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Original Article

Massive segmental bone loss due to pantibial osteomyelitis in children reconstructed by medial fibular transport with Ilizarov frame

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الملخص

أهداف البحث: نقل الشظية بالأوعية الدموية أو من غير الأوعية الدموية هو إجراء جديد من إجراءات إنقاذ الأطراف، ولكنه ارتبط بمعدلات فشل ومضاعفات عالية. نقل الجزءالإنسي من الشظية بنفس الجهة باستخدام جهاز إليزاروف هو تعديل الإجراء الجراحي لمنع المضاعفات وزيادة فرص النجاح. وتعرض هذه المقالة أكبر سلسلة من إنقاذ الأطراف لفقدان جزء كبير من العظم الظنبوبي لدى الأطفال بسبب إلتهاب العظم والنقي الكامل، بواسطة نقل الجزء الإنسي من الشظية بنفس الجهة بجهاز إليزاروف.

طرق البحث: نَصف في هذه المقالة سلسلة من الحالات ل ١٢ مريضا بمتوسط عمر ١٢ عاما (٦-١٨). في المرحلة الأولى من الجراحة، تم استئصال جميع العظم الميت، وتم تثبيت جهاز إليزاروف من غير شد. وفي المرحلة الثانية، عادة بعد شهر من إعادة التشكيل تتم بواسطة النقل التدريجي للجزء الإنسي للشظية في نفس الجهة باستخدام جهاز إليزاروف للشد بواسطة أسلاك الزيتون، بعد عمل القص العظمي للجزءالقاصي والداني للشظية. في المرحلة الثالثة، تم تنضير مواقع استقبال الظنبوب للشظية. وكان الحد الأدنى للمتابعة عامين.

النتائج: يصحب تحمل كامل الوزن تضخم في حجم الشظية المنقولة، وحركة مرضية للمفصل تحدث عند جميع المرضى. وإزالة العظام المحجوزة تؤدي إلى التحكم في الإلتهاب في ١٧.٢٧ ±٧.٧٦ يوما. يأخذ نقل الشظية ٥٨.١٦ ± ١٤.٤ يوما. وكان طول الجزء المفقود من عظمة الظنبوب والمستبدل بالشظية ٩.٥ ± ٢.٢٣ سم. بينما كان متوسط الأيام اللازمة لإتحاد العظام بعد تنضير موقع الاستقبال ٧٦.٥٨ ± ٦.٢ يوما.

الاستنتاجات: يعمل إطار اليزاروف للإلتهاب الكامل للعظم والنقي الظنبوبي بواسطة استئصال العظم ونقل الجزء الإنسي من الشظية بشكل جيد لإنقاذ الأطراف عند الأطفال.

الكلمات المفتاحية: نقل الشظية؛ تضخم؛ إليزاروف؛ إلتهاب العظم والنقي؛ البتر

Abstract

Objectives: Vascularized or non-vascularized fibula transport is a novel procedure for limb salvage but has been associated with high failure rates and complications. Ipsilateral medial fibular transport (IMFT) using Ilizarov apparatus is a modification of the procedure to prevent complications and increase success rate. This article presents the largest series of limb salvage for massive tibial bone loss in children due to pan-osteomyelitis by IMFT with Ilizarov apparatus.

Methods: A case series of 12 patients with a mean age of 12 (6–18) years is described. At the first stage of surgery, the excision of all dead bone was performed, and Ilizarov without traction apparatus was applied. In second stage, ipsilateral fibula is gradually transferred to tibial defect with the help of ilizarov olive wires. In the third stage, the freshening of docking sites of fibula to tibia was performed. The minimum follow up was of two years.

Results: Hypertrophy of the transported fibula accompanied by full weight bearing and satisfactory joint motion occurred in all patients. Removal of sequestrated bone resulted in control of infection in 27.17 ± 7.76 days. Fibular transport took 16.58 ± 4.14 days. The length of

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tibial bone loss replaced by fibula was 9.50 ± 2.23 cm. The mean days required for union after freshening of the docking site was 76.58 ± 6.20 days.

Conclusions: Ilizarov frame for pan tibial osteomyelitis with bone excision and medial fibular transport works well for limb salvage in children.

Keywords: Docking; Fibular transport; Hypertrophy; Ilizarov; Osteomyelitis

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Introduction

Chronic osteomyelitis usually results from poorly treated or untreated acute osteomyelitis, open fractures, orthopaedic surgeries or infected soft tissue spread.[1] Chronic osteomyelitis is seen much more frequently in developing countries compared to the developed world.[2] In developing countries, such as Pakistan, several factors contribute to this condition, including virulent pathogenic bacteria in these countries; late presentation; poor nutritional and immune status of the patients; low socio-economic status and relatively poor access to antibiotic drugs.[3] The long bones are affected most commonly, and the femur and tibia account for approximately half of the cases.[4] Boys are affected twice as much as girls.[5]

The diagnosis and management of chronic osteomyelitis is still a challenge for orthopaedic surgeons.[6] Amputation was considered as a simple solution for management of these patients in the past but it is not always acceptable to patients and relatives.[7] Although several investigators have reported that the initial hospitalization costs are considerably less for amputation than for limb salvage,[4] others suggested that the long-term costs of amputation are more than limb salvage because of the prosthesis needs.[8,9]

The treatment strategy for chronic osteomyelitis has changed significantly over the past twenty years.[10] Various techniques have been introduced to treat large segmental tibial defects such as autogenous cortical bone grafts, tibiofibular synostosis, ipsilateral fibular graft with or without Ilizarov apparatus, allograft reconstruction, vascularized free fibula transfer and bone transport.[11]

Ipsilateral transport of fibula is a novel option in limb salvage surgery for patients with large tibial defects.[12] Ipsilateral fibular graft to treat massive tibial bone loss was first credited to Hanh in 1884.[6] In 1905, Huntington described the transfer of a whole segment of fibular graft in two stages to bridge a tibial defect.[13] In 1998, the method of ipsilateral fibular transport was introduced with the Ilizarov frame, describing its application in three patients with massive tibial bone loss (range, 13–28 cm).[12] In the same year, Kim et al. reported the use of a ring fixator to transport a fibular segment to replace a 17-cm tibial bone loss in one patient.[12]

We questioned whether ipsilateral medial fibular transport with the Ilizarov frame could result in replacement of massive tibial bone loss and hypertrophy of the ipsilateral transported fibula in children, due to pan osteomyelitis. This study is the largest reported series in literature and also suggested some modifications in previous reported surgical method of fibular transport using ilizarov apparatus.

Materials and Methods

This prospective descriptive study was conducted on twelve patients with a mean age of 8.25 ± 2.59 (range 4–12) years at our institution. Seven male and five female patients were selected between 2007 and 2014. The lowest defect was 5 cm, and the highest defects were 12 cm with a mean of 9.52 cm and SD of 3.23 cm.

The purpose of this study is to describe the percentage of cases that were able to get union, infection control and hypertrophy of fibula after its close transport through the olive wires of Ilizarov in massive loss of sequestrated bone segment due to chronic osteomyelitis of tibia. We also noted the following: the length of tibia bone loss replaced by fibula; the mobilization status in terms of time using walking assist and the start of full weight bearing; postoperative range of motion of ankle and knee; additional procedures and possible complications in terms of re-fracture, infection, nonunion, pain, etc. We excluded patients with compromised blood supply of the limb or neurological loss.

Approval for this study taken from the hospital ethical committee.

Preoperatively written informed consent, detailed history, examination, and investigations including radiographs of tibia, with knee and ankle of the involved side (both AP and lateral views), taken. The preoperative range of motion of the knee and ankle were also recorded.

The surgery was performed in three stages. In the first stage, excision of all sequestrated dead bone was performed and a pre-assembled Ilizarov frame without traction apparatus was applied. If periosteum was available, it was close, similar to an empty sleeve. The drain was removed after two days. The patient was kept on intravenous antibiotics based on culture and sensitivity. Patients were sent home and regular follow-up visits were arranged every two weeks. The second stage was decided when there was no frank pus from the wound or discharging sinus. In the second stage, usually after six weeks, an Ilizarov traction apparatus with olive wires, after proximal and distal fibular osteotomies, was applied. The osteotomies depended on the length of the segment required. Five days after the operation, fibular transport was started at the rate of 1 mm per day. It takes a week or two for complete fibular transport to the tibial defect. Once the fibula reached the target position, in the third stage, freshening of proximal and distal docking site of fibula was performed and fibula held there with one or two k wires. K wires were removed after 8 weeks. Once consolidation was complete, Ilizarov was removed, and a Patellar tendon bearing brace was applied. All of the surgeries were performed by the same team of surgeons (Figures 1 and 2).

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