

Original paper

## MODEL OF CARE FOR A PATIENT WITH A PRESSURE ULCER RESULTING FROM SPINAL CORD DYSFUNCTION QUALIFIED FOR SURGICAL TREATMENT

Dariusz Bazaliński<sup>1,2</sup>, Ewelina Matek<sup>3</sup>, Bartosz Mańkowski<sup>4,5</sup>, Anna Nowak<sup>6</sup>, Maria Kózka<sup>7</sup>

<sup>1</sup>Podkarpackie Specialist Oncology Centre, Specialist Hospital in Brzozów Father B. Markiewicz, Brzozów, Poland

<sup>2</sup>Institute of Health Sciences, College of Medical Sciences, University of Rzeszów, Poland

<sup>3</sup>Postgraduate Nursing and Midwifery Education Centre, Rzeszów, Poland

<sup>4</sup>General Surgery and Multi-Organ Disorders Ward, Multidisciplinary Municipal J. Struś Memorial Hospital, Poznań, Poland

<sup>5</sup>Craniofacial Surgery Clinic, University of Medical Sciences, Poznań, Poland

<sup>6</sup>University of Rzeszów, Rzeszów, Poland

<sup>7</sup>Department of Clinical Nursing, Faculty of Health Sciences, Institute of Nursing and Midwifery, Jagiellonian University Medical College, Kraków, Poland

Pielęgniarstwo Chirurgiczne i Angiologiczne 2024; 18(1): 6–13

DOI: <https://doi.org/10.5114/pchia.2024.138926>

Submitted: 16.11.2023, accepted: 07.02.2024

Address for correspondence:

mgr **Ewelina Matek**, Postgraduate Nursing and Midwifery Education Centre, Rzeszów, Poland, e-mail: ewelin.malek@gmail.com

### Summary

**Introduction:** Sensory and motor dysfunction is one of the major determinants of pressure ulcers in people with spinal cord dysfunction. In the absence of effective local treatment, surgical intervention is a radical method of treating pressure injuries and is indicated in deep, penetrating wounds. Achieving the expected treatment results while reducing their costs, as well as reducing the length of hospitalization, is possible by implementing a preoperative care model based on the concept of patient-centred care (PCC) and/or patient's family-centred care (PFCC). The aim was to develop a model of patient care with a surgically treated pressure ulcer based on the concept of PCC and/or PFCC.

**Material and methods:** The literature on the concept of PCC and the treatment of pressure injuries was reviewed. Selected national (Termedia) and global (PubMed, Medline) databases were searched using the keywords "surgical treatment of pressure injuries, decubitus ulcer, professional care". Based on the collected material, an attempt was made to develop a model of care for a patient with surgical management of pressure ulcers.

**Conclusions:** Sensory and motor dysfunctions associated with spinal cord dysfunction pose a high risk of developing deep penetrating pressure sores. The treatment process may require the use of radical reconstructive surgery, for which the patient should be prepared and motivated to work for health.

**Key words:** pressure ulcer, reconstruction, preparation for surgery, patient-centred care.

### Introduction

Pressure ulcers mostly involve bony prominences, although these lesions can also occur at other sites as a result of destruction of hypoxic tissues [1]. Individuals who are particularly prone to developing pressure sores are: the elderly with self-care deficits, limited consciousness and cognitive abilities, eating disorders and spinal cord dysfunctions [2–4].

Spinal cord dysfunctions result from congenital defects of the neural tube (often with dysraphic origin). Trauma and demyelinating diseases are key predisposing factors for neurogenic pressure ulcers. Motor dysfunction, numbness (sensory loss or impairment of conduction of nerve impulses from central structures

to the peripheral ones including muscles, skin and internal organs) and skin lesions associated with incontinence occurring in spinal cord dysfunction significantly increase the incidence of pressure injuries. Damage to sensory and motor pathways results in the patient demonstrating apart from pain and temperature sensory dysfunction, a lack of motor stimulation (spasticity or flaccid paralysis), which leads to muscular atrophy and over time, also including subcutaneous tissue. Lack of adipose tissue support over bony prominences, along with other factors, determines the risk of pressure injuries [5, 6]

According to data from the National Spina Bifida Patient Registry in the US, 26% of individuals reported

a history of pressure injuries, which were confirmed in 19% within the past year, and associated complications were found to be the second most common complaint [7]. In this group of patients, the process of topical treatment was further impaired by co-morbid spasticity, muscular atrophy, sphincter dysfunction, and pathological habits and patterns [8].

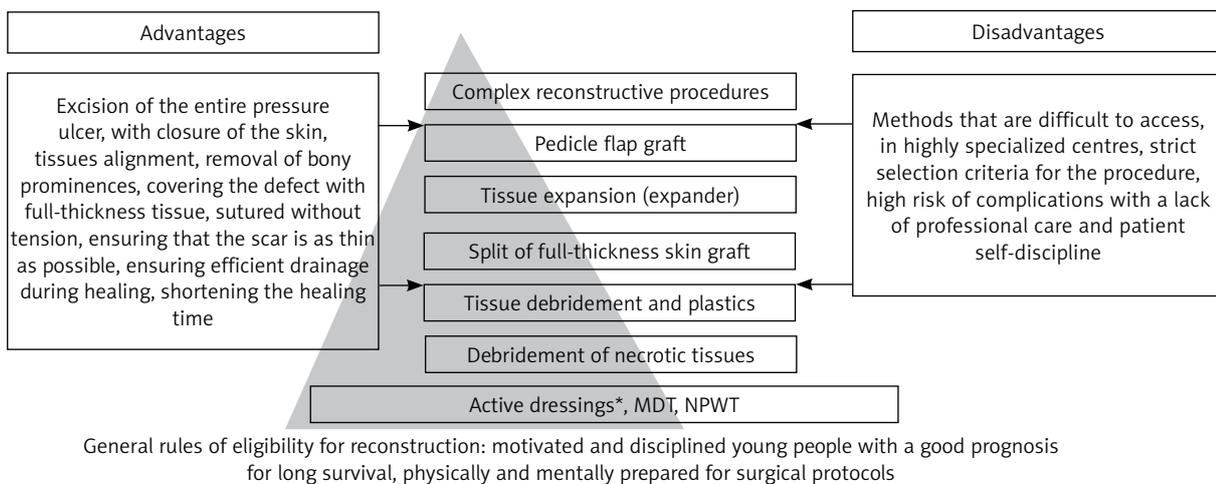
Burns and O’Connell noted that pressure injuries occur “virtually in 100%” of people after spinal cord injury, despite not being specific to spinal cord injury (SCI), and no less predisposing to frequent complications and the need for hospitalization [5]. In addition, experts note the possibility of external and modifiable risk factors in this group as well.

In patients with spinal cord dysfunction, pressure injuries most often occur in the sacral and perineal regions (ischial and greater femoral tuberosities, calcaneal tuberosities). Their incidence is estimated at about 30–40%. Pressure ulcers of the perineal region are most often associated with the action of simple pressure. Wounds can be seemingly small in size, but often with a tendency to drip into organs located within the pelvis. Wounds can penetrate deep structures, including perforation of the rectum, bladder, or vagina. Subsequently, serious septic complications with life-threatening consequences may occur. A review of the literature provides little information on the incidence of pressure sores in the perineal area; however, the cases presented most often involve patients with spinal dysfunction (spina bifida, SB), who spend a lot of time in a sitting position loading the ischial tuberosities and perineal area [9, 10].

The most effective method of managing patients at risk of pressure sores is to use preventive measures, and those who have already developed pressure injuries require local treatment with strict guidelines regarding unloading [11, 12].

Despite prophylaxis and local treatment, some patients develop deep pressure injuries that require surgical debridement and reconstruction of the tissue defect. Surgical treatment of pressure injuries is carried out in one or more stages in the case of deep, penetrating wounds often with concomitant bone destruction. The first stage of surgical treatment is radical and sharp surgical debridement, and excision of the wound with all devitalized or pathologically altered tissues. In some situations, it is necessary to remove muscles and necrotic fascia, as well as osteomyelitically altered bone in the wound bed. The second stage is to cover the tissue defect with living and valuable tissue, which in practice means applying reconstructive techniques and using dermal-fascia, dermal-muscular local or free flaps. Performing the first and second stages within one procedure provides an opportunity for the patient to have all open wounds closed after the surgery [13, 14]. Due to the risk of postoperative complications, surgical tissue reconstruction is indicated for a narrow, disciplined, motivated and optimally mentally and physically prepared group of patients. The patient’s preparation for surgery and post-operative care is a key part of the therapeutic process and largely determine the final outcome of treatment with effective wound healing (Fig. 1).

Patients with spinal dysfunction are a group that is a challenge to treat and later rehabilitate due to impaired physiological processes (including sphincter function), low levels of motivation, and penetrating, often infected wounds. Implementing the principles of the patient-centred care (PCC) concept into the preoperative care of this group of patients (and sometimes their family) will help increase their level of motivation and involvement in the therapeutic process, and thus reduce the risk of postoperative complications including wound dehiscence and infection. Development of a model of care of a patient



\* The possibility of implementation at any stage of treatment  
 MDT – maggot debridement therapy, NPWT – negative pressure wound therapy

**Fig. 1.** Potential advantages and disadvantages of surgical methods of pressure ulcer reconstruction  
 Source: developed by the authors based on [15]

with a surgically treated pressure ulcer based on the concept of PCC is described.

### Material and methods

The literature on the concept of PCC and the treatment of pressure injuries was reviewed. Selected national (Termedia) and global (PubMed, Medline) databases were searched within the time period of 2005–2022 using the keywords “surgical treatment of pressure injuries, decubitus ulcer, professional care”. Based on the collected material, an attempt was made to create a model of care for a patient scheduled for surgical reconstruction of pressure injuries. For practical and didactic purposes, the model was divided into three stages of interdisciplinary care: preoperative (prehabilitation), operative (surgical), postoperative (adaptive).

### General assumptions of the patient-centred care model

The patient-centred care model (Fig. 2) has been recognized in many countries as a standard approach in health care to improve its quality [16, 17]. Its main essence is respecting the patient’s values, experiences, needs and preferences in planning, coordinating and delivering care at every stage [18–20]. Central to this

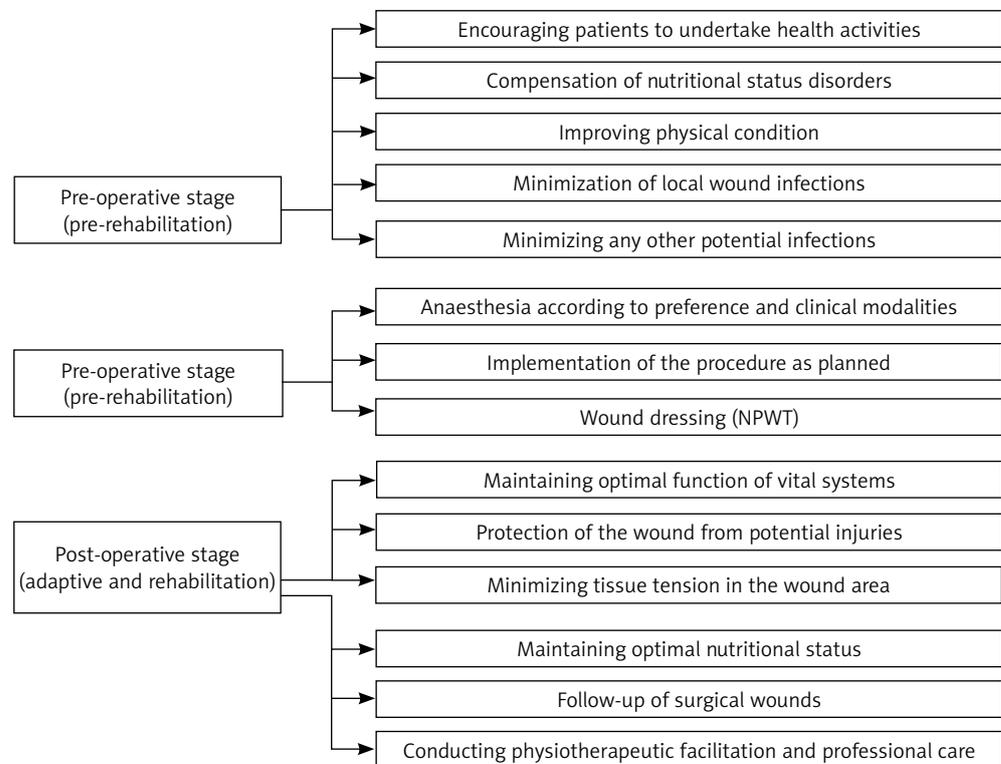
model is the therapeutic relationship between the patient and health care providers. Numerous studies have shown that the implementation of PCC into practice contributes to improved care outcomes, reduced hospitalization times, lower costs and increased patient satisfaction with care [21–24].

Various approaches to PCC are presented in the literature, but the most widely recognized is the model developed by the Picker Institute Europe and Harvard School of Medicine. It assumes that there are certain practices that create a positive patient experience of the care provided. Based on these practices, the principles of PCC were created and grouped into eight dimensions. These are: respecting patient preferences, coordination and integration of care, involvement of family and significant others, information and education, providing comfort, emotional support, continuity of care after discharge, and access to care [25]. Elements of PCC in terms of the problem of a patient with pressure injuries, including areas of care and tasks of team members, are illustrated in Table 1.

### Results

#### Pre-operative care (prehabilitation stage)

The decision to perform surgical reconstruction of pressure injury in a patient with neurological dys-



NPWT – negative pressure wound therapy

Fig. 2. The main directions of nursing activities in patient-centred care

**Table 1.** Key predictors of patient-centred care with respect to the patient with pressure injuries [7, 9, 15, 16]

Areas of patient-centred care	Tasks for members of the health care team
Respecting the patient's preferences	<p>Age, patient's preferences and modifiable cultural factors are of key importance. (For the most part, the selected group will be young people with different self-care capabilities determined by the degree and type of dysfunction (paraplegia, tetraplegia).</p> <p>Taking into account the autonomy of the patient, understood as the freedom to decide on the examinations performed, procedures, treatment and professional care with elements of prehabilitation.</p> <p>Providing individualized care tailored to the patient's needs, preferences, values, feelings, beliefs, concerns and expectations.</p> <p>Analysing the patient's experience of past care and the impact of the disease on his or her functioning in daily life to increase potential outcomes and improve the patient's quality of life</p>
Coordination and integration of care	<p>Application of a holistic model of patient care by the therapeutic team. Assistance and counselling in working with various care providers (psychologist, psychotherapist, spiritual person) to alleviate the feelings of helplessness and powerlessness experienced by the patient and family in illness. In this area, it is crucial to implement interdisciplinary activities aimed at improving the patient's general health and well-being before planned surgical treatment. The directions of intervention activities should result from the concept of prehabilitation. Wound preparation through management should be based on the recommended algorithms resulting from the TIMERS concept. Therapeutic and rehabilitation activities should be carried out according to an individual plan approved by the team members (doctor, physiotherapist, nurse and medical guardian). The expected effects are to improve care and minimize the effects of self-care limitations and neurological dysfunction. The use of specialized equipment, i.e. anti-decubitus mattresses and amenities, specialized beds, positioners, wheelchairs with head support (<i>etc.</i>), is intended to increase the ability to act. Dietary consultation and dietary modification (fortification, supplementation) create positive conditions to support the immune system and increase the body's regeneration. Coordination of the activities of all members of the therapeutic team gives a chance for a successful prognosis for the operation and the entire therapeutic process, including healing of the postoperative wound. Implement measures to improve care and minimize the effects of self-care limitations, i.e., anti-bedsore mattresses and amenities, specialized beds, wheelchairs with head support (<i>etc.</i>)</p>
Involvement of family and significant others	<p>Involve family and significant others in the patient's care by recognizing needs, providing support and preparing for care including nursing, therapy and improvement interventions (education and instruction). Taking action in this regard must be based on the expectations and consent of the patient himself</p>
Providing comfort	<p>Improving the patient's physical comfort by implementing measures for effective pain relief, reducing spasticity (pharmacological and non-pharmacological methods), which will also significantly affect the patient's mental state. Reducing muscle tension and improving joint mobility are among the key measures before the planned surgery</p>
Information and education	<p>Informing the patient about his/her condition and planned activities in the context of the entire therapeutic process, care provided and prognosis. The information provided should be tailored to the needs and capabilities of the individual patient including his psycho-emotional state. Conducting educational activities, supporting the patient's self-care (to the extent possible) in self-care and health promotion. Educating and enforcing health-promoting behaviours at this stage is crucial to the success of the treatment. Weight reduction, smoking cessation, hygiene of the mouth and intimate area as well as regulating bowel movements and reducing incontinence are among the many health issues that need to be minimized or eliminated. The patient should have access to medical, psychosocial, physical support and financial support from public and non-public institutions</p>

Table 1. C.d.

Areas of patient-centred care	Tasks for members of the health care team
Emotional support	Targeting nursing activities to alleviate the patient's anxiety, fear and distress related to the course of the disease, its treatment and prognosis. Educating the patient on how to cope with negative emotions, incorporating a psychologist, psychotherapist, or psychiatrist into care when appropriate, considering various forms of non-pharmacological supportive therapy. Pharmacotherapy to improve mood, reduce discomfort, symptoms of depression only under the supervision of a specialist
Continuity of care following discharge	Preparation of the patient for discharge should include the provision of clear and appropriately detailed information about medications, physical restrictions, nutrition and other recommendations based on the patient's needs and condition. At discharge, the patient and family should also receive information on the provision of follow-up treatment (outpatient, long-term care, home care) and the possibility of non-professional care support, e.g. support groups operating in the care area and region. The information provided should also include reimbursement rules for medical devices or drugs
Access to care	Patients should have access to care taking into account their preferences, e.g. in terms of the location of the care provider and its distance from the patient's residence, the ability to obtain referrals and delivery of specialized medical services

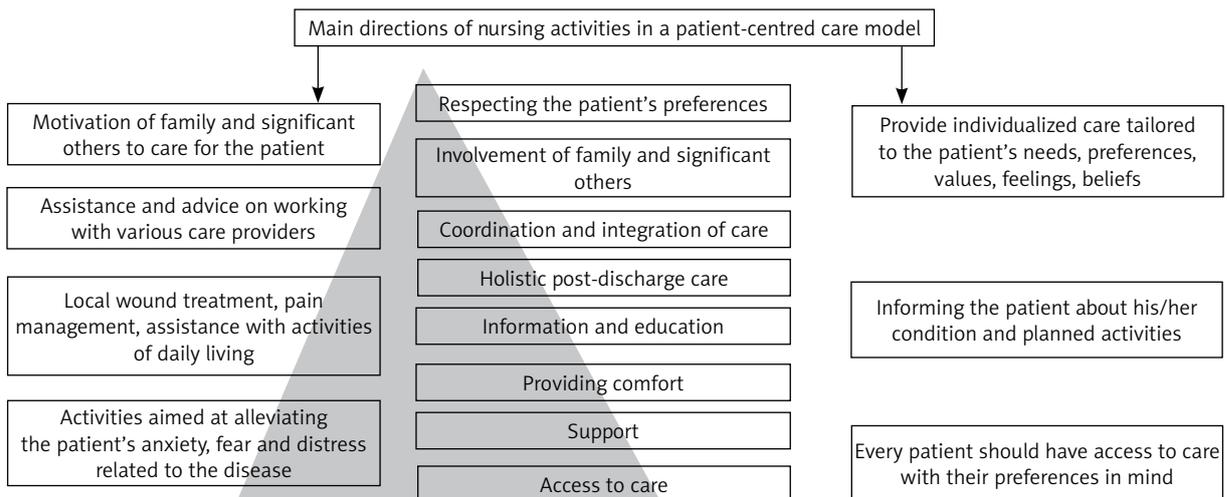


Fig. 3. Main directions in the patient care model

function is burdened with the risk of post-operative complications, and therefore should be well planned and discussed with them and/or their caregiver to accept the principles related to preparation for surgery and post-operative care, and to express their willingness to cooperate [13, 14]. The preparation time for elective surgery with a professional, interdisciplinary approach is referred to as prehabilitation. It is a multifaceted concept designed to create and strengthen functional and metabolic reserves for the heavy burden of surgery [26, 27]. Thoughtful and planned preoperative measures are crucial to the success of surgical activities. According to scientific reports, the rate of recurrent pressure injuries already after surgical closure

in this group of patients is high, in the range 19–90% [28]. For this reason, preparing a patient with spinal cord dysfunction for a pressure injury reconstruction should be a comprehensive effort, in which team members implement care using the PCC concept, and the assumptions of evidence-based practice [22]. Reducing potential postoperative complications by activating the body's reserves can be achieved by implementing care in accordance with the developed model. The stages and main directions of care are illustrated in Figure 3. Preparing for surgery, regardless of the condition and cause, always requires specific and timed actions [29]. Optimizing/stabilizing the patient's condition prior to surgery is intended to reduce emotional tension and improve the health

and condition of the tissues that will undergo surgical correction, thereby increasing the chances of success of the surgery itself and its long-term benefits [30, 31].

The key directions in preoperative care are first and foremost to obtain homeostasis of the systems and organs and compensate for nutritional deficiencies (minimize anaemia, hypoalbuminaemia). Improving physical function, including respiratory function, is also required. The risk of infection needs to be minimized by adhering to the principles of asepsis and antisepsis during wound dressing and treatment, and innovative methods of local treatment need to be implemented. Potential sources of infection such as inflammation of the teeth, tonsils, mouth, *etc.* are to be eliminated. Stabilization of the patient's emotional and mental state is also an indispensable part of the patient's preoperative preparation. The most common psycho-emotional problems in the preoperative period are anxiety and fear of anaesthesia, death, surgical wound dehiscence, pain, *etc.* caused by uncertain postoperative prognosis, a number of deficits resulting from the underlying disease and intensified by the specifics of the surgical procedure [13, 14, 18]. A key role at this stage is to establish the best possible contact with the patient, to build an atmosphere of mutual trust and calm, to encourage verbalization of thoughts and feelings, in order to satisfy the patient's mental and emotional needs as much as possible [10]. All measures taken should aim to build a positive attitude of the patient towards the treatment process and reduce tension before the planned procedure.

### Operative care (surgical stage)

The interdisciplinary model of care for a patient scheduled for a surgical procedure involves the integrated efforts of the medical staff of the operating theatre, recovery room, and surgery department in terms of patient safety and care as well as preventive measures to reduce surgical site infection (SSI) [32]. Reconstructive surgery includes the following elements: radical resection of bony protrusions and necrotic bones, inflamed bursae, covering tissue defects and necrotic spaces with cutaneous-fascial and cutaneous-muscular flaps so as to release the patient from the wound, in the place of which a healthy, living tissue will appear. The goal of surgical as well as reconstructive treatment is to remove the pressure injuries along with the damaged fragments of the bony prominences with single-stage or deferred tissue coverage. The planned surgical measures are aimed at reducing the risk of a new pressure ulcer at this site, improving the quality of life and motivating the patient to carry out pro-health activities.

### Post-operative care (adaptive stage)

The outcome of the surgical procedures performed are conditioned by certain factors on the part of the

patients themselves, their caregiver (commitment, willingness to cooperate, discipline, positive attitude, completing tasks ordered during preparation for the surgery) and also on the part of the medical staff (prehabilitation, balancing disorders, soothing infections, determination of eligibility for the surgery, execution of the procedure by an experienced surgeon, preoperative preparation and provision of care in the postoperative period including physiotherapeutic, dietary and psychological nursing care).

### Discussion

The possibility of post-operative complications (SSI, bleeding, haematoma, anastomosis dehiscence) depends on various factors including the patient's general condition and the extent as well as the duration of the procedure [13]. After surgery, in addition to the generally accepted procedures aimed at pain management and stabilization of vital systems, a local review should also be carried out regarding the viability of the flap and the appearance of potential signs of SSI. It is important to maintain Redon-type drains until the wound area exudate is reduced to 20–30 ml/day over 3–5 (and even up to 9) days [14]. In deep perineal and lower extremity wounds, the use of a temporary colostomy to reduce the risk of postoperative wound contamination (uncontrolled defecation) as well as mechanical damage associated with defecation (e.g., using a bedpan) is controversial, especially in situations where patients are not optimally prepared for surgery (prehabilitation assumptions have not been implemented) [26, 33]. Rubio *et al.* noted that permanent colostomy performed in patients with sacral decubitus ulcers is associated with a significant risk of postoperative death. According to the authors, surgeons should carefully consider the risk of diversion in this patient population, especially in malnourished patients with hypoalbuminaemia [33].

With a low surgical risk and with upper limb function and maintenance of bowel movements of physiological consistency, the concept of a decompressive colostomy seems valid and will probably significantly improve the patient's self-care capabilities; the decision is left to the operator after obtaining the patient's written consent for this form of surgery. The role of nursing staff is education and instruction related to securing the fistula [34]. Despite comorbidities, surgical debridement and tissue reconstruction is a potentially safe procedure. Proper choice of debridement technique with subsequent tissue closure can prevent sepsis and death in patients with multiple comorbidities [13, 14, 35]. Using the method of controlled negative pressure (75–125 mm Hg) in the wound increases blood flow, accelerating the migration of fibroblasts, effectively reduces exudate, and decreases bacterial

titres, which has a significant impact on accelerating the repair processes in the wound and reducing the risk of SSI [36]. Implementation of closed incision negative pressure wound therapy into practice is now one of the most popular methods of prevention of surgical site infection. Preventive measures are a basic management strategy in modern surgical medicine, which can effectively, simply and without great expense realistically affect the incidence of complications of the healing process, including wound infection. The essence of effective prophylaxis can be not only an absolute reduction in the number of SSIs, but also a reduction in the percentage of deep SSIs with their further complications [37, 38]. The most common early postoperative complications involve suture line separation or wound dehiscence, and superficial as well as deep tissue infection. Lack of visual signs of adhesion and regeneration and features of infection may be related to the care and nursing activities carried out in the postoperative period, result from the patient's failure to follow postoperative instructions or be a consequence of the patient's general condition [39, 40]. Lindqvist *et al.* conducted a retrospective cohort study including patients with SCI undergoing surgery between 2002 and 2019. Out of 118 operations, 51 (43%) had postoperative complications. The vast majority (44 cases, 86% of all complications) were minor complications (grade 1 or 2 on the Clavien-Dindo scale – an objective and reproducible classification of postoperative complications). Seven subjects (6%) had complications of grade 3 or higher (Clavien-Dindo), requiring re-treatment with surgery or in an intensive care unit setting. The authors noted that being overweight or underweight was associated with an increased risk of postoperative complications ( $p < 0.05$ ) [41]. The occurrence of systemic complications is rare but can be life-threatening for patients. In a study by Han *et al.* that included 57 patients with severe limitations in self-care after tissue reconstruction following resection of a decubitus ulcer in the postoperative period, mild to severe pneumonia was confirmed in 21% ( $n = 12$ ), local healing complications in 12% of subjects ( $n = 8$ ), and one person died due to complications [42]. An analysis by Kwok *et al.* from 2005 to 2015 identified 1,248 cases with a complication rate of 35.0%. Obesity predisposed to an increased risk of complications. The 30-day mortality rate was 3.3%. Older age and diabetes were associated with increased mortality [38].

The educational and therapeutic process in the adaptation and rehabilitation phase from the moment of leaving the hospital should be systematic, based on observation for occurrence of complications, wound healing and gradual activation of the patient. A holistic approach and knowledge of potential disorders provide the opportunity for qualified and experienced personnel to create an individualized care plan tailored to the patient's capabilities as well as needs. Developing

pressure-relief strategies, controlling incontinence and potential infections, nutritional fortification or supplementation, and keeping the patient as active as possible are tasks that should be paramount during this period [39]. The amount of time that is necessary to carry out therapeutic activities should be determined by the team leader after consultation with team members. Proper wound healing and reconstruction can take a minimum of 8–12 weeks, by which time the supervision of the patient should be obligatory and meet the criteria of thoughtful and planned holistic care. The authors emphasize that the knowledge of medical personnel on the prevention of bedsores is still insufficient [43–46]. Therefore, every effort should be made to increase access to knowledge and staff training in order to change attitudes related to the prevention of bedsores, the incidence of which is high among people with neurogenic dysfunction.

## Conclusions

Sensory and motor disorders associated with spinal cord dysfunction pose a high risk of developing deep penetrating pressure injuries. The treatment process may require radical methods of reconstructive surgery, for which the patient should be prepared and motivated to work towards health. Optimizing the therapeutic effect involves implementing a model of preoperative care, which should be PCC and sometimes patient family-centred (mainly in terms of educational activities). Respecting the patient's values, experiences, needs and preferences should be the basis for planning, coordinating and delivery of professional care. The model concept of patient care requires further consideration and empirical research in a group of patients with neurogenic pressure injuries.

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*The authors declare no conflict of interest.*

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