed by death. He told me, by adopting this plan, his practice was very successful.

The following case becomes interesting from its occurring at nearly the same time, so that we had both of them under our care at once; the boy being of like station and similar period of life, with other circumstances of resemblance. But in this instance the bones could be made to approximate, so that it will shew what difference in time, trouble, pain, and success, proceeded from this circumstance; and it will also prove how simple the treatment of compound fractures becomes, when deprived of those incessant sources of irritation arising from the spiculæ of the fractured bone. The little advantage in time was, as might be expected, in favour of the latter and less serious case; but I believe the other boy suffered less from pain, and has now as good a leg.

March 28, 1821.—2 P. M. Johnson Turton, aged sixteen, was at work in the ship-yard of Messrs. Tindell's, when a plank of wood, eighteen feet in length, five in breadth, and half a foot in thickness, was thrown from the ship, which struck the middle of his leg, in attempting to avoid it. When Mr. Travis and myself arrived, we found him on a squab, the wound bleeding a little, and the foot turned inwards. His stocking was now removed, his trowsers cut off, the wound washed and examined, and a loose portion of bone taken

away with the fingers. Both the tibia and fibula were fractured ; the ends of the former protruded from a very long wound, above half the length of his leg, which had the appearance of a clean cut. The ends of the bone were very ragged ; the most forcible extension could not place them in coaptation. We, therefore, determined to saw off their extremities, with the common amputating saw. The upper portion, as in the former case, was removed first, a steel spatula being placed underneath, and a linen retractor round the bone, to defend the muscles ; but the latter was so inconvenient that I threw it away, and depended on our hands. As the lower portion of bone was connected posteriorly with the muscles, the saw was withdrawn when it had gone nearly through, and the operation was completed with the bone forceps. No hæmorrhage followed, of any consequence ; the wound was cleaned, the bones put in apposition. About half an inch of the exterior part of the tibia was left denuded of its periosteum, which was considered of no importance, as the rest of its circumference was connected with living parts. The edges of the wound were brought as near together as we could, and retained with three stitches, adhesive straps, and an eighteen tailed bandage. The limb appeared to be very straight, splints were applied, and it was placed on a pillow in the extended position. The boy complained as little as the other during the operation.

8 P. M. Pulse soft, no sickness, feels uneasy from the hardness of the squab, from which we did not think it proper to remove him; but we relieved him by placing a bed upon it.—29th, Passed an uneasy night, pulse but little accelerated, tongue rather dry, skin and face warm but not hot; he took some jalap with infus. sennæ tam. which occasioned three motions. In the evening, the face being flushed, it was sponged with cold water; the bandages were kept cool with the same; he feels pain in the wound, which makes him restless. *R* Tinct. opii gtt. xv. in a saline draught at bed time; tongue dry and crusted; the saline mixture ordered, and he is to suck many oranges.—30th, Complained of his *jaw* at night; by mistake he had omitted taking his night draught; the limb was swelled, the pulse calm.—31st. Took the draught; had a better night; all the symptoms favourable.

April 2.—The dressings at the lower part of the leg were released with scissors, some discharge oozed underneath.—3d. The limb dressed for the first time, the wound assumed a fine healthy aspect; nearly two inches of the upper part appeared to be almost healed, only seeming to want the cuticle.—4th. Much relieved by being dressed, passed a good night, pulse soft; to take his ordinary diet, with half a pint of beer per diem.—5th. Complained of pain on dressing, stitches released, the upper part of the wound, which ap-

peared nearly united, again broke out, and the edges are receding. The edges were much inflamed, and injured by the stitches. A medical friend fancied the appearance of his limb so formidable, and the case likely to be so troublesome, that he said he would have removed the limb at first. But the pain and inflamed edges seemed to me to have been only the effect of the undue tightness of the suture, arising from the endeavour to bring the edges in contact.—9th. There seemed to be a sinus running from the fibula; we began to strap the whole limb with diachylon plaister on linen. The wound did not require dressing again till the 12th, when it looked much better, with the edges cicatrizing; discharge from the sinus considerably less, although at the first it did exceed a table spoonful at a dressing.—17th. Of late so much better that he is only dressed once a week; the wound much cicatrized; the limb seems to be beginning to unite, and to acquire firmness; he is very easy.

From this period the limb advanced rapidly to a firm union. But in July, although he walked about with crutches, an ulcer remained opposite the part of the tibia where the membrane was denuded, which seemed to indicate slight exfoliation; but, after poulticing, followed by adhesive straps, it compleatly healed. At the beginning of August he laid aside his crutches, and in September I saw him following his usual work in the

ship-yard. Much pain might have been saved to this patient by the simple use of straps, instead of stitches; although the wound had so much the appearance of a cut, and the suture is so strongly recommended by the late Mr. Hey, in his "Practical Observations," I think it right never to make use of them in a similar case again.

Case of Amputation of a projecting Edge of the Tibia, after the Union of a Simple Fracture.

Thomas Solliff, aged 30, a man of irregular habits, had fractured both bones of his leg, on May 18, 1821. They united in the ordinary period; but, from his want of steadiness, the bones were not in exact apposition; the sharp edge of the tibia projected against the skin so as to occasion much pain, some deformity, and considerable difficulty in setting his foot on the ground. The skin was inflamed, and would soon have ulcerated. I accordingly, with the assistance of my colleague, (26th of June,) made a semilunar incision of the integuments, reflected them backwards, and with Hey's saw amputated the sharp angle of the bone. I did not remove a great deal, as I found Hey's saw a much inferior instrument to the common or metacarpal one. The vena saphæna major, which passed directly over the part, would have bled freely, but it was easily stopped

by pressure. The skin being replaced over the wound, it was completely healed in four days. His leg looked much straighter, and in September I met him walking very well, in the pursuit of his ordinary business.

In concluding this paper I must beg to make my acknowledgments to Mr. Haggard, for his unremitting attention to the first case ; and to my partner, Mr. Travis, for his ready concurrence and zealous co-operation in all.