Periosteal stripping in achondroplastic children

Little effect on limb length in 10 cases

Dennis J Edwards, Derek B Bickerstaff and Mike J Bell

We present a prospective study of the results of periosteal stripping and division in 10 achondroplastic children. A single limb (femur and tibia) was operated on and the change in actual length of each bone and the percentage change in growth compared to that of the non-operated limb was measured by scanogram. The mean absolute increase in growth was small, measuring 3 mm for the femur and 2 mm for the tibia There was no measurable growth difference after 18 months. This method of increasing limb length in achondroplastic children prior to definitive and extensive lengthening procedures is not recommended.

Sheffield Children's Hospital, Sheffield S10, G.B. Correspondence: Dr. D Edwards, Sportsmed SA, 32 Payneham Rd, Stepney 5069, Adelaide, Australia. Tel +61–8 362 7788. Fax –8 362 0071
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The techniques of chondrodiastasis or callotasis (De Bastiani et al. 1986a,b, Villarubias et al. 1988) have been successful in achieving extensive limb lengthening in children of short stature. However, these methods require prolonged hospitalization and may therefore disrupt the normal development of the child. In order to reduce the amount of lengthening needed ultimately by either one of these two methods, attention has been given to other methods of increasing limb length at an earlier age. Crilly (1972) demonstrated in the chicken that periosteal division increased the growth. This has been confirmed by a number of authors and has been used as a method of correcting limb length inequality (Chan and Hodgson 1970, Jenkins et al. 1975, Wilde and Baker 1987). In addition, this procedure has been associated with few complications. In view of these observations, we have prospectively studied the efficacy of periosteal stripping and division in a consecutive series of achondroplastic children, prior to later extensive limb lengthening.

Patients and methods

Between 1985 and 1990, 10 achondroplastic children underwent circumferential periosteal division and stripping of the femur and tibia of one limb. There were 4 girls and 6 boys with a mean age at initial assessment of 29 (5–60) months and a mean age at operation of 45 (14–77) months. The children were followed-up for a mean of 2 years.

One limb (femur and tibia) was operated on and the growth of that limb was compared with that of the non-operated limb. At operation, the femur was approached through a distal lateral incision. The vastus lateralis was reflected anteriorly and the periosteum exposed proximal to the distal femoral physis. A circumferential division was made at this level and the periosteum was then stripped for 2–3 cm along the length of the femur. A similar procedure was performed on the tibia through a proximal anterior medial incision. The periosteum was again divided circumferentially just distal to the proximal tibial physis and again a 2 cm length stripped distally away from the physis. Some difficulty was encountered in stripping the periosteum adequately along both the medial border of the femur and the lateral border of the tibia because of the size of the approach used.

Limb length was assessed radiographically using scanograms of both limbs at presentation, pre-operatively, and at 6-month intervals post-operatively until final review. All films were measured by one observer to avoid inter-observer variations. Femoral and tibial bone lengths were measured from the same bony landmarks in each case. In these young children, the femoral head, condyles or proximal tibia can be difficult to visualize accurately. The physis, however, is easily seen and provides a ready landmark for measurement. Therefore, in cases where the margins of the epiphysis were indistinct, measurements were taken from between the same physeal landmarks.

The duration of hospital stay was on average 2 (1–3) days.

Results

The mean absolute increase in growth was small, measuring 3.2 mm for the femur and 1.7 mm for the tibia (Table 1). There was a large variation in the amount of additional growth achieved in individual cases. The percentage rate of increase in growth demonstrated that all measurable change in growth had ceased by 18 months. There were no complications, but a mild valgus deformity of the tibia was noted in 4 children with a maximum deformity of 5 degrees in 1.

Table 1. Difference in scanogram measurements of operated and non-operated limbs

	Increase in length mm	*SD*	Percentage increase	*SD*
Femur	3.2	*2.2*	0.92	*1.5*
Tibia	1.7	*2.3*	1.1	*1.2*
Total	4.9	*1.7*	2.0	*1.6*

Discussion

Our results are contrary to those reported by Jenkins et al. (1975) and Wilde and Baker (1987) who reported significant increases in leg length following periosteal division. In addition, we found that all growth had ceased by 18 months.

Jenkins et al. (1975) and Houghton and Rooker (1979) have reported a valgus deformity of the ankle, following isolated tibial periosteal stripping. This is thought to be due to a relative increase in tibial growth, in comparison with that of the fibula. The finding could be of potential value in achondroplastic children in correcting their pre-existent varus deformity and it was indeed apparent in four of our cases.

In view of the small increase in length expected from the procedure, a reproducible measurement technique is required to convincingly demonstrate these changes. Anthropometric and scanogram measurements have been criticized for their inaccuracy (Green et al. 1946, Nichols and Bailey 1955, Huurman et al. 1987). The reliability of scanograms depends on the accurate positioning of the limb, the measuring device and the radiographic beam (Green et al. 1946, Huurman et al. 1987). In addition, in this type of skeletal dysplasia, the bony landmarks can be difficult to determine. We have not calculated the reproducibility of the technique itself, but Huurman et al. (1987) and Lang et al. (1989) have shown that there is a considerable observer error in interpreting the radiographs.

We believe that periosteal division and stripping is of little value in achondroplastic children where an increase in limb length is desired. The changes are minimal and could easily be incorporated into the program of extensive limb lengthening when the child is older.

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