

## FOOT PROBLEMS IN INFANTS AND CHILDREN

### ROTATIONAL DEVIATIONS OF LOWER EXTREMITIES

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**F**EW problems are more disturbing to pediatrician and parent alike than that of the child who toes in or toes out. Most commonly, the problem is one of deciding whether or not to reassure an anxious parent that the condition is a self-limiting one—that it is a physiological variation of the normal. At present there seems to be no unanimity of thought as to what is normal and what requires treatment. Thus, the pediatrician asks himself three questions: (1) Can the parent be safely reassured that this is a self-limited condition which requires no treatment? (2) Are simple conservative measures which the pediatrician can recommend sufficient? (3) Is this a problem for the orthopedist? It is the purpose of this paper to outline a method for handling such problems.

#### THE PROBLEM

Four situations are most commonly met:

1. The infant or prewalker who holds his feet turned in.
2. The infant or prewalker who holds his feet (and legs) turned out.
3. The walking child who toes in.
4. The walking child who toes out.

1. *The Infant or Pre-Walker Who Holds His Feet Turned In.*—This may be caused by one of two things:

a. *Internal Tibial Torsion:* Here the entire leg below the knee is turned inward. Most infants are born with internal tibial torsion since it is the

“fetal position” of the lower extremities. Spontaneous derotation takes place in the majority of cases before the infant starts to walk. In some, however, a persistent internal rotation of the entire leg below the knee in the older infant gives rise to concern by the parent. Frequently, one leg retains its internally rotated position while the other derotates to normal. For some unexplained reason, the left leg is the most common offender.

In examining for internal tibial torsion, the infant is placed on his back. There are three key landmarks to observe: the anterior superior iliac spines, the patellae, and the second toes of each foot. Taking each lower extremity separately, first palpate the anterior superior iliac spine. Next, palpate the patella and turn the thigh so that the patella faces straight up toward the ceiling. Normally, a straight line drawn from the anterosuperior iliac spine through the patella should run through the second toe (Fig. 1). In internal tibial torsion, this line runs through the lateral border of the foot (Fig. 2).

*Treatment.* As mentioned before, most cases of internal tibial torsion spontaneously rotate to normal position before the child begins to walk. Therefore, it is perfectly safe to wait until the infant is at least 6 months of age before considering any active therapy. If the torsion is still quite marked beyond that age, a derotation bar may be used. This bar, which is a

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Denis-Browne splint attached to the shoes, may be adjusted to permit any degree of outward rotation (Fig. 3). It is worn day and night, removed only for bathing, for a period of four to six weeks. Then it may be used during naps and at night for an additional

three to four weeks. The improvement is usually rapid and the brace is generally well tolerated by the infant.

b. *Metatarsus Varus*: This is the other common cause of toeing-in by the infant or prewalker. Occasionally, metatarsus varus and internal tibial

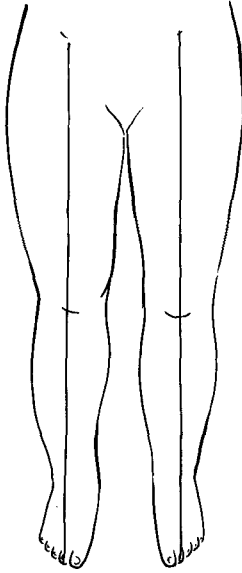


Fig. 1.—Normally, a straight line drawn from the anterior superior spine of the ilium through the center of the patella should be in line with the second toe. These are the key landmarks in aligning the lower extremity.

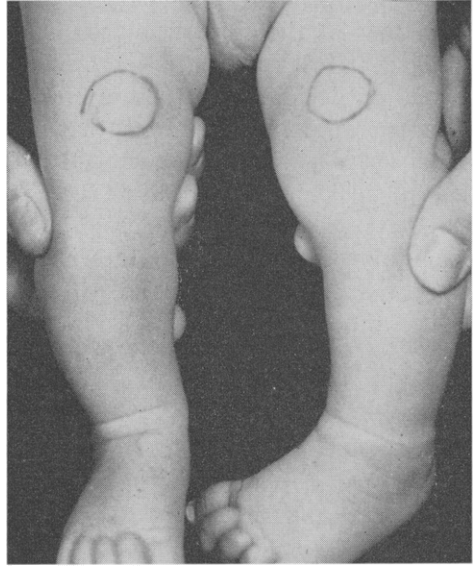


Fig. 2.—Internal tibial torsion of the left lower extremity. Right lower extremity is normally aligned. Patellae are outlined with skin pencil markings. Internal tibial torsion is the most common cause for toeing-in.

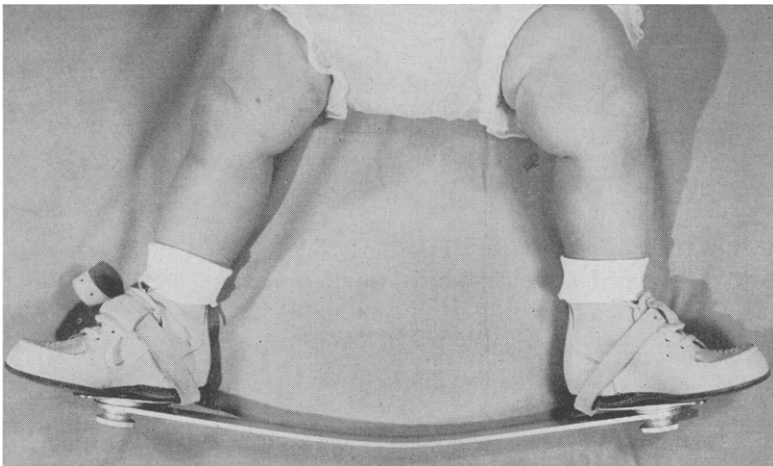


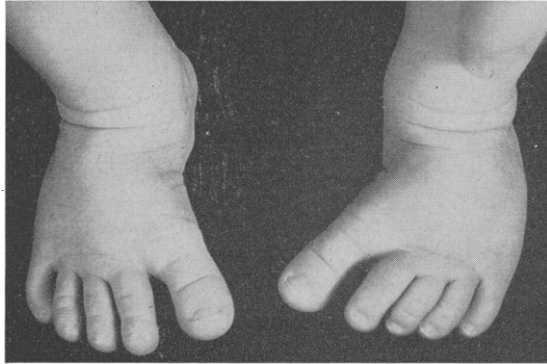
Fig. 3.—Derotation splint as used to hold legs in correct alignment for persistent or severe internal tibial torsion. Screw clamp on bar permits any desired degree of rotation.

torsion may coexist. This condition, which has been termed "one-third of a clubfoot," is recognized by the fact that the toes turn inward in relation to the rest of the foot (Fig. 4, A).

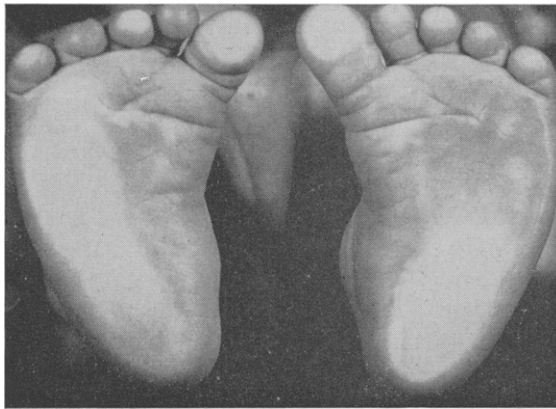
The examination for metatarsus varus is easier when the soles of the feet are examined. Normally, the

foot is tickled, to the severe form where the foot cannot be manually straightened, even with the use of some pressure.

*Treatment.* In the mild form, where stimulation of the foot causes the infant to pull the toes into normal position, it is sufficient to wait and watch.



A.



B.

Fig. 4.—A, Bilateral metatarsus varus. Forefoot is adducted in relation to the heel. B, Note the convexity of the outer border of the sole in metatarsus varus. Left foot shows severe degree of metatarsus varus. Right foot is involved to a much milder extent.

lateral border of the foot is a straight line. In metatarsus varus, the lateral border of the foot is convex (Fig. 4, B).

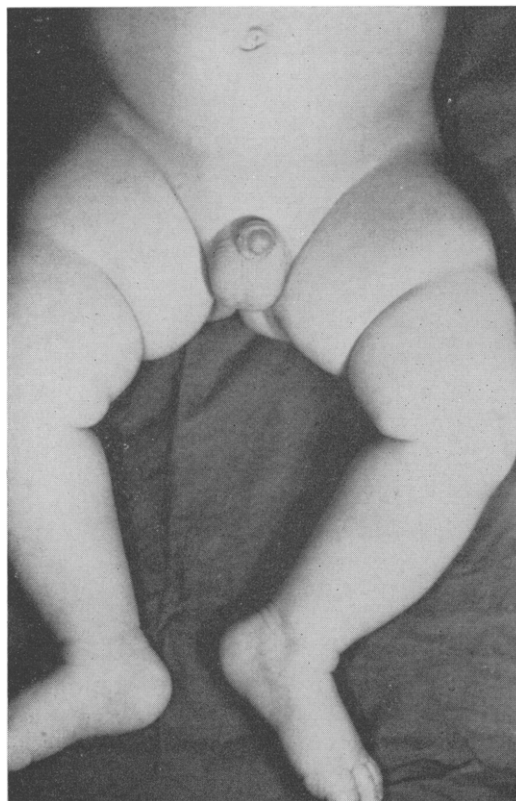
Degrees of severity of metatarsus varus vary from the mild forms in which the infant spontaneously corrects the turning in when the bottom of the

The more contracted cases require active treatment by an orthopedist, usually manipulation and casts.

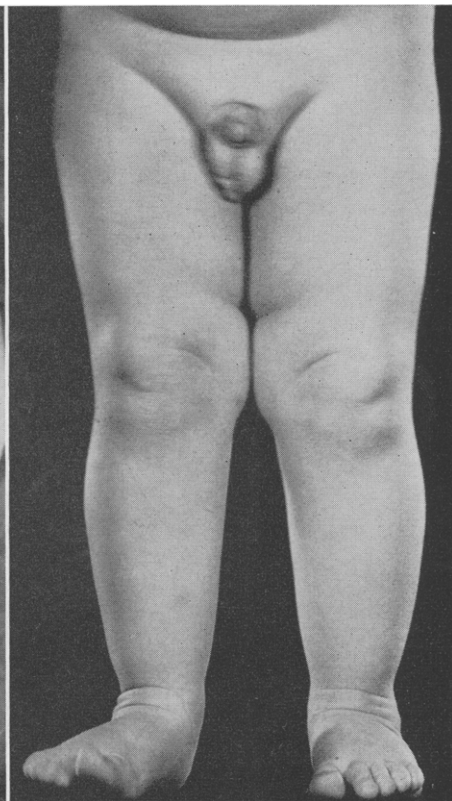
2. *The Infant or Prewalker Who Holds His Feet (and Legs) Turned Out.*—This is due to external rotation of the entire lower extremity from the



A.



B.



C.

Fig. 5.—A, Derotation splint as used for correction of persistent or severe cases of external rotation attitudes. B, External rotation of the hips. Child lies with legs spread-eagled. They can be rotated inwardly only with difficulty. C, Same child as in Fig. 5, A and B following correction of external rotation of hips with derotation splint.

hips down. Usually, it is bilateral and occurs in infants with fat thighs (Fig. 5, A, B, C).

The examination is performed with the infant on his back. In this position, it may be seen that both lower extremities lie spread-eagled on the examining table so that the kneecaps point toward opposite walls of the room. If both thighs are grasped by the examiner and an attempt made to turn them in, it will usually be found that there is limitation of internal rotation. Whereas, normally, it should be possible to turn the patellae in so that they almost face each other; in infants with external rotation attitudes of the lower extremities, it is only with some force that the patellae can be made to point straight up.

*Treatment.* Since spontaneous correction here is the rule, it is permissible to apply very simple measures until the infant is 6 months of age. The mother should be instructed to apply only single-thickness diapers since any bulky mass of clothing between the thighs exaggerates the external rotation attitude. If the external rotation is still marked after 6 months of age, a derotation bar is employed in a manner similar to its use in internal tibial torsion. In external rotation contractures, of course, the feet are faced in by the bar.

3. *The Walking Child Who Toes In.*—One of two conditions causes a child to walk toeing-in. The most frequent cause, by far, is a persistent internal tibial torsion. A neglected or recurrent metatarsus varus or true clubfoot in a walking child accounts for the remaining few.

The child should, of course, be observed while walking to determine the degree of toeing-in and whether the in-

volvement is unilateral or bilateral. The gait should be examined with shoes on and after removing them. Improvement in walking while barefooted may indicate that the shoes are too short. Finally, the feet and legs are examined for evidence of metatarsus varus and internal tibial torsion.

*Treatment.* The common observation that many children walk toeing-in while so few adults, without treatment, walk pigeon-toed, is ample evidence that spontaneous correction takes place in practically all cases. In many instances, it is sufficient to reassure parents that the condition is one which corrects itself. Certainly, in mild cases of persistent internal tibial torsion in children under the age of 4 years, nothing further is necessary. If the toeing-in is so severe that the child trips over his feet, the only effective treatment is one which derotates the tibias. This can be accomplished by a derotation bar between the shoes as previously described. Because of the difficulty of keeping an active child off his feet for four to six weeks, derotation bars at this age are used for two or three hours during the day and during sleeping hours. Twister braces may be used as an alternative. These permit walking but are cumbersome and expensive.

The treatment for neglected or recurrent metatarsus varus in the walking child is manipulation and casts.

4. *The Walking Child Who Toes Out.*—This condition is caused either by persistent external rotation at the hips or by pes valgoplanus (flatfeet) or both. The examination for external rotation at the hips has been described. Examination of the feet for pes valgoplanus should include observing the gait with and without shoes. It will

be seen that frequently the child wears the heels of his shoes down rapidly on the inner sides. In the standing position, attention should be directed to the ankles. In pes valgoplanus the ankles sag toward the inner side of the foot (Fig. 6). Observe, too, the longitudinal arch of the foot for its height.

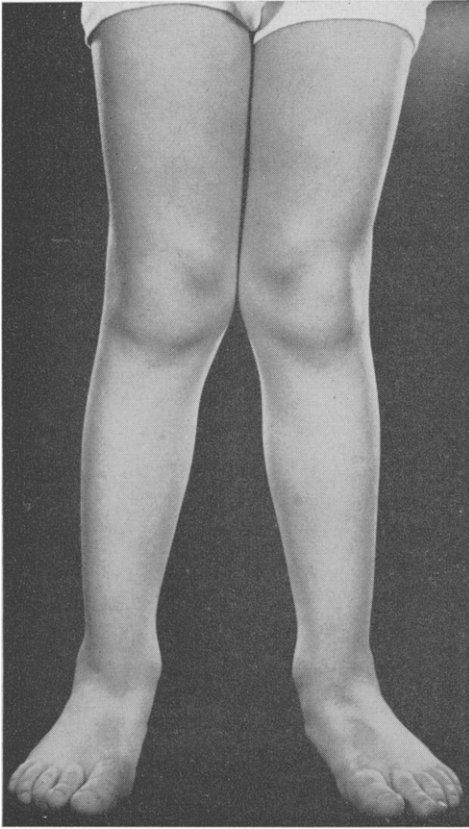


Fig. 6.—Pes valgoplanus on the left, here associated with a mild genu valgum (knock-knee).

*Treatment.* When toeing-out is caused by external rotation at the hips, and is particularly awkward or unsightly, the use of a derotation bar may be justified. It should be worn at all times, except for a few hours during the day, and continued for from four to six weeks. After this, it may be con-

tinued as a night and nap splint for an additional six to eight weeks. In the child who is over 3 years of age, such appliances are not well tolerated. However, it is possible at this age to start gait training under the direction of a competent physical therapist.

Pes valgoplanus is a congenital deviation from the normal and is usually asymptomatic. If flatfeet are causing no pain and no difficulty with gait, all that is needed is for the child to wear good sturdy shoes which will not break down in the inner counter. (This is the stiff portion of the shoe that encases the heel.) Where the gait is awkward and the heel wears down on the inner side, an inner heel wedge of one-eighth to three-sixteenths of an inch is used. A Thomas heel may be used for the shoes of a child of 2 years and over. This is usually counterbalanced by an equal wedge placed on the outer side of the sole of the shoe. The two equal and opposite wedges do not cancel each other's effectiveness since the "normal" foot is one in which the forefoot is in slight pronation in relation to the heel.

Severe flatfeet which are painful and associated with an unsightly gait require more extensive orthopedic care. Arch supports made from tracings or casted models, rather than the so-called arch support shoes, are often indicated in such cases.

#### DISCUSSION

In the foregoing we have outlined what we feel is a rational approach to this common problem. There has been intentional omission of many commonly accepted measures because, in our hands, they have not been of therapeutic value. For the sake of completeness, some of these will now be discussed.

*Manual Stretching.*—This refers to the practice of instructing the mother in manipulation of the infant's feet. While there is no evidence to show that intermittent manual stretching, even when properly done, is effective, some justification for its use may be found. Certain parents are not secure unless some form of therapy is recommended. Gentle manipulation serves this need in a harmless and inexpensive way.

*Reversing the Shoes.*—This produces an effective optical illusion until the shoes have become molded by the feet. In mild cases of metatarsus varus it may help to hold the feet in the position of correction, after casts have accomplished actual correction.

*Shoe Corrections for Children Who Toe In or Out.*—The use of heel or sole wedges in order to correct the gait in the absence of flatfeet has been of no value in our experience. External rotation takes place at the hips and internal rotation at the knees or occasionally the hips. Shoe wedges do not influence gait variations due to these causes.

*Foot Exercises.*—In pes valgoplanus this modality has been recommended to "build up an arch." While exercises may help strengthen the intrinsic and extrinsic muscles of the foot, they will not manufacture an arch where one is congenitally absent. It is unnecessary trauma to parents to make them go through the anguish of trying to call an active child indoors from vigorous play to go through a series of monotonous foot exercises.

*Shoes.*—Shoes should be considered merely as a means of protecting the feet rather than as a therapeutic instrument. Until the child begins to stand there is no need to wear shoes except

as protection against the cold. The first shoe is a high-top shoe with a soft or semirigid sole. After he has begun to walk, a more rigid sole is used. Ordinarily, high-top shoes are used up to about 2 years of age. The main reason for a high-top shoe is that the young child has a poorly demarcated heel until about 2 years of age. A low shoe or oxford will not stay on a foot until the heel is wide enough to fit into the counter. The main consideration to be given the selection of footwear is fit. A normal, healthy child with feet which are not deformed can wear anything which will protect his feet from cuts and the weather. A child with deformed feet will derive no benefit from a shoe besides the protection it affords. Indifference of the medical profession to this common-sense fact has permitted the exploitation of anxious parents by some unscrupulous shoe manufacturers.

#### WHAT TO TELL THE PARENTS

Most parents today can be approached with utter frankness. In many instances there is only need for reassurance and if the condition is simply explained they will be satisfied. We have had the opportunity to view this situation at close range, since one of the authors has a son who had both metatarsus varus and internal tibial torsion at birth. The metatarsus varus responded promptly to cast correction but the tibial torsion persisted until he was 3 years of age. In order to follow accurately its natural course, no treatment was undertaken for the internal tibial torsion. The condition spontaneously corrected itself by the time the child was 40 months of age. Even at 3½ years of age he toed in

when he was tired, but when told to "walk straight" he easily corrected this. (This is the earliest age at which most children will respond to direction.) During the child's first eighteen months as a walker there was considerable eyebrow raising among members of the family. The boy was very well-coordinated in spite of his awkwardness of gait, but it required considerable and repetitious reassurance to convince many well-meaning individuals that he was not "a shoemaker's child without shoes." The boy's mother, it should be noted, needed no convincing after trying to match his speed afoot.

This personal experience has led to a clearer understanding of the "heckling" by relatives and friends to which the parents are subjected. Parents in a situation such as this understandably have feelings of anxiety and fear that they are neglecting the child.

Based on this experience, it has been our practice, in situations where spontaneous correction can be expected, to carefully explain the condition to the parents. They are told that it is one which can be confidently expected to correct itself but that they must be willing to accept a certain amount of variation from what is considered normal gait for a year or two. They are

told that in the more severe cases derotation bars can be applied and the chances of hastening correction are improved. The choice of awaiting spontaneous correction or of attempting active correction with derotation bars can sometimes be left to the parents. In this regard, however, if the physician senses indecision on the part of the parent he should make a firm recommendation for one or the other plan of treatment. Internal tibial torsion and external rotation attitude are the two main conditions which fall into this category.

There is less of a problem where active treatment is indicated. Parents readily accept cast correction for metatarsus varus or calcaneovalgus deformities, and shoe corrections for flatfeet.

#### SUMMARY

1. An outline has been presented for a rational approach to the problem of handling the child who toes in or toes out.

2. Causes for each of these situations have been enumerated.

3. The methods that we, as practicing physicians, one a pediatrician and the other an orthopedist, use to cope with these conditions are discussed.