Management of the Short Leg

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INEQUALITIES of bone length are important causes of deformity in the human body.

A short arm can be disguised adequately by the clothing and is of no real significance. A discrepancy in leg length however produces a definite disability.

Little is known about the factors which govern the rate of growth or the symmetry of the limbs and differences amounting to ¾″ are found in the length of the legs of otherwise normal individuals. These minor discrepancies are usually symptomless and require no special treatment. The more severe deficiencies and those that are known to be progressive are the subject of this discussion.

From a practical point of view any discrepancy of 1″ requires treatment.

COMMON CAUSES OF INEQUALITY IN LIMB LENGTH

1. Anterior Poliomyelitis

This disease is probably the commonest cause of shortening although it rarely gives rise to severe degrees of it. The behaviour of growth in a paralytic limb is unpredictable. Completely paralysed limbs may show little or no shortening whereas others with only partial paralysis may show 2″ or more. Furthermore the shortening, may not be progressive, or if progressive, may not be uniformly so over a number of years.

2. Tuberculous Arthritis of the Hip.

Most of the severe grades of shortening are due to this cause. Up to 8″ of shortening at maturity can occur. Here the cause for the shortening soon becomes evident. The epiphyses around the knee joint close prematurely. This complication, the mechanism of which is not clearly understood, was a real danger when Tuberculosis of the hip was treated by prolonged immobilisation of the affected limb on a splint or frame. It would appear that the advent of the anti-biotics, and the shorter duration of immobilisation now required in treatment, has significantly decreased this hazard.

3. Congenital Deformities

These may cause inequality of limb length in two ways. Congenital shortening of the major long bones of the limb or absence of one of these bones will give rise to a short limb, whereas arterio-venous communications of congenital origin will give rise to a longer limb. In the first type we find such conditions as congenital shortening or partial absence of the femur, or congenital absence of the tibia or fibula. In theory, these cases should be the most ideal for surgical treatment. The disability is due to the shortening per se, and normal function should result from successful lengthening of the limb. Unfortunately it is precisely these cases where surgery does not succeed in gaining more than about ¾″ of increase. The hypertrophy of the soft tissues in the limb may be the factor which offers resistance to lengthening.

There are other causes of inequality such as infective or traumatic destruction of growing epiphyses. On the other hand, certain infective lesions close to growing epiphyses stimulate epiphyseal growth and therefore cause discrepancy by causing lengthening on the affected side. The commonest types however, fall into one of the three main groups mentioned above.

METHODS AVAILABLE TO OVERCOME DISCREPENCY

A. Alterations to Footwear.

B. Surgery.

A. *Alterations to Footwear*

Shoes may be modified in a number of ways to compensate for shortening. The particular method adopted will depend on the amount of raise required, the sex of the patient and the amount of movement present in the associated joints.

A raise of ½″ is easily obtained by adding ¼″ to one heel and shaving ¼″ off the other heel. A raise of 1″—2″ can be provided by having a shoe made with a cork insole built inside. The appearance of such a raised shoe should not be unduly resented by the patient.

Any further raise above 2″ should not be applied to shoes and boots should be provided and adapted for this purpose. Boots adequately built up with insoles can compensate for discrepancies up to 4½″. Beyond this, it is necessary to provide an outside cork sole either alone, or in conjunction with the insole.

It is possible to compensate up to 7″—8″ with footwear but the appliance becomes cumbersome and particularly unsightly for a woman.

B. *Surgery*

The surgery of limb length discrepancy may be carried out on the shorter or longer limb and it may be planned to take place during the growth period of the individual or when growth has ceased.

Surgery of the Longer Limb

During the growth period the rate of growth in the longer limb may be permanently retarded by destroying one or more of the epiphyseal plates. This will allow the short limb to catch up. This is the operation of epiphyseodesis popularised by Phemister. There are two essentials for a successful result with this operation. The first is that the epiphyseal plate must be totally ablated in order to achieve complete bony fusion between the epiphysis and the metaphysis. This ablation must be accurate and symmetrical or else deformity will supervene. The second essential is that the anticipated amount of growth both in the longer and the shorter limb has to be accurately predicted to enable one to decide what number of and at what age the epiphyseal plates should be ablated.

The average annual growth increment at the lower femoral and upper tibial epiphyseal plates has been estimated by measurement in a large series of normal children. Graphs and tables have been compiled from these figures and one can therefore refer to them to assess the correct time for operation in an individual case.

There are objections to the operation of epiphyseodesis and the two main ones are:—

(a) that it is an operation on the normal limb and any failure or mishap would be catastrophic.

(b) it leads to a loss in anticipated height at maturity.

The site for this operation is usually the lower femur and the upper tibia. The two epiphyseal areas at these levels give rise to almost ¾ of the growth in length of the lower extremity. The remaining ¼ being provided for by the epiphysis at the upper end of the femur and the lower end of the tibia. The operation of stapling which is attributed to Haas and popularised by Blount attempts to retard growth temporarily. Here metallic staples are so placed that the limbs straddle the epiphyseal plates and thus tether the epiphysis to the metaphysis. They are left in situ until the discrepancy has been made up and can then be removed.

Growth is then resumed at a more or less normal rate. Although attractive in principle this method is also rought with certain dangers and is not completely reliable.

When the period of growth is over, or nearly so, shortening of the shafts of one or more of the long bones—usually the femur—may be undertaken. This is a simple relatively easy and accurate procedure, almost devoid of complications. It has the drawback again of reducing the height of the patient and the hazard of an operation on the normal limb.

Surgery of the Shorter Limb

Theoretically the ideal solution to the problem of inequality would be to stimulate growth in the shorter limb. Attempts to do this have been made by trying to increase the blood supply in a limb as a whole. The operation of sympathectomy was at one time enthusiastically undertaken for this purpose. The results soon showed that the amount of length gained was insignificant and the only improvement was in the skin circulation, in the cold blue limbs seen from time to time in poliomyelitis. Foreign bodies were introduced in the region of the growing epiphyses around the knee-joint to cause local hyperaemia and therefore stimulation of growth. These operations were, however, unsuccessful and a reliable method of growth stimulation is yet to be found.

Leg Lengthening

During the last 20 years much attention has been given to the problem of lengthening of the short limb. Early attempts were attended by serious complications due largely to failure to control the alignment of the divided bone.

In the case of the tibia the problem was solved by Abbot who devised the apparatus and described the mechanical principles which must be observed for the successful lengthening of bone. In principle the bone is divided in a Z cut fashion so that there is some contact between the two ends throughout. The upper and lower fragments are transfixed with metal pins which are attached to a distraction apparatus. The limb and the apparatus is attached to a frame. By daily adjustment the transfixed fragments are slowly distracted until the maximum amount of lengthening tolerated by the patient is obtained. The major danger is of course due to over-distraction of the blood-vessels and nerves in the limb, but with adequate care and attention to details and constant supervision up to 3″ of lengthening may be obtained in the tibia.

This apparatus although easily adapted to the tibia cannot be applied to the femur for anatomical reasons and in attempting to lengthen this bone the main difficulty is still that of maintaining alignment. The upper fragment almost inevitably angulates forward resulting in a high incidence of malunion and non-union.

Amputation

This is probably the oldest of all operations for a shortened limb. It is indicated in cases where severe shortening is associated with gross deformity or marked vascular disturbance.

Conclusion

Certainly no surgical interference of any description should be contemplated until the patient has been given a fair trial with suitable boot or shoe correction. There are no absolute indications for any of the procedures described and apart from the varying degrees of risk involved in all of the procedures one must bear in mind that only rarely will successful lengthening improve function.