April 15th. The posterior angle presented a small granulating surface, which was touched with nitrate of silver.

April 17th. About a tablespoonful of dark coloured puriform matter oozed out from the posterior angle of the stump. There was a little inflammation round the stump and pain on pressure, which he attributed to his having moved too much about the ward the preceding day. The pulse was rather quicker than it had been previously.

April 18th.—He was much better in all respects than on the previous day; the discharge had almost ceased; the pain and redness had disappeared.

April 19th. The lower angle was touched with nitrate of silver.

April 20th. There was scarcely any discharge. His general health was greatly improved.

April 22nd. The stump was entirely united.

May 19th. He left the hospital, moving about comfortably on a wooden leg.

Original Communications.

ON UNUNITED FRACTURE.

By W. J. Moore, Esq., H.M. Indian Medical Service, Bombay Establishment; formerly Senior Resident Surgeon at the Queen's Hospital, Birmingham.

[*Continued from page* 444.]

The pathological condition of non-ossific union varies in different cases. There may either be a confused mass of fibro-cartilaginous substance between or about the ends of the bones; they may be bound pretty tightly together, by means of a more strictly fibrous medium; or there may be formed what can be termed a false joint. That is to say, there will be a cavity between the ends of the bones, and the deposited tissue lined with a surface which presents all the appearances of a secreting synovial membrane. According to Paget (*Surgical Pathology*, vol. ii, p. 260), this fibrous tissue is an example of arrested development of the reparative material. The same author says:—"In other cases, failure seems to occur earlier, no reparative material is formed, and the fragments remain quite disunited. This may be the result of accidental hindrances; but it sometimes appears like a simple defect of formative power—a defect which cannot be explained, and which seems the more remarkable when we observe the many changes which may at a later period be effected, as if to diminish the evil of want of union," such as the formation of a "quasi" synovial membrane and the irritation of a fibrous capsule.

A man, about 35, had his thigh amputated in the Queen's Hospital for ununited fracture. The following was the condition of the parts:—The skin was thickened; the cellular tissue plentiful, and exuding a yellow serum; the muscles were atrophied, discoloured, and interspersed with softer patches. The nerves also were discoloured. The arteries and veins were healthy. The fractured ends were joined together by, and embedded in, a dense fibrous mass, in the centre of which a smooth surface was visible, evidently the commencement of a secreting membrane between the fragments. Another case of false joint I examined in the same hospital presented appearances simulating those described; but this being of old standing, the "quasi" articulating surfaces were more apparent. Sometimes tuberculated or cauliflower deposits of bone are found round the sides of the extremities of the fragments.

The period after a fracture when it may be supposed the powers of nature are insufficient to produce the full reparative process, varies in different cases. Supposing the patient to be affected with any constitutional disease, or to be placed in localities, miasmatous or otherwise, inimical to health, suspicion of non-union would soon arise. Malgaigne says:—"It is difficult to say, unless five or six months have passed away, if we have to deal with delayed union, or actually a false joint." No definite rule can be given on this point; but at least for four or five months neither retentive apparatus or hopes of cure should be abandoned. On this head, Mr. Stanley observes (after recording a successful instance):—"Since in this case the firmness of union had not commenced at the expiration of four months from the occurrence of the fracture, it almost warrants the conclusion that no period is too late for the commencement of that stage of the reparative process of fractures, upon which union depends." (*Medical Gazette*, Nov. 29th, 1844.)

The treatment of these cases will of necessity vary according to the class with which we have to deal. It will be right to give the patient the benefit of a trial of constitutional remedies, and these, according to what we may suppose, after due consideration, retards the union of the fracture. I believe I have saved several from the calamity of a false joint by the timely exhibition of quinine; and I consider that this resulted from the alkaloid repairing the anæmic condition of the system, produced by malarious atmosphere.

Sir Benjamin Brodie, in the twelfth volume of the *Medical Gazette*, relates an instance where union was promoted by an allowance of spirits, to which the patient had previously been accustomed. Fergusson (*Practical Surgery*, chap. 19, part 1) gives cases of the same kind. B. Cooper mentions that mercury given to salivation cured a patient (Druitt's *Surgeon's Vade-Mecum*, p. 222); and Mr. Colles, of Dublin, recommended this mineral with success. (Sir Astley Cooper *On Fractures and Dislocations*, p. 575.) It is, however, quite an empirical method of treatment; and it is difficult to understand, with our present knowledge of the action of mercury on the human frame, how it could aid a case of the kind. I should not feel much inclined to try it, excepting perhaps as a *dernier ressort* in cases where a syphilitic taint existed.

Liquor calcis and phosphate of lime, phosphorus and phosphoric acid, have also been recommended, the second particularly, by Dr. Druitt and some German writers.

Should none of these remedies, combined with perfect apposition and rest, succeed, some more active interference becomes necessary; and the indication is to excite just sufficient inflammatory action to lead to reparation and no more. The most usual method of attempting this, and what should always be tried in most instances during the time of constitutional treatment, is, rubbing the ends of the bones together. This is a very ancient practice, and is mentioned by Celsus (lib. viii, chap. x, sect. vii, "si quando vera ossa," etc.); it is, however, very uncertain in its results; but inasmuch as a cure sometimes follows, and the practice is safe, it should never be neglected.

Some, chiefly continental, surgeons have applied pressure externally over the seat of fracture, by means of graduated compresses, tourniquets of different constructions, or apparatus acting in the same manner; but, as far as I am aware, these means have not been followed by any satisfactory result in this country, although three cases of cure are related in the *American Journal of Medical Science*, vol. ii, p. 70.

An unsatisfactory result has also followed the application of irritants: as blisters, nitrate of silver, iodine, and potassa fusa, to the surface; and, indeed, it is not very easy to explain what indication induced surgeons to try such means.

The limb may be put up firmly in gutta percha, leather, or the starched apparatus, and the patient allowed to move about. This treatment has been modified, or rather extended by Mr. Smith of the United States, who places the limb in an apparatus combining pressure on the fracture with power of movement, and reports ten cases of cure out of fourteen so treated. Mr. Stanley, after recording the cure of an individual who was allowed to move about with the femur in a starched casing, appears to suppose the result might be due "to the influence of the action of the muscles around the fracture." (*Medical Gazette*, Nov. 29, 1844.)

It has also been proposed to allow the patient to use the limb for a time, without any retentive apparatus. In an instance where I saw this plan tried, it failed to produce any excess of inflammatory action, and perhaps made matters worse. A successful case of this kind, however, has been recorded by Mr. Houghton, of Dudley, in the *Provincial Medical and Surgical Journal* for October 16, 1850. Amesbury, in his work on fractures (p. 273), recommended an apparatus which he used, by means of which the broken ends of the bones were pressed firmly against each other, and gives cases of cures by such means. Regarding this plan, Mr. Stanley observes: "It should not be the object to maintain the fractured ends of the bones in contact, but rather that the two portions of the bone should overlap, to allow of the periosteal surfaces being pressed together from which osseous deposits immediately proceed."

Galvanism has been proposed by Mr. Bowman (*Edinburgh Monthly Journal of Medical Science*, Feb. 1840), who gives a successful case, but the limb was well kept in apposition during the whole time. We may therefore doubt if the galvanism was

the curative agent, especially as it has been tried in other instances without good effect.

Next, there are operative proceedings, consisting in the introduction of one or other description of instrument to the seat of injury. The fracture may be cut down on and caustic potash applied, as recommended by the younger Cline. Small holes may be drilled in the bone, and ivory or silver pegs driven in. This was first proposed by Dieffenbach, and several cases terminating successfully after this treatment have been recorded; one by Mr. Stanley, occurring at St. Bartholomew's Hospital; others by Mr. Bowman, of King's College, and Mr. Teale, of Leeds. The originator of this method was first led to employ the pegs from noticing that a leaden bullet, embedded in bone, gave rise to osseous formations around it; but the late experiments of Dr. Brainard, of the United States, on the effects of foreign bodies when allowed to remain in contact with bony tissue, tend, for the most part, to prove they promote absorption, and, and induce no tendency to the production of callus (*American Journal of Medical Science*, Jan. 1858). Indeed, Dr. Brainard proposes as a means of cure in some forms of exostosis, the introduction of silver or ivory pegs. Next, the ends of the bones may be cut down on and scarified. A seton, as first used by Dr. Physick in 1802, may be passed between them, or, as is better, to the one side. Erichsen mentions a plan of passing a silver wire round the fracture and, by gradually tightening, cutting through the false joint. Professor Porter of Edinburgh cured two cases by using the chain-saw in the same manner (*Edin. Medical and Surgical Journal*, Jan. 1842). A metallic cannula and heated wire have been recommended by the German surgeons. Injections of irritating fluid have been spoken of. A piece of silver wire has been used in lieu of a seton. Nitrate of silver or butter of antimony have been applied to the fragments. Lastly, the broken ends may be sawn off.

Of all these operations, there are few I should feel inclined to countenance, and then only on the failure of the method presently to be mentioned. The application of potassa fusa, nitrate of silver, antimony, etc., cannot, in my opinion, afford any prospect of cure; neither should I much like to inject irritating fluids into a patient's leg or arm. Dieffenbach's pegs, and the seton, have failed in numerous instances; and sawing off the ends of the bones is an operation too dangerous to be lightly undertaken, especially so in the arm or thigh. Liston (*Practical Surgery*, p. 100), while admitting the uncertainty of most operations, seems to have placed most reliance on the seton, and gives a caution regarding the length of time it should be permitted to remain; and by way of enforcing this, brings forward a case which occurred, where the seton was allowed to remain thirteen months; for what purpose it is difficult to say, and, of course, without any good result.

The operation of sawing off the ends of the bones was first practised by White, in the middle of the last century, but has been condemned by very many authorities. Mr. South considers sawing off applicable to the fore-arm and leg, but not to the upper arm or thigh (*Chelius*, p. 889); and Mr. Lawrence is, or was, of the same opinion (*Lectures, Lancet*, 1830, vol. ii). Miller (*Principles of Surgery*, chap. 21, p. 246) states the operation proved inadequate in practice, and may now be considered abandoned, while Erichsen, Fergusson, and Syme, speak of only as a "*dernier ressort*".

The operation has, however, in some instances succeeded. Two successful cases are recorded in the *Lancet* (Feb. 5, 1859) by Mr. Davies, of Merthyr Tydfil. Mr. Spence, of Edinburgh, performed the operation with success, after the seton had failed (*Edin. Medical and Surgical Journal*, Nov. 1855). Other instances may be found in the medical journals; while from the statistics of Norris, referred to in an earlier part of this paper, we learn, that out of thirty-eight cases in which the ends of the bones were either resected or scraped, twenty-four were cured, seven received no benefit, and six died. It is unfortunate that it is not stated what number had the ends of the bones sawn off, or how many died from that operation alone. In six cases, the particulars of which I am familiar with, where resection was performed, two died, three recovered, and one received no benefit.

Had I to take my choice of these operative proceedings, I should first prefer scarifying the ends of the bones, making a very small external opening, as recommended by Dr. Brainard; next to that, the silver wire seton, taking care to retain it only till inflammatory action was excited; and not before I had tried these means should I take into consideration the propriety of sawing off the ends of the bones, and then only should the limb prove too great an incumbrance for the patient to bear. This, however, does not always happen. I have seen a man with an ununited thigh-bone, who, having the part well supported by a strong leather apparatus, went about his daily avocations; and I have also seen several instances of false joint in the upper extremities, which appeared to give the patient very little inconvenience. A case of this kind is also mentioned by Mr. Crompton, of Birmingham (*Medical Gazette*, Nov. 15, 1850).

In attempts, therefore, at cure or relief, such cases must be borne in mind. The position in which the patient may be placed, and his means of livelihood must be considered, and not unless the limb prevents him following his employment, or earning his living, should he be advised to incur a serious risk, for what may, after the lapse of a short period, become merely an inconvenience or slight incumbrance.

[*To be continued.*]

CONTRIBUTIONS TO CLINICAL SURGERY.

By Oliver Pemberton, Esq., Surgeon to the Birmingham General Hospital.

V.—The Radical Cure of Reducible Inguinal Hernia.

Owing to the ability and perseverance of Mr. Spencer Wells, the lecturer on surgery at the Grosvenor Place School of Medicine in London, an operation for the radical cure of reducible inguinal hernia, on the principle of the invagination of the scrotal integument in the inguinal canal and rings, has at length taken firm hold on the attention of the profession.

Since 1850, when Mr. Wells, for the first time, performed the operation in this country, but more especially since 1856, when Mr. Holmes Coote carried it into effect at St. Bartholomew's Hospital, the procedure has been gaining ground; so that at this time we may deem it as undergoing the fairest test as to both utility and permanence.

The invagination of a plug of skin taken from the scrotum, and its subsequent retention at the mouth of the sac, or at the margins of the internal ring, appears to have had origin in the plan proposed by Gerdy, who published his account of the proceeding in 1835, and again in 1837.

Here, then, was a principle fairly started, possessing the claim to consideration of being apparently free from those dangers which had beset well-nigh all previous operations proposed for the radical cure of reducible hernia. But the closure of the rings and canal was not permanent. The mode adopted for effecting this failed in the majority of instances; so that it remained for the followers of Gerdy to advance the principle a step further.

This has been accomplished by Wützer and Rothmund. Wützer happily devised, to retain the plug in the inguinal canal, the use of a cylinder perforated by a needle which fixed it effectually, for a time, to the margin of the internal ring; whilst carefully regulated pressure, by means of covers fitted so as to press on the inguinal canal and its contents, ensured the production of such a degree of adhesion between the plug and the canal, or such an amount of contraction at the internal ring, that protrusion of the bowel was prevented.

Rothmund modified the shape of the cylinder; but the merit of perfecting the principle suggested by Gerdy belongs to Wützer.

The instruments essential to the accomplishment of this operation, as approved of in the present experience of the profession on the subject, consist, then, of a cylinder, nearly oval in shape, capable of being fitted to side pieces of various dimensions, according to the size of the canal. The cylinder carries within it a passage terminating a little short of its extremity in an aperture destined to give exit to a silver-pointed needle, by the protrusion of which, when the cylinder has taken the place of the index finger in the canal, the scrotum is fixed to the margin of the internal ring. Lastly, a cover, slightly concave in shape, is fitted over the point of the needle, and, by the aid of adjusting screws, is made to exercise a pressure, capable of exact regulation, on the structures between it and the cylinder, so as to more certainly ensure the retention and adhesion of the plug of scrotal skin in its new situation. Where it is desired, the cylinder can be so constructed that two or more needles can be made use of to retain the invaginated scrotum.