Issue Rehabil. Orthop. Neurophysiol. Sport Promot. 2019; 26: 85–91.
DOI: 10.19271/IRONS-00090 2019 26
ISSN 2300-0767

CASE REPORT

EWING'S SARCOMA OF LOWER EXTREMITY COEXISTING WITH PATELLAR TENDON RUPTURE-FUNCTIONAL OUTCOME AFTER REHABILITATION

OCENA FUNKCJONALNA PO REHABILITACJI PACJENTKI LECZONEJ Z POWODU MIĘSAKA EWINA I ZERWANIA WIĘZADŁA WŁAŚCIWEGO RZEPKI

Agnieszka Wareńczak[1], Joanna Pałucka[1,2], Przemysław Lisiński[1]
[1]Clinic for Rehabilitation, Poznań University of Medical Sciences, Poznań, Poland
[2]Department of Rehabilitation, Greater Poland Cancer Centre, Poznań, Poland

ABSTRACT

Introduction

Ewing's sarcomas are primary malignant bone tumors. The location in the femur (the second most frequent – 16.4%) may impair gait pattern and balance.

Aim

This case presents results after rehabilitation over two months period, a young woman diagnosed with Ewing sarcoma of the proximal femur who underwent limb-saving surgery and chemotherapy treatment. Subsequently, she experienced traumatic patellar tendon rupture.

Methods

Kinesitherapy (including balance force platform training and gait training), manual therapy and psychotherapy were performed. Functional tests, static and dynamic tests on balance force platform and questionnaires (The Toronto Extremity Salvage Score Lower Extremity Questionnaire and the Musculoskeletal Tumour Society Scoring System) were used.

Results

Improvements in body stability, muscle strength, a range of motion of the knee, gait quality and increase independence in activities of daily living were observed.

Conclusion

Comprehensive rehabilitation procedures have improved the examined clinical parameters and finally the functional condition of the patient.

Keywords: bone neoplasms, limb salvage surgery, postural balance, rehabilitation

Author responsible for correspondence:
Agnieszka Wareńczak, Klinika Rehabilitacji Uniwersytet Medyczny w Poznaniu
ul. 28 Czerwca 1956, Nr 135/147, 60-545 Poznań, Poland
e-mail: agnieszka.warenczak@gmail.com

Date received: 16th December 2018
Date accepted: 28th February 2019

Authors reported no source of funding
Authors declared no conflict of interest

STRESZCZENIE

Wstęp

Mięsaki z grupy Ewinga to pierwotne nowotwory złośliwe kości. Lokalizacja w obrębie kości udowej (jest to druga pod względem częstotliwości występowania – 16,4%) może wpływać na wzorzec chodu i pogorszenie równowagi.

Cel

Praca przedstawia wyniki dwumiesięcznej rehabilitacji młodej pacjentki leczonej w sposób skojarzony z powodu mięsaka Ewinga proksymalnej części kości udowej (zabieg oszczędzający kończynę i chemioterapia). Ponadto pacjentka doznała urazowego uszkodzenia więzadła właściwego rzepki.

Metody

U pacjentki zastosowano kinezyterapię (zawierającą trening równowagi na platformie balansowej oraz trening chodu), terapię manualną oraz psychoterapię. Przeprowadzono testy funkcjonalne, testy statyczne i dynamiczne na platformie balansowej oraz kwestionariusze (The Toronto Extremity Salvage Score Lower Extremity Questionnaire and the Musculoskeletal Tumour Society Scoring System).

Wyniki

Zaobserwowano poprawę stabilności postawy, siły mięśniowej, zakresu ruchu w stawie kolanowym, jakości chodu oraz poprawę niezależności podczas wykonywania czynności codziennych.

Wnioski

Kompleksowa rehabilitacja poprawiła oceniane parametry kliniczne oraz stan funkcjonalny pacjentki.

Słowa kluczowe: nowotwór kości, zabieg oszczędzający kończynę, równowaga, rehabilitacja

Introduction

Ewing's sarcomas are primary malignant bone tumours. They occur mostly between the age of 8 and 25, and their incidence is ranked second among childhood primary malignant bone tumours. Most frequently they are located in the area of the pelvis (24.7%) and femur (16.4%); subsequently they can be found below the knee joint and in the area of ribs, spine and humerus. The most common symptoms include localised pain and swelling, in the course of time followed by systemic reactions such as: low-grade fevers, weakness and overall malaise. In the course of diagnostics metastases are found in 20% of patients. Therapy includes both local (surgery) and systemic (chemotherapy) treatment. Radiotherapy is recommended for non-operative patients, or it is treated as adjuvant therapy following some non-radical procedures (Robert *et al.,* 2013).

The location in the lower limb may impair gait pattern. Correct gait is conditioned by, among other, range of joints' motion, lower limb muscle strength and proprioception (Pesenti *et al.,* 2018). Any deficiencies in the three areas above can lead to anomalies in gait pattern, high energy expenditure associated with every attempt at walking a given distance, and the subsequent irregularities in the structure and functioning of other parts of the locomotor system. Most frequently, in such cases the latter are revealed as gait asymmetry (shortening of stride and support phase) and impaired body balance. In the purely existential area, the aforementioned deficits result in a decline in independent self-care and limitations as far as active participation in both social and professional life are concerned (Nagai *et al.,* 2018). That is why the basic long-term standardized plan of patients' improvement after lower limb surgery boils down to the application of exercises to enhance mobility, muscle strength and proprioception. This seemingly simple treatment protocol gets considerably more complex in cases when the dysfunction of a lower limb is the effect of a combination of the treatment of neoplastic diseases. The purpose of the present study is to present the possibilities of the rehabilitation of a patient with dysfunction as described above.

Materials and methods

The study concerns a patient in her twenties who had been suffering from long-term pain of a lower limb which had not been caused by any trauma. Neither the interview nor the physical examination allowed finding the origin of the pain, which is why the diagnostics was extended with additional tests. An X-ray image revealed that the right proximal femur was destroyed at the length of 12 cm. The patient was referred to a specialist centre (Poland), where both a scintigraphic examination and a tumour biopsy were performed. Once the histopathological examination results had been obtained, the patient was diagnosed with Ewing's sarcoma. The MR test performed in the femoral bone area, revealed an image of a bone lesion destroying the bone tissue across the cross-section, with tumour transition into the soft tissues around the back perimeter. The longitudinal dimension of the lesion equalled 10 cm, whereas the transverse dimensions were 4.2 × 4.7 cm. Within the soft tissues, the infiltration encompassed the distal part of the attachment of the gluteus maximus, the attachments of the adductor magnus and adductor longus, the short head of the biceps femoris muscle, as well as the attachments of all of the vastus lateralis muscles.

The patient reported for treatment (USA) and further underwent neoadjuvant chemotherapy according to the VAI scheme (4 cycles every 2–3 weeks with the use of vincristine, doxorubicin and ifosfamide). According to the medical records available, during the first cycle of chemotherapy, while attempting to put some weight on the leg, there occurred a pathological fracture of the right femur. It was decided to apply external stabilization to the patient's leg and continue chemotherapy (Figure 1).

Three months later an operation of the proximal femoral resection with prosthesis reconstruction was performed (Figure 2). The histopathological tests indicated the diagnosed Ewing sarcoma pT2, pNx. The tumour had the dimensions of 11 × 4.5 × 4.2 cm, with negative margins, the smallest margin being 1 cm, and the tissues within the tumour were 100% necrotic (which is a good prognostic factor). Adjuvant

Figure 1. Pathological fracture of the right femur. Condition after external stabilization was in place. A-P view.

chemotherapy was commenced with the use of VAI protocol.

patient fell on both bent knees, which resulted in the patellar tendon rupture of the right leg.

Figure 2 a–c. Condition after hip joint endoprosthetics.

During the last cycle, there appeared the symptoms of myelosuppression and neutropenic fever. Once the consolidation treatment had been completed, in view of the persisting limited flexion range of the right knee joint (80°) the manipulation of the knee joint was performed (under anaesthesia) and the flexion of 100° was obtained. There was a plan to begin restoration of function in private rehabilitation clinic (Germany). As a consequence of the immobilisation after the first operation and chemotherapy, the range of motion in the joints of the right leg was drastically limited as a result of greater stiffness of the structures of joints, muscles and ligaments. On the second day of her stay at the clinic, the The ruptured patellar tendon was sutured with the use of the McLaughlin-Loop. The operating surgeon specified the dynamics of the rehabilitation process. He indicated approximately the stages of motion range recovery in the operated knee joint, stressing the need to stabilize the limb between the exercises with an orthosis and relieve the leg from weight bearing through the use of crutches while walking.

Results

The scope of the performed surgery precluded the execution of intensive rehabilitation procedures. As a result, the limitation of mobility scope and reduction in muscle strength persisted. The patient

reported to our rehabilitation centre (Poland) in order to start mobility improvement treatment. Rehabilitation procedures were performed at the Day Care Wards. Establishing a precise protocol for the rehabilitation based on the operator's criteria required a thorough functional assessment of the patient. The same set of tests was repeated after two months. Detailed assessment involved scar flexibility, increase in the range of motion in the hip and knee joints, muscle strength, limb load symmetry. The perimeters of the lower limbs were measured as well. In addition, the study was supplemented with gait assessment on the basis of the TUG and gait test at a distance of 3 m as well as the evaluation of balance and coordination skills with the use of static and dynamic tests performed on the Metitur balance force platform. The methodology of these tests is described in Table 1. The patient also filled in two questionnaires: The Toronto Extremity Salvage Score Lower Extremity Questionnaire and the Musculoskeletal Tumour Society Scoring System (Table 2) (Clayer *et al.* 2012, Quadir *et al.* 2012).

resulted from the external stabilization process and suturing of the patellar tendon. The patient also had considerable atrophies of the right lower limb muscles. The perimeter of the right thigh measured at the height of 20 cm above the knee joint gap was 7 cm shorter than the perimeter of the left thigh. The results obtained during the knee joint flexion range measurements and functional tests are presented in Table 2. The quadriceps strength in the right leg measured according to the Lovett scale amounted to 3+. On a daily basis the patient was walking with two crutches. The patient was observed to have huge asymmetry in lower limb weight bearing while standing – with her eyes open, she was putting a 37% weight load on her right leg, whereas with her eyes closed it was 38%.

The results obtained in the static and dynamic test performed on the balance platform are presented in Table 3.

Having analysed the patient's medical history and test results, the interdisciplinary team jointly designated rehabilitation treatment goals. In the

Table 1. The tests applied to the assessment of the patient's functional condition.

Tests		**Assessedparameters**	**Description of test performance**
Functionaltests	Leg raising	height (cm) time (s)	One leg bent in hip and knee joints, the other leg straight, raised above the couch
	TUG – 2 crutches	time (s)	Getting up from the chair, walking 3 m, turning around behind the line (180º), returning to the chair and the sitting position
	TUG – 1 crutch		
	3 m		Walking the distance of 3 m without crutches
Static test on balance force platform	EO	COP displacement speed (mm/s)	Standing position, parallel feet, placed 20 cm from each other, eyes open
	EC		Standing position, parallel feet, placed 20 cm from each other, eyes closed
	TLF and TRF		Standing position, left or right foot placed directly in front of the other, eyes open
Dynamic test on balance force platform	A100 B100 D100	time (s) distance (mm)	Standing position, parallel feet. The task is to change the placement of COP in specific directions indicated by the points displayed on the screen.

Along the right side of the patient's thigh surface, there was an S-shaped scar which was immovable in the distal part of the thigh. The scar had healed but it was tender to the touch. Additionally, some point scars were observed on the front surface of the knee joint which

long term, the plan assumed life quality improvement and increased independence of the patient in her daily routines. The short-term goals included the enhancement of lower limb mobility scope, advance of muscle strength, especially of the weakened quadriceps muscle, improvement

Table 2. Range of knee joint movement (flexion) and the results obtained in the functional tests and in the functional assessment questionnaires. The resultswhichwereimprovedare printed in bold.

Tests		**08.11.2016**	**09.01.2017**	**Difference**
ROM – maximal knee joint flexion	active	48°	87°	39°
	passive	55°	102°	47°
Straight leg raising test	height (cm)	11.5	83	71.5
	time (s)	1	36	35
TUG	2 crutches (s)	14.6	9.8	−4.8
	1 crutch (s)	13.5	9.3	−4.2
3 m	withoutwalking aids (s)	6.9	3.3	−3.6
Toronto Extremity Salvage Score Lower Extremity Questionnaire	percentage	58.6%	68.3%	9.7%
Musculosceletal Tumor Society Scoring System	points	15/30	18/30	3

in proprioception and acceleration of gait pace. In both centres, the patient was submitted to manual therapy, kinesiotherapy and hydrotherapy treatment. The patient cooperated willingly and was very much involved in the treatment process. She also had an opportunity to make use of psychological care.

become the treatment of choice in more than 90% of patients over the past few years (Shehadeh *et al.,* 2013). In the case under discussion, the difficulties encountered in the course of the rehabilitation process were related to the vast resection of soft tissues (muscles) of the right thigh, and resultantly – to the deterioration of muscle strength of the right leg, as well as

Table 3. The results obtained in the static and dynamic test performed on the balance platform.

Tests		**08.11.2016**	**09.01.2017**	**Difference**
EO	Y (mm/s)	7.8	5.7	-2.1
	X (mm/s)	8.1	6.5	-1.6
EC	Y (mm/s)	9.1	11.3	2.1
	X (mm/s)	10.3	8.9	−1.4
TLP	Y (mm/s)	20.6	13.4	−7.2
	X (mm/s)	14.7	10.0	−4.7
TPP	Y (mm/s)	30.3	16.4	−13.9
	X (mm/s)	20.2	11.7	−8.5
A100	time (s)	12.26	9.44	−1.82
	distance (mm)	694.8	770.8	76.0
B100	time (s)	9.62	6.85	−2.77
	distance (mm)	987.3	886.0	−101.3
D100	time (s)	10.47	10.40	−0.07
	distance (mm)	767.0	913.9	146.7

Discussion

The resection of primary malignant bone tumours with the use of limb-sparing techniques has

to the consequences of the systemic treatment (overall fatigue) (Shehadeh *et al.,* 2013). The evident flexion deficit of the knee joint which

may have resulted from the vast scope of the primary surgery, as well as the occurrence of extraskeletal calcifications revealed during imaging examinations, could be conducive to the rupture of the patellar tendon at low-energy trauma. The consequence of that trauma was pain amplification and considerable restraint of the knee joint flexion.

Since the standard attempts at increasing the range of motion failed, the treatment protocol was supplemented with manual therapy procedures (scar mobilisation, joint mobilisation, deep tissue massage, post isometric muscle relaxation). Gradual increase of the knee flexion range was observed. The obtained functional motion improvement allowed for the better mobility of the patient during her daily routines. The tests performed on the balance force platform revealed substantial improvement of body stability in the normal standing position with eyes open as well as in the tandem position. The results obtained during dynamic measurements improved considerably. During the last test, the patient performed the tasks faster and more precisely than during the first take of measurements. The observed progress in stability parameters could have been influenced by balance and coordination training, but also, indirectly, by enhanced muscle strength.

In the course of the two-months-long rehabilitation cycle, partial functional improvement has been obtained, mostly with respect to raising gait efficiency and increasing independent self-service capacity. When it comes to locomotion activities, the patient's walking distance has extended and gait quality has improved (less pelvis tilt, no need to use the stabilizing orthosis, walking short distances on flat surfaces without crutches). Walking on uneven surfaces has still been causing a lot of difficulties, which will be addressed in the next phases of rehabilitation. Regular oncological check-ups and orthopaedic loop removal constitute the subsequent medical care procedures.

Conclusion

Comprehensive rehabilitation procedures performed after the treatment of the primary bone tumour of the femur and patellar tendon rupture have improved the examined clinical parameters and finally the functional condition of the patient.

REFERENCES

Clayer, M., Doyle, S., Sangha, N., Grimer, R. (2012) *'The Toronto Extremity Salvage Score in Unoperated Controls: An Age, Gender, and Country Comparison.'* Sarcoma. 2012; 2012:717213.

Nagai, K., Ikutomo, H., Tagomori, K., Miura, N., Tsuboyama, T., Masuhara, K. (2018) *'Fear of Falling Restricts Activities of Daily Living after Total Hip Arthroplasty: A One-Year Longitudinal Study.'* ClinGerontol., 41(4), pp. 308–314.

Pesenti, S., Peltier, E., Pomero, V., Authier, G., Roscigni, L., Viehweger, E., Jouve, JL. (2018) *'Knee function after limb salvage surgery for malignant bone tumor: comparison of megaprosthesis and distal femur allograft with epiphysis sparing.'* IntOrthop., 42(2), pp. 427–436.

Qadir I, Umer M, Baloch N. (2012) *'Functional outcome of limb salvage surgery with mega-endoprosthetic reconstruction for bone tumors.'* Arch Orthop Trauma Surg. 132(9), pp. 1227–1232.

Robert, B., Marcus, Jr. (2013) *'Ewing Tumor.' In: Halperin EC, Brady LW, Perez CA, Wazer DE. Perez and Brady's Principles and practice of radiation oncology.'* 6th ed. New York: Lippincott Williams & Wilkins, pp. 1688–1693.

Shehadeh, A., El Dahleh, M., Salem, A.,Sarhan, Y., Sultan, I., Henshaw, RM., Aboulafia AJ. (2013) *'Standardization of rehabilitation after limb salvage surgery for sarcomas improves patients' outcome.'* HematolOncol Stem Cell Ther. 6(3–4), pp. 105–111.