THE NON-TOUCH TECHNIQUE

WITH SPECIAL REFERENCE TO THE OPERATIVE TREATMENT OF SIMPLE FRACTURES

BY

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When Arbuthnot Lane (1894) first advocated the extended use of internal fixation in the treatment of simple fractures he insisted on a scrupulous aseptic technique. A technique founded on his original suggestions has become the routine practice of a large number of surgeons for every operation with the exception of those—e.g., abdominal operations—in which the introduction of the gloved hands into the wound is necessary. This is now known as the "non-touch technique," an essential feature of which is that a gloved finger is never allowed to come in contact with the wound or with anything introduced into it. When surgeons speak of the non-touch technique do they all mean precisely the same thing? The answer must, I think, be in the negative, particularly if the details are examined minutely. Assuming this view to be correct, it occurred to me that it might be useful to describe in detail the precautions which many surgeons consider advisable in every operation. It cannot be too strongly insisted that the scrupulous care inherent in this technique should not be regarded as called for only when a simple fracture is plated. If the precautions are accepted as advisable, even imperative, for the internal fixation of a fractured bone, they are surely advisable in every operation, with a few well-recognized exceptions.

The reason for the technique is that gloves are unreliable and cannot be guaranteed against perforation, particularly if forcible use of the hands is necessary. The technique and theatre routine described below are approximately those which, under the inspiration and guidance of Arbuthnot Lane many years ago, became the general practice of the surgeons working at the Hospital for Sick Children, Great Ormond Street. The same or a closely similar technique is now the routine practice in many other hospitals. Scrupulous attention to detail by all concerned with the operation is essential.

Theatre Routine

The skin over a *wide* area should receive a double preparation, with an interval of some hours between them, before the case is taken to the theatre. On the table the part is again painted with a solution of iodine or other preparation. The operation area is surrounded by a generous supply of sterile mackintoshes and towels, the latter being firmly clipped together and to the skin. If it is necessary to palpate the part before making the incision the skin is covered with a sterile towel or a swab consisting of several layers of gauze.

All instruments, swabs, etc., are dry: no germicide is used except that in which ligatures and suture materials are normally kept. Dissecting forceps, artery clips, retractors, and, in fact, the instruments generally, are long, so that the hands are kept well away from the wound. The theatre sister holds an instrument with forceps when passing it to the surgeon, or at any rate carefully avoids touching "the business end." All needles are threaded with the help of two pairs of forceps, and are passed to the surgeon gripped in a needle-holder. Ligatures, if used at all, are touched only with forceps and scissors and they are tied with forceps. Swabs, preferably of dry gauze, are never handled by anyone: all swabbing is done with forceps. The chief assistant is never without a pair of dissecting forceps in one hand for this purpose. Instruments used for any length of time, or forcibly, are resterilized. The knife employed for incising the skin is discarded, and a fresh knife taken for the deeper dissection. When the bleeding vessels have been secured and the wound is dry, the cut edges of the skin may be painted with iodine solution. Towels, tetra-cloths, or "veils"—call them what you will—are clipped *over* the edges of the wound, special care being taken at the extremities of the incision, to exclude the possibility of any instrument, suture, or swab coming in contact later with the raw edges of the skin. Experience shows that it is necessary to stress this point: it is the cut edge and not the surface of the skin which is the special danger. If the wound is large, towels may be used; if smaller, a sheet of close-mesh butter muslin is more convenient. I prefer specially prepared sheets of waterproof batiste between layers of muslin or gauze for this purpose. Lane insisted that the skin-edge clips should be long and heavy, so that they lie well away from the wound. For the vessels he preferred the Mayo-Ochsner type of clips, which are not only long and heavy but are powerful enough to crush the vessels and make ligatures unnecessary for any but the larger vessels. For feeling, blunt dissection, etc., a Buchanan's dissector is a most useful instrument. A needle-holder is indispensable: all sutures, including those in the skin, are tied with this and a pair of dissecting forceps.

In the open method of fracture treatment there is one, and only one, additional precaution to be taken. On a table beside the instrument table is a small sterilizer, the water in which is kept on the boil throughout the operation. All drills, screws, plates, nails, wire, etc., are left in this till required. Screw-holders, plate-holders, screw-drivers, etc., shortly before use are transferred from the instrument table to the small sterilizer, the handles projecting over the edge. After use on each occasion these instruments and the drill are returned to the sterilizer till again required. The business ends of the drill and screw-driver are returned to the boiling water after the insertion of *each* screw. In short, any non-absorbable foreign body that is to be left in the wound, and every instrument that comes in contact with these, is guarded from air-borne infection so far as is possible.

Points in Fracture Treatment

Before deciding to operate on a closed fracture that cannot be satisfactorily dealt with by other methods, the surgeon should never fail to ask himself these among other questions: Is this a reasonably easy carpentering job? If I tackle it, have I a good chance of achieving something approaching anatomical perfection? Is there enough accessible bone on both sides of the fracture for the number of screws necessary to maintain the position securely? If not, can the fragments be held securely by some other device?

A few other points may be mentioned. The best period during which to operate on a simple fracture is, in my opinion, the second to the fourth day after the accident. This gives the patient time to recover from the injury, and the surgeon time to make the necessary arrangements for the operation and to have the patient's skin carefully prepared. Two assistants are necessary besides the sister in charge of the instruments. Lane insisted on a generous incision giving free access to the fragments, due regard being paid to the avoidance of damage to important structures. He stripped the periosteum from the bones, and this certainly facilitates exposure of the bone ends, the clearing of clot and muscle, and the reduction of displacement. It is questionable whether stripping the periosteum is altogether wise, and some surgeons prefer to do as little of this as possible. The subperiosteal operation gives rise to less bleeding in a *recent* fracture. Retraction of muscles is achieved with long levers, the curved ends of which are slipped beneath the bone. Lane's tapered lever with serrated edges ("rotating instrument") is useful between the fragments for sliding one on the other and overcoming shortening.

In a transverse fracture, angulation of the limb at the site of fracture till the ends of the fragments engage, followed by straightening the limb, used to be of value more often than it is in these days of orthopaedic tables with facilities for mechanical extension. Peter's lion forceps (double- and single-claw), with a screw to lock the handles, are invaluable for holding the fragments in place while the screws are inserted. When difficulty is experienced in preventing the fragments from slipping, and particularly when a third fragment of some size is present, it may be helpful to include the plate as well as the fragments in the grip of the forceps. The plate must be bent till it accurately fits the surface to which it is applied.

There must be no spring exerting a pull on the screws. Plates should, if possible, be applied to a surface of the bone that is covered by muscle, and they must be stout enough to make bending or breaking improbable. Drills must correspond to screws: soft or cancellous bone calls for smaller drills than hard bone. Lane advised that screws should pierce the distal compact bone only in young children. Particular care has to be taken that the drill-holes for the first two screws correspond with the centres of the holes in the plate, or the fragments may be slightly distracted—an undesirable though fortunately not necessarily a fatal fault. Screws should be driven home tight. The number of screws inserted in each fragment *must* be adequate for the work they have to do. For the femur, at least four screws in each fragment are necessary; for the tibia three screws; and for the radius and ulna two screws in each fragment. One of the commonest mistakes is the use of too short a plate and an insufficient number of screws. Another common fault is inadequate post-operative external splintage, or, if adequate, not maintaining this splintage long enough. These errors all lead to undue strain on the screws, which become loose, with disastrous results. It is not always remembered that with internal fixation of the fragments callus is reduced to a minimum, and in many cases no provisional callus whatsoever is formed. External splintage is necessary for a longer period, if the shaft of a bone is involved, than if a fracture is treated without operation, the apposition of the fragments being equally good in both. In the forearm the fragments may be sufficiently stable when placed in apposition to make a plate unnecessary.

The Vitallium Screw

Vitallium screws, long enough to pierce the cortex on both sides of the medullary canal, are coming into fashion, and some surgeons are showing an inclination to rely entirely on them, no splints of any kind being used. This tendency must be watched: careful judgment is necessary if disasters are to be avoided. Incidentally it is my opinion that the introduction of vitallium should not be regarded as the solution of all our troubles. Great care to guard against sepsis is still just as necessary as it was. I consider that trouble with plates and screws points to a faulty technique on the part of the surgeon. Screws become loose because they are subjected to too great a strain or because they are infected, or both. The theory of electro-chemical irritation around a steel screw is attractive but not very convincing. How do the supporters of this theory explain the by no means rare experience of finding, when removal of steel screws is called for long after their insertion, that one screw is loose while its neighbour can only be removed with the help of a screw-driver? The thread of the vitallium screws reaching this country seems to be quite unnecessarily fine: a coarser thread would, I think, be an advantage. Wires and bands around the shaft of a bone are to be avoided as a rule. Wire rarely affords adequate fixation in the shaft of a bone: disasters following the use of wire are fortunately less common than they were. Parham bands, an attractive device for an oblique fracture of a shaft which is of even diameter in the region of the fracture, are dangerous. If used at all they should be removed later. In the absence of all obvious signs of infection a circular line of absorption of the bone may occur beneath the band, and as there is no sub-periosteal callus formed whatsoever, this may weaken the bone to a dangerous degree.

There are definite indications that the pendulum, which I think had swung rather too far from operative to non-operative methods of treatment for simple fractures, is swinging back towards the more extended use of internal fixation. This tendency will need careful watching, or the pendulum may again swing too far.

Finally, I venture to remind my readers that cutting down on a simple fracture is not an operation to be lightly undertaken by any surgeon. Like many another specialized operation, it is a justifiable procedure only in the hands of a surgeon with the necessary training and, above all, one whose technique is above reproach.

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SURGICAL AMPUTATIONS AND THE FITTING OF ARTIFICIAL LIMBS

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I would like first to express my indebtedness to the Ministry of Pensions, including all the surgical, medical, and technical officers, for granting facilities to make use of the data and information collected in the past 25 years, and in particular to Dr. R. Langdale-Kelham, the senior limb-fitting surgeon to the Ministry, with whom I have worked for some time and who has given me the opportunity of studying the question of fitting of limbs in detail. It is hoped the information and suggestions incorporated in this paper may be of some service to surgeons and possibly to amputees.

Amputations and Rehabilitation

Amputations have been recorded in many surgical textbooks over a number of years, particularly since the advent of aseptic surgery. The types and sites of similar amputations have varied, with the result that a difficult problem is left in many instances for those called upon to supply the prosthesis. It is stated that a good limb-maker should be able to provide a suitable prosthesis for any type of amputation, whether following a surgical operation or due to a congenital deformity. This is quite true, but it is definitely established from results of limb-fitting during the past 25 years that only certain lengths and types of stumps render the amputee free from further surgical attention. Also, latterly the artificial limb has been improved and re-designed to cause less strain and give more comfort to the wearer.

When an amputation is performed upon any limb it starts a new phase in the life of the amputee. He must rehabilitate himself, and rehabilitation is obtained only by co-operation between the patient, surgeon, and all responsible for the treatment of the stump up to and including the actual fitment of the prosthesis. There are three main objectives: first, the surgeon should provide a stump which will not require any further surgical attention; secondly, the nursing staff and others concerned should treat the stump by correct bandaging and exercises, so that it may be fitted in the shortest time with a prosthesis of a design suitable for the patient's future work; thirdly, the patient should be taught to use the prosthesis correctly to enable a speedy return to his original work or some other suitable employment, and so remove the fear of being styled a "cripple."

With the exception of Service cases from the last war it can be stated generally that surgeons have not been able to follow up and watch closely the results of amputations they have performed. Once the operation scar is healed the amputee leaves the hospital with little instruction upon the care of the stump or of the prosthesis he obtains. If the stump breaks down for any reason the amputee consults his own doctor, who may have had little experience in the treatment of such cases.

During the latter part of the war of 1914–18 the Ministry of Pensions set up an organization, with its main centre at Roehampton and 17 centres in the provinces, to provide all Service amputees with prostheses, to supervise the fitting, and to repair broken or worn parts. A very important feature was the regular inspection of the amputations, with the appropriate treatment when required. Records of this work were carefully summarized, with the result that valuable information was obtained, as I shall attempt to show.

Above-knee Amputations

Weight-bearing.—Nature has so developed the human body that, when walking, the weight is borne by the foot, and when sitting by the ischial tuberosity. If the lower limb is amputated at any level the weight ought therefore to be supported by the ischial tuberosity. About 20 years ago most amputees took the weight upon the end of the stump, but within five years over