ON BURIED SUTURES, WITH REMARKS ON THE IMPORTANCE OF SUTURING SEPARATELY, PERIOSTEUM TO PERIOSTEUM, MUSCLE TO MUSCLE, DEEP FASCIA TO DEEP FASCIA, AND SKIN TO SKIN, AFTER DEEP INCISIONS OF ALL KINDS.

By C. B. KEETLEY, F.R.C.S.,

Senior Surgeon to the West London Hospital; Surgeon to the Surgical Aid Society.

BURIED sutures, or "sunk sutures," as they have been also called, are such as are completely covered by the skin, and do not involve that structure at all. In the form of sutures uniting the fragments of fractured bones, especially the olecranon and patella, they have long been employed, and also as sutures to unite divided nerves and tendons, as well as wounded veins, intestines, and other hollow structures. But all the above mentioned forms of buried suture differ essentially in their objects from those to which I wish to call attention. The former have each a narrow and very limited, though, perhaps, extremely important aim. For instance, a patella is sutured with a view to getting secure bony union, a wounded intestine with a view to preventing extravasation of fæces into the abdominal cavity.

The sutures of which I now wish to speak, are employed with intent to influence the whole course and final result of wounds in general. For instance, let us suppose buried sutures of the first kind to have been used to unite the two ends of a divided nerve; the use of the other kind of buried sutures would now commence, and proceed as follows.

Whatever muscles or aponeuroses had been divided in cutting down upon the nerve would be restored to their original relationships, and kept there by aseptic animal sutures, such as carbolised gut; then the wound in the deep fascia would be separately sewn up. Finally, the wound in the skin would be closed by either catgut or silver, or whatever might be preferred. What good do we expect to get from this?

1. We need no drainage-tubes. No spaces or pockets are left wherein blood or serum can collect, and, therefore, it does not collect. I presume that all wounded vessels, of a size such that the blood-pressure would force blood out of them in spite of the buried sutures, have been carefully secured, and that the wound is thoroughly aseptic.

2. The sutured muscles and aponeuroses are eventually perfectly restored as regards function, as also is the deep fascia. Even the deep fascia has important functions, especially in certain localities, and in connection with the following points.

3. Deep, rough, and depressed cicatrices are avoided.

4. Necrosis of bone and sloughing of soft tissues are prevented.

To dwell for a moment or two on the history of the subject (before illustrating its practical application by a description of my own experience), it has first of all to be confessed that this, like other important developments of antiseptic surgery, has attracted most attention in Germany. There it appears to have originated in the practice of Werth, the gynecologist, who praised these sutures highly, as tending to success in operations for ruptured perinæum. It is, however, Esmarch's assistant, Neuber (the inventor of decalcified bone drainage-tubes) and Professor Küster, who are the chief apostles and pioneers of this great advance in surgery, for such I esteem it. It was a pamphlet by the former, giving an account of the amputations done at Kiel during last year, which first called my own attention to the matter.

Neuber has worked out the subject thoroughly, more especially in a pamphlet entitled *Vorschläge zur Beseitigung der Drainage für alle frischen Wunden* (Lipsius and Fischer, Kiel, 1884).

Küster read his paper at the last meeting of the Society of German surgeons. In the discussion which followed, Esmarch having stated that, with these sunk sutures, drainage-tubes could be altogether dispensed with, he was asked, "What, after excision of the hip?" He thereupon answered, shortly and decisively, "Yes."

Turning to my own experience, which, though sufficiently varied, is small as compared with that upon which Neuber, Küster, and Esmarch base their assertions, I have carefully recorded the details of two amputations of the thigh, and one of the leg, two excisions of the hip, one case of *evidement* of the bones of the knee-joint, one wedge-osteotomy of the hip, one osteotomy of the tibia and fibula, one operation for ununited fracture of the same bones, two suturings of frac-

tured patellæ, one removal of sequestrum in necrosis of the symphysis pubis, with large abscess in the abdominal wall; one operation for congenital contraction of the knee by open antiseptic incision; one incision to examine a chronic swelling of the parotid, one excision of multiple sebaceous glands of the head, and two cases of resection of the quadriceps extensor cruris. In all these seventeen cases, except two, the buried sutures have done all which sanguine hopes could expect of them. But, in stating this, I must confess that I have not always dared to dispense with drainage-tubes. I simply thought I ought to feel my way cautiously. Of the two cases which I have mentioned as being exceptions, one was an almost hopeless case of amputation of the thigh in an old lady, over 70, who suffered from sloughing of almost all the soft parts of one lower extremity, from the knee downwards, with burrowing of pus up to the hip, the cause being erysipelas. She died forty-eight hours after the operation. The remaining case possibly casts a slur upon buried sutures, or upon their employment in my hands. A man, aged 30, with advanced strumous disease of the knee, tuberculous disease of both lungs, and hectic fever, had the knee freely excised, and all the diseased synovial tissues removed with scissors and sharp spoons. The bones were then fixed firmly together with silver sutures, and the wounded soft parts secured with buried sutures. His only hope could lie in speedy osseous union. Unfortunately, the edges of the flap sloughed. Thus, frequent changes of dressing, with consequent slight disturbances of the ends of the bone, were necessitated. Finally, our efforts to keep the wound aseptic failed, and amputation was performed. I think it possible that my covered sutures had seriously interfered with the imperfect blood-supply in this poor enfeebled creature.

I will describe briefly two or three of the above cases and their results. In amputating the leg, two lateral and very short rounded skin-flaps were made. A very short distance (about half an inch) above the angles of junction of the skin-flaps, the muscles were divided by a circular sweep. The periosteum was divided nearly as low down as the muscles, and turned back up to the level where the bones were divided. The periosteum must be reflected to an eighth of an inch or more beyond the point of division of the bone, and carefully held out of the way, without being stripped further up, while the saw is being used. Next, the vessels are tied until it is time to put in the sutures. About three or four will draw the periosteum securely over the cut surfaces of each bone, leaving a small opening opposite the medulla. Next, the muscles and aponeuroses of the extensor side are united to those of the flexor side, more or less *en masse*, by five or six sutures of strong catgut. These sutures had better not, as a rule, be made to go quite through to the deep surfaces of these structures, but should be half an inch to one inch from the cut edges at the superficial surface. The bones are thus completely covered. Next, the deep fascia should be separately sutured, and lastly the skin.

Almost the first time I ever tried buried sutures was in an amputation of the leg (middle third) done in February 1884 in the West London Hospital. The flaps, when thus sewn up, were too tight to allow room for a drainage-tube to be inserted without violence. Therefore none was used, except one of very small size passed through one corner of the skin-incision, but not into the depth of the wound. This case was further complicated by the fact that, owing to an unhealthy condition of the marrow, the medulla of both tibia and fibula was scraped out right up to the upper epiphyses of those bones; and the medullary cavities, thus emptied, were injected with liquor hydrargyri perchloridi (whose strength, it may be remembered, is just over 1 in 1,000).

Healing took place throughout by the first intention, except as regards the skin, which gaped a little when its sutures gave way. However, the muscles, and doubtless the periosteal sutures, held on; and the edges of skin soon, as it were, crept together again. The temperature rose on several days to 101°, and then gradually sank to normal on the tenth day. There it remained, except that, once or twice during the next month, it rose to 102°, for no reason in any way connected with the stump, as far as could be made out. The patient has long been quite convalescent, and is using an artificial leg.

After the excisions, the wedge-osteotomies and the suturing of the patellæ, the excellent results, as regards freedom of the skin-cicatrix from cicatricial anchorage to the bone, were very manifest. They contrasted strongly with the deep valleys which soon follow incisions for resection, when sutured in the ordinary way. This good effect is, of course, particularly valuable in the face.

Resection of the quadriceps extensor for infantile paralysis, with loose knee, would not be justifiable without the use of buried sutures. Concerning the ultimate result of these cases, there has not been time yet to judge; but in each of my cases I have succeeded in shortening the muscle an inch and a half, with rapid healing of the wound by

first intention, no deformity or depression, and merely a longitudinal, linear, undepressed cutaneous scar. No drainage-tubes were used.

The large abscess-cavity in connection with the necrosed symphysis pubis extended outwards as far as the iliac crest, and was nearly as wide. It was supposed, when sent to me, to be an inguinal hernia. I slit it up, scraped out its lining thoroughly, and closed it in with sutures which passed from side to side beneath its floor, but not through the skin; it was thus reduced to a long narrow and shallow groove. This I closed with superficial sutures. The deep sutures held on till the depth of the cavity was obliterated by the healing process. At the lowest angle of the wound, a drainage-tube was passed straight down to the small cavity from which the necrosed symphysis had been extracted.

In no cases have I found these sutures more brilliantly successful than in dealing with sebaceous cysts of the head. Having dissected out three from the scalp of a gentleman, I obliterated the remaining cavities by two buried sutures in each, passing them well beneath the floor of each small wound. No cutaneous sutures were used at all; the skin-wounds did not gape. Over the wounds was placed a coat of salicylic acid dissolved in ether, as well as a little powdered salicylic acid. No bandages were used. The patient went daily to his work at Somerset House, attended a garden-party in the meanwhile, and, a fortnight afterwards, washed the salicylic scab, as it might be called, off three sound linear cicatrices. It is important to say that he was not allowed to brush his hair during the treatment; it was kept both tidy and aseptic by occasionally sponging with a wash containing spirit, corrosive sublimate, and rose-water.

In conclusion, I have to say that it is only in strictly antiseptic surgery I would venture to recommend the use of these sutures; but that, in the case of all surgeons who have faith in antiseptic theory and practice, they will find in buried sutures an effective and beautiful addition to their methods.

THE PATHOLOGY OF RODENT ULCER.

By F. T. PAUL, F.R.C.S.,
Surgeon to the Royal Southern Hospital.

WRITINGS on the microscopic characters of rodent ulcer may be said to have originated in the well known monograph by Thiersch, on epithelial cancer, published in 1865. Anterior to this, the clinical features of the disease had been very carefully studied and described by Jacob, Paget, Hutchinson, and Lebert; and though they recognised its distinct identity as an infiltrating and ulcerating growth of a specific nature, a better knowledge of its minute structure was required to avoid the very natural difficulty of confounding it with lupus, syphilis, tuberculosis, or epithelioma. Thiersch's contribution is in every way worthy of the position which it occupies, and the illustrations accompanying the text show the author's clear conception of the histological features of this disease, which he described as flat epithelial cancer, in contradistinction to the ordinary infiltrating form of epithelioma. Though regarding rodent ulcer as a variety of epithelioma, his researches encourage the opinion that it has a special origin in the sebaceous glands. Other observers soon followed, and their writings are without exception the result of careful and thorough investigation, becoming more and more valuable as the work of the microscope has become more and more perfect. In 1867, Mr. Moore of the Middlesex Hospital, published his pamphlet, in which he described rodent ulcer as a form of epithelioma. In 1871 and 1873, Mr. Hulke expressed similar views at the Pathological Society. In 1872, Dr. Collins Warren, in his Boylstonian prize-essay, maintained the opinion that the growth commenced in a small-cell exudation, which developed under the influence of the rete Malpighii; this, of course, must be regarded as a variety of the epithelioma view. In 1878 and 1879, Dr. Thin, at the Pathological Society, originated and supported what has since been called the sweat-gland theory. In 1879, Drs. Tilbury and Calcott Fox, at the same Society, read their paper in support of the opinion that the growth started in the root-sheath of the hairs; Mr. Butlin, in the discussion which followed, supported the sebaceous gland theory of Thiersch. In 1882, Dr. Sangster, at the annual meeting of the British Medical Association, read a paper also in support of the root-sheath view; and an additional paper, tending in the same direction, has since been published in the BRITISH MEDICAL JOURNAL, by Mr. Hume, of Newcastle.

There has then been a considerable diversity of opinion concerning the true nature of rodent ulcer, since the appearance of the writings of Thiersch. They may be classified as follows.

1. As a variety of epithelioma—Moore, Hulke, Collins Warren; and as depending upon the nature of the soil in which it grows—Hutchinson.
2. As a carcinoma of the sebaceous glands—Thiersch, Butlin, and others.
3. As a carcinoma of the sweat glands—Thin.
4. As a carcinoma of the hair-follicles,—Tilbury and Calcott Fox, Sangster, and Hume.

The present communication is based upon the microscopic examination of twenty-two cases, in all of which the entire growth has been excised with the knife, and placed in my hands for investigation. Twenty of them were clinically unmistakable, the other two were doubtful. A few more cases of chronic epithelioma of the hand were clinically regarded as allied to rodent ulcer; but, since their structure is distinctly epitheliomatous, they are not included, though it is quite possible that they may have equal claims to be. It would occupy too much space to describe the cases individually; and I shall, therefore, be content with generalising some of the broader clinical facts, asking that the diagnoses may be accepted as correct, on the ground of the clinical experience of the observers, confirmed, if you will, by a personal examination of the specimens, as there are microscopical preparations here from every one of the cases.¹

The strange observation that rodent ulcer is, with very rare exceptions, limited to the face, is borne out by these cases, as all occurred in the skin of the face. Seven were on the cheeks; seven on the eyelids (the two doubtful ones both on the upper eyelid); three on the forehead; three on the side of the nose; and two in the skin of the lips, one the upper and the other the lower, but both quite away from the red border. Sixteen occurred in males and six in females, bearing out the general opinion that the disease is more common in men than in women. The average age of commencement was 50, varying from 35 to 72; the earliest cases being in women. The great length of time occupied by an ordinary rodent ulcer in attaining a sufficient degree of severity to awaken any apprehension in the class of people who are usually attacked by it, is such as to mislead us to a certain extent as to the age when it commences; and I am sure that it ought not to be regarded as a very uncommon occurrence in the fourth decade of life. The average duration of the disease before operation was six years, varying from six months to fourteen years. This fact is, of course, of no great value, as the disease varied proportionally in extent, except that it is in accordance with the usual experience of the chronic nature of the growth. Those ulcers which were of short duration were small shallow sores, covered with a scab, and showing the characteristic pale raised border of infiltration; while in one case the growth was a mostly subcutaneous nodule in the loose skin of the lower eyelid. The older growths had all the usual rodent characters, destroying the skin, muscle, eye, bone, etc., just as they happened to fall within the area of infiltration.

The specimens have generally, and always recently, been prepared by hardening the tissue in bichromate of ammonia, and subsequently in spirit; the sections have been cut by Bevan Lewis's microtome, stained in logwood and eosine, and mounted in Farrant's solution. The sections have, of course, always been taken through the growing margin into the surrounding skin, which has in all cases been carefully examined.

It is not necessary, at the present time, to say anything in reference to the purely carcinomatous type of the disease; that is admitted on all hands. I have, therefore, directed my attention entirely towards elucidating to what variety of carcinoma rodent ulcer belongs; or, in other words, of what epithelial tissue it is an atypical form. In some cancers this is a point which is easily decided; for instance, in epithelioma, cylindrical epithelioma, and some thyroid, hepatic, and other cancers. In others, it is equally difficult. Take, for example, an ordinary scirrhus of the breast. This is so mildly typical of breast-tissue, that most pathologists, even now, regard a scirrhus of the breast as a type of cancer which may occur at any part of the body, when it cannot possibly bear any other relation to a primary cancer of another organ, than that they are all epithelial new growths. Rodent ulcer also is so slightly typical of any epithelial cutaneous structure—or, rather, it is so liable to show relationship with all the dermal epithelial evolutions, that great difficulty is met with in attempting to class it satisfactorily.

It being accepted that rodent ulcer is a carcinoma of the skin, we have to decide whether it must be regarded as a carcinoma of the entire skin,

¹ The specimens, which were shown in the Section of Pathology at the annual meeting of the Association in Belfast, were obtained as follows: five from Mr. Bickersteth; two from Mr. Reginald Harrison; two from Mr. Mitchell Banks; three from Mr. Rushton Parker; two from Mr. Shadford Walker; two from Mr. Edgar Browne; one from Mr. Puzey; one from Dr. Little; and four were my own.