Angular Deformities of the Knee in Children

B. A. Solagberu

Department of Surgery, University of Ilorin Teaching Hospital, Ilorin

ABSTRACT

Reports from Ibadan and Zaria showed variations in the types of angular deformities of the knee in children. This work was done to determine the varieties of the deformities and their causes at the University of Ilorin Teaching Hospital Ilorin, Nigeria and review the problem in Nigeria. A prospective analysis of all children with angular knee deformities seen at the orthopaedic clinic of the University of Ilorin Teaching hospital Ilorin, Nigeria was carried out over a one-year period. The patients were evaluated clinically, radiologically and biochemically and their results analysed. Seventy two children comprising 38 males and 34 females (M: F=1.1:1) with deformities in their knee were seen. The age range was 1.5 to 11 years. Forty-two children had physiological changes of growth, 66.6% of them were boys while 18 children had rickets, 14 of them, (77.8%) were girls. Additionally, Blount's disease was seen in ten, six of who were girls. Two boys had posttraumatic genu valga. The commonest presentation was bilateral genu deformities. Diagnosis of rickets was made clinically and radiologically, serum biochemistry was not contributory. Thirty-four patients had corrective osteotomy. When compared with other reports from Nigeria, it appears that the scope of genu deformities in children varies from centre to centre. There is a need to conduct a multi-centre study to determine the true pattern in Nigeria *(Nig J Surg Res 2000; 2:62-67)*

KEY WORDS: Knee deformities, Rickets, Blount's disease, Osteotomy, Geny varum, Genu valgum, Children

Introduction

Orthopaedics derived its name from "orthos" and "paedis". The former meaning "straight" while the latter means "Child". Thus for historical reasons, the practice or orthopaedics probably evolved around

Reprint, requests to: Dr. B.A. Solagberu, Department of Surgery University of Ilorin Teaching Hospital, Ilorin. E-mail: tunde@ilorin.skannet.com

ensuring that the child has straight legs by treating deformed legs or preventing a deformity before it occurs. In Nigeria, at least two published works from Western and Northern parts, with different diets and cultural practices, found different varieties of angular deformities around the knee. In our centre, located in the Middle belt region between these two others, we decided to study the pattern of knee deformities in order to determine variations around Nigeria.

A noticeable number of parents bring their children to the orthopaedic clinic because of angular deformities at the knee(s) of their children. They want the child's leg straightened. These deformities are often termed "bow leg" and "K-leg" by the parents equivalent to genu varum and genu valgum. The deformity may be unilateral or bilateral either of one variety or combining the two varieties, one on each leg and both constituting a "windswept deformity". The practice at our clinic requires thorough evaluation of the child and planning a treatment format which many times is reassurance of the worried parents. Indeed, the parents will mount pressure on the attending surgeon "to do something" translating to a demand for surgical correction because of the embarrassments they claim to face in their child's badly shaped legs. Salawu[1] from Zaria published 70% rickets rate among the 103 cases seen whereas Oyemade[2] from Ibadan has reported a preponderance of non-rachitic patients, 67 out of the 114 (58.8%) children reviewed.

Materials and Methodology

All patients referred to the orthopaedic clinic between July 1998 and June 1999 with angular deformities of the knee were evaluated prospectively, taking note of their age, sex and type of deformity. Further examination was done to detect wrist bulges, chest wall costo-chondral swelling (rickety-rosary), Harrison's sulcus and bossing of the skull. Radiographs of the knees and the wrists if there were bulges were requested in addition to a full blood count, haemoglobin genotype to exclude sickle cell disease and blood chemistry for serum calcium, phosphate and alkaline phosphatase levels. Patients were then followed up within the next two weeks it took them to get results of these requests for review. Those that have rickets based on clinical and radiological grounds were placed on treatment, some with mild, physiological deformity were reassured and the others were booked for corrective osteotomy if indicated. This group comprised posttraumatic genu deformity, Blount's disease, or severe physiological variety. Postoperative radiographs of the knee confirm correction of the deformity while the limb is in plaster of Paris (POP). During the application of the POP, an attempt at over correction is made. Sutures are routinely removed by the $10^{th} - 14^{th}$ day through a window in the POP. At variable periods of six to ten weeks, the POP is removed and the patient allowed to walk freely or taught with the aid of crutches in older children.

Results

Seventy-two children with age range of 1.5 - 11 years and median age of 3 years were studied having presented with angular deformities of the knee. There were 38 males

and 34 females (M:1.1:1). Forty-two children had physiological changes of growth - a diagnosis of exclusion when clinical, radiological and biochemical results were normal. Two-thirds of these (28 of 42) were males whereas majority of the patients with rickets were females. (14 of 18, 77.8%) Of the ten Blount's disease patients, six were females and four were males. Two patients (both boys) had post-traumatic genu valgus deformity. The commonest presentation was bilateral deformities in 34 children nearly equally shared by valga, (16) and vara deformities (18), followed by isolated valgus deformity in 16 children, eight each on the right and left legs. Windswept deformity was seen in ten patients, six others presented with left genu varus and six with anterior bowing of the tibiae mainly. No child had isolated right genu varus deformity. Majority of the children were between two and five years (58 of 72, 80.6%) 24 of them having valgus deformity and 22 varus deformity. Whereas radiographs were able to confirm the clinical suspicion of rickets 100% of the time, serum biochemistry of calcium, phosphate and alkaline phosphatease were not as helpful. Thirty- four patients had corrective osteotomy, all of them were offered

Table 1: Clinical Features of Rickets and percentage of Patients presenting with them

Clinical Features	Percentage
Tibia deformity	100
Wrist Bulge	100
Rickety-rosary	66.6

Table 2: Knee Radiological Sings and percentage of Patients with the signs

Radiological Signs	Percentage
Widening of the physis	100
Splaying of Metaphysis	100
Cupping of metaphysis	80
Fraying	50

Table 3: Age and Types of Angular Deformities

Age Presentation	1-2yrs	2-3 yrs	3-4yrs	4-5yrs	5yrs	Total
Valgus	6	4	10	10	2	32
Varus deformity	0	10	6	6	2	24
Windswept deformity	0	6	2	2	0	10
Tibia bowing	2	0	2	0	2	6
Total	8	20	20	18	6	72

a closing wedge type but one. The only opening wedge corrective osteotomy done was for one of the two patients with Blount's disease whose tibia plateau was elevated and the ensuing opening wedge filled with fibula grafts.

Discussion

Bateson in 1966[3] and 1968,[4] and Salenius and Vankka[5] in 1975 have described the physiological changes in the knees of a young child with a radiographic varus at birth, which

later converts to a valgus. The former occurs between ages 1-3 years while the later is common between 2-7 years. Spontaneous reduction is the rule in most children. However, much earlier in 1922, Erlacher first reported tibia vara. It was later fully described by Blount[6] in 1937 (after whom it is named). Blount described two varieties -- infantile (seen within 1-3 years) adolescent type (starting at about age 8 years) with the infantile type being more severe, more progressive and more common. Usually both legs are affected but the condition may be unilateral. Thus, a physiological angular deformity of the knee may give rise to a radiologically recognized Blount's disease later.

In developing countries with a high prevalence of malnutrition, cultural or religious practice places housewives in purdah- in Islamic practice of complete restriction of a wife in the inner compartment of household and in covered dresses without outsiders seeing her. This is often associated with poor exposure of the offspring of such a woman to sufficient sunlight leading to vitamin D deficiency. Oyemade[2] had reported a high rickets rate among children of mothers involved in this practice. In his study of 114 patients, 47 had rickets with 35 of these being children of women in purdah. Salawu[1] gave a rickets rate of 70% among the 103 patients he reviewed in Northern Nigeria where the practice of purdah is more prevalent but he did not attribute the high rate to purdah. In this report, none of our patients came from homes engaged in purdah practice. It is controvertible whether this is what is responsible for the lower rickets rate of 25% in Ilorin (18 of 72 patients) when compared to the 70% and 41% reported by Salawu[1] and Oyemade.[2] Indeed, physiological genu deformities accounted for 42 of 72 (59%) patients in this series agreeing with the Oyemade's[2] series as the commonest cause of deformities around the knee followed by rickets

All the rickets were of nutritional variety; none was due to renal disease. Diagnosis of rickets was initially made clinically, with all the patients presenting with tibia deformity causing one form or another of genu deformity, wrist bulge (100%) and swellings at the costo-chondral junctions of the ribs made prominent by elevating the upper extremity of the patient. This was found positive in 60% of the patients (Table 1). Radiographs of the knee and wrist further confirmed rickets. Findings included widening of the growth plate, splaying of the metaphysis and its cupping concavity facing the epiphysis, fraying due to inflammation in the physis and thinning of the stem of the bone giving on over-all picture of an "inverted" champagne glass appearance with reference to the distal femur. All these changes are, however, not always present (Table 2). The rickets patient is not operated until there are radiological signs of healing as evidenced by a reduction in the size of the growth plate and opacification of significant part of it suggesting enhanced calcification. Serum biochemistry was not of help in making diagnosis or follow up of the patients as the figures were not consistent with expected values. We had instances of elevated serum alkaline phosphatase (SAP) both in rickets and non-rachitic patients. The calcium levels too are either normal or low. In rickets, initially, the level of calcium is low but this low level is the stimulus for parathormone secretion, which stimulates osteoclasts to mobilize calcium from bone and tends to push up the low calcium level

towards normal. Hence, late rickets as most of our patients presented with is associated usually, with a normal calcium level. Serum chemistry is therefore unnecessary in the management of these patients as previously noted by Jackson.[7]

The male preponderance of 1.1:1 in the present report is similar to the ratio of 1.3:1 in a report by Oyemade.[2] Interestingly, the significance of female preponderance in rickets and Blount's disease remains to be ascertained. The common presentation of bilaterality of most of the patients suggests a possible contribution by the weight of the patient. Kessel[8] proposed this in patients with Blount's disease, which he felt was due to early weight bearing such that the pressure on the medial tibia epiphysis slows down its growth. The normal growth rate of the fibula, later helped by static forces, encourages genu varum. This would not explain the bilateral valga cases in patients without Blount's disease. Nonetheless, age 2-3 years was predominantly for varus deformity while other ages had valga deformity. Patients with wind-swept deformity usually have only one of the bones diseased, the other appeared to be compensating for the ensuring reduction in height of the patient (Table 3).

The patients with rickets were placed on balanced diet and vitamin D supplements 5,000 IV day or 10,000 IV every other day. The author does not believe in adding calcium since what is missing in nutritional rickets is the vitamin D to drive absorption of the calcium in the intestines and kidneys rather than a wholesome calcium deficiency. All the patients, judged fit for surgical correction had closing wedge oeteotomy in the tibia for genu, varum and the femur for genu valga. The 11 years old girl with severe Blount's disease had an opening wedge osteotomy – a modification of Siffert osteotomy[9] without growth plate arrest, with fibula graft in the space created after elevation of the depressed medial epiphysis. For centuries, it has been known that following an incomplete fracture, the subsequent healing in the bone will produce a genu deformity.[8] Two of our patients had this in the femur and presented with genu valgum. Taylor[10] also described this for the tibia. Only 34 patients had surgery, meaning that 38 patients were not operated, underscoring the importance of careful patient selection using objective criteria such as absence of bone disease (rickets), presence of severe deformity and worsening deformity on follow up. A larger study may explain the seeming preponderance of girls in the Blount's disease and rickets groups.

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