and replacing them or were aware that they could be obtained separately.

Prominent among other sources of error is disparity between the size of the cuff and the circumference of the arm. This was recognised in 1909⁹ and has been the subject of several careful studies.¹⁰⁻¹² None the less the *BMJ** takes a defeatist view: "The usual standard cuff of 12 × 33 cm is too short . . . though the suggestion that (a 12 × 35 cm cuff) is the correct standard seems unlikely to be followed widely in Britain, and we must accept that there is generally a small error." Certainly there is no likelihood of a 12 × 35 cm arm cuff being widely adopted in Britain since we have been unable to buy one, but we see no reason for accepting the error which is not always small. King's study¹² showed enormous errors when a very short bladder was employed so the mistaken use of paediatric cuffs on adults may introduce some wildly inaccurate readings; we suggest that such cuffs should be labelled for the sake of inexperienced nurses.

The standard cuff used by King¹² had a bag of 26 × 15 cm. Even with this there was a small but significant over-reading of blood pressure with arm circumference of 32 cm or above (8% of our patients). With a bag that completely encircled the arm King¹² found that width above 11 cm was not critical, but if length is deficient width becomes important and the World Health Organisation have recommended a 14 cm width.¹³ Pickering² has published a table of corrections for blood pressure readings on fat arms but it seems better to avoid the problem altogether by using a cuff with a bag 35-40 cm long. Overlapping of the bag in a thin arm does not introduce an important error.¹²

We cannot calculate from any published data the likely error introduced by the standard British cuff. On normal arms, as the *BMJ* implies, it is probably small. In the most obese 10% of our patients it must be higher than the few mm Hg found by King with his larger cuff.¹² If enough doctors asked for 35-40 cm cuffs manufacturers would start producing them. They might add £1-2 to the cost of a sphygmomanometer, a small price to pay for accuracy in one of the commonest and most important clinical measurements.

SC was supported by Grant CAPES—Coordenação no Aperfeiçoamento pessoal de Nivel Superior, Brasília, Brazil

References

- ¹ Kirkendall, W M, *et al*, *Circulation*, 1967, **36**, 980.
- ² Pickering, G, *High Blood Pressure*, ch 2, 2nd edn. London, Churchill, 1968.
- ³ Littler, W A, *et al*, *Circulation*, 1975, **51**, 1101.
- ⁴ *Journal of the American Medical Association*, 1951, **147**, 632.
- ⁵ King, G E, *Journal of the American Medical Association*, 1969, **209**, 1902.
- ⁶ Rose, G A, Holland, W W, and Crowley, E A, *Lancet*, 1964, **1**, 296.
- ⁷ Thulin, T, Andersson, G, and Scherstén, B, *Postgraduate Medical Journal*, 1975, **51**, 390.
- ⁸ *British Medical Journal*, 1975, **4**, 366.
- ⁹ von Recklinghausen, H, *Archiv für experimentelle Pathologie und Pharmacologie*, 1901, **46**, 78.
- ¹⁰ Karvonen, M J, Telivuo, L J, and Järvinen, E J K, *American Journal of Cardiology*, 1964, **13**, 688.
- ¹¹ Simpson, J A, *et al*, *American Heart Journal*, 1965, **70**, 208.
- ¹² King, G E, *Clinical Science*, 1967, **32**, 223.
- ¹³ *World Health Organisation Technical Report Series*, 1962, **231**, 4.

Problems of Childhood

Intoeing and flat feet

W J W SHARRARD

British Medical Journal, 1976, **1**, 888-889

Intoeing

After flat foot and knock knee, walking with the toes turned in is the third commonest cause for parental concern when a child starts to walk. The parent may complain that the child turns his toes in or that he tends to throw one leg round the other or that he tends to fall over his own toes.

CAUSES

Two completely different causes for intoeing need to be distinguished from each other. In the commoner type, the deformity is not at the foot but above the knee—in other words, the child is walking with the whole limb turned medially. A less common cause for intoeing is a varus and adduction deformity of the foot. It is not difficult to distinguish the two conditions.

If the intoeing is due to medial rotation of the limb as a whole, the child walks with his knees facing a little towards each other and examination of the feet shows no abnormality of the foot itself. A child with varus and adduction of the forefoot (metatarsus varus) walks with his knees facing forwards or slightly outwards and the forefoot is turned medially relative to the hindfoot. The shoe shows a corresponding deformity. Inquiry from the parents will usually disclose that the foot deformity has been present since birth or at least recognised before the child started to walk.

Intoeing not associated with foot deformity is due to a medial torsion of the limb above the knee level. The possible causes for a medially rotated position of the limb could be that the acetabulum is facing more forwards than normal; that the femoral neck is abnormally anteverted; or that the femoral shaft has an abnormal degree of medial torsion—or there may be a combination of more than one factor. Fortunately, it does not matter much what the exact cause is because the abnormality almost always corrects spontaneously with growth. Confirmation that the rotation deformity is above knee level is given by lying the child down with his hips extended and testing the range of medial and lateral rotation. In a child from 18 months to 3 years medial rotation is not normally over 50° and lateral rotation not less than 40°. In a child who toes in medial rotation will be found to be 70° or more and lateral rotation 35° or less.

Royal Infirmary, Sheffield S6 3DA

W J W SHARRARD, MD, FRCS, orthopaedic surgeon

TREATMENT

Treatment by any kind of splints, particularly splints with twister cables to try to force lateral rotation of the limb, are not only useless but are dangerous in that they may cause damage to the foot or the knee. Passive exercises to try to improve the range of lateral rotation of the hip are safe provided that they are not undertaken too vigorously but it is doubtful indeed whether they do any good. The parents should be told that by the age of 6 the intoeing will correct itself in all but a very few children and, if need be, this prognosis may be confirmed by regular estimations of the range of lateral rotation at six-monthly intervals.

Much less commonly, intoeing persists after the age of 7 or 8 or appears for the first time at this age. The prognosis for intoeing in late childhood or adolescence is much less favourable. About half the children so affected may still correct their medial torsion by the time limb growth is complete when aged from 15 to 17, but if the range of lateral rotation is less than 20° in a child of 10 some tendency to intoeing is likely to be permanent. A child, particularly a girl, is likely to be the subject of much banter and teasing at school and the boys are not likely to excel at athletic pursuits (though a few do).

A helpful criterion of the likelihood of the torsion persisting into adult life is the presence of a similar torsion in one or other parent. The only certain method of correction is by a lateral rotation osteotomy of the femur, a major operation that needs to be done bilaterally and requires a period of six weeks immobilisation in a plaster spica. If the range of lateral rotation of the hip with the hips extended is 20° or less in a child over the age of 10 and observation for a year shows no change in the range of lateral rotation, operative treatment could be offered but not insisted upon. The final decision must lie with the child and his parents since the deformity is as much a matter of appearance as it is of function and, however carefully an operation is done, and incisions placed posterolaterally at the upper or lower end of the femur, a visible scar is inevitable.

METATARSUS VARUS

Intoeing due to metatarsus varus deformity of the feet is much less common than intoeing due to medial femoral torsion but is commoner than talipes equinovarus (club foot). For a mild deformity, in which there is less than 30° of adduction of the forefoot relative to the hindfoot, simple passive stretching by the mother and the wearing of well-made shoes will result in spontaneous correction by the time the child is 3. Some deformity more severe than this may also correct spontaneously with growth but there is no guarantee of this and passive stretching may need to be supplemented by periods of treatment in plaster or even, if the deformity persists beyond the age of 3, surgery to release a contracture of the medial side of the foot.

Flat feet

When any child or adult with a normal foot stands in the relaxed position his heels go into eversion and the medial arch is depressed until the joints of the tarsus become fixed in the locked position. The extent of the eversion and depression of the medial arch is related to the shape of the bones of the foot and the elasticity and length of the ligaments affecting the joints, particularly the calcaneonavicular or spring ligament. During walking, when a person rises on to the toes, the everted position of the heel disappears and is replaced by slight inversion.

When a child first stands and walks with support his feet are spread apart and everted. As his balance improves and his strength increases he brings the feet closer together so that the everted position of the feet during walking disappears. In the standing position some degree of eversion is present and in many children is such that the medial arch is depressed to a degree that gives rise to concern by the parent, general practitioner, or school physician. Almost all such feet are, nevertheless, normal and the child will eventually develop an arch appropriate to the anatomical design of the foot by the time he reaches adult life.

Flat foot which is within the normal physiological range should disappear when the child rises on his toes and the foot should show a full range of painless mobility. The heel of the shoe should show wear slightly to the outer side of the middle line. If all these conditions are fulfilled treatment is contraindicated and the parents should be advised very strongly that there is nothing whatsoever wrong with the child.

TREATMENT

In a few children the degree of flat-footedness, though not associated with any serious abnormality of the foot, does demand some specific measures. If the maximum wear at the heel of the shoe is to the inner side of the mid-line this implies that the child is walking with his heel everted. As the shoe wears the worn shoe in itself tends to aggravate the everted position when the child is walking and treatment is needed for the shoe. The choice lies between applying an inside raise to the under surface of the heel of 2 mm ($3/16$ in); purchasing a shoe with a built-in inside raise; or inserting a wedge or heel seat into the shoe. All three variations have their strong advocates and all can claim success, since the condition corrects itself spontaneously by the time the child is 6 or 7 in all but a few. In some children the heel of the shoe does not show abnormal wear but the inner side of the upper is distorted, particularly if the shoe gives inadequate support in the region of the medial arch and the child tends to be heavy. A stronger shoe or the insertion of additional leather stiffening in the shoe beneath the medial longitudinal arch is all that is needed. If the heel is raised on the inner side, a disastrous degree of wear on the outer side of the heel may result.

For most children the need for alterations to the shoes ceases by the time he is 6 or 7, but these may sometimes be needed up to 12. Even if altered shoes are indicated there is no need to insist that heavy shoes should be worn at all times. A well-made sandal is harmless provided it is not worn for too much of the day, and only if there is pain or fatigue when sandals or slippers are worn is continuous use of stronger footwear advisable. There is certainly no need, as some orthopaedic surgeons have suggested, for a child to wear heavy shoes on the beach. Foot exercises have no proved value in flat feet except to keep the parents occupied if nothing else will satisfy them.

OTHER CAUSES

A few children with flat feet are found to be suffering from a pathological lesion. In the rare condition of congenital flat foot or vertical talus the foot shows a rocker-bottom appearance at birth or long before the child starts to walk and the deformity is a fixed one with very limited movements at all joints in the foot. Correction of this deformity is difficult and is likely to require surgery in infancy. Flat foot developing for the first time in a child more than 6 or 7 years old and associated with pain may be due to a congenital fusion between two of the bones of the tarsus, usually the calcaneus and the navicular. Clinical examination shows a foot with rigid valgus deformity associated with peroneal spasm. Surgical treatment to remove the abnormal bony bar may be indicated.

Another uncommon cause of flat foot may be seen as a secondary consequence of a short tendo calcaneus (tendo Achillis). A short tendo calcaneus is shown by the fact that the ankle will not dorsiflex beyond a right angle with the foot inverted and, if this is present, elongation of the tendo calcaneus may be indicated.

Mobile or postural flat foot may be aggravated by a knock-knee deformity or intoeing due to medial femoral torsion. If a child presents to a general practitioner, school doctor, or paediatrician with a combination of intoeing, knock knee, and flat foot, all at the same time, it may be difficult for the doctor to convince the parents that all will be well given time or if just a simple alteration is made to the shoe. In this event, it may be justifiable to seek the advice of an orthopaedic surgeon to reinforce the statement that time will produce complete correction of all the problems.