

*On the use of Sutures in Surgery, and on their advantages over adhesive straps and other modes for producing coaptation of the edges of wounds.* BY W. T. WRAGG, M.D.

QUESTIONS often arise on points of practice where they might be least expected. The experience of ages seems inadequate to set at rest differences of opinion where, theoretically, there would seem to be no room for doubt. The use of sutures we find amongst the earliest means employed for the treatment of wounds. At first promiscuously applied to every case, without regard to the nature, extent or situation of the wound; and made to supply the deficiencies of the incomplete apparatus of infant surgery, they were often injudiciously and unskilfully employed. Whether the early Surgeons were as far wrong as we are at present apt to believe, in their use of sutures, is a question not worth while discussing now. It may, however, well be remarked, that where few resources were at hand it was a necessary consequence that they would be called into operation in many cases where they would not have been applicable had better means been available. It scarcely admits of a doubt that had adhesive plasters and straps, such as we now have in use, been in the possession of the old pioneers and fathers of surgery; and had a knowledge of anatomy more perfect than had then been attained, formed a part of the education of the Surgeon, fewer wounds would have been sewed up. Could hemorrhage have been arrested by other and better practice, and the effect of position been estimated in counteracting the tendency of cut parts to separate: could the pathological differences between the condition of parts in a simple solution of continuity and one accompanied with contusion, laceration or burning, have been accurately known and their import comprehended, there cannot be a reasonable doubt that wounds would have been differently dressed.

Very early in the history of modern surgery we find the practice with regard to sutures undergoing a change. The indiscriminate and injudicious manner in which they had been employed on all occasions was renounced. But soon, from being

universally and in all kinds of wounds applied, with a degree of ingenuity and variety altogether unknown at the present day, except to those who are curious in studying out the earlier history of our science, they fell into disrepute, and, under the teachings of the ancient Academy of Surgery, in France, were described as not merely unnecessary but dangerous. I am not aware that any body at the present day entertains misgivings as to the *safety* of using them, but not a few still reject them altogether from practice for various reasons. My object in this paper will be to offer the results of my own experience of sutures.

In a large number of wounds I consider the suture dressing so much superior to the unaided use of adhesive straps that the objection on the score of increased pain would on this account alone be removed, did it not fall to the ground at once since the employment of anæsthetic agents. The surgeon is quite right to hesitate at the infliction of any additional pain on his patient unless he can assure him of sufficient advantage to compensate fully. But as Ether or Chloroform may, in most cases, be employed to prevent pain, as well during the time the dressing is going on as in the course of an operation, there can remain no shadow of force in this objection, even when scanned with regard to the patient and to his temporary and personal suffering during the act of making the first dressing. But I am not disposed to let this much used and constantly enforced argument pass with only a negative refutation. I am convinced, from close personal observation, that suture dressings are *less* painful than adhesive straps. These give great pain by the pressure they exert on the cut and bruised surfaces, and at every repetition of the dressings the removal of the straps is effected only at the expense of a degree of suffering far more severe than was inflicted by the insertion of the sutures: and this is particularly the case in parts covered sparsely with hair. While in parts where the surface is thickly furnished with hair, this must be removed by shaving, which is often as painful a process as that of inserting the sutures themselves; and is, when effected, only of temporary service, for the bristly growth which soon follows is even a greater obstacle to the adhesion of the plaster than the long hair was.

Another argument against the use of sutures is that a due

regard to position will effect the coaptation of the parts as well or better than this can be done by stitching the edges together. Position, it will be readily admitted, is of the utmost importance. But only in a co-operation with other means. It can as well obviate the necessity of adhesive straps as of sutures. By bending a limb in which the flexor muscles have been cut, the tendency to separation in the edges of the wound is lessened, but the effects of twitching and jerking are not provided against, and commencing adhesion may, at any moment be broken up, unless the parts are kept together, by more efficient means. In many cases, and in many situations, position has not the slightest influence; and in many, where it has its most perfect application, its advantages are annulled by the slightest movement made by the patient; and the difficulty of keeping a patient quiet, who is suffering under the pain of feverishness of a wound, is too well known.

But going a step farther it may be said that in many situations where position is most efficient in bringing the edges of cut surfaces together, the difficulties of maintaining them in apposition, without the aid of sutures, is even greater than in other situations. Thus, in parts which are pressed closely together when in one position, and carried widely apart when in another, as in the groin, arm pit, ham, bend of the arm, &c., it is impossible, for obvious reasons, to keep the parts in the utmost degree of relaxation by fixing the thigh against the abdomen, the arm against the side of the body, the leg against the thigh, &c., and it is even, in many cases, impossible to keep these parts steadily at any angle, in consequence of the incessant calls upon them for necessary movements. Hence other means must be employed. Adhesive straps but imperfectly effect the object, for they are deranged by the slightest movement, which alters the angle of the parts. If the angle be increased, they lose their hold, by tearing away from the skin, and then no longer keep the cut together; and if it be diminished they become relaxed and yield their hold. Similar difficulties occur in dressing stumps with straps where the amputation is near the trunk. In such cases sutures are far more effect the desired object and at the same time in position.

Again it has been urged that they

occasion too much irritation of the edges of the wound, thereby causing them to suppurate, and so counteracting the very object for which they were used. The force of this argument depends upon the prior establishment of another point. It must be first proved that the means substituted are free from all objection on this hand. Adhesive straps, I am of opinion, do create in many cases quite as much irritation as sutures. And in warm weather, and warm climates especially, are they obnoxious to this charge. If to these conditions be added the ward-atmosphere of crowded hospitals, with the want of cleanliness, fitting diet and the other circumstances attending hospital practice, which concur towards producing an irritable state of the system, they will be found to produce this effect in very frequent instances. If both are liable to the same objection, then it only remains for us to find out under what circumstances and to what extent the one plan of treatment may be substituted for the other; or which of the two should be employed under given circumstances.

When the wound is upon a limb and is in a longitudinal direction, it may be easily brought together, and the edges kept in apposition by adhesive straps, because neither the movements of the parts or the muscular contractions tend to draw them asunder. The only, or the principal force to be overcome, is the contractility of the skin. This is easily counteracted if the skin is still attached to the firmer parts beneath, and it may be effected by adhesive straps. But if the attachments of the skin have been extensively disturbed, straps no longer answer the purpose. They easily relax their hold under the retractile action of the skin, and the edges of this tissue having support neither from within nor without, curl under, so as to offer surfaces incapable of contracting adhesion, even when they are made to touch each other. Under these circumstances the protracted use of the adhesive straps irritate the surface to which they are attached, and abrasions, eruptions and often suppurations occur. I am of opinion that the Erysipelatous inflammation of the skin and cellular tissue, which not only prevents the formation of adhesions between cut surfaces, but often melts down and destroys those which had already formed, is due in a great many cases to the irritating action of the plasters.

I prefer using sutures, therefore, whenever the skin is exten-

sively separated from the adjacent parts. The practice is common enough in cases of wounds of the head. The rules which make them admissible there, are applicable, and sometimes even with additional force, to similar wounds in other situations. It is scarcely possible, I apprehend, where the flap of skin is angular or cut into slits or shreds, to bring the parts into accurate coaptation without sutures.

For extensive and penetrating wounds of the abdomen, abundant authority for the use of sutures is at hand. Similar reasons will justify their use in analogous parts on different portions of the body, as on the testicle.

In speaking of *position*, it was remarked that many parts could not be maintained in place by that means alone; as for instance, where the wound was in the groin, arm-pit, &c. Here adhesive straps are equally out of place, and sutures alone answer the purpose. The case is strengthened in favor of sutures, if the parts are liable to moisture, (as most of these parts are,) which presents an insuperable obstacle in the way of procuring firm and tenacious sticking of the plasters. This objection against the use of adhesive plasters, is, indeed, of far more extensive application than this. Those who so uncompromisingly abuse sutures, would, if they were ingenuous, admit its force. In every wound there is moisture; first the moisture of blood, then that of serum, then that of pus; and daily, after the first dressings have been removed, there is the moisture of warm water. From one or other of these causes, it is often exceedingly difficult to get the straps to adhere at all, and still more often to keep them in place after the dressing is done. Hence, let the edges be ever so nicely adjusted at the time of putting on the straps, but a short time will elapse before they lose their hold on the skin, and the parts are left to gape asunder, to the utter frustration of all attempts at reunion, by any other than the slow process of granulation.

The advantages of sutures in situations where there is much motion and moisture, and their entire freedom from most objections, except that of the pain they inflict, is well illustrated in their effect upon the lip, after operations or accidents there. Adhesive straps are perfectly inadequate to keep the parts in coaptation, and the sutures which are resorted to, ~~al~~

painful and irritating of any that are in use, never produce any but the most satisfactory results.

In anaplastic operations, the practice of those who have been most successful in these delicate manipulations, is in accordance with the views here taken of the general use of sutures. Adhesive straps are not relied on—for the unanswerable reason that they cannot keep the parts closely and steadily enough in apposition. It is necessary, in order to obtain union between parts so absolutely separate, that no motion of the slightest degree be allowed, and that the coaptation and fitting of the newly carved and newly brought together parts, be steadily, closely and permanently maintained, 'till time for this to take place has been allowed. By general—by universal consent, sutures are selected as best adapted to effect this object. How could they answer this purpose, if, as many persons allege against them, they occasion inflammation and suppuration of the cut edges? Their application, under the circumstances alluded to, by the universal consent of all those who have been considered as the inventors or the most successful appliers of this new branch of surgery, is the most irrefutable argument both against the danger of sutures and in favor of their usefulness, that can be imagined.

A more extended examination into the applicability of sutures to other kinds of wounds, and to wounds in other situations and under other circumstances, would furnish ample material for sustaining the views I have been advocating; but as this would only be to elaborate an argument which appears to be most plainly and forcibly put in the illustration afforded by anaplastic operations, it may be dismissed where that illustration leaves it.

I will go on to state how I think the only plausible objection against sutures (the objection which I have shown is equally applicable to adhesive straps) may be, to a very considerable extent, removed. The means to which I refer has been sufficiently tested by actual and repeated experiment, to allow me to speak of it with confidence. I allude to the use of the deer sinew thread for the substance of the suture. In an article published in this Journal some months since, (September, 1847,) the deer sinew was recommended as the best substance which had been tested for making ligatures for arteries. Many cases were detailed, in which it had been employed for that purpose

and also for sutures. I will not now do more than refer to that article, and cite the second and third conclusions I drew from the facts and reasoning there spread out. 1. "That they produce less inflammation of the living tissues with which they are placed in contact, during the time they remain as foreign bodies, in these tissues, than other substances." 2. "That they are susceptible of being absorbed and carried away by the action of the living parts in the midst of which they are placed." I will also extract the following passages from one of the cases related. At page 505, (South. Journ. Med. and Pharm., vol. ii. No. 5,) the case is thus related: "A boy employed as a wheelwright, was engaged in chopping, with the adze, a piece of wood which was on an elevation alongside of him. The tool slipped and wounded him in the calf of the leg. A cutaneous branch of the posterior tibial was cut, and required a ligature. I used the deer sinew, and clipped the ends close to the knot. The wound was then brought together by four interrupted sutures, also of deer sinew. Those used for sutures softened when oozing from the wound commenced, and soon began to have a macerated appearance. Where the moisture was most abundant, this was most perceptible, and soon the texture and substance of the sinew began to be removed; so that after a time (varying in proportion to the quantity of moisture) an entire segment of the circle of the suture was removed, and the knot dropped out, just as if the scissors had been employed for the purpose. On examining these, no doubt could remain as to the manner in which the separation had been effected. The knot was perfect, and therefore some destructive power must have been in operation, capable of breaking down and removing the animal matter; and from the jagged, uneven and shredy appearance of the separated ends, it seemed positive that the absorbents must have been at work."

Acting upon the views above stated, I have been in the habit of using sutures rather freely in the treatment of such wounds as are in the proper circumstances for healing by first intention, as well as others, which though not likely so to heal, may have their exposed surfaces lessened by being kept close together. After amputations, I bring the flaps or edges together by a few

stitches, using animal threads, and assisting the stitches by adhesive straps in the intervals.

This plan of dressing stumps is recommended, I think, by the greater freedom which is allowed for the flowing out of the humours. Fewer straps being required than when the sutures are omitted, there are larger spaces left through which moisture may find its way out; and when there is so much moisture about the wound as to detach the straps, the sutures are still there to keep the edges together.

By allowing free vent for all fluid, whether blood or pus, one of the greatest sources of pain and uneasiness to the patient, after the first few hours from the amputation have passed, (*viz.:*) the accumulation of such humors, is effectually prevented. That tension, so common about ten or twelve hours after an amputation, and so painful to the patient, causing fever and all its consequences, where the lips of the wound are perfectly closed and firmly pressed together by adhesive straps, is effectually avoided. All oozing passes out at once on the dressings, instead of being retained within the wound, to the infinite suffering of the patient, and the effectual prevention of adhesion between the surfaces. With the free openings which the sutures leave, and the careful adjustment of a compressing bandage, these parts are placed in the most favorable circumstances that can be imagined for acquiring adhesion by the first intention. Should this fail to take place, and the sutures relax their hold, by being absorbed, or be cut away when no longer useful, the soreness of the wounded flesh is then so much worn off, that it may be handled and compressed by straps, without inflicting such suffering upon the patient.

Another recommendation in favor of the plan of dressing stumps here advocated is this. In amputations of the thigh and arm the most careful adjustment of the straps cannot prevent the pressure being made in such a way as to give the bone a tendency to protrude. The immediate action of these bands, when drawn tight enough to effect, most perfectly, the double object of keeping the edges of the cut, and the faces of the raw surfaces together, is at the same time to press the whole of these parts backwards so that they are brought with force against the projecting end of the bone. If sufficient care has been taken to



guard against the extremity of the bone presenting at the lips of the wound, still it is left with no other covering than the skin, and if any accident should cause this to slough, exposure of the bone at once takes place.

This condition is particularly apt to occur in cases where the amputation has been performed for old chronic disease, when the patient is emaciated, and when the cellular tissue, deprived of its fat, leaves nothing for the flap, after the retraction of the muscles, but their skin. Under these circumstances, unless the extent of the flap has been most carefully calculated, the same difficulty is experienced even where there are two bones. And further, in such cases I have often seen much trouble and delay result from the curling under of the edges of the skin, as mentioned above. Both of these difficulties are effectually guarded against by carefully adjusting the edges of the wound and confining them by a few sutures. The adhesive straps may then be applied so as to relieve the parts of a portion of the traction exerted by the stitches and at the same time to act in concert with the compresses and bandage in pressing the faces of the wound together.

I am of opinion that a large number of the cases of exposure of the bone, after amputations, take place from the cause alluded to. This opinion will not, perhaps, appear altogether unfounded, if it be remembered that any deviation from the exact proportions which the flaps ought to possess, either in excess or deficiency, tend to produce this result, when adhesive straps alone are relied on, unless they are applied with the utmost skill and care.

Farther illustration of the views above expressed would follow from a more extended review of the character of the wounds resulting from amputations, and of the plans employed by different Surgeons of high authority in treating them. But it has been my object principally to express what has occurred to myself. These opinions have been arrived at in opposition to preconceived notions, for they are not such as accord with the French School of Surgery. I offer them, however, with confidence, and rather than lengthen this paper unnecessarily, will extend it no farther than to select promiscuously, a few passages from some of the recent authorities on these subjects, confirmatory

of them;—extending the reference no farther than to those which happen to be at hand.

Bell's opening sentence is so much in point that I cannot refrain from quoting it. He says :—"As sutures of one kind or another are found necessary, not only in every large wound, but in almost every operation of importance, the consideration of this subject seems first to require our attention."—(*Benj. Bell System of Surgery.*)

"Some object to stitches in the dressing of wounds, on the ground of the additional pain and irritation they occasion ; but I am firmly convinced, from considerable experience, that the pain is amply compensated for by the security they give, and the irritation seems to me considerably less than that caused by the farrago of straps and bandages, often employed instead."—(*Fergusson's Pract. Surg., Norris, p. 43.*) Describing amputations, of the first joint fingers he says at p. 242 :—"And in both a single stitch will suffice to keep the edges in contact." Of phalanges, one or more, p. 243—"The opposite surfaces should be kept in apposition by means of a couple of stitches." Of the fore arm, p. 253—"The flaps may next be laid together and retained by means of three or four stitches." Of the arm, p. 250—"The flaps should then be brought into contact and kept in apposition with four or five stitches."

Velveau says :—"This method, used by Pigray, Wiseman, Fabricius de Hildanus, Sharp, &c., with a view of holding the integuments firm together, has been especially lauded, in latter times, by Hey, M. Benedict, of Breslaw, and by Delpech, who asserts that he has derived the greatest advantage from it ; at Montpellier they scarcely ever dispense with it in amputations." "For more safety and to relieve the threads, we may also, after the manner of Delpech, place some adhesive straps between them. If the employment of the suture, of which we are speaking, was not necessarily accompanied with much severe pain ; if the union of the teguments was the most important part of the operation ; and if the plasters did not effect the same object when they are properly applied, there is no doubt that it would have been long ago adopted, but the contrary being generally admitted, every thing induces us to believe that for the future, except in a small number of cases, the adhesive

plaster will continue to be substituted.”—(*Mott's Velpseau, vol. 1 p. 57.*) At p. 350 of the same volume he says:—“The partisans for and against it have both exceeded the limits of truth. If the suture does not merit the praises which were formerly bestowed upon it, it merits still less, perhaps, the disuse into which it has in our days fallen. The only well founded objections that can be urged against it, are that of augmenting the pain, and prolonging the operation; but it is only necessary to have been a witness to what takes place in hare-lip, staphyloraphy, rhinoplasty, genoplasty, chrioplasty and enteroraphy, to be convinced that these inconveniences have been exaggerated. In these kinds of unions, neither the pain nor the inflammation are the objections; and the practitioner would be too fortunate if he had no other difficulties to overcome or combat. As to the greater duration of the operation, who would venture to make a serious objection on that account, if the suture had the advantages that were attributed to it before the time of Pelrac and Louis?”

“To speak emphatically it is requisite that we should remark, that *the suture is not in reality dangerous, as the ancient Academy of Surgery pretended, but only that it is useless in an infinity of circumstances, and scarcely ever indispensable.* It is only indicated in wounds in which we desire immediate union; there are, also, in these kinds of lesions a great number of cases in which it might be dispensed with, without inconvenience, as there are also others where it is totally impracticable. Preferable to all kinds of bandages and plasters, where we wish to keep in coaptation large flaps, moveable or badly supported integuments, membranous or very delicate organs, it would give but little assistance in wounds, with firm lips, abundantly supplied with cellular tissue, and which penetrate the thick muscles of the limbs or trunk, and the edges of which follow only the movements of the subjacent parts.”

“With the suture no pressure is necessary; we may dress lightly and afterwards dispense with any traction upon the teguments in the neighborhood; the coaptation which runs no risk of being displaced, is effected through the whole thickness of the bleeding borders. With adhesive straps, or bandages, we produce more or less irritation upon the skin: the contact is rarely perfect and should the cutaneous surface be somewhat

flabby and detached, the lips of the wound constantly tend to roll up inwards, and do not touch but upon that part of their line which is nearest approximated to the epidermis ; the least effort, the least imprudence causes them to be displaced, and all the regions of the body do not permit of their application. We do not see, in fact, how, in case of strangulation, it would be at all more difficult to relax or divide a stitch of the suture than an adhesive strap or a piece of linen. Without, therefore, conceding as much favor to this remedy as Delpech, M. Gensoul, and the greater part of our Surgeons in the principal towns in the South of France do, whose views M. Serre (*Traité de la Réunion Immédiate, &c.*, Paris, 1830) has so correctly embodied, I think, with this last author, that it deserves to be reinstated to a certain degree of consideration in surgery."

I need not apologize for the rather unreasonable length of this extract from the highest of French authors, since it affords such exact and forcible support to the views I have advanced ; and since it furnishes me with the favorable testimony of an open opponent of the use of sutures, extorted as it were against his will by an overpowering sense of justice.

Chelius rejects the suture altogether in dressing his stumps. He says "union of an amputation wound with sutures I consider injurious."—(*System of Surgery, translated by South. vol. 3, p. 646, Philadelphia Edition.*) But his accomplished translator is less decided. He says, in the paragraph immediately following the one just quoted : "I do not think it of much consequence whether sutures be used or not in bringing the edges of the wound together ; sometimes I use them, sometimes not, as I feel disposed at the time ; but I have never seen any inconvenience arise from their employment, and therefore the Surgeon, I think, may use his own discretion, in regard to them." But further on, in describing exarticulation of the thigh at the hip, Chelius himself says : "The wound should be brought together with sutures and strips of plaster," &c.

Liston thus describes the manner of dressing a stump: "After six or eight hours, as already stated, any clots that have formed are to be taken away gently, and the glazed edges of the wound are then brought accurately and neatly together by the adhesive composition recommended at page 132, *supra*,—with the dif-

ference of being spread upon slips of oiled silk, which I have found more pliable, and altogether preferable to the glazed ribbon. Interstices are left for the sutures and the ends of the ligatures, and the latter may now be abridged slightly. This mode of keeping the edges in contact I can confidently recommend from experience."

Sabattier remarks: "There are certain wounds which require sutures. Examples will be seen when we speak of penetrating and simple wounds of the abdomen, of those made by obtuse bodies striking the head and separating flaps of those resulting from the operation of hare-lip and the excision of cancer of the lower lip. Others may be met with, particularly among those which have flaps; but the sutures ought always to be assisted by position and the bandage."—(*Médecine Opératoire*, edited by Sanson & Bégin, vol. 1, p. 423.) I have cited this passage from Sabatier in consideration of the judicious remark he makes with regard to wounds having flaps. To follow him farther would lead to times when stumps were filled up with lint and made to suppurate.

One or two extracts from Lisfranc's long and interesting article on the subject of sutures, in his "*Précis de Médecine Opératoire*," will conclude this paper, already much longer than was at first intended. At page 560, (4th livraison,) he says: "The inflammation, the suppuration caused by the presence of needles or of threads in the thickness of the flesh are rare." "The reproach has been made against sutures that they tear the lips of the wound, thus producing ugly cicatrices: if the solution of continuity be attentively observed, if but a small quantity of the sub-cutaneous cellular tissue be embraced by the needles or the thread, when the borders of the division are not too thick, and the perforation of the muscle is only superficial, this reproach, which has been much insisted on, is unfounded; for it is rare that they cut the flesh extensively--and besides, as the commencement of this may be seen, the suture may at once be cut: it has already done something towards immediate reunion, and bandages or adhesive straps, or both together, obtain a result quite favorable, and superior for wounds of the face, to what would have been obtained, if the plasters or bandages had been exclusively applied at first."

“I think that the application of the bandage will produce inflammation not less frequently than the presence of the threads or needles in the thickness of the tissues.” “It is certain that if the wound is not too deep, the interrupted, twisted and Rigal’s sutures keep the borders in more perfect contact than adhesive straps.” “When the skin is thin, soft and dissected, it may roll on itself, if the plaster, the bandage, or both together are used; here the needles or the threads are preferable.” “If the wound is situated where either involuntary or indispensable movements must necessarily take place, the adhesive straps may get displaced, and not fulfil the indication; as for the bandage, it will fail, though not so frequently. Here again the object of obtaining immediate union, should cause a preference to be given to the suture.”

Farther extracts to the same effect might be made from Lisfranc’s work, but those already spread before the reader, will suffice to show that similar views were entertained by the distinguished French surgeon, both as to the positive advantages of the suture, and the utter futility of the objections urged against it, to those I have advocated. There are several other works, both from French and English pens, which might be made tributary to the same end; but my object has not been to argue out the cause of sutures, but only to add the mite of my experience in their favour.