

Assessing the effectiveness of rehabilitation after total hip arthroplasty in a patient treated through cancer fast-track pathways: A case study

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Abstract:

To accelerate and improve the quality of oncological care in Poland, clinicians use the Oncology Diagnosis and Treatment Card (DiLO Card). The decision to perform total hip arthroplasty in a patient with cancer must be based on the patient's functional status, evidence of pathological tissue proliferation at the fracture site, and the locations of previous surgical procedures involving tumor resection. The potential for metastasis substantially complicates accurate assessment of rehabilitation progress after total hip arthroplasty in oncology patients. The aim of this study was to assess the efficacy of therapeutic exercises following total hip arthroplasty in a patient who had undergone a hysterectomy for cervical cancer treated via the cancer fast-track pathways. The study included a 48-year-old female patient who, at the age of 44 (March 2022), underwent a surgical treatment for cervical cancer (hysterectomy with salpingo-oophorectomy). The use of infrared thermography in this situation is one of safe and non-invasive methods for assessing inflammatory hyperaemia in the area of a post-operative scar; moreover, this method poses no risk to oncology patients as it does not involve ionising radiation. Furthermore, the benefits of using this method lie in the ability to detect inflammation within the operated joint at an early stage, which enables the prompt implementation of treatment protocols aimed at rapid diagnosis, with a view to the possible use of revision surgery.

Key Words: oncology care - exercises – infrared thermography – range of motion – total hip arthroplasty

Introduction

Despite all the differences between cancers and national and regional resources and approaches to cancer care, there is a common goal: to strive for broader and more equal access to the best available care for all European citizens (EBCP, 2022). Each EU Member State organises its healthcare system independently, which means that the procedures designed to speed up the diagnosis of cancer and the treatment of such patients vary in form, name and the IT tools used (Horgan T. et al., 2022). To speed up and improve the quality of care of oncology patients in Poland, the Oncology Diagnosis and Treatment Card (DiLO Card) is used (Kiedlik D. et al., 2025). If a cancer patient holds this card, it enables the cancer fast-track pathways to be activated in emergency situations where the patient's life may be at risk as a result of unforeseen events. This may include a fracture of the femur resulting from prolonged immobilisation, physical inactivity and impaired motor coordination associated with long-term oncology treatment (Avancini A. et al., 2025). The aim of the procedure is to restore the limb's weight-bearing function, enabling the patient to carry out activities independently (Jabłoński et al., 2003). It is estimated that, globally, the total number of total hip arthroplasties (THA) will increase by over 137 per cent between 2005 and 2030, and the number of complications is also likely to rise. Alongside this trend, the total number of revision operations and associated complications will also increase (Scanagatta & Scapin, 2024).

The decision on performing the surgical procedure of the total hip arthroplasty in an oncology patient has to be based on their functional status, data on pathological hyperplasia at the fracture site and sites of previous surgical interventions involving tumour resection. (Horgan T. et al., 2022; Scanagatta & Scapin, 2024; Avancini A. et al., 2025). The risk of metastases makes it much more difficult to properly assess the progress of the rehabilitation process in oncology patients after the total hip arthroplasty. Infrared thermography, according to many researchers and clinicians, is an innovative, cheaper and non-ionising imaging technique that can be proposed as a complementary method to the routine assessment of patients with joint prostheses and for monitoring their inflammatory response following serious complications (Zeng Y. et al., 2016; Radziejowska M. et al., 2020a; Radziejowska M. et al., 2020b; Kumar P. et al., 2021; De Marciani L. et al., 2023; Radziejowski P. et al., 2023; Watts A. et al., 2024; Liu Q. et al., 2025; Radziejowska M. et al., 2025;).

The aim of this study was to assess the efficacy of therapeutic exercises following total hip arthroplasty in a patient who had undergone a hysterectomy for cervical cancer treated via the cancer fast-track pathways.

Material & methods

Participants

The study included a 48-year-old patient (body weight – 57,3 kg, height – 1,60 m, BMI – 20,98 kg/m²) that underwent surgical intervention due to cervical cancer (hysterectomy with salpingo-oophorectomy 68.41 and 65.61) at the age of 44 years (March 2022). The results of the histopathological examination performed after the procedure on 21 March 2022 showed cervical squamous cell carcinoma, basaloid subtype (G3) – material: cervix sections (punch biopsy). Two months after the procedure another surgical treatment was performed on her (extending the previous procedure) – laparoscopy, relaparotomy, and adhesiolysis. The discharge abstract: cervical squamous cell carcinoma, basaloid subtype (G3), post hysterectomy with salpingo-oophorectomy; bilateral pelvic lymphadenectomy; bilateral parametrectomy (25 May 2022). The results of histopathological examination of the removed tissue showed no neoplasm nor metastases. After the procedure, the patient obtained the necessary care and nutrition advice. In addition, the patient worked with a physiotherapist which included: learning the correct sitting technique; correct postoperative behaviour; prevention of pelvic floor dysfunction; and information on the possibility of urogynaecology physical therapy. The patient refused to participate in the sessions and was discharged with the following physiotherapeutic recommendations: cardio exercises of lower and upper limbs, laying down and sitting down with legs hanging off the bed; re-education of correct posture; perfecting walking technique; waking around the room with aid; motor coordination exercises (it was recommended to repeat the exercises 2–3 times a day).

On 25 August 2022, a follow-up scan was performed to assess the post-operative status following surgery for cervical cancer, i.e. transverse and coronal MRI scans of the pelvis, with a dynamic contrast-enhanced sequence; the dynamic scan did not reveal any pathological lesions suggestive of metastasis.

The patient holds the Oncology Diagnosis and Treatment Card (DiLO Card) issued on 6 April 2022.

On 29 November 2023, a CT scan was performed, with the following result: post-hysterectomy status; the bed with no signs of recurrence of hyperplasia.

On 28 January 2026, the patient suffered a fracture of the left femoral neck following a fall. The primary cause of the fall, as identified by the patient, was impaired motor coordination, possibly resulting from prolonged immobilisation followed by physical inactivity during treatment and rehabilitation following the removal of a tumour. As the patient held the DiLO Card, a contrast-enhanced CT scan of the pelvis was performed on 29 January 2026 prior to the hip arthroplasty surgery, comparing the results with those from 28 November 2023. The findings were: post-hysterectomy status; the bed with no signs of recurrence of hyperplasia.

On 2 February 2026, the patient underwent an emergency surgery for a fracture of the left femoral neck – left hip arthroplasty. The type of procedure was: hybrid left hip arthroplasty, using an Acoolate/Trident-Stryker implant. ICD-10PL: S72.0 – Fracture of the femur – Fracture of the neck of the femur (left side); 81.512. Total primary hip reconstruction; 00.783. Hip joint operations – one element fixed with cement, the other cementless; 79.35 Open reduction of fracture with internal fixation, femur.

The following has been recommended: walking whilst bearing partial weight on the operated limb, using crutches or a walking frame. Performing the exercises learnt during hospitalisation. Referral to the rehabilitation department.

On 5 February 2026, referrals were issued to the musculoskeletal rehabilitation department – purpose: rehabilitation following total left hip arthroplasty due to a femoral neck fracture.

On 18 February 2026, the results of the microscopic examination of the head of the left femur were received (bone tissue showing signs of a fracture, with no evidence of neoplastic growth).

Procedure

On 16 March 2026, the patient began physiotherapy sessions, in accordance with the recommendations set out in the educational materials on post-operative care following hip arthroplasty surgery (Ridan T. et al., 2013). The sessions took place daily for two weeks under the supervision of a physiotherapist.

Measure/Instruments

The following assessment tools were used to evaluate the impact of the exercise sessions: the classic Borg scale (RPE 6–20) to assess fatigue levels and the intensity of physical activity, the Visual Analogue Scale for the subjective assessment of pain intensity, and the Range of Motion (ROM) of hip flexion and extension measured using the angular method. The Timed Up and Go (TUG) test was also used, in which the patient's task was to stand up from a chair, walk a distance of 3 metres, turn around, return to the chair and sit down again. The time was measured using a stopwatch from the moment the patient's back left the backrest. The 30-Second Chair Stand Test was also used to assess the dynamics of rehabilitation progress; this test is used to evaluate lower limb muscle strength as well as overall mobility and balance, and helps to estimate the risk of falls. Most of the tests were carried out at the following time points: I – start of therapy (16 March 2026); II – third day of therapy (18 March 2026); III – seventh day of therapy (23 May 2026); IV – the ninth day of therapy (25 March 2026); V – the fourteenth day of therapy, end of hospitalization in the rehabilitation department (30 March 2026); VI – the

first session at home (2 April 2026); VII – the seventh day of sessions at home following discharge from the rehabilitation department, end of observation (6 April 2026).

During exercise sessions, heart rate (HR) and blood pressure (BP) were also measured: systolic (SBP) and diastolic (DBP) blood pressure, measured using an Omron M2 Essential (HEM-7188-E) electronic blood pressure monitor (Japan); and the rate of respiratory movements of the chest per minute (f).

The thermograms were taken using a FLIR-6 thermal imaging camera (Tallinn, Estonia). Thermal images of the left hip joint (the operated one) were taken on the lateral side of the joint, as this was where the post-operative scar was located. In some cases, images of the right hip joint – which was not operated – were also taken to compare skin temperature in the lateral region of the right hip joint. The thermograms were analysed using FLIR Tools software (Tallinn, Estonia). During skin temperature measurements, the thermal imaging camera was positioned at a distance of 1 m, with the following general parameters set: emissivity – 0.6; reflected temperature – 34.0°C.

Results

The use of the cancer fast-track pathways enabled the implementation of physiotherapy measures in the patient's rehabilitation as quickly as possible, whilst taking into account the need to carry out the necessary comparative and follow-up examinations against her condition prior to the fracture of the left femoral neck, in order to rule out the presence of neoplastic growths within the bone tissue. The results of the functional tests used during the kinesitherapy sessions (Ridan T. et al., 2013) to monitor the impact of the exercises on the patient's physical condition are presented in Table 1.

Table 1.

Results of functional tests and other follow-up examinations during the course of kinesitherapy treatment

Measured parameters	Beginning of the therapy I												End of hospitalisation V						End of the observation VII		
	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c
Systolic blood pressure, mmHg	112	115	116	102	104		102	108		91	125	104	107	114	100	104	128	11	114	127	113
Diastolic blood pressure, mmHg	78	86	77	70	69		71	73		69	83	72	71	77	73	71	78	81	71	84	83
Respiratory rate, breaths per minute	10	12	11	12	11						12	11	10	15	12	12	14	12	10	13	12
30-Second Chair Stand Test	6												6						7		
Visual Analogue Scale	4	5	5	3	5	4	4	7	6	4	4	4	0	2	2	4	2	2	2	3	3
Timed Up and Go (TUG), seconds	40.3																		26.9		
classic Borg scale (RPE 6–20)	6	8	7	6	7		6	8		6	8		6	7		7	8		6	8	
Range of Motion ROM flexion, °	75																		80		

At the start of the therapeutic exercise programme, the patient reported pain in her right, non-operated hip; she felt a stabbing pain when standing up, but this improved after a few steps. The patient was putting more weight on her right, non-operated hip, relieving the pressure on her left, operated hip. From the second and third assessment points onwards, the patient complained of back pain, saying that she found it difficult to stand up straight; however, after a few exercises, the pain level decreased (see Table 1, VAS), the patient moved around with the aid of a walker, which allowed her to rest fully on her forearms, and she walked with a slightly bent posture, explaining that this was the most comfortable position for her. During kinesitherapy at assessment points IV, V and VI, the patient complained of pain in her right, unoperated hip; she said she felt almost no pain in her left hip. At the end of her hospitalization (assessment point V), an attempt was made to have her walk with the therapist's assistance; the patient overcame her fear – she had been constantly afraid of falling again – and

attempted to walk up the stairs. After being discharged from the hospital's rehabilitation department, the patient complained of a stabbing pain in her left, i.e. operated hip, which occurred in the evening and after prolonged walking; the patient continued to walk with the aid of a walker, but of a different design, which allowed her to walk in an upright position; final exercises focusing on shifting her centre of gravity enabled the patient to bear more weight on the operated limb, which has led to an improvement in her gait pattern. At the end of therapy, the Romberg test was attempted ("+"); however, although she was able to perform the test, the patient was unable to maintain her balance with her eyes open, maintaining balance for 1 seconds.

Of particular interest are the changes in patient's heart rate during the kinesitherapy treatment, which, in our view, reflected the cardiovascular system's adaptation to the physical activity undertaken during the sessions. (Fig. 1.) Changes in heart rate showed a clear downward trend from the start of treatment until the end of the observation period for the effects of the kinesitherapy sessions, which indicated that the sessions led to adaptation to the recommended level of exercise and did not cause spikes in blood pressure (see Table 1), which the patient had been very concerned about at the start of therapy.

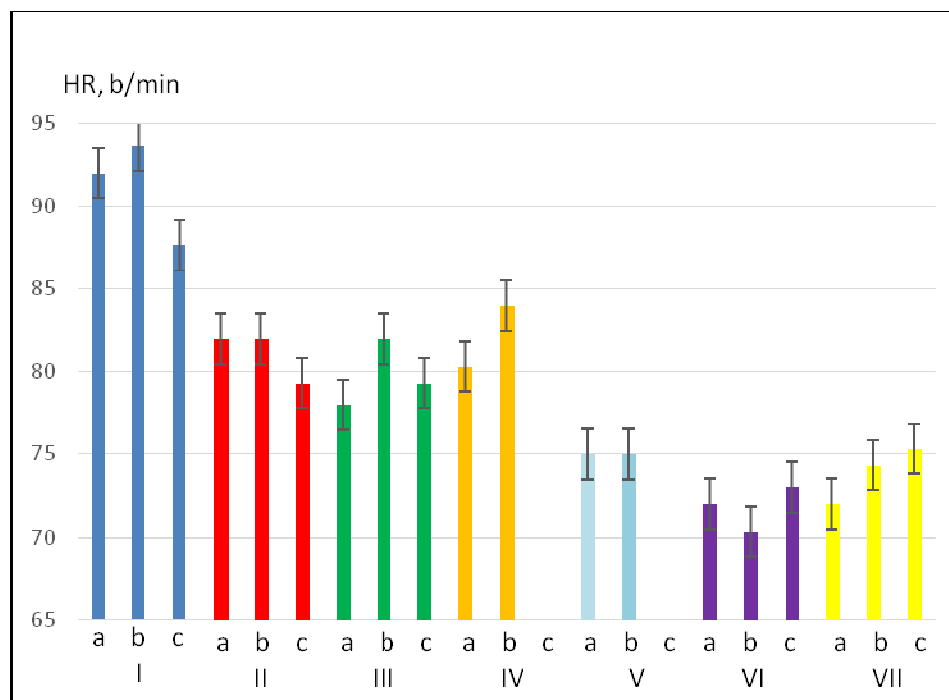


Fig. 1 Changes in heart rate during exercises after hip replacement surgery at the rehabilitation department (the mean and standard deviation of three heart rate measurements under each of the conditions described are given), where: a – before exercising; b – immediately after exercising; c – after a 5-minute recovery period: I – start of therapy (16 March 2026); II – third day of therapy (18 March 2026); III – seventh day of therapy (23 May 2026); IV – ninth day of therapy (25 March 2026); V – fourteenth day of therapy (30 March 2026); VI – first home session (2 April 2026); VII – seventh day of home sessions following discharge from the rehabilitation department (6 April 2026).

In order to monitor the potential for developing inflammation within the prosthesis of the operated left hip joint, thermal imaging measurements of the post-operative scar area were carried out daily. Neither at the start of treatment (Fig. 2) nor at the end of the observation period (Fig. 3) was there an increase in the temperature of the post-operative scar; this certainly suggests the absence of signs of local inflammation in the area under investigation. An interesting finding was also observed: an increase in temperature in the post-operative scar area following therapeutic exercises (2.3°C), which, by the end of the observation period, had decreased to just 1°C; this may indirectly indicate a reduction in the stimulatory effect of the exercises used, meaning that the same exercises no longer induced the same degree of increased blood flow and, consequently, the same increase in temperature in the examined area at the end of the observation period compared with the results at the start of the exercise programme (see Fig. 2; Fig. 3).

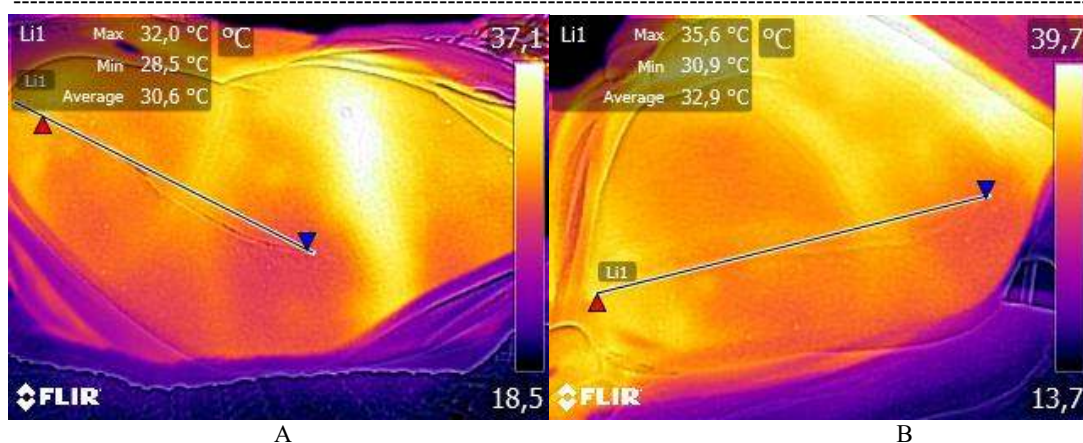


Fig. 1. A thermogram of the post-operative scar area on the first day of treatment, where: A – at rest before the kinesiotherapy session; B – immediately after performing the therapeutic exercises.

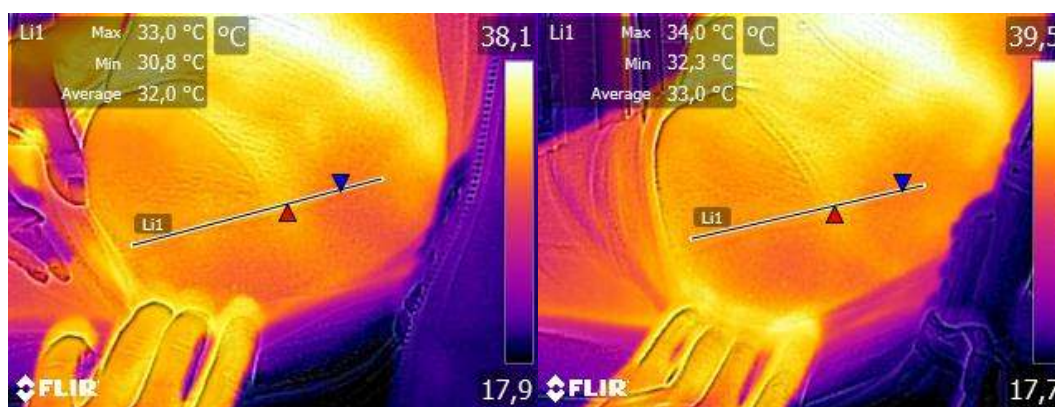


Fig. 2. A thermogram of the post-operative scar area on the final day of treatment in the rehabilitation department, where: A – at rest before the kinesiotherapy session; B – immediately after performing the therapeutic exercises.

The success of the recovery process was confirmed by a good result in the ROM flexion test, which showed a five-degree increase in the range of flexion in the operated hip joint (see Table 1).

Discussion

Cancer care in Poland, the EU and worldwide is based on standards for multidisciplinary treatment (European Commission, Europe's Beating Cancer Plan, 2022; Tumenbayeva Z. et al., 2023; Valeriano R. et al., 2023). In Poland, the 'cancer fast-track' system is based on the Oncology Diagnosis and Treatment Card (DiLO Card). It ensures that patients with suspected or diagnosed cancer are given priority access to diagnosis and treatment at facilities contracted by the National Health Fund (NFZ) (Kiedik D. et al., 2025). There is no doubt that incorporating kinesiotherapy exercises into the comprehensive treatment of cancer patients who also suffer from health problems resulting from falls and other consequences of prolonged immobilisation and physical inactivity enhances the effectiveness of this treatment and improves patients' quality of life (de Brito M.A. et al., 2020; Galvão D.A. et al., 2025). It is very important to enable early diagnosis for such patients and to carry out diagnostic and comparative procedures in order to determine the presence of neoplastic growths, particularly at the prosthesis implant site in the event of a femoral neck fracture, as in our case. Following total hip arthroplasty in a patient who had undergone a hysterectomy, the treatment team utilised infrared thermography to monitor the progress of rehabilitation and to prevent early inflammation around the implanted prosthesis. Unfortunately, among the complications following lower limb joint replacement surgery, the occurrence of inflammation is one of the primary reasons for referring patients for revision surgeries (Izakovicova P. et al., 2019; McNally M. et al., 2021; Schiavon G. et al., 2021; Scanagatta & Scapin, 2024). The results of our study confirmed the existing literature findings regarding the non-invasiveness, convenience and accuracy of this method in assessing the temperature of the post-operative scar area in general patients with orthopaedic conditions, which in turn enabled the assessment of the presence of post-operative inflammatory hyperaemia (Scheidt S. et al., 2020; Castonguay T. & Dover G., 2023; de Marciani L. et al., 2023; Watts A.T. et al., 2024). No increase in temperature above the reference values (Fernandes A.D.A. et al., 2018; Radziejowska M. et al., 2020a; Radziejowska M. et al., 2020b;

Kumar P. et al., 2021; De Marciani L. et al., 2023; Radziejowski P. et al., 2023; Jestry F. et al., 2025; Radziejowska M. et al., 2025), an increase in the range of hip flexion in the operated limb (Damayanti R. et al., 2024) and a positive trend in the improvement of functional test results (Nioti P. et al., 2022) confirm the high efficacy of thermography as a method for monitoring inflammation within the surgical scar following total hip arthroplasty in the studied patient.

Conclusions

In our opinion, the results of the study allow us to give a positive assessment of the implementation of kinesiotherapy following total hip arthroplasty in a patient who had undergone a hysterectomy for cervical cancer and was treated via the cancer fast-track pathways. The use of infrared thermography in this context is one of the safe and non-invasive methods for assessing inflammatory hyperaemia in the area of the post-operative scar; furthermore, this method poses no risk to cancer patients as it does not involve ionising radiation. The benefits of applying this method lie in its ability to detect inflammation within the operated joint at an early stage, which facilitates the prompt implementation of therapeutic protocols aimed at fast diagnosis, particularly in the context of potential revision surgery (Radziejowska M. et al., 2025).

Conflicts of interest. The authors declare that there is no conflict of interest.

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