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PRESSURE ULCERS INCIDENCE IN A PERIOPERATIVE NEUROSURGICAL SETTING

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Summary

Background. Pressure ulcer is a major burden in surgical patients, increasing the length of hospital stay and the healing process, possibly leading to infectious complications and higher health care costs. In current literature there is no consensus on which element is mainly responsible for the onset of these lesions neither the role of surgery has been clarified.

Methods. We collected a case series of consecutive admitted patients to Cattinara Hospital Neurosurgery Department in Trieste from March 2019 to June 2019. All the patients were assessed for surgery related pressure ulcer (SRPU) risk using the Pressure Score Risk Assessment Scale modified by Scotts. Epidemiologic data of all patients were recorded and the incidence of surgical related pressure ulcer calculated. The sample consisted of 124 patients with an average hospitalization length of 12.45 days; 71.8% of the enrolled patients were elective surgery patients, 5.5% emergency surgery and 22.6% urgency surgery. Comorbidity data were collected for each patient and surgical related time procedures noted.

Results. The calculated incidence rate of surgery related pressure ulcer in a single center perioperative neurosurgical setting was 4.8%; the average surgery duration time was 213 minutes (mean ± 81 standard deviation, SD) whilst four out of six of these patients were admitted to intensive care unit due to unstable clinical conditions (average ICU stay time: 2.83 days; mean ± 4.99 standard deviation, SD). Time to SRPU onset was 6.83 days (mean ± 3.66 standard deviation, SD). The main site of SRPU onset was sacrum (66% of patients with developed SRPU).

Discussion. This study evaluates single-center incidence of SRPU in neurosurgical perioperative setting with specifically SRPU management trained healthcare providers; deeper and systematic understanding of SRPU epidemiology in other local hospital wards and multi-centered comparison are needed.

Key words: incidence, neurosurgery, pressure ulcer, prevention, SRPU

INTRODUCTION

Pressure ulcer development is a major burden in surgical patients, increasing the length of hospital stay and the healing process, possibly leading to

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infectious complications and higher health care costs [1,2]. Despite the continuous release of novel matrices and products stimulating tissue regeneration and despite progress made in the field reconstructive surgery thus far, medical and conventional surgical strategies for loss of substance lesions present limits when it comes to complex tissue defects requiring fine reconstruction and generate large part of pathology associated high morbidities and costs [3-8]. Pressure ulcers are recognized as an unfavorable prognostic factor that is associated with increasing morbidity and mortality [9-11].

Many intrinsic and extrinsic factors contribute to the formation of surgical related pressure ulcers (SRPUs) [12-14]. Among these, diabetes mellitus, peripheral arteriopathy, older age, cardiopathy can be listed among the intrinsic ones whereas the length of the surgery, hypothermia, blood loss, compression secondary to the position in the operatory room are considered extrinsic ones. The length of the surgery has been implicated as one of the factors involved in the onset of ulcers, even if its role remains ambiguous [15,16].

In addition, during surgery the patient is not able to feel pain or move, nor he/she can change position. This situation lasts even longer than the surgery itself because of pre- and postoperative immobilization. Moreover, patients own tissue tolerance contributes to the susceptibility to develop these lesions.

In current literature there is no consensus on which element is mainly responsible for the onset of these lesions neither the role of surgery has been clarified [15,16].

The aim of this case series was to estimate the incidence of surgery related pressure ulcers in patients undergoing neurosurgery at Cattinara Hospital in Trieste. It is paramount to precise that all the patients were placed on the same anti-decubitus devices in the operating room.

MATERIALS AND METHODS

124 patients consecutively admitted to Cattinara Hospital Neurosurgery Department were enrolled between March 2019 and June 2019. The study sample included all patients who were listed on the surgical schedule during this period. Patients already hospitalized before the beginning of the study were excluded.

All the patients were assessed for SRPU risk using the Norton Pressure Score Risk. Assessment Scale modified by Scotts at admission, in the period of stay and on discharge. Norton Pressure Score Risk Assessment Scale modified by Scotts, originally intended for use within the geriatric hospital population, is nowadays an extensively employed score in order to assess the likelihood of pressure ulcers development due to its quick and simple administration. Despite score intrinsic limitations (sensitivity, specificity, reproducibility), it allows a certain degree of standardization in clinical evaluation; Norton Pressure Score Risk Assessment Scale modified by Scotts consists of five criteria, each of them can be rated from 1 (high risk) to 4 (low risk): physical condition, mental condition, activity, mobility and sphincteric incontinence. Therefore, the final score ranges from 5 to 20, where 5 indicates maximum sore risk and 20 indicates that the patient is unlikely to develop pressure ulcer. The general rule for interpreting the result states that the higher the score, the better prognosis the patient has; risk specific categories have been defined: a score below 9 implies very high risk of SRPU development, from 10 to 14 high risk, from 14 to 17 medium risk and above 18 low risk (Tab. I) [17].

The nurse on duty entered the description of the lesion, the site and the stage in the collecting data system, G2 application. We used the definition of pressure ulcer given by the European Pressure Ulcer advisory Panel (EPUAP), i.g. “a localized injury to the skin and/or underlying tissue usually over a bony prominence that appears as a result of pressure or pressure in combination with shear and/or friction”. The integrity of the skin was assessed with the same time schedule of modified Norton Pressure Score Risk Assessment Scale administration [18,19].

Before the study started, all the staff was provided with a specific training on prevention, evaluation and classification of SRPUs. In the event of an ulcer being identified, the nurse on duty entered the description of the lesion, the site and stage according to the EPUAP 2014 classification in the G2 software.

A total of 124 patients were then observed, of these 55 were female and 69 males. Among the patients enrolled we included those who underwent neurosurgery at the hospital of Trieste from March to June 2019 aged over 18 years. Patients aged under 18 years old and already hospitalized at the neurosurgery ward were excluded.

Epidemiologic data such as age, gender, body mass index (BMI), major comorbidities, the evaluation of preexisting skin lesions, the patient intra- and postsurgery

Table I. Norton Pressure Score Risk Assessment Scale modified by Scotts Risk stratification.

Norton pressure Score	Pressure ulcer risk
< 10	Very high risk
10-14	High risk
14-18	Medium risk
> 18	Low risk

mobilization were recorded by entering them in the clinical G2 application for the entire time of the study; nutritional data (serum total proteins and albumin levels) were collected from the same clinical G2 application as result of laboratory analysis.
The time of the surgery included the time needed for the patient to be positioned in the operating room, the time for the anaesthesiologic induction and that for the surgery.
In the operating room all the patient were placed on antidecubitus surface provided by the hospital.
The surface used was a pad made of high-density polyurethane foam, which reduces the pressure, favors the circulation and guarantees the correct placement of the patient on the surgical table. High-density foams generally retain their performance properties for longer and can therefore be used in longer surgeries. Latest generation surfaces can achieve different densities for layers and/or body segments; the head and heel areas generally have a lower density than the lumbo-sacral zone. Density is a key feature and it is an important indicator of foam performance, which includes: comfort, support capacity, consistency and durability. The mattress was protected by a microfibre bedsheet which is used for patient movement [19,20]. All the other anti-decubitus systems used i.g. headrests, the ones for the limbs etc. were always made of high-density corrugated foam.
During the surgery procedure, if necessary, the patient could be positioned in Trendelenburg and anti-Trendelenburg position. Finally, the number of surgical related pressure ulcers were recorded to calculate the incidence of SRPU. Investigators did not collect time to first mobilization after surgery as parameter.

RESULTS

124 patients were admitted at the Neurosurgery ward of Cattinara Hospital, Trieste (Italy) from March 2019 to June 2019. The sample was represented by fifty-five females with an average age of 64 years (mean ± 14 standard deviation, SD) and sixty-nine males with an average age of 63 (mean ± 14 SD). The average hospitalization length was 12.45 days. The average body mass index (BMI) was 25.,3 ± 3.4 (SD). Many patients had one or more underlying medical conditions, i.g. 32 patients (25%) had cardiovascular related diseases, 12 (9.6%) had diabetes, 21 (16.9%) had oncologic issues. The type of surgery performed was classified into three major categories: vascular diseases 38 patients (30.6%), spine related diseases 65 (52.4%), cancer diseases 21 (16.9%) 71.8% of the surgical procedures were carried out in elective setting (89), 5.5% in emergency setting (7) and 22.6% in urgency setting (28).

The risk assessment of pressure ulcers was carried out using the Norton Pressure Score Risk Assessment Scale at the time of admission, at periodical intervals and at any significant changes in the patient state of health. Of the total of sample patients, 9 patients were scored at very high risk (7.2%), 21 at high risk (17%), 17 at medium risk (13.8%) and 77 at low risk (62%) at admission. Once surgery was over and patient's vital functions were stable, he/she was transferred from the operatory room to the neurosurgery ward or to the intensive care unit (31 patients, 25%). It should be noted that for those patients who, because of their clinical instability, were transferred to the intensive care unit prior to the neurosurgery ward, the evaluation was not always carried out within 24 hours, but few days later. For all the other patients it was carried out within 24 hours after the admission to the neurosurgery ward (Tab. II).
The onset of SRPU was recorded in 6 patients in total (4.8% of the enrolled population): of these, four were male and two were female, three underwent elective surgery, two urgency surgery and the other emergency surgery. The surgery lasted less than 180 minutes in two cases, while it lasted more than 180 minutes for all the others; among patients developing SRPU the average surgery duration time was 213 minutes (mean ± 81 standard deviation, SD) whilst four out of six of these patients were admitted to intensive care unit due to unstable clinical conditions (average ICU stay time: 2.83 days; mean ± 4.99 standard deviation, SD). Mean time to SRPU onset was 6.83 days (mean ± 3.66 standard deviation, SD).
Three out of six patients developing SRPU underwent surgery for vascular pathology; the other three underwent surgery for cancer. Intraoperative positioning was supine for four patients, prone for the other two; two patients required Mayfield skull clamp positioning.
The main site of SRPU onset was sacrum (4 out of six patients with SRPU) whereas other anatomical sites

Table II. Epidemiologic data and comorbidities of the patients.

Epidemiogic data	
Gender, n female, (Age, years ± SD)	55, (64y ± 14)
Gender, n male, (Age, years ±SD)	69, (63y ± 14)
Body Mass Index (BMI) (mean ± SD)	25.3 ± 3.4
Norton Scale score at admission (n, %)	
Very high risk	9, 7.2%
High risk	21, 17%
Medium risk	17, 13.8%
Low risk	77, 62%
Comorbidities	
Cardiovascular disease, n % (yes)	32 (25%)
Diabetes, n % (yes)	12 (9.6%)
Oncologic issues	21(16.9%)

involved were occiput (one patient; specifically treated for subtentorial affection) and heels (two patients). Four out of six patients presented with first grade lesion according to EPUAP classification, the others with grade 2 lesion (nonhigher-grade ulcers were diagnosed among enrolled patients).
Five out of six presented hypertension as relevant comorbidity whereas two patients were diagnosed with diabetes prior to surgery and hospital admission.
Each patient was screened for nutritional state by assessing Serum Total Proteins and Serum Albumin levels at admission: the 50% of SRPU developing patients presented with both Total Proteins and Albumin below reference range levels.
None of the patients developing SRPU had been treated with prior chemotherapy nor radiotherapy; finally, all patients of this group presented at clinical examination with sensory and motor impairment (Tabs. IIIA and IIIB).

DISCUSSION

Surgery represents an independent risk factor for the occurrence of pressure ulcers, even for those patients who do not seem to be predisposed. A study conducted in 2002 shows that among the several parameters recorded, the only predictor of SRPUs was the duration of the operation [21]. The complex pathophysiology of ulcer damage, the high prevalence in surgical wards of comorbidities reducing wound-healing potential such as diabetes (despite novel local modulatory medications), the insidious reconstruction challenges of pressure ulcers and their infectious complications, the impossibility to influence the duration of the surgery make prevention the paramount strategy in order to reduce the risk of pressure and shear forces before, during and after surgical procedures [22-26].
Many preventive interventions can be adopted in order to prevent pressure ulcers such as the use of alternative pressure mattress or gel pad on the operating table during surgery [27-29].
The support surfaces are conceived to work against SRPU redistributing the weight over the maximum body surface area, mechanically alternating pressure below the body and redistributing pressure. A good operating support should be considerate adequate for optimal positioning when it is able to reach a pressure below the bone prominences capable of supporting the patient, but below the microcirculation pressure gradient (32 mmHg). According to our OR protocol we used the same anti-decubitus surfaces for all the patients (i.e., polyurethane, air release or air fluctuation devices) for all the patients enrolled. Early mobilization and accurate detection of new SPRUs have shown to be the most effective systems to avoid these lesions. It is worthwhile to focus on the preoperative phase, as prevention seems to be the key factor that can significantly affect the incidence of SRPUs. Continuous training for operating room and ward staff is pivotal to significantly reduce the onset of such injuries; this kind of training has been implemented in our regional healthcare system since 1996 along with specific protocols and motor and ADL/IADL early recovery approaches.
Accurate and timely reporting must be considered a priority in order to foster continuity of care and prevent

Table IIIA. Characteristics of the patients who developed surgical related pressure ulcers (SRPUs) during our study.

Cases										
N	**Gender**	**Age**	**BMI**	**Comorbidities**	**Norton score**	**Length of the surgery (min)**	**Type of surgery**	**Priority of surgery**	**Site**	**Stadium**
1.	M	84	24	H	10-/-11	160	Vascular	Urgency	L and R heel	2°
2.	M	79	25	H, cancer	7-7-7	90	Tumour	Election	Heel and sacrum	2°
3.	M	61	27	H, diabetes	14-13-9	270	Tumour	Election	Sacrum	1°
4.	M	76	20	H, cancer	11-10-11	320	Tumour	Election	Sacrum	1°
5.	F	72	24	H, diabetes	10-/-11	225	Vascular	Emergency	Occiput	1°
6.	F	64	24	//	11-10-10	210	Vascular	Urgency	Sacrum	1°

Abbreviations: BMI: Body Mass Index; H: Hypertension.

Norton score nb.-nb.-nb. /Prior Surgery- Neurosurgery Ward Admission- Neurosurgery Ward Discharge.

Table IIIB. Characteristics of the patients who developed surgical related pressure ulcers (SRPUs) during our study.

Cases						
N	**Time to SRPU onset (days)**	**Admission total protein/serum albumin (mg/dL)**	**Motor impairment**	**Prior chemotherapy/ prior radiotherapy**	**Intraoperative positioning**	**Surgery**
1.	12	5.6/3.40	Yes	No	Supine	Subdural hematoma evacuation
2.	5	7.5/4.17	Yes	No	Prone	Subtentorial tumour resection
3.	7	6.4/4.0	Yes	No	Prone+Mayfield	Left parietal tumour resection
4.	10	4.6/2.71	Yes	No	Supine + Mayfield	Frontal lesions biopsy
5.	5	5.5/3.57	Yes	No	Supine	Subdural hematoma evacuation
6.	2	4.8/ 2.91	Yes	No	Supine	Subdural hematoma evacuation

Total protein normal reference, range 6.0-8.0.

Serum albumin normal reference, range 3.50-5.20.

the onset of adverse events. Our data show that the incidence is considerably lower in comparison with data reported in current literature (4.8 *vs* 10.8%) [30-35]. With specific focus to neurosurgical settings, it is important to underline the fact that high incidence rates variability is reported in literature [36,37].

It is crucial to underline how the majority of patients with SRPU had undergone major surgery lasting more than 180 minutes: surgery length profoundly shapes pressure ulcer risk and we suggest further investigation to determine linear or exponential growth of the risk.

Our study underlined how nutritional status (recognized risk factor by EPUAP guidelines) was poor in 50% of the patient developing SRPU, suggesting that efforts to foster proper nutritional state optimization is paramount.

The fact that all patients with SRPU onset had cognitive and motor impairment is strictly connected with hospitalization and specific postoperative neurosurgery setting: time to first mobilization after surgery and specific assessment of postoperative/post dismissal should be evaluated, extending patient monitoring even after hospitalization period in order to further assess the impact of neurological deficits variations in pressure ulcer onset/resolution.

Despite main location pressure ulcers was sacrum in the collected sample, we highlight a neurosurgical setting peculiar site of SRPU onset which is the occiput: a proper understanding of occiput pressure ulcer in neurosurgical setting is advised, in particular the possible relation between specific craniotomy procedure and occiput pressure ulcer development (in our study the reported occiput SRPU patient underwent surgery for infratentorial tumoral lesion).

Main limitations of this study are the temporal restricted data collection time, the single center-limited experience and the lack of epidemiological results confrontation with other wards of our local hospital. Further investigation and profound data analysis in prospective design study protocols involving different perioperative settings will be implemented.

In order to achieve better understanding of local SRPU impact we suggest creation of a local register for SRPU developing patients in specific high-risk patients, such as the investigated perioperative setting, following analogous models implemented for other plastic surgery issues [38].

Conflict of interest statement

The authors declare no conflict of interest.

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Author contributions

BV: DT, W
EM: D, W
PS: A,W
LG: DT
LS: D, W
VR: A
GP: A, W

Abbreviation

A: conceived and designed the analysis
D: collected the data
DT: contributed data or analysis tool
S: performed the analysis
W: wrote the paper
O: other contribution (specify contribution in more detail)

Ethical consideration

The study was registered within the internal database of audits held in the Hospital institution and its design architecture is a case series.
All patients filled an informed valid consent prior to the surgery. This study was performed in accordance with the ethical standards of the 1964 Declaration of Helsinki as revised in 2013.

References

1 Allman RM, Goode PS, Burst N, Pressure ulcers,hospital complications, and disease severity: impact on hospital costs and length of stay. Adv Wound Care 1999;12:22-30.

2 Knoblauch DJ, Bettis MA, Lundy F. Financial implications of starting a mobility protocol in a surgical intensive care unit. Crit Care Nurs Q 2013;36:120-126. https:doi.org/10.1097/CNQ.0b013e3182753725

3 Mazzocchi M, Sigorini G, Cerciello E, et al. The use of Exashape™ Bioshield Pocket in prepectoral breast reconstruction: a preliminary experience. PRRS 2022;1:51-57. https://doi.org/10.57604/PRRS-064

4 Cervelli V, Longo B. Plastic and reconstructive surgery: roots and future direction of a constantly evolving discipline. PRRS 2022;1:49-50. https://doi.org/10.57604/PRRS-090

5 Ramella V, Stocco C, Grezar L, et al. A new male nipple areolar complex design in trans men chest masculinization. PRRS 2022;1:58-63. https://doi.org/10.57604/PRRS-031

6 Longo B, D'Orsi G, Pistoia A, et al. T-inverted shaped rectus abdominis myocutaneous (Ti-RAM) flap for chest wall reconstruction. PRRS 2022;1:64-68. https://doi.org/10.57604/ PRRS-028

7 Schonauer F, Cavaliere A, Pezone G, et al. Letter to the Editor in Chief. Thoraco-acromial artery perforator (TAAP) flap for reconstruction of a recurrent dermatofibrosarcoma protuberans of the clavicular region. PRRS 2022;1:79-81. https://doi.org/10.57604/ PRRS-083

8 Felici N, Delle Femmine PF, Tosi D, et al. Common peroneal nerve injuries at the knee: outcomes of nerve repair. PRRS 2022;1:6-13. https://doi.org/10.57604/PRRS-001

9 Bernabei R, Manes-Gravina E, Mammarella F, et al. Epidemiologia delle piaghe da decubito. G.Gerontol 2011;59:237-243.

10 Berlowitz DR, Brandeis GH, Anderson J, et al. Effect of pressure ulcers on the survival of longterm care residents. J Gerontol A Biol Sci Med Sci 1997;52:M106-M110. https://doi.org/10.1093/gerona/52a.2.m106

11 Thomas DR, Goode PS, Tarquine PH, et al. Hospital-acquired pressure ulcers and risk of death. J Am Geriatr Soc 1996; 44:1435-1440 care residents. J Gerontol A Biol Sci Med Sci 1997;52:M106-M110. https://doi.org/10.1111/j.1532-5415.1996.tb04067.x

12 Lindgren M, Unosson M, Krantz AM, Pressure ulcer risk factors in patients undergoing surgery. J Adv Nurs 2005;50:605-612. https://doi.org/10.1111/j.1365-2648.2005.03441.x

13 Frankel H, SperryJ, Kaplan L. Risk factors for pressure ulcer development in a best practice surgical intensive care unit. Am Surg 2007;73:1215-1217.

14 Primiano M, Friend M, McClure C, Pressure ulcer prevalence and risk factors during prolonged surgical procedures. AORN J 2011;94:555-566. https://doi.org/10.1016/j.aorn.2011.03.014

15 Aronovitch SA. Intraoperatively acquired pressure ulcer prevalence: a national study. J Wound Ostomy Continence Nurs 1999;26:130-136. https://doi.org/10.1016/s1071-5754(99)90030-x

16 Lewicki LJ, Mion L, Splane KG, Patient risk factors for pressure ulcers during cardiac surgery. AORN J 1997;65:933-942. https://doi.org/10.1016/s0001-2092(06)62976-1

17 Bååth C, Hall-Lord ML, Idvall E, et al. Interrater reliability using Modified Norton Scale, Pressure Ulcer Card, Short Form-Mini Nutritional Assessment by registered and enrolled nurses in clinical practice. J Clin Nurs 2008;17:618-626. https://doi.org/10.1111/j.1365-2702.2007.02131.x

18 National Pressure Ulcer Advisory Pane, Pressure Ulcers: Incidence, Economics, Risk Assessment, Consensus Development Conference Statement, S-N Publications, West Dundee, Ill, USA, 1989.

19 Mc Ewen Intraoperative positioning of surgical patients-study program including question and answer key, Mc Ewen, 1996, June, 1-20. In: Preventing intraoperative positioning injuries. Nursing Management 2006;37:9-10.

20 Hoshowsky VM, Schramm CA. Intraoperative pressure ulcer prevention: an analisys of bedding materials. Research in Nursing and Helth 1994;17:333-339. https://doi.org/10.1002/nur.4770170504

21 Schoonhoven L, Defloor T, van der Tweel I, et al. Risk indicators for pressure ulcers during surgery. Appl Nurs Res 2002;15:16. https://doi.org/10.1053/apnr.2002.34145

22 Liu Y, Guo S, Wei S, et al. A novel nitric oxide-releasing gel for diabetic wounds. PRRS 2022;1:24-33. https://doi.org/10.57604/PRRS-004

23 Lovero S, Marchica P, Romeo M, et al. Clostridium septicum fasciitis in a patient with occult colon malignancy: a

case report and literature review. PRRS 2022;1:69-75. https://doi. org/10.57604/PRRS-084

24 Pierazzi DM, Arleo S, Faini G. Combination of LICAP and IMAP flap for treatment of long-lasting cutaneous fistulas of the chest wall with osteomyelitis. PRRS 2022;1:20-23. https://doi.org/10.57604/PRRS-003

25 European Pressure Ulcer Advisory Panel and American National Ulcer Advisor Panel EPUAP, 2009.

26 Pressure Ulcer Prevention. Retrieved from: LLGG NPUAP 2010 - Institute for Healthcare Improvement, 2012.

27 Walton-Geer PS. Prevention of pressure ulcers in the surgical patient. AORN J 2009;89:15. https://doi.org/10.1016/j.aorn.2008.12.022

28 Spruce L. Back to basics: preventing perioperative pressure injuries. AORN J 2017;105:92-99. https://doi.org/10.1016/j.aorn.2016.10.018

29 Health Quality Ontario. Pressure ulcer prevention: an evidence-based analysis. Ont Health Technol Assess Ser 2009;9:1-104.

30 Schultz A, Bien M, Dumond K, et al. Etiology and incidence of pressure ulcers in surgical patients. AORN J. 1999;70:434, 437-440, 443-449. https://doi.org/10.1016/s0001-2092(06)62325-9

31 Kemp MG, Keithley JK, Smith DW, et al. Factors that contribute to pressure sores in surgical patients. Res Nurs Health 1990;13:293-301. https://doi.org/10.1002/nur.4770130505

32 Tschannen D, Bates O, Talsma A, et al. Patient-specific and surgical characteristics in the development of pressure ulcers. Am J Crit Care 2013;21:116-125. https://doi.org/10.4037/ajcc2012716

33 Moore Z, Avsar P, Conaty L, et al. The prevalence of pressure ulcers in Europe, what does the European data tell us: a systematic review. J Wound Care 2019;28:710-719. https://doi.org/10.12968/jowc.2019.28.11.710

34 Bulfone G, Marzoli I, Quattrin R, et al. A longitudinal study of the incidence of pressure sores and the associated risks and strategies adopted in Italian operating theatres. J Perioper Pract 2012;22:50-56 https://doi.org/10.1177/175045891202200202

35 Loorham-Battersby CM, McGuiness W. Heel damage and epidural analgesia: is there a connection? J Wound Care 2011;20:28, 30, 2-4. https://doi.org/10.12968/jowc.2011.20.1.28

36 Qazi M, Khattak AF, Barki MT. Pressure ulcers in admitted patients at a tertiary care hospital 2022;14:e24298. https://doi.org/10.7759/cureus.24298

37 Zakrasek EC, Creasey G, Crew JD. Pressure ulcers in people with spinal cord injury in developing nations Affiliations expand. https://doi.org/10.1038/sc.2014.179

38 Campanale A, Ventimiglia M, Minella D, et al. National breast implant registry in Italy. Competent authority perspective to improve patients' safety. PRRS 2022;1:34-45. https://doi.org/10.57604/PRRS-005