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Long-term follow-up of patients with rotationplasty

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ABSTRACT

INTRODUCTION AND IMPORTANCE: Rotationplasty considered a limb-salvage procedure and has a lot of advantages when comparing it with endoprostheses or above-knee amputation.
CASE PRESENTATION: We report two cases of young patients with osteosarcoma with rotationplasty being performed for both of them.
CLINICAL DISCUSSION: Patients with rotationplasty have less restrictions in daily life activities due to pain comparing with patients with endoprostheses.
CONCLUSION: Our aim here is to confirm that rotationplasty is an applicable, successful and alternative procedure to endoprostheses or above-knee amputation, when doing it based on an accurate indication and patients regain their previous daily life activities and satisfaction.
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1. Introduction

Rotationplasty was introduced in 1974 by Salzer et al. [1] as a limb-salvage procedure alternative to amputation. Winkelmann classification was put taking into consideration the location of the tumor [2]. Nowadays many limb-salvage procedures are performed, but rotationplasty can be recommended in patients diagnosed with extensive soft tissue tumors, failed limb-salvage procedure [3] or adolescents even young children as an alternative to endoprostheses [4]. Patients with rotationplasty limbs have excellent functional and psychological outcomes [2–4,15]. In low-income countries rotationplasty is considered an alternative procedure to endoprostheses. When performing rotationplasty many factors are considered such as: age of patient, daily life activity, range of motion of the ankle joint, type and stage of the tumor and the extension of the tumor. In our institute we performed rotationplasty on two patients with an A1-Rotationplasty according to Winkelmann's classification [2] and a complete short-term and long-term follow-up was archived. These two cases were the first ones to be operated on in our country and were documented. **This case report has been reported in line with the SCARE 2020 criteria** [5].

Table 1
patients' details.

Number	Patient 1	Patient 2
Sex	Male	Male
Age at operation	19	14
Diagnosis	Osteosarcoma	Osteosarcoma
Site of tumor	Distal femur	Distal femur
Chemotherapy	Yes	Yes
Follow-up	10 years	3 years

2. Case presentation

Two young male patients with ages (14,19) i.e the mean age (16.5) year-old diagnosed with osteosarcoma (Fig. 1) without any comorbidity were treated with an A1-Rotationplasty based on Winkelmann's classification [2] as a limb-salvage procedure (Table 1).

A1 rotationplasty describes a tumor in the distal femur. **The operation was performed by a Professor of Orthopedic Oncology with 25 years of experience**. The main steps of the procedure could be summarized as: firstly, determining the osteotomy site which was at the junction between proximal and middle third of femur and the proximal tibia distal to the tibial tubercle. Secondly, dissecting the neurovascular bundle even the great saphenous vein without doing any intravascular intervention.

Thirdly, rotating the distal remaining limb 180° around the vertical axis and reattached to the femur creating a neo-knee joint. Fourthly, internal fixation with plate and screws. Fifthly, anastomosing the great saphenous vein in one patient and being ligated in the second patient. Finally, reconstruct-

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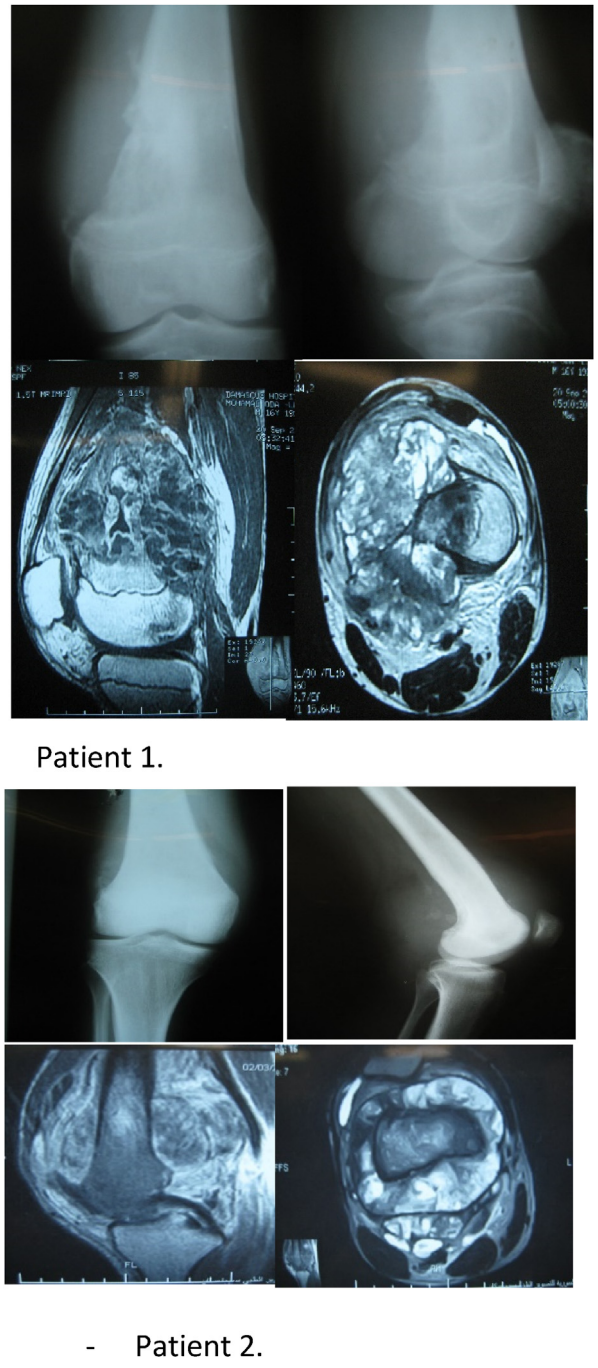


Fig. 1. Pre-operative plain X-ray and Magnetic Resonance Imaging (MRI) of the two patients demonstrate an extra compartmental tumor with an intact neurovascular bundle.

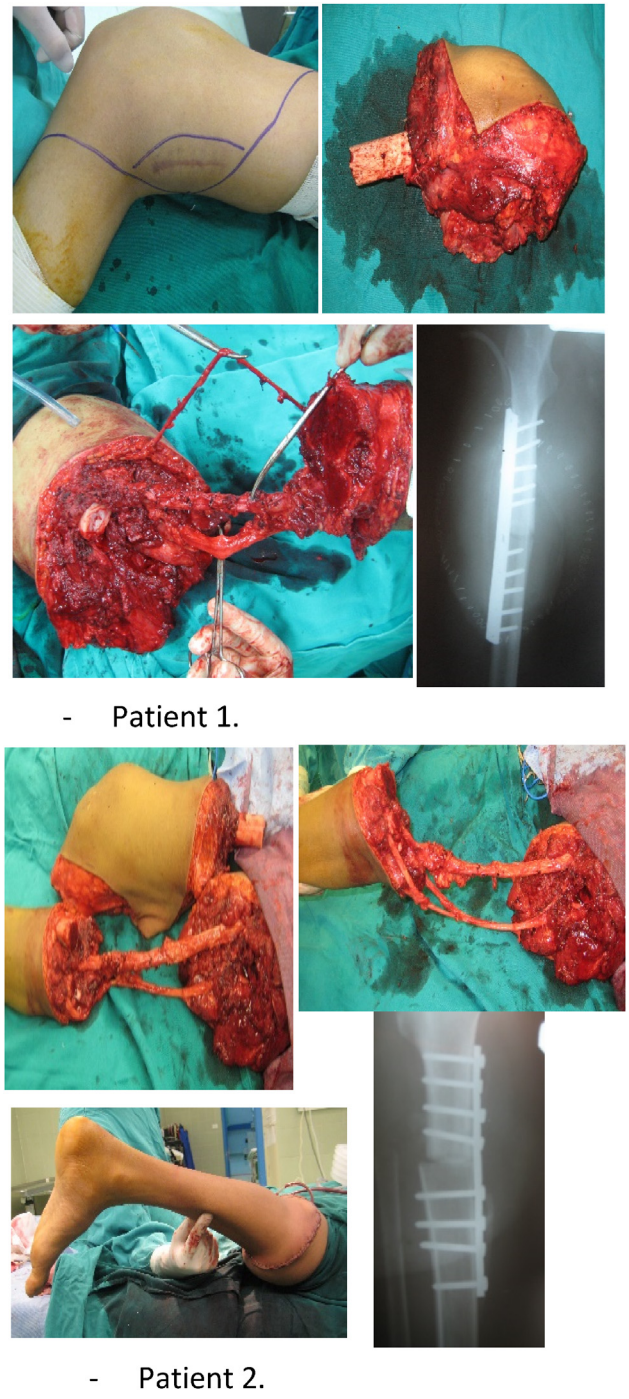


Fig. 2. Intra-operative illustrations of the procedure and X-ray post-operatively for both patients.

ing the remaining soft tissue followed by drainage and closing the wound layer by layer and application of compressive tape (Fig. 2).

The indication for rotationplasty in our two patients was osteosarcoma with extensive invasion to the soft tissue with intact neurovascular bundle without nodes or metastases existence. Adjuvant chemotherapy and neoadjuvant chemotherapy were applied pre- and post-operatively. Taking into consideration the young age of the two patients and high demand daily life activities, rotationplasty was performed to regain a range of motion comparing to fixed extension posture of the limb when performing above-knee amputation. The two patients were instructed to begin early physiotherapy after surgery and unfortunately there was lack in fitted prostheses because this procedure was performed for the first time ever in our country. The reattachment site was healed four months after surgery without any complications (Fig. 3).

No splints or casts were applied post-operatively. No wound healing complications or deep venous thrombosis (DVT) occurred. Both patients received anticoagulant drugs post-operatively until the prostheses were applied. None of the patients had local recurrence after surgery. Both patients walked wearing prosthesis with aid of a cane. The prostheses were being applied after 6 months post-operatively to the first patient and 4



Fig. 3. Post-operative X-rays demonstrate bone healing in the two patients.

months post-operatively to the second one (Fig. 4). A physiotherapy and rehabilitation program were initiated. The first patient was followed ten years after surgery without any complication or recurrence, whereas the second patient was followed 3 years after surgery when he had lung metastases and died eventually.

In this retrospective study the complications after surgery and the functional outcomes were evaluated to Enneking et al. [6].

3. Discussion

Rotationplasty is considered a limb-salvage procedure for treatment tumors especially around the knee joint. It offers a wide surgical margin resection with functional remaining limb. Gait analysis studies have shown coordination in neo-knee movements and gait [7]. Patients with rotationplasty have less restrictions in daily life activities due to pain comparing with patients with endoprostheses [8]. The most disadvantage of Rotationplasty is that the toes pointed backward as a cosmetic issue [9]. When comparing post-operative complications one can see much higher complications in endoprostheses groups than rotationplasty groups [10]. It is stated that 85% of patients with rotationplasty were participating in high-level sports [11]. In the literature, patients with rotationplasty walk more efficiently according to consumption of oxygen in comparing to above-knee amputation patients [12]. This article shows a feasible procedure being performed on young patients with low-income status taking into consideration the exact indication to regain the ultimate benefit from rotationplasty. Periprosthetic infections cause increasing concern [13]. Hardes et al. found that rotationplasty is a good alternative to above-knee amputation even in old patients [14].

4. Conclusion

Rotationplasty is an applicable, successful and alternative procedure to endoprostheses or above-knee amputation, when doing it with proper indication especially for young patients with low-income status as an alternative to endoprostheses or above-knee amputation and enables patients to regain near ultimate functional performance and satisfaction.



Fig. 4. Range of motions of the neo-knee, the prosthesis and patient 1 wearing it.

Declaration of Competing Interest

The authors have no conflict of interest to disclose.

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Ethical approval

This study is exempt from ethical approval at our institution.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Ali Mahmoud: conceptualization, investigation, data curation, writing and reviewing.

Muhammed Fayez Aboujaib: conceptualization, investigation, data curation, writing, editing and reviewing and is the corresponding author.

Muhammad Rafat Meda: conceptualization, data curation, writing, reviewing.

Registration of research studies

Not Applicable.

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Muhammed Fayez Aboujaib.

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