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PHYSIOLOGICAL GENU VARUM

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The lower extremities of the newborn child are normally somewhat bent in the sagittal and frontal plane (Böhm 1928, Forrest 1949) usually combined with inward torsion of the whole extremity or the tibia (Blount 1966). Normally there is a certain genu varum at birth; this usually disappears during the first or second year of life. During the third or fourth year, it often changes to genu valgum, which disappears at about six years of age (Böhm 1928, Bragard 1932, Renotte 1968).

Some children have a more pronounced genu varum with spontaneous correction later than normal. The deformity is often referred to as physiological or developmental genu varum (Sharrard 1971) and can create differential diagnostic difficulties and be hard to distinguish from various pathological forms of genu varum.

Various causes have been mentioned or physiological genu varum (Myers 1948, Jacobsson 1949, Kite 1954, de Palma 1955, Bateson 1966, Shands & Raney 1967). Blount (1966) asserted that the spontaneous correction of physiological genu varum is due to the varus position stimulating the growth on the medial side of the proximal tibia.

It has earlier been found that there is a connexion between physiological genu varum and the infantile type of Mb Blount (Langenskiöld 1952, Golding & McNeil-Smith 1963, Langenskiöld & Riska 1964, Blount 1966, Zayer 1973). The present work investigates this connexion in closer detail.

MATERIAL AND METHODS

In an investigation of Mb Blount (Zayer 1973), material was collected from 180 patients with pronounced genu varum who were suspected of having Mb Blount. They were collected from orthopaedic, paediatric, and roentgenological clinics throughout Sweden. The investigation was made clinically and roentgenologically on repeated occasions from childhood to, in most cases, adult ages.

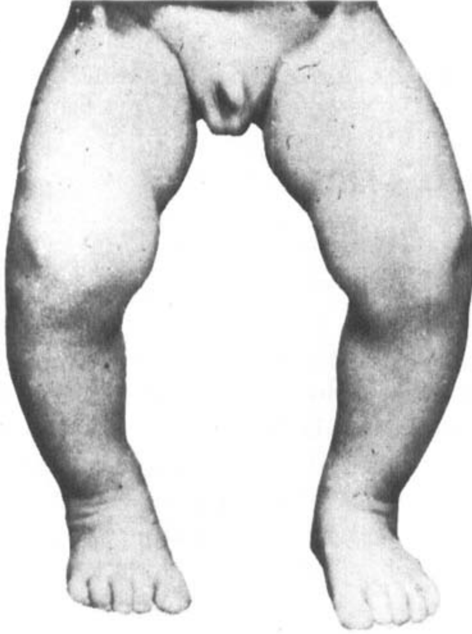


Figure 1.
Physiological genu varum at 1 year 8 months.

(Figures 1–4 depict the same patient.)

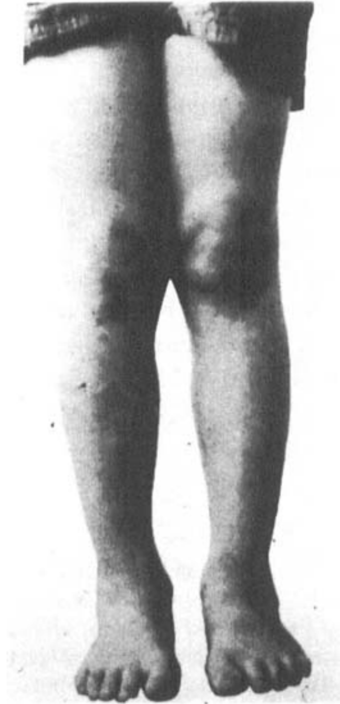


Figure 2. Genu valgum at 9 years 8 months.

3 a

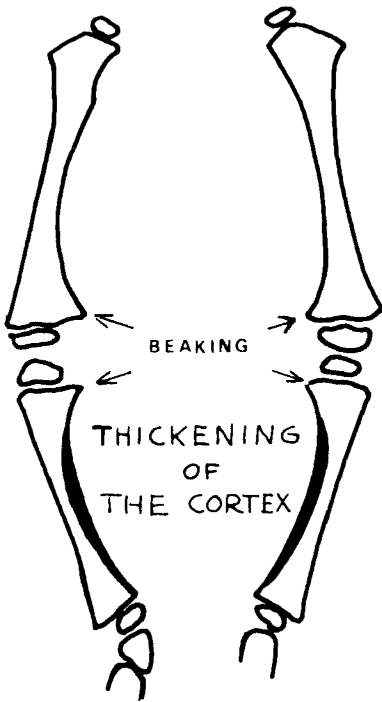
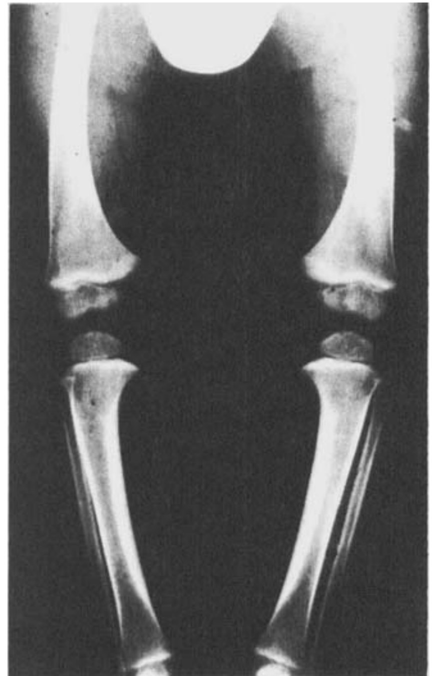


Figure 3. Physiological genu varum at the age of 1 year 8 months with typical roentgenological changes in the distal femur and the proximal tibia.



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RESULTS

At a follow-up of the cases, 85 were diagnosed as Mb Blount, of which 52 were of the infantile type and 33 of the juvenile type; 76 were diagnosed as bilateral physiological genu varum and 19 showed a different pathological genesis. Of the 52 with infantile Mb Blount, 11 had Mb Blount on one side and physiological genu varum on the other. Thus the final material consisted of 76 cases with bilateral physiological genu varum and 11 with unilateral physiological genu varum.

Course

Of the physiological genu varum cases 58 were boys and 29 were girls. In all of them, a varus deformity in the knee joints was recorded at birth. This deformity increased during the latter part of the first year of life and when the child began to walk. The varus deformity was usually most pronounced in the first and second year of life. It could then amount to 30–40 degrees at clinical investigation (Figure 1). The deformity was successively reduced during the following year and most often was eliminated between the ages of three and five in both boys and girls. In nine instances, during the following years up to the age of 11, a lesser valgus position (Figure 2) arose; this often remained.

In 28 cases, there is information regarding a similar varus deformity during childhood in the parents, siblings, or close relatives. There was no difference in the course of those with bilateral physiological genu varum and the 11 with unilateral physiological genu varum.

Roentgen

All cases showed a medio-dorsal beaking in the metaphysis of femur and tibia, thickening of the medio-dorsal cortex, and some reduction in the size of the bone epiphysis of the distal femur. The medial parts of the bone epiphysis of the proximal tibia and also the bone epiphysis of the distal femur were often wedge-shaped, the wedge pointing medially (Figure 3). These changes were present between the ages of one and two years and differed from the normal roentgen picture, as shown by Scheller (1960). During the following years, the roentgenological picture gradually became normal (Figure 4).

Treatment

In 63 out of 87 cases, different degrees of pes planu-valgus were recorded; in 19, this was treated with supports of varying types and

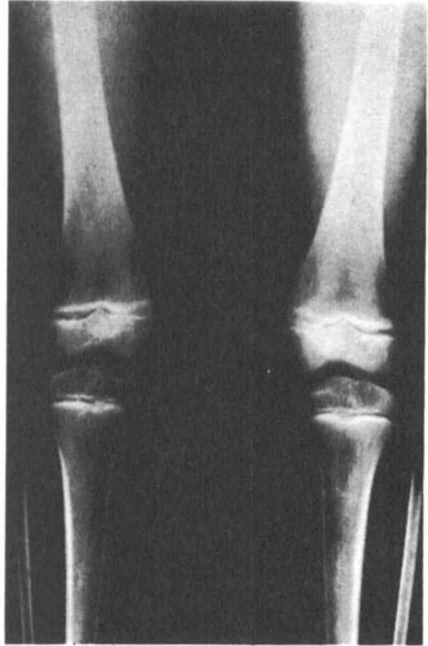


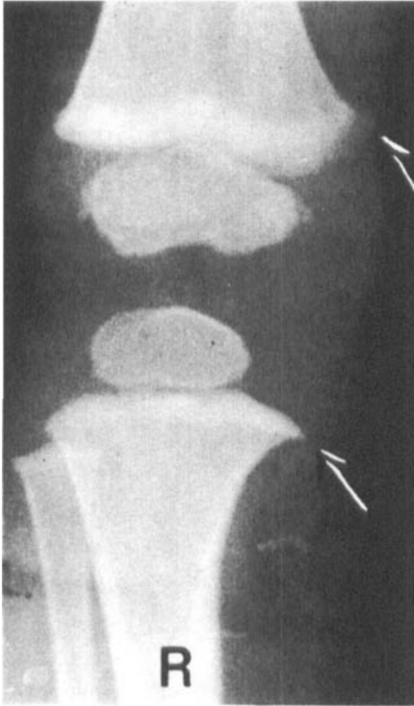
Figure 4. Genu valgum at 9 years 8 months. The roentgen examination shows normal conditions.

for varying lengths of time. In five, boots or night splints were prescribed. One was put into plaster bilaterally at almost two years of age. In three, the varus deformity was corrected with the aid of a bilateral tibial osteotomy at the age of 1½–2 years. Unilateral stapling according to Blount was performed in one patient in the lateral part of the proximal tibia at almost three years of age. This operation had no positive effect on the varus position, probably because of poor attachment of the staple. Both the operated and the non-operated side underwent the same correction.

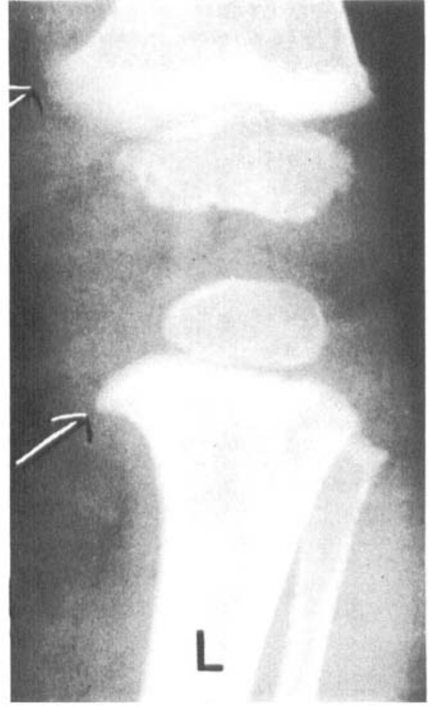
In the 11 cases, where there was physiological genu varum on one side and Mb Blount on the other, the metaphysial stage (see below) was present roentgenologically in all cases, whereas one case progressed to the epiphyseal stage (Figures 5–8). Of these, only one at the metaphysial stage was corrected by osteotomy through the proximal tibia. The other side with physiological genu varum was not treated.

DISCUSSION

The most important differential diagnoses of physiological genu varum are Mb Blount, prenatal genu varum, healed rachitis, hypophosphataemia, and post-traumatic genu varum after physial injury.



5 a (Right).



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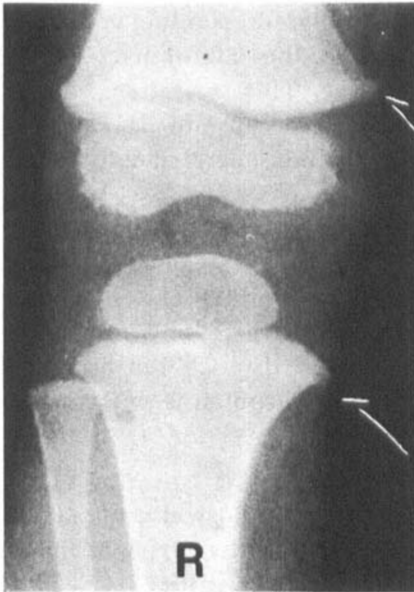
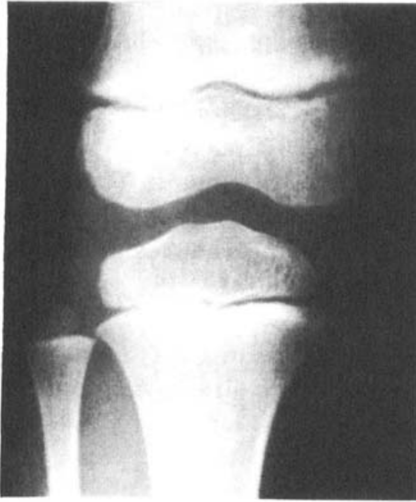
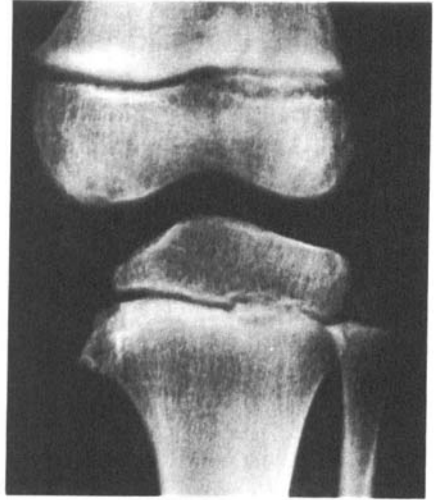


6 a (Right).

6 b (Left).



7 a (Right).



7 b (Left).

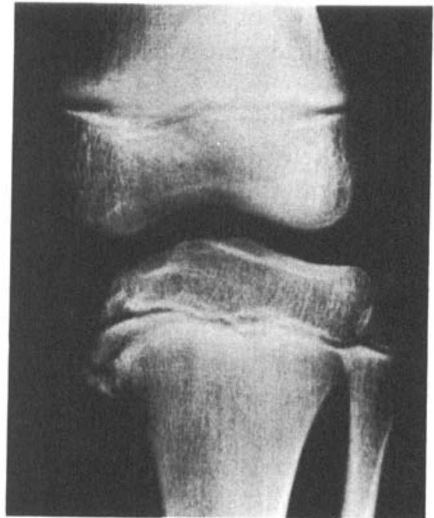
Figures 5–8. Roentgen examination of a patient with right-sided physiological genu varum and left-sided Mb Blount at different ages and different stages.

Figure 5. 1 year 4 months.
a. Physiological genu varum.
b. Mb Blount—initial stage.

Figure 6. 2 years.
a. Physiological genu varum.
b. Mb Blount—metaphysial stage.

Figure 7. 4 years.
a. Normal.
b. Mb Blount—metaphysial stage

Figure 8. 7 years 2 months.
Mb Blount—epiphysial stage.



8 (Left).

Mb Blount is a growth disturbance localized to the postero-medial part of the proximal tibia, where it disturbs the growth in the metaphysis, the physis, and the bone epiphysis. The infantile type is usually bilateral and generally found when the child begins to walk, whereas the juvenile type is usually unilateral and has its debut between the

ages of 6 and 14 years. The infantile type goes through four roentgenological stages: initial, metaphysial, epiphysial, and adult (Zayer 1973). Before the age of two, it is impossible to distinguish cases of physiological genu varum from the initial stage of Mb Blount (Golding & McNeil-Smith 1963, Blount 1966, Zayer 1973). Physiological genu varum can well be a reversible pre-stage of Mb Blount. The latter opinion is supported by the results in the present investigation, where in 11 cases Mb Blount was present on one side and changes indicating physiological genu varum on the other side.

In prenatal genu varum (Caffey 1967), however, there are less difficulties of differential diagnostics in distinguishing it from physiological genu varum because the varus deformity is already pronounced at birth, and there is a dimple on the convex curvature of the lower leg. The varus position is usually present up to the age of 2 years, and roentgenologically, it can then resemble healed rachitis, Mb Blount, and physiological genu varum.

The healed rachitis creates differential diagnostic difficulties because the varus deformity of this condition remains and can resemble physiological genu varum or Mb Blount.

In hypophosphataemia, a varus deformity is present in both the femur and tibia. The growth zones are in addition thicker and irregular, and on the roentgen picture, the structure is coarse and irregular. From the laboratory standpoint, this condition shows characteristic features.

Post-traumatic genu varum most often arises after longitudinal trauma. The varus deformity is then frequently unilateral and does not usually appear during the first years of life.

As a rule, it is not necessary to introduce any type of treatment for physiological genu varum. In the present material, all cases became normal, irrespective of whether or not they were treated. On the other hand, it is important to investigate and follow-up children with genu varum so that a pathological genesis can be excluded.

SUMMARY

Physiological genu varum is a condition which, during the first years of life, usually does not require any treatment, but it can present differential diagnostic difficulties. The condition can be distinguished from Mb Blount, prenatal genu varum, hypophosphataemia, rachitis, and post-traumatic genu varum in its course, roentgenological picture, and laboratory examination. It is highly probable that physiological

genu varum is the reversible initial stage at Mb Blount, because both physiological genu and Mb Blount can occur at the same time in the same patient.

REFERENCES

Bateson, E. M. (1966) Non-rachitic bow leg and knock-knee deformities in young Jamaican children. *Brit. J. Radiol.* **39**, 92.

Blount, W. P. (1966) Tibia vara, osteochondrosis deformans tibiae. In: *Current practice in orthopaedic surgery*, ed. Adams, J. P. p. 141. Mosby, St. Louis.

Bragard, K. (1932) Das genu valgum. *Z. Orthop.* **57** (Beilageheft).

Böhm, M. (1928) Genu varum and genu valgum infantum. *Z. Orthop.* **49**, 321.

Caffey, J. (1967) *Pediatric x-ray diagnosis.* Year Book Publishers, Chicago.

De Palma, A. F. (1955) Lesions of the knee in childhood. *Pediat. Clin. N. Amer.* **2**, 1048.

Forrest, H. J. (1949) Physiologic bow legs. *Arch. Pediat.* **66**, 349.

Golding, J. S. R. & McNeil-Smith, J. D. G. (1963) Observations on the etiology of tibia vara. *J. Bone Jt Surg.* **45**-B, 320.

Jacobson, E. (1949) Jambes arquees non rachitiques chez l'enfant. *Arch. franç. Pédiat.* **6**, 361.

Kite, J. H. (1954) Nonrachitic bowing of the tibia (Abstract). *Sth. med. J. (Bgham, Ala.)* **47**, 205.

Langenskiöld, A. (1952) Tibia vara (osteochondrosis deformans tibiae). *Acta chir. scand.* **103**, 1.

Langenskiöld, A. & Riska, E. B. (1964) Tibia vara (osteochondrosis deformans tibiae). *J. Bone Jt Surg.* **46**-A, 1405.

Myers, E. (1948) Knock knee and bowleg. *Kentucky med. J.* **46**, 14.

Rennotte, A. (1968) Le genu valgum statique entre deux et cinq ans. *Rev. med. Liège* **23**, 459.

Sharrard, W. J. W. (1971) *Paediatric orthopaedics and fractures.* Blackwell, Oxford and Edinburgh.

Scheller, S. (1960) Roentgenographic studies on epiphysial growth and ossification in the knee. *Acta radiol. (Stockh.)* Suppl. 195.

Shands, A. R. Jr. & Raney, R. B. (1967) *Handbook of orthopaedic surgery.* Mosby, St. Louis.

Zayer, M. (1973) *Natural history of osteochondrosis tibiae (Mb Blount).* Gleerups, Lund.

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