

FOUR-DAY COURSE ON PROSTHETICS, AMPUTATIONS AND AMPUTEE REHABILITATION

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Many articles have been written in the various physiotherapy journals on amputations, which shows that this is something that has worried us all at some stage. In the course given by Dr. J. Kolbye and Mr. E. Linquist from Copenhagen, ideas were expressed and exchanged in the attempt to find the best way to approach this problem as a team.

The greatest impression made on me by this course was the possibility of good team work as is practised at the Copenhagen hospital, which can only be to the patient's benefit. The importance of the patient in this team was stressed with the other members playing an equal role in the final rehabilitation of the patient.

Without intense pre-operative management, good surgery and a well fitting limb, the chances of a patient returning completely to society were slim. The Surgeon, therapists and prosthetist work in close harmony, and it is found that soon, they are able to interpret and anticipate one another's wishes. Many of the fields in the treatment of the patient overlap, and by the interaction of the team, the patient's rehabilitation is achieved smoothly and much sooner than would have otherwise been possible.

The surgeon must decide on the site of amputation, bearing in mind that the longest **functional** length is desirable. Ideally, the stump must be endbearing and well shaped to be able to fit snugly in a total contact socket. By **functional length** is meant the ability to manipulate a prosthesis in as normal manner as possible with well balanced muscles surrounding the stump and mobile joints.

Because of the need to preserve as much of the limb as possible, great strides are being made in the assessment of the viability of the skin. Arteriographs do not give accurate measurement of the skin circulation which is important in the healing of the stump. At a special centre in Copenhagen, patients are referred for tests to determine the state of the circulation. One of the tests is done by means of radio-isotopes which give an indication of the blood flow through the skin at various levels. It has been found by experience that a diastolic B.P. in the skin of less than 30 mm Hg will not allow healing of ulcers, while pressures of 40-50 mm Hg will ensure good wound healing.

Before surgery is performed, intensive pre-operative treatment is given. This is considered to be one of the most important physiotherapy periods when the patient is prepared for final rehabilitation. Strengthening and mobilising exercises to the body as a whole are given to prepare the patient for early weightbearing. This can be achieved by individual strengthening programmes using P.N.F. techniques as well as twice-daily ward classes.

The affected leg is exercised as well to gain maximum strength of muscles which will be required to manipulate the prosthesis. This is even more important in the vascular patient who has been incapacitated for some time by pain and ulceration. Positioning of the affected leg and mobility exercises are given to prevent de-

formities, while Buerger's exercises are used to attempt to improve circulation. It is important that patients do these exercises on their own during the day, and continue them long after discharge. A modified form using active exercises while the limb is in the dependant position may be advocated as it is said to increase the circulation even more.

During this stage, which is obviously longer in non-traumatic cases, team work is in evidence. The psychological preparation of the patient is the duty of both surgeon and therapist, although a greater load will be thrown on the therapist who is with the patient for longer periods during the day. She will have to assist in preparing the patient for the amputation, allay his fears and help him to look forward to a more normal life in the case of vascular insufficiency, where the patient has been immobile and in pain.

It is also important to control infection prior to surgery and any metabolic complications should be treated. This will include medical treatment of diabetes, cardiac failure and similar problems as well as anti-coagulants, hyperbaric exposure, and correction of N and Hb deficiency to improve the vitality of the skin.

It is imperative for the social worker to meet the patient as early as possible to see whether any alterations will be needed in the home. In Copenhagen, the therapists are responsible for visiting the homes to recommend widening of doors, replacement of stairs with ramps and other adaptations to help the more handicapped patient achieve independence. These alterations are paid for by the centre with apparently no difficulty!

Immediate fitting of a prosthesis is favoured for almost all the amputations done. It has been found that the rigid plaster cast applied in theatre has the following advantages:

1. Improves the healing of the wound.
2. Decreases post-surgical oedema.
3. Minimises pain — most patients report very little pain after 24-48 hours.
4. Gains maturation of the stump at an earlier stage.
5. Allows early mobilisation and the fitting of a permanent prosthesis. Within 4 weeks of amputation, the measurements can be made and by 6 weeks the permanent prosthesis will be available.

With the more conventional treatment of securing the dressing with a crepe bandage, the bandage will not stay in place for more than a few hours. The tendency to slip can cause strangulation of the stump with oedema formation distally resulting in a wait of several months for stump maturation. This method can also lead to pressure being placed on one point of the stump, especially with the through-knee amputation, as the patient will attempt to hold the limb in a position of comfort. This pressure can lead to ulceration which will delay the rehabilitation of the patient. The rigid cast, on the other hand, will distribute the weight more evenly and prevent this complication.

The rigid cast consists of two sterile stump socks, adhesive padding and plaster of paris. The inner sock is put on carefully and holds the dressing in place, after strips of padding are in place to relieve pressure on bony points, the outer sock is applied around which elastic plaster of paris bandages are used as they are easier to apply with even pressure. At this stage the surgeon moulds the stump and prevents traction on the scar.

When the rigid cast is in place, a connecting mechanism for the shank and foot piece are added before the patient is returned to the ward. Twenty-four hours later the patient is allowed up in the parallel bars, with only minimum weight being taken on the stump. Patient is walked twice a day in the bars which can be progressed to elbow crutches after one week in the younger patient. With older patients the progress is slower although most of the amputees will be fitted with their permanent prosthesis by six weeks in the absence of any secondary complications.

The early fitting of a prosthesis is obviously a psychological boost to the patient. The young patient will be able to return to his work and hobbies sooner than with the conventional method of treatment, while the geriatric patient will be more easily motivated. It will also give the team the opportunity to assess the patient's ability to handle a prosthesis, a chance which every patient should be given.

Too often we have seen the elderly patient who was co-operative and enthusiastic in the ward, lose the will to persevere. He is sent home at a fairly early stage due to shortage of beds and must attend weeks of outpatient treatment where he will be taught to walk with crutches, which he often finds very difficult. Coming of his stump is usually necessary which need not have been so if a rigid cast had been used.

By the time that his stump is suitable for the fitting of a limb he has often accepted his fate and resigned himself to a life in a wheelchair. Often a pylon with an open socket is first given, making it difficult for the patient to manipulate. Such a pylon, when not well fitting and giving total contact, feels heavy to the patient, and he finds it awkward to use.

If he had been given the opportunity to walk with a prosthesis in the early stages, he would probably have found this much easier. His balance would not have been so disturbed, walking would have been less of a strain on his arms and remaining leg and he would have been conditioned into accepting the prosthesis as part of himself.

The Geriatric Amputee

The earlier the team goes into action, the better the chances of final rehabilitation. As the age of the population rises, so will this problem increase, and these geriatric amputees must be given every opportunity to achieve independence.

It has been found that in a unilateral above-knee amputation there is a 50% chance that the patient will use the prosthesis. As this patient suffers from vascular disease, the chances of his losing the other limb are high, which makes it imperative to attempt to get him mobile. A bilateral below-knee amputee is very likely to achieve a functional gait while the bilateral above-knee patient is never likely to walk unless he is strongly motivated.

In the handling of these elderly amputees, every effort is made to ensure that the patient will be able to continue living at home. This often necessitates altering the home and the limb unit will arrange for daily outside help if this is deemed desirable. Although these patients are given a wheelchair automatically, it has been found that this does not alter the number of patients who make use of their prosthesis. In the early post-operative care the patients are allowed to spend as much time in their wheelchairs as they do in prone lying, which reduces the likelihood of flexion contractures.

The type of prosthesis made for these patients does, however, present some problems. Although the same basic principles apply in the manufacture of the limb, certain modifications are nearly always necessary. Suspension belts and straps must provide maximum comfort and simplicity of application is essential. These amputees often find that the total contact or suction socket is too difficult to get into, and an easier method has to be found. As the patient is also weaker, the limb must be as light as possible, and although this will mean the replacement of the more intricate and heavier components, it will allow more use of the leg.

The patient must feel secure in the limb as there are often associated problems such as joint damage and poor vision which will retard rehabilitation. The prosthesis is therefore built with extra safeguards which may lead to abnormal gait patterns. For example, a locked knee is usually necessary which will cause the patient to go up on his toes to clear the limb, but this is preferable to a better gait which is seldom used.

Through Knee Amputation

This was considered the most useful operation if the knee joint could not be saved. It has not been used as frequently as its advantages would seem to suggest as the fitting of a cosmetically acceptable prosthesis had been a problem for many years.

The through-knee amputation provides a long functional stump, with perfect muscle balance and is fully endbearing. It is ideal in children especially when it is remembered that 80% of growth of the femur occurs at the distal epiphysis. It should also be used in vascular cases where the chances of loss of the other limb are high.

During operation the patella tendon is secured to the remnants of the cruciate ligaments and the scar comes to lie centrally and posterior which will allow full endbearing. As the stump gives a wide surface for weight bearing, pressure areas are rare while the bulbous end of the stump allows for good suspension of the prosthesis.

Fitting of a prosthesis has been made easier by the newly designed polycentral knee joint which allows for a more normal gait pattern. The conventional knee mechanism will increase the length of the upper segment of the limb and necessitates medial and lateral side stays, thus increasing the width of the prosthesis, and will be cosmetically unacceptable to most female patients.

The laced leather socket which used to be used has been replaced by a lighter fibre type. A plate can be cut out on the medial side to allow the bulbous end of the stump easy access, and will be less cumbersome.

The four bar linkage knee piece allows for the shank to move under the thigh when sitting, giving a more normal thigh length. At the same time, it allows for greater stability as the point of rotation is higher up the thigh, and together with the piston action of the shank, control of the knee swing is possible.

With these new discoveries regarding the operation and fitting of a prosthesis, it is hoped that more through-knee amputations will be performed. It would seem to be far superior to any above-knee amputation where there is always some muscle imbalance resulting in a more awkward gait.

Below Knee Amputation

As every effort should be made to preserve the knee, the pre-operative management is very important, to prevent later complications which may lead to re-amputation at a higher site. It has often been found that a limb which appeared beyond help at first, can be improved by pre-operative control of infection, improvement of circulation etc., allowing the below-knee surgery instead of higher up.

During surgery, an osteomyoplasty is done whereby the muscle ends are secured to the tibia via drill holes and sutures. This is also the technique of choice in above knee amputations. This is done to produce a reasonable shaped stump which is usually healthier and gives greater proprioceptive sensation. The stump will hold its shape as muscles cannot retract, and if combined with a rigid cast, oedema is prevented. The earlier myoplasties in which a muscle loop was formed, did lead to a floating bone within the stump and the formation of a painful bursa, which is now prevented by securing the muscles to the bone.

The patella tendon bearing prosthesis is the one of choice although modifications of this are now being

used. The normal P.T.B. prosthesis gave some instability with very short stumps, and its suspension was one of its weak points. Thus the patella-tendon supra-patella prosthesis is now used which allows for a higher socket and suspension over the condyles. In all below-knee prostheses the socket must be a total contact one with pressure taken on all areas and not only on the patella tendon, otherwise oedema and ulceration may result.

Great emphasis was placed on the immediate or very early fitting of a prosthesis to allow maximum rehabilitation. This has also been found to be true in the limb deficient child, especially where the upper limb is involved. In the past, a prosthesis was supplied at the age of five, but it was found that by this stage, the child had learnt to adapt and usually rejected the artificial limb. Hence the baby is now fitted with a simple arm and mitten at the age of six months. The child learns to accept this as part of himself and will make use of the more complicated gadgets which are supplied at two years.

At the first visit to the centre, the parents and the rest of the rehabilitation team get together to discuss the reason why a prosthesis will be to the baby's advantage. By means of slide shows and weekly meetings with other parents with their similarly affected children, their fears can be allayed and new hope can be instilled.

The rehabilitation of an amputee can no longer be divided into different stages but must be seen as a continuous process involving all members of the team. It starts when the patient is first admitted, with great emphasis being placed on the pre-operative management. The surgery is an extension of the final aim to independence and the patient is not sent home until every member of the team is satisfied that he has reached the maximum of his ability. He is also not discharged until the team are sure that he will be able to cope at home, and that all members of his family are geared to his achieving final acceptance back into society.