

## CASE REPORT

# Vascularized free fibular graft in the treatment of congenital pseudarthrosis of tibia

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**Abstract:** Aim of the study was to evaluate the results of the patients with “congenital pseudarthrosis of tibia” treated by vascularized fibular graft transferred from the contralateral calf.

**Material and methods:** The cohort consist of four patients (2 boys and 2 girls) aged 5.75 y (range 4–8 years) in the time of the transfer of vascularized fibular graft from the contralateral calf into the resected tibia suffered from pseudarthrosis Crawford type II, III and IV. Patients were operated on between 1999–2007.

**Results:** A total graft union was achieved in three patients in one-year follow-up period. In one girl, treatment failed due to infection and was treated later with intramedullar Rush nail fixation and additional spongioplasty with an unsatisfactory result.

**Conclusion:** Authors believe that after an accurate preoperative planning in cooperation with the microsurgeon, the treatment of congenital pseudarthrosis of the tibia by vascularized fibular graft should be considered as a very effective, accurate and relatively safe method (Tab. 2, Fig. 4, Ref. 7). Full Text (Free, PDF) [www.bmj.sk](http://www.bmj.sk).  
Key words: congenital pseudoarthrosis of tibia, vascularized bone graft.

Congenital pseudarthrosis of the tibia is a rare, not accurately defined disease. Bowing of the diaphysis of the tibia is usually noted at birth or shortly after, and thus the term “congenital” is appropriate when describing these conditions. Because most pseudarthroses of the tibia are not present at birth, the term “congenital pseudarthrosis of tibia” is somewhat inaccurate, and dysplasia is the preferred term. Anterolateral bowing of the tibia with congenital dysplasia poses one of the most challenging treatment problems due to the compounded difficulty of achieving and maintaining union and providing functional lower extremity. Up to 55 % of cases of anterolateral bowing and pseudarthrosis are associated with neurofibromatosis.

The natural history of tibial dysplasia is extremely unfavorable, and once a fracture occurs, there is little tendency for the lesion to heal spontaneously. The effective methods of treatment include segment transport with the external fixator and the transfer of the vascularized fibula. For resistant pseudarthrosis when other extensive treatments have not achieved a functional extremity, either due to persistent nonunion or due to dysfunctional angular deformity, shortening, atrophy and stiffness, the amputation is entirely appropriate. Weber (7) reported amputation of the calf in 9–14 % of patients.

The aim of our study was to evaluate the results of the patients with anterolateral bowing and congenital dysplasia of tibia treated by vascularized fibular graft transferred from the contralateral calf.

## Patients and methods

Between years 1999–2007, four patients with congenital pseudarthrosis of the tibia were operated at University department of pediatric orthopaedics in Bratislava (Tab. 1). The signs of peripheral neurofibromatosis were found in three of four patients. Angiography, angio CT or angio MRI were made in preoperative planning in all patients. The type of pseudarthrosis was evaluated according to Crawford classification (Tab. 2). Surgical team consisted of pediatric orthopaedic surgeons and plastic-microsurgeon. Resection of the pseudarthrosis to healthy tissue was performed and a vascularized graft from contralateral fibula was transplanted and fixed to tibia with screws or intramedullary with Kirschner wires. The vascular pedicle of the fibular graft was connected to the surrounding vessels (arteria fibularis to arteria tibialis anterior) and the extremity was immobilized in the plaster cast for 6 weeks. Additional fixation was performed by KAFO orthosis for 12 weeks. Screws were extracted after one year at least.

## Results

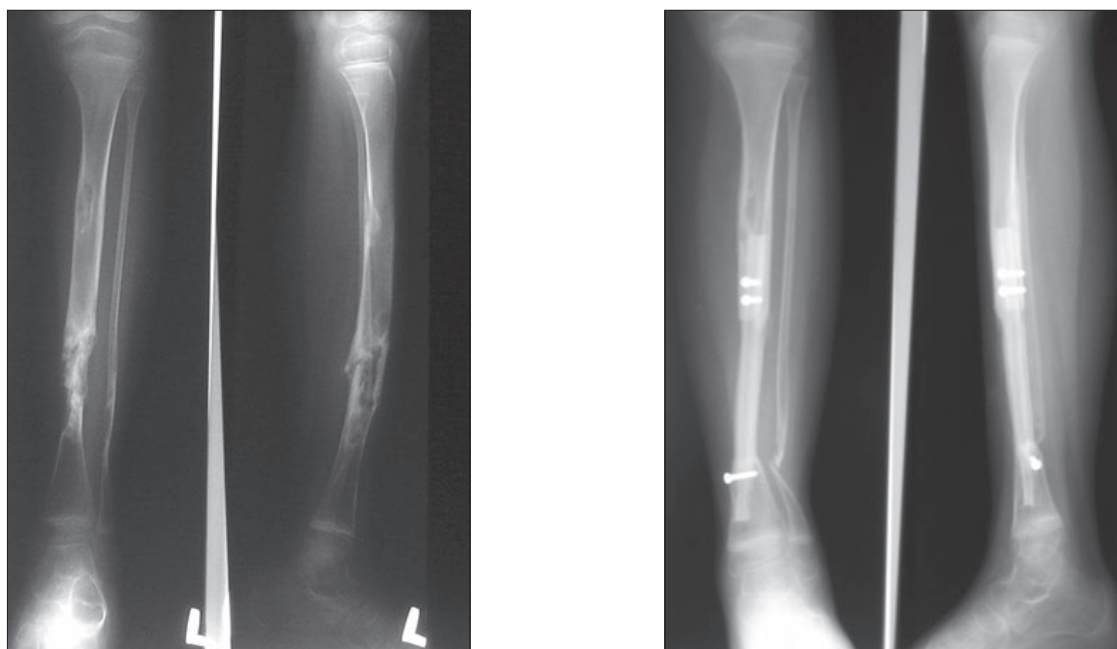
Patients were followed-up for 1–9 years after the operation (Tab. 1).

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**Table 1** Distribution of patients according to sex, Crawford classification, timing of operations, final results and complications

Patient	1	2	3	4
Sex	M	F	F	M
Side	left	right	right	right
Medical history	Bowing 6 y trauma, fract.	Bowing orthosis, fract	Bowing orthosis, fract.	Bowing orthosis, fract.
Crawford type	III cystic	II sclerotic	IV dysplastic	IV dysplastic
Neurofibromatosis	–	–	+	+
Previous op./age	6 y. Boyd	–	2 y. Boyd - infection	–
Age at the time of vasc. fib. traspl.	1999 – 7 y.a.f. on a.t.a.	2005 - 4 y. a.f. on a.t.a.	2004 – 4 y. a.f. on a.t.a.	2007 – 8 y.
Later op.	ankle valgus – supramalleolar osteotomy	–	Rush nail stabilisation – spongioplasty	–
Final result	excellent	excellent	fair	excellent
Leg length discr.	5 mm	no	45 mm	no
Complications	no	no	infection - non union	no

**Fig. 1.** Patient 1 with cystic pseudoarthrosis of left tibia (left), 6 months after transfer of vascularized fibular graft (right).

The first patient – a boy with cystic pseudoarthrosis of tibia – type III according to Crawford was followed-up for 9 years. Due to a 40-degree valgosity in the ankle joint, the supramalleolar tibial osteotomy was performed. He feels excellent, walked independently, without orthosis, he liked sport – cycling. Residual shortening of tibia is 5 mm (Fig. 1).

The second patient – a girl with sclerotic pseudoarthrosis of tibia – type II according to Crawford was followed up for 3 years. The result of operation were considered excellent, full weight bearing was allowed one year after surgery, she walked without orthosis, there is no leg length discrepancy (Fig. 2).

The third patient was a girl with neurofibromatosis, dysplastic pseudoarthrosis of tibia – type IV according to Crawford. The surgery was complicated by the infection (staphylococcus

spec. and *Corynebacterium spec.*), and recurrence of pseudoarthrosis. Two years after the first operation an additional spongioplasty and Rush nail fixation was performed. After one year, the fracture of the Rush nail was registered. The actual shortening of tibia was 45 mm, the pathological movement of the calf was present. We plan the resection of pseudoarthrosis, compressive fixation in Ilizarov frame combined with intramedullar Kirschner fixation and distraction of proximal tibia by Taylor spatial frame (Fig. 3).

The fourth patient was a boy with neurofibromatosis, dysplastic pseudoarthrosis of tibia – type IV of Crawford classification. The follow-up of this patient is only one year, but radiologically the healing effect was excellent, patient walked in the orthosis, he feels no pain and no pathological movement (Fig. 4).

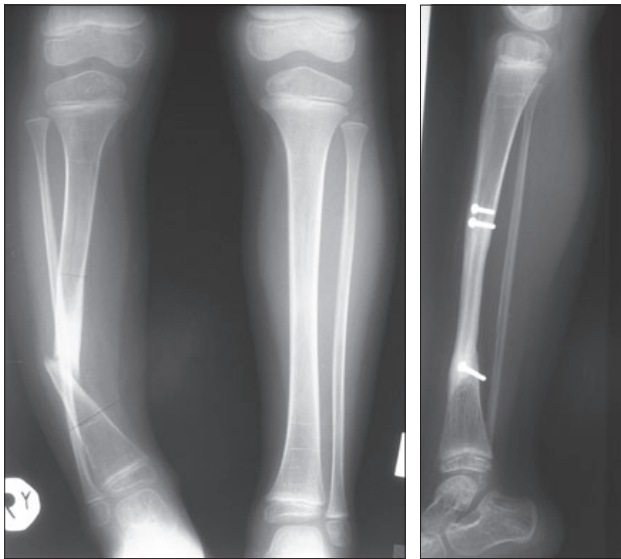


Fig. 2. Patient 2 with sclerotic pseudoarthrosis of the right tibia and fracture (left), one year after transfer of vascularized fibular graft (right).

Table 2 Crawford classification

Type	Description
I	Anterolateral bow with a dense medullary canal. These patients have the best prognosis, can usually be followed up without bracing.
II	Anterolateral bow with an increased medullary canal and a tabulation defect, These patients should be protected from the time the diagnosis is made and prepared for surgical intervention.
III	Anterolateral bow with a cystic lesion. This is a cystic prefracture lesion that may represent some early healing of a previous fracture. These patients should have early bone grafting because of their tendency to fracture early.
IV	Anterolateral bow with fracture, cysts or frank pseudoarthrosis. These patients have the worst prognosis.



Fig. 3. Patient 3 with dysplastic pseudoarthrosis of the right tibia (left), Boyd operation (middle), three months after the transfer of vascularized fibular graft (right).

## Discussion

The first report on treatment of congenital pseudoarthrosis of the tibia with a free vascularized fibular graft appeared in 1979 by Chen (5). More than 30 reports have been published since the introduction of this procedure. The reported primary healing rate was 73 %, with 27 % requiring further surgery.

In the data collected for the EPOS multicenter study (3), 40 patients had a vascularized fibular transfer. Information on previous operations was available for 17 patients, who had undergone a total of 40 procedures. Grafting was performed 16 times, plating three times, intramedullary rodding ten times, external fixator was applied 20 times, correction of length of deformity 13 times and other procedure five times. Information on surgical



Fig. 4. Patient 4 with bowing (left) dysplastic pseudoarthrosis (middle) and one year after the transfer of vascularized graft (right).

procedures after the fibular transfer was available for 23 patients who underwent 62 procedures. Grafting was performed 23 times, plating six times, intramedullary rodding nine times, external fixator 36 times, correction of angular and leg length discrepancies 20 times, and other procedures 11 times.

In the cohort of free contralateral fibular transfer a valgus deformity of the ankle of more than 10 degrees was reported in 7 cases.

The interpretation of results of any multicentre study has inherent limitations. The different types of pseudoarthroses, the effect of previous treatment, need of follow up until skeletal maturity, the timing of the procedures and the definition of what is a successful result make it difficult to compare. There are however some conclusions that can be mentioned.

Vascularized fibular transfer is highly successful in obtaining union, but cannot solve all problems, and certainly not simultaneously, a facility offered by the ring fixator (1, 2, 4). Vascularized fibular transfer is also not risk free. There can be an insufficient consolidation of one or two ends of the grafts, stress fractures can occur, leg-length discrepancy is not corrected, and there is donor site immobility (6). Free vascular fibular transfer is a demanding surgery, with operating times of between six and twelve hours. Anyway, in interdisciplinary cooperation should treat the most difficult cases.

In the EPOS study, Slovakia was not mentioned. And that's the reason why we tried to fill this scientific space.

## Conclusions

Authors believe that after an accurate preoperative planning in cooperation with the plastic microsurgeon, the treatment of

congenital pseudoarthrosis of the tibia with vascularized fibular graft should be considered as a very effective, accurate and safe method.

## References

1. Coleman SS, Coleman DA. Congenital pseudoarthrosis of the tibia: treatment by transfer of the ipsilateral fibula with vascular pedicle. *J Pediatr Orthop* 1994; 14: 156—160.
2. Ghanem I, Damsim JP, Carlouz H. Ilizarov technique in the treatment of congenital pseudoarthrosis of the tibia. *J Pediatr Orthop* 1997; 17: 685—690.
3. Grill F, Bollini G, Dungal P. Treatment approaches for congenital pseudoarthrosis of tibia. Results of the EPOS multicenter study. *J Pediatr Orthop B* 2000; 9: 75—89.
4. Hefti F, Grill F. Congenital pseudoarthrosis of the tibia. In: Lemaire R, Scott J, Horan F, Villar R (Eds). *European instructional course lectures vol 7.*, London, EFORT, 2005.
5. Chen CW, Yu ZJ, Wang Y. A new method of treatment of congenital tibial pseudoarthrosis using free vascularized fibular graft: A preliminary report. *Ann Acad Med Singapore* 1979; 8: 465—473.
6. Poul J, Veselý J, Gál P, Bajerová J, Justan I. Treatment of congenital pseudoarthrosis of tibia by vascularized fibular graft. *Acta Chir Orthop Traum Cech* 2006; 73: 10—17.
7. Weber M. Neurovascular calcaneo-cutaneous pedicle graft for stump capping in congenital pseudoarthrosis of the tibia: Preliminary report of a new technique. *J Pediatr Orthop B* 2002; 11: 47—52.

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