Factors associated with the development of pressure injuries in elective surgery: integrative review

Fatores associados ao desenvolvimento de lesões por pressão em cirurgia eletiva: revisão integrativa

Factores asociados al desarrollo de lesiones por presión en cirugía electiva: revisión integrativa

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ABSTRACT: Objective: To identify factors associated with the development of pressure injuries (PI) in the perioperative period in individuals undergoing elective surgery. Method: Integrative literature review carried out in 2021 with the help of Biblioteca Virtual em Saúde (BVS). Results: 135 articles were identified in the database, of which 19 were selected for extraction of results. The inclusion criteria of the articles were: being original, answering the research question, published in Portuguese, English or Spanish, presenting as a population: surgical patients; as exposure: preoperative, intraoperative or postoperative risk factors; and as a result: LP development. Of the articles included, 15.8% were carried out in Brazil, with a predominance of the level of evidence LE=2 (n = 15; 68.2%). Conclusion: Intrinsic and extrinsic factors related to surgery, medications in use, comorbidities, pre-surgical clinical status, sex, age, being admitted from a place other than their residence, open surgeries, type of surgery were associated with the development of injury, type of anesthesia, hypotensive episodes, transfusion, surgical time, use of cushion, skin conditions, increased intraoperative pressure, skin temperature, hypothermia. Keywords: General surgery. Perioperative nursing. Specialties, surgical. Risk factors. Pressure risk.


RESUMEN: Objetivo: Identificar factores asociados al desarrollo de lesiones por presión (LP) en el periodo perioperatorio en sujetos sometidos a cirugía electiva. Método: Revisión integrativa de la literatura realizada en la Biblioteca Virtual en Salud (BVS) en 2021. Resultados: 135 artículos fueron identificados en la base de datos y 19 fueron seleccionados para la extracción de resultados. Los criterios de inclusión de los artículos fueron: ser originales, responder a la pregunta de investigación, publicados en portugués, inglés o español, con la siguiente población: pacientes quirúrgicos; como exposición: factores de riesgo preoperatorios, intraoperatorios o postoperatorios; y como resultado: desarrollo de LP. De los artículos incluidos, 15,8% fueron realizados en Brasil con predominio del nivel de evidencia NE=2 (n = 15; 68,2%). Conclusión: Asociados con el desarrollo de lesiones, están: Factores intrínsecos y extrínsecos relacionados con la cirugía, medicamentos en uso, comorbilidades, estado clínico prequirúrgico, sexo, edad, ser ingresado de lugar diferente al de residencia, cirugías abiertas, tipo de cirugía, tipo de anestesia, episodios de hipotensión, transfusión, tiempo quirúrgico, uso de almohadillas, afecciones de la piel, aumento de la presión intraoperatoria, temperatura de la piel, hipotermia. Palabras clave: Cirugía general. Enfermería perioperatoria. Especialidades quirúrgicas. Factores de riesgo. Úlcera por presión.
Pressure injury (PI) can be defined as localized damage to the skin and/or underlying soft tissues, usually over a bony prominence, as a result of intense and/or prolonged pressure or pressure with shear1. In the global scenario, a recent study identified an incidence of PI in hospitalized patients of 8.5%; while another had an incidence of PI in surgical patients of 4.7% and a prevalence of 30.6%. In Brazil, the incidence in individuals varies from 6.4 to 49.2%.

With regard to surgical patients, it is necessary to consider that, during the intraoperative period, they are immobilized, positioned on a relatively hard surface, unable to feel the pain caused by pressure and shear forces, in addition to the inability to change their position to relieve pressure when under the effect of anesthetic agents. In this context, it is noteworthy that around 50% of patients undergoing elective surgery are at high risk of developing PI in the perioperative period.

It is noteworthy that PIs can be considered an indicator of the quality of health care provided and perioperative nurses play an important role in the results on patient safety. In addition, the cost of treating these injuries is high and can lead to an overload on the nursing team. The National Health Surveillance Agency (Agência Nacional de Vigilância Sanitária – ANVISA) published a technical note that discusses the prevention of PI in health services. In this sense, one should invest in the prevention of these injuries, and the production of evidence about the factors associated with the development of PI resulting from surgical positioning can contribute to the understanding of this complex problem. In addition, this study may provide support for the implementation of nursing interventions with the purpose of reducing the risk of developing these lesions in the perioperative period.

Although there are already systematic reviews on risk factors in relation to the development of PI, these were performed with specific types of surgeries, such as cardiovascular, general, lower limb amputation and cardiac. Hence the need to perform an integrative review with elective surgeries.

**OBJECTIVE**

To identify factors associated with the development of PI in the perioperative period in individuals undergoing elective surgery.
referring to the sample and surgical specialty, in addition to factors associated with the development of PI. This information can be viewed in Chart 1.

The quality of the literature included in this review was not prioritized, but its level of evidence (LE) was assessed, according to the primary research objective. As all the articles included were aimed at the etiology, only this classification of evidence was used. This information is contained in Chart 2.

LE 1 was considered: synthesis of cohort or case-control studies; LE 2: cohort study or case control; LE 3: meta-synthesis or synthesis of descriptive studies; EL 4: descriptive or qualitative study; EL 5: expert opinion.

Step 5: to evaluate the characteristics of the studies, a simple descriptive statistical analysis was performed, presenting absolute and relative frequency. Furthermore, a synthesis of the evidence found was carried out.

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Figure 1. Flowchart of identification, selection and inclusion of studies, prepared based on PRISMA recommendations.
**Chart 1.** Sample, mean age, type of surgery and summary of factors associated with pressure injury development of the included studies.

<table>
<thead>
<tr>
<th>Cod.*</th>
<th>Sample</th>
<th>Mean age or age range</th>
<th>Type of surgery</th>
<th>Factors associated with the development of PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1(^{17})</td>
<td>n = 803</td>
<td>59 years</td>
<td>Hepatobiliary gastrointestinal surgery</td>
<td>- Pancreatoduodenectomy, - Open surgery, - Surgical time greater than 197 minutes, - Intraoperative hypotensive episodes.</td>
</tr>
<tr>
<td>A2(^{18})</td>
<td>n = 29</td>
<td>44.4 years</td>
<td>Neurosurgery</td>
<td>- Increase in skin temperature.</td>
</tr>
<tr>
<td>A3(^{19})</td>
<td>n = 286</td>
<td>46.9 years</td>
<td>Cardiovascular surgery</td>
<td>- Perioperative administration of corticosteroids.</td>
</tr>
<tr>
<td>A4(^{20})</td>
<td>n = 32,963</td>
<td>58 years</td>
<td>Cardiac, general, hepatobiliary, neurological, oncological, plastic, thoracic, transplant, trauma, urological and vascular surgery</td>
<td>- Surgery time.</td>
</tr>
<tr>
<td>A5(^{21})</td>
<td>n = 534</td>
<td>54.1 years</td>
<td>General and orthopedic surgery</td>
<td>- Reduced turgor or edema, - Being admitted from a place other than one’s residence, - Advanced age.</td>
</tr>
<tr>
<td>A6(^{22})</td>
<td>n = 88</td>
<td>61.84 years</td>
<td>Head and neck surgery</td>
<td>- Decreased age, - Surgery time.</td>
</tr>
<tr>
<td>A7(^{23})</td>
<td>n = 2,695</td>
<td>60 years (without PI) and 63 years (with PI)</td>
<td>Surgery of patients in burn ICU, surgical ICU, and cardiovascular ICU</td>
<td>- Intraoperative transfusion of blood products.</td>
</tr>
<tr>
<td>A8(^{24})</td>
<td>n = 102</td>
<td>62.3 years</td>
<td>Cardiac, neurological, plastic, vascular and general surgery</td>
<td>- Diabetes mellitus, - Heart diseases, - Time on the operating table greater than 6.15 hours, - Intraoperative hypothermia.</td>
</tr>
<tr>
<td>A9(^{25})</td>
<td>n = 199</td>
<td>52.6 years</td>
<td>Orthopedic, neurological and gastrointestinal surgery</td>
<td>- Prone position, - General anesthesia, - Sheet cushion, - Surgery time.</td>
</tr>
<tr>
<td>A10(^{26})</td>
<td>n = 258</td>
<td>46 to 75 years</td>
<td>General, neurological, orthopedic, and other surgeries lasting three hours or more</td>
<td>- Diabetes mellitus, - Age ≥ 70 years, - Low score on the Braden scale in the immediate postoperative period.</td>
</tr>
<tr>
<td>A11(^{27})</td>
<td>n = 100</td>
<td>63.5 (men) and 65.8 (women)</td>
<td>Cardiac surgery</td>
<td>The variables evaluated in the study did not show statistical significance with the development of PI.</td>
</tr>
<tr>
<td>A12(^{28})</td>
<td>n = 34</td>
<td>74.3 years</td>
<td>Hip or knee replacement surgery</td>
<td>- Knee replacement surgery (heels do not float during surgery), - Type of anesthesis: peripheral nerve block.</td>
</tr>
<tr>
<td>A13(^{29})</td>
<td>n = 286</td>
<td>67.1 years</td>
<td>Orthopedic, cardiac, abdominal, elective and emergency surgery</td>
<td>- Women, - High ASA surgical risk score, - High NYHA heart failure classification score, - Nutritional status.</td>
</tr>
<tr>
<td>A14(^{30})</td>
<td>n = 208</td>
<td>61 years</td>
<td>Cardiac, neurological, head and neck oncology, vascular, orthopedic, oncology, gastroenterology, plastic and urology surgery</td>
<td>- Surgery time over 4 hours.</td>
</tr>
</tbody>
</table>
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**Chart 1.** Continuation.

<table>
<thead>
<tr>
<th>Cod.*</th>
<th>Sample</th>
<th>Mean age or age range</th>
<th>Type of surgery</th>
<th>Factors associated with the development of PI</th>
</tr>
</thead>
</table>
| A15^21 | n = 163 | 64.5 years | Cardiac and vascular surgery | - Low hemoglobin concentration on admission,  
- Low score on the Braden scale in the postoperative period,  
- Use of corticosteroids in the postoperative period. |
| A16^22 | n = 45  | 50.9 years | Elective surgery | - Age ≥ 46,  
- Systemic arterial hypertension. |
| A17^23 | n = 5,136 | 57.76 years | Digestive tract surgery | - Preoperative skin change (erythema, ecchymosis, blister, lesions),  
- Reduction of preoperative physical mobility,  
- Surgical positioning,  
- Increased intraoperative pressure. |
| A18^24 | n = 269 | 63 years | Elective surgery | - Age ≥ 75 years,  
- Women,  
- ASA surgical risk score ≥ 3,  
- BMI < 23,  
- Low score on the Braden scale in the preoperative period,  
- Anemia, respiratory diseases, and hypertension. |
| A19^25 | n = 278 | 48.7 years | Elective surgery | - Women,  
- Advanced age,  
- Altered BMI. |

*Cod: encoding. PI: pressure injury; ASA: American Society of Anesthesiologists; NYHA: New York Heart Association; BMI: body mass index. Several factors associated with the development of pressure injuries in individuals undergoing elective surgery were identified, which are explained in Chart 2.3.

**Chart 2.** Factors associated with the development of pressure injuries divided by levels of evidence.

<table>
<thead>
<tr>
<th>LE 2</th>
<th>LE 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factors associated with the development of PI in individuals undergoing elective surgeries</strong></td>
<td><strong>Decreased age^36</strong></td>
</tr>
<tr>
<td>Diabetes mellitus^24,26</td>
<td>Anemia^34</td>
</tr>
<tr>
<td>Prolonged surgery time^20,22,25,30</td>
<td>Respiratory diseases^34</td>
</tr>
<tr>
<td>Women^34,35</td>
<td>Altered body mass index or &lt; 23^35</td>
</tr>
<tr>
<td>Advanced age^21,24,32,35</td>
<td>Prone position^25</td>
</tr>
<tr>
<td>Systemic arterial hypertension^22,34</td>
<td>General anesthesia^25</td>
</tr>
<tr>
<td>Heart diseases^34</td>
<td>Intraoperative transfusion of blood products^23</td>
</tr>
<tr>
<td>Altered body mass index^35</td>
<td>Sheet Cushion^25</td>
</tr>
<tr>
<td>Nutritional status^29</td>
<td>Low score on the Braden scale in the preoperative period^26</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Being admitted from a place other than one’s residence^21</td>
<td></td>
</tr>
<tr>
<td>Low hemoglobin concentration on admission^31</td>
<td></td>
</tr>
<tr>
<td>Reduction of preoperative physical mobility^13</td>
<td></td>
</tr>
<tr>
<td>Open surgeries^27</td>
<td></td>
</tr>
<tr>
<td>Type of surgery; pancreatoduodenectomy^27 or knee replacement surgery^28</td>
<td></td>
</tr>
<tr>
<td>Surgical positioning^33</td>
<td></td>
</tr>
<tr>
<td>Peripheral nerve block^28</td>
<td></td>
</tr>
<tr>
<td>Intraoperative hypotensive episodes^17</td>
<td></td>
</tr>
<tr>
<td>Time on the operating table^24</td>
<td></td>
</tr>
<tr>
<td>High surgical risk score from the American Society of Anesthesiologists^29,34 or high score from the New York Heart Association classification of heart failure^29</td>
<td></td>
</tr>
<tr>
<td>Skin conditions such as reduced turgor, edema^21, erythema, ecchymosis, blister, and lesions^33</td>
<td></td>
</tr>
<tr>
<td>Increased intraoperative pressure^33</td>
<td></td>
</tr>
<tr>
<td>Increase in skin temperature^18</td>
<td></td>
</tr>
<tr>
<td>Intraoperative hypothermia^24</td>
<td></td>
</tr>
<tr>
<td>Low score on the Braden scale in the postoperative period^24,31</td>
<td></td>
</tr>
<tr>
<td>Perioperative administration of corticosteroids^19,31</td>
<td></td>
</tr>
</tbody>
</table>
RESULTS

In the present review, 19 articles were analyzed. The articles were published between 1998 and 2019, with the majority (57.9%) of the studies published between 2014 and 2019. It is noteworthy that only three (15.8%) studies were carried out in Brazil, while the others were carried out in China (n = 3; 15.8%), in the United States (n = 3; 15.8%), in Australia (n = 2; 10.5%), among other countries. The most common types of study were prospective (47.4%) and retrospective (31.6%). The surgical specialties that appeared the most were cardiovascular (26.3%), followed by gastrointestinal (15.8%), neurological (15.8%) and orthopedic (15.8%). As for the levels of evidence, a predominance of studies classified as LE 2 was identified (n = 15; 68.2%). These characteristics are presented in Chart 317-35.

The intrinsic factors associated with the development of PI most mentioned in the included studies were: advanced age (26.3%); female gender (15.8%); and diabetes mellitus (10.5%).

The most mentioned extrinsic factor associated with the development of PI was the surgical time (31.6%). Regarding the type of surgery mentioned in the included studies, cardiovascular surgeries were mentioned in 42.1%, orthopedic in 31.6%, neurological in 26.3%, gastrointestinal in 21%, among others.

In studies in which individuals underwent cardiovascular surgery, the most common factor associated with the development of PI was the duration of surgery (n = 3; 37.5%). In orthopedic surgeries, the duration of surgery (n = 2; 33.3%) and advanced age (n = 2; 33.3%) were the most common factors associated with the development of PI. In neurological surgeries, the duration of surgery (n = 3; 60%) and the presence of diabetes mellitus (n = 2; 40%) were the associated factors that most contributed to the development of PI. Furthermore, studies that submitted individuals to gastrointestinal surgeries brought the duration of surgery (n = 3; 75%) and surgical positioning (n = 2; 50%) as factors associated with the development of PI.

DISCUSSION

Several factors were found to be associated with the development of PI in the perioperative period in individuals undergoing...
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elective surgery. The evidence found refers to intrinsic factors and to several extrinsic ones. The factors associated with the development of PI that appeared the most in the included studies were: advanced age, female gender, diabetes mellitus, and time of surgery.

The studies included were classified as LE 2 to 4, with the majority (n = 15; 78.9%) of the studies classified as LE 2 (cohort or case control studies)⁴. This finding indicates that the theme is widely explored in the literature; however, studies were performed with a variety of surgical specialties, making it complex to generalize these findings to all elective surgeries.

Advanced age is associated with the development of PI due to the very physiology of human aging, which causes a decrease in skin thickness, reduction of subcutaneous adipose tissue in the limbs, reduction of dermal capillaries, among other factors⁵. In relation to females, the development of lesions may occur due to the large amount of adipose tissue present in women, which leads to increased pressure exerted on the tissues and exposure to hypoxia, as reported by Ribeiro in his review⁶.

It is noteworthy that the international guidelines for the prevention and treatment of PI recommend performing a risk assessment using a risk assessment tool, added to the assessment of additional risk factors⁷. The use of scales that help in the detection of the risk of developing a lesion collaborates for the prevention of PI, such as the Risk Assessment Scale for the Development of Injuries Resulting from the Surgical Position of the Patient (Escala de Avaliação de Risco para o Desenvolvimento de Lesões Decorrentes do Posicionamento Cirúrgico do Paciente – ELPO), which is used as a parameter to detect the risk of surgical patients developing pressure injuries, the type of surgical position, time of surgery, type of anesthesia, support surface, limb position, comorbidities, and age of the patient⁸.

Patients with diabetes mellitus are considered a population at risk for the development of PI, as they may have vascular compromise, with consequent changes in perfusion, in addition to peripheral neuropathy, which can reduce tissue tolerance to pressure⁹.

Regarding the prolonged duration of surgery, despite several studies⁴,⁵,⁶,⁷ identifying this as a risk factor for the development of PI, there is no consensus among authors about the time limit. It is noteworthy that the longer the surgical time, in which the patient is immobilized in the same position, the greater the risk of developing these lesions⁹.

Based on the findings of this study, it is recommended that health professionals, especially nurses, include the assessment of the estimated time of surgery and the presence of diabetes in the risk assessment of PI in patients undergoing elective surgeries. Despite being a topic widely explored in the literature, there is still a lack of studies that define, for example, surgery time limit for the development of PI. This study has as limitations the search in a single virtual library.

CONCLUSION

Several factors associated with the development of PI in the perioperative period in individuals undergoing elective surgery were identified, among which diabetes mellitus and prolonged surgery time stand out. Therefore, it is possible to conclude that the results of this study contribute to the advancement of surgical nursing, aiming, mainly, at the prevention of PI in the perioperative period.

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None.

CONFLICT OF INTERESTS

The author declare there is no conflict of interests.

AUTHORS’ CONTRIBUTION

KPPS: Project administration, Formal analysis, Conceptualization, Data curation, Investigation, Methodology, Resources, Writing — original draft, Writing — review & editing, Supervision, Validation, Visualization. SBSL: Project administration, Validação, Visualização. TDE: Project administration, Formal analysis, Conceptualization, Methodology, Resources, Writing — original draft, Writing — review & editing, Supervision, Validation, Visualization. LBTDS: Supervision, Validation, Visualization. RSAS: Supervision, Validation, Visualization. BRP: Data curation, Investigation, Writing — review & editing.


