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RESULTS OF TIBIAL LENGTHENING BY ILIZAROV TECHNIQUE

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ABSTRACT

Tibial lengthening using Ilizarov technique was performed in 20 patients (12 females and 8 males) aged 12-35 years (mean 19 years) with a mean follow up of 3 years (2-4 years). The etiology of the shortening was post-infective in 9 patients, post-traumatic in 7, post polio residual Palsy in 3, and congenital pseudarthosis of tibia in one patient. All except one patient achieved the desired length ranging from 3 to 8cm (mean 5.3cm). The average healing index was 5.7 weeks per cm and ranged from 5 weeks/cm to 7.2 weeks/cm. All patients improved their gait pattern. Pin tract infection was the commonest problem and equinus was the commonest obstacle to lengthening. The results were rated as excellent in 12 and good in 7. The Ilizarov technique for limb lengthening is safe and very effective.

KEYWORDS: Limb lengthening- Tibial lengthening- Ilizarov Technique.

INTRODUCTION

Over the years various techniques have been used for lengthening of short limbs. The earlier methods involved acute distraction through calcaneal pin[1] or slow distraction (5mm per day) with the use of an external fixator.[2] The technique was modified by using different types of osteotomies and apparatuses.[3-5] However these methods were associated with major complications and were deficient in the control of the bony fragments. Further modifications included lengthening over an intramedullary nail[6] to control the bony fragments and the use of slotted cortical allograft to shorten the healing time.[7] In 1970's Wagner's technique became most popular in the western world because of its better fixation and early ambulation, but this technique could not decrease the major complications

associated with lengthening. Compared to these Ilizarov's technique combines the advantages of efficient fixation, early ambulation, elimination of the bone grafting and decrease in the complication rate. This study was aimed at ascertaining the efficiency and safety of this technique for limb lengthening in our patient population.

PATIENTS AND METHODS

Twenty patients aged between 12 and 35 years (mean 19 years) undergoing tibial lengthening using Ilizarov technique between July 1997 and June 2000 were included in the study. Patients were followed up for a period ranging from 2 to 4 years with a mean follow up of 3 years. Shortening as a result of infection, trauma, congenital disorders and poliomyelitis were indications for lengthening. Discrepancies due to tumors, hemophilia and shortening associated with uncorrectable contractures were excluded from the study. The study was approved by the institutional review board and informed consent was obtained from all patients. The Ilizarov external fixator was pre-constructed to decrease the operation time. The ring size was determined clinically as the one, which would leave at least two-finger breadth space on all sides. Italian modification of the Ilizarov technique was followed.[9] The pre-construct consisted of two proximal and two distal rings. A 5/8th ring of appropriate size was used as the first ring in the proximal block in order to allow free range of motion at knee joint.

Table. I. (Assessment of results).

Additions (total of 100 points)

	20 points	**15 points**	**10 points**	**0 points**
Length achieved	Within 1 cm of goal	Within 3 cm of goal	With in 5 cm. of goal	
	Discrepancy > 5 cm	Range of motion knee	Same as pre-op	75%
of Pre-op	50% of pre-op	< 50% of pre op	Range of motion ankle	
	Same as pre-op	75% of Pre-op	50% of pre-op	<
50% of pre op	Change in gait	0,1to 0	1,2 to 1	0 to 1or 1,2 to 2	0 to 2
Healing Index	4 - 5 Wks/ Cm	5 - 6 Wks / Cm	6 - 7 Wks / Cm	> 7 Wks / cm

Subtractions	
Any major complications	-20
Any minor complications	-10
Any additional surgical intervention performed during lengthening	-5

Final Score	
90 - 100	Excellent
75 – 89	Good
50 – 74	Fair

This was connected to a full ring by means of hexagonal sockets. The distal block consisted of two full rings. The proximal and distal blocks were connected by graduated telescopic rods. The pre- construct was superimposed on the radiograph of the tibia to be lengthened and adjustments made in order to have the proximal and distal rings at least 2cm away from the joint line and the first ring at the level of head of fibula. Surgery was performed under general/ Epidural anesthesia. The pre-construct was fixed to tibia using Ilizarov wires in the safe anatomical zones using standard Ilizarov principles. Osteotomy of fibula was carried out at the junction of its middle and distal third. This was followed by tibial corticotomy a the proximal metaphysis. Distraction was started at an average on the seventh day of surgery at a rate of 0.25 mm four times a day. The rate of distraction was adjusted according to the quality of the regenerate and was continued till the desired length was achieved. During the whole process of lengthening the patients were encouraged to bear weight, as per tolerance on the operated limb and do active physiotherapy. Fixator removal was planned when at least three cortices were visible radiologicaly. At this time the fixator was dynamized. Fixator removal was performed when the patients could bear weight without any pain in the dynamized ring. Removal of the fixator was carried out as an O.P.D procedure. The results of the technique were assessed using a scoring system (Table I) modified from Paley et al.[10] The score originally meant for femoral lengthening was modified so as to be useful for assessment of tibial lengthening. We felt the need of inclusion of healing index and complications of procedure necessary for final assessment.

RESULTS

Twenty patients (12 female and 8 male) aged 12 to 35 years (mean19 yrs) were included in the study. The etiology of shortening was post infective in 9 patients, post traumatic in 7, post polio residual paralysis in 3 and congenital pseudoarthosis of tibia in one patient. Shortening involved right limb in 8 patients and left limb in 12 patients. Shortening involved femur in 9 patients, tibia in 9 patients and both tibia and femur in 2 patients. In nine patients tibial lengthening was performed despite femoral shortening because the shortened segment was not found feasible for lengthening. Similarly in two patients where shortening involved both segments, tibial lengthening was preferred. The small difference in the knee height on either side thus anticipated was explained to the patients. All except one patient achieved the desired length (Fig. 1).

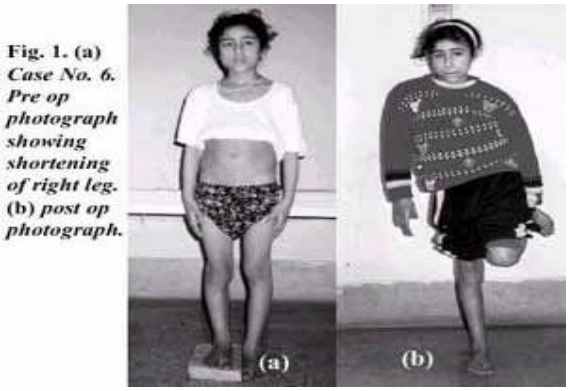

Fig. 1. (a) *Case No. 6. Pre op photograph showing shortening of right leg.* (b) *post op photograph.*

Results of Tibial Lengthening By Ilizarov Technique

Table II. (Results of tibial lengthening).

Patient No.	Discrepancy Pre-op cm.	Post-op cm.	Length achieved cm.	Healing index wks/cm	Follow up years	Score	Result
1	5	0	5	5.2	4	95	Excellent
2	7.5	0	7.5	5	4	90	Excellent
3	4	0	4	5.5	4	95	Excellent
4	8	1	7	5.4	4	85	Good
5	9.5	2	7.5	5.7	4	85	Good
6	3	0	4.5	6.6	3.5	90	Excellent
7	4	0	4	5.7	3.5	95	Excellent
8	3	0	3	7	3.5	85	Good
9	5	0	5	6.8	3.5	90	Excellent
10	4	0	4	7.2	3.5	80	Good
11	7	2	5	5.2			Excluded
12	7	1	6	6.3	3	85	Good
13	5.5	0	5.5	6	2.5	90	Excellent
14	5	0	5	5.2	2.5	85	Good
15	7	0	7	5.4	2.5	95	Excellent
16	7.5	1.5	6	5	2.5	80	Good
17	3	0	3	5.3	2.5	95	Excellent
18	8	0	8	5.2	2	95	Excellent
19	5	0	5	5.6	2	95	Excellent
20	7	2	5	5	2	95	Excellent

One patient was excluded from the results because of her non-compliance. This patient returned when the regenerate had already consolidated and did not agree for any further intervention. Shortening ranged from 3 cm to 9.5 cm (mean of 5.7 cm). The length achieved ranged from 3 cm to 8 cm (mean of 5.3 cm). In one patient over lengthening was performed by 1.5 cm using Manelaus formula in order to match the future growth.[12] At the last follow up discrepancy in this patient was within one cm. In two patients because of stiffness of knee joint 2 cm of shortening was left to allow for the ground clearance. he healing index ranged from 5 wks/cm to 7.2 wks /cm (Mean 5.7wks/ cm) (table II).

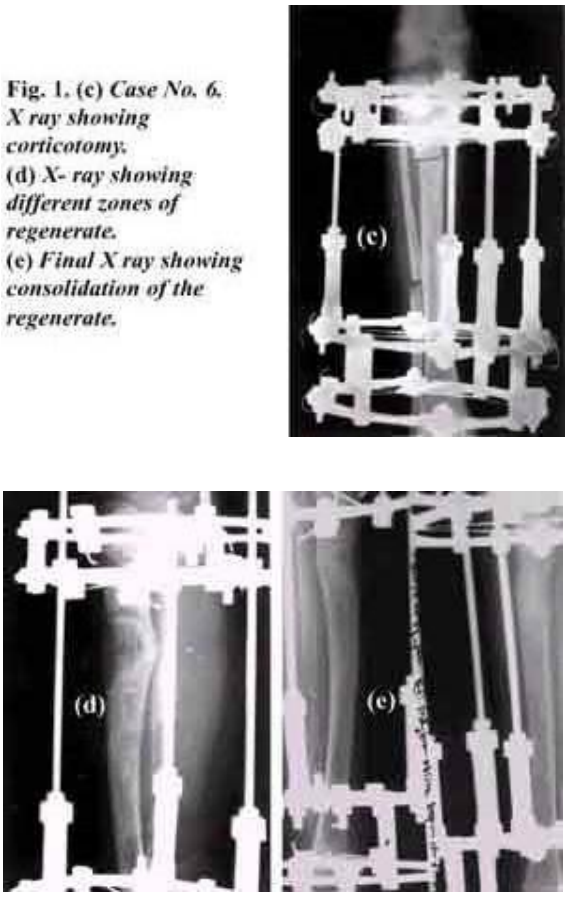

Fig. 1. (c) *Case No. 6. X ray showing corticotomy.*
(d) *X- ray showing different zones of regenerate.*
(e) *Final X ray showing consolidation of the regenerate.*

The results were rated as excellent in 12 and good in 7 patients. The complications of the technique were classified according to the classification of Paley.[11] We had 13 problems and 7 obstacles with no true complications. Delayed consolidation in one patient was managed by accordion maneuver of alternate compression and distraction of the regenerate. In another patient a 20-degree knee flexion contracture was corrected by arthodiastasis by using another ring above knee. There were no neuro -vascular complications, no non-union, refracture or any major deformity.

DISCUSSION

Tibial lengthening with Ilizarov's technique was safe and efficacious on our patient population. Our series presents an average lengthening of 5.3cm with a healing index of 5.7 wks/cm. This is in accordance with the results of other series in the literature.[11,13,14] The major advance in lengthening by Ilizarov technique is its significantly lower complication rate. Older techniques not only were associated with high complication rate but also had difficulty in fixation of the bony fragments.2,4-6 Wagner's technique which has been widely used has still a very high complication rate.[15-17] Pin tract infection, stress fractures, non-union, angulation deformities and a prolonged hospital stay remain a major concern

with Wagner's technique. In contrast we had only 9 problems and 8 obstacles with no true complications. Pin tract infection though common in our series was not of a serious nature. The small diameters of the Ilizarov wires, which are under tension, explain the low incidence of pin tract infection. In contrast to Ilizarov lengthening, pin loosening, pin tract infection, malalignment of the regenerate are common in otherwise less bulky apparatus of orthofix.18 Tightness of the tendo achilles was a major obstacle in our series, which need lengthening. Stanistski et al report a tightness of tendo achilles in 6 patients in their series of 60 patients.13 Higher incidence in our series was possibly because of lack of physiotherapy drive in our patients. Despite the dif ficulties encountered during lengthening, our series presents an average lengthening at a lower complication rate and thus a definite improvement over the previous techniques. We find the technique safe, effective and believe it to be the method of choice for tibial lengthening

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