AMPUTATION STUMPS

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It was not until the latter part of the first world war and the years that followed that it
became possible to make a collective survey of such large numbers of amputations as 40,000
which resulted from that war. This survey became possible only because the Government
organised a limb service under medical control for the prosthetic treatment of war amputees,
which in later years has widened its activities to cover all civilian amputees in the country
treated in hospital in the National Health Service.

The large number of patients studied in those early days were mainly young servicemen
who lost their limbs as a result of gunshot wounds, immersion, and trench foot. During
that study it became clear to the medical staff that there were certain levels of amputation
in the lower and the upper extremity that were good and better than any other levels, and
those came to be termed "ideal." The reason why they were ideal was because not only
were they best able to activate the best type of limbs and fittings then available, but also
because in doing so they stood up to the stresses and strains of limb wearing and seldom
broke down surgically (Mitchell 1943). The main object of all concerned then, as now, was
to provide a stump that could best function with an artificial limb, and which would not
require further surgical attention. The ideal lengths of those days were as follows: above
the knee, ten to twelve inches (25–30 centimetres) from top of greater trochanter; below the
knee, five and a half inches (14 centimetres) from the medial edge of the tibial plateau; above
the elbow, eight inches (20 centimetres) from the tip of the acromion; below the elbow,
seven inches (18 centimetres) from the tip of the olecranon. These lengths, for years accepted
in this country, were agreed by the Prosthetic Working Party Sub-Committee of the Brussels
Treaty Organisation at their meeting in Utrecht (British Medical Journal 1953).

The experience in dealing with amputees since the 1914 war, through the 1939 war, and
in handling some 40,000 civilian amputees to date, has not caused us to modify our views
that the sites mentioned above are "ideal" when conditions render it necessary to perform
an amputation through the shaft of the femur, tibia, humerus, or radius and ulna. We have
been led to believe, however, that in individual cases it may not be necessary to adhere to
these specified levels of amputation if there is a surgical alternative for operation as opposed
to bone section at a lower level. This view is strengthened by the improved design and fitting
of limbs to unconventional stumps; such limbs now match in functional efficiency those
supplied for stumps of ideal lengths. Our present views upon amputation levels are as follows.
Above the knee—If an amputation through the femoral shaft must be performed and conditions
permit of a ten- to twelve-inch stump in an adult, that stump length remains the ideal. If the
level of bone section were to be determined from the line of the knee joint rather than from
the trochanter the measurement would depend upon the length of the whole femur. For
instance, if the femur were seventeen inches long, bone section to provide a twelve-inch
stump would be performed five inches above the line of the knee joint. In children and young
adolescents the division of bone would be as low as possible. Bone section below the level
of the shaft, such as transcondylar amputation, still fails to provide long-lasting stumps in
most cases in this country, and are not advocated. For thigh amputations the anterior flap
method with posterior transverse scar has proved the best. The least possible injury should
be inflicted upon the sciatic nerve. Muscles may be divided at or below the level of bone
section. Deep fascia should be sutured separately. When it is not possible to provide a
stump of ideal length, good functional results are obtained with a femoral stump as short as seven inches, and reasonable function has been obtained in stumps of less than five inches provided they are not bulky. If a thigh prosthesis cannot be fitted but a tilting table is essential, it is still desirable when conditions permit to retain the head, neck and greater trochanter. When conditions demand a disarticulation at the hip, as in the case of a high amputation for neoplasm, the posterior flap method is preferred.

Disarticulation at the knee—When bone section of the femur is not essential and conditions permit of a disarticulation at the knee, disarticulation (with or without excision of the patella) is strongly to be recommended, especially for old persons and children. For the skin flap an incision with convexity downwards should be made about four inches below the level of the knee joint. This operation offers the advantages of speed, avoidance of shock, and preservation of muscle sheaths. From the prosthetic aspect an excellent limb can be fitted and control of the shin is possible. Full and true end bearing is a great advantage and facilitates rapid rehabilitation; and few of these stumps have failed even after years of limb wearing. Under certain circumstances, therefore, this becomes an ideal stump.

Below the knee—The ideal length of tibia for a definitive amputation continues to be five and a half inches. Stumps longer than this tend to show signs of intolerance with limb wearing, though their longevity is sometimes increased by full ischial bearing.

Equal anterior and posterior flaps have proved most satisfactory; the distal anterior extremity of the tibia should be bevelled off and the fibula divided an inch higher than the tibia. Excision of the fibula is not recommended unless it becomes abducted, as happens on occasions in short stumps. Stumps measuring one and a half inches have functioned well in a below-knee limb provided they have no redundant tissues (Thomas and Haddan 1945). In earlier years such a stump would have been immobilised and fitted with a kneeling limb or amputated above the knee.

The Syme amputation—This operation met with disfavour after the first world war for a number of reasons which can be summarised as follows. Many patients never reached the stage of limb fitting and may have been subjected to operation under unfavourable conditions. Many underwent re-amputation within five years of the end of the war and many failed to tolerate full end bearing for more than a few years. The fact that limbs in those days provided for full end bearing contributed to the failure of many of these stumps, as did the introduction of the modified Syme's amputation with division of the bone at a higher level (Shelswell 1954).

In 1929 limbs were provided to allow for partial or full tibial bearing, and these have been used ever since. Re-amputations after the Syme operation are now uncommon.

It is felt that a perfect Syme's amputation performed under good conditions on a man provides an ideal stump, and such amputations are known to have lasted for forty years or more. For young boys and girls a Syme's amputation is indicated when possible as the operation of choice, to avoid the prolific overgrowth of bone that is frequently observed when the bone is divided before the epiphyses have fused.

The place of the Syme amputation in a girl or woman remains controversial. For many such patients the cosmetic result is very important. With a Syme prosthesis the disablement is always noticeable, and some women have regretted that the amputation had not been performed below the knee, for the prosthesis can be matched perfectly with the sound limb.

Amputation above the elbow—The ideal humeral stump remains eight inches, not because circulatory defects sometimes arise in longer stumps, but rather because such a length provides all the leverage needed and enables the best type of limb to be provided, with the best functional results. This length is also ideal in cases of amputation for complete brachial plexus palsy, in which cases it is recommended that the shoulder be arthrodesed in slight abduction.

Shorter stumps give good functional results but there must be at least an inch of stump below the lower level of the anterior axillary border. In some cases this necessary inch has been obtained by division of the lower fibres of the pectoralis major. The retention of the
head of the humerus is always advisable when it is practicable, even though there will be no functional stump.

Humeral stumps longer than the ideal may prevent the fitting of the type of arm that provides the best functional results, because there is not enough space for the fitting of the automatic elbow mechanism.

Disarticulations at the elbow are still in disfavour; the extra leverage is of no advantage, and the prosthesis that can be fitted is not comparable in efficiency with that available for the ideal stump.

Amputation below the elbow—The ideal length continues to be seven inches. Owing to improved methods of fitting and suspension much shorter below-elbow stumps can now be fitted than was once found possible, and therefore the elbow joint should not be sacrificed without much consideration. Stumps longer than the ideal tend to develop circulatory defects, and the extra length is of no advantage.

For all arm stumps amputation by equal anterior and posterior flaps, giving a terminal transverse scar, provides the best results.

Disarticulation at the wrist—This operation has always been regarded with disfavour in past years because the limb provided was bulky and projected beyond the extremity of the natural hand. Recently, however, the prosthesis has been redesigned to avoid excessive length. Although the stump is bulky it is considered that this operation has a place in men (Perkins 1953) but not in women for cosmetic reasons.

REFERENCES