**RISK FACTORS FOR SSI AFTER KNEE REPLACEMENT ARTHROPLASTY: SCOPING REVIEW**

Fatores de risco de ilc após artroplastia do joelho: scoping review

Factores de riesgo de ISQ después de una artroplastia de rodilla: revisión del alcance

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**ABSTRACT**

**Background**: the risk factors for surgical site infection (SSI) after Knee Replacement Arthroplasty have an impact on the safety and quality of life of the person in the perioperative situation and on increased costs for healthcare units. It appears that this topic is mostly studied in conjunction with the risk factors for SSI after hip arthroplasty. It is essential to approach it in isolation, to create risk identification tools that allow identifying the people most vulnerable to surgical site infections in this surgery. **Objectives**: to map the evidence on the risk factors for SSI in people undergoing Knee Replacement Arthroplasty. **Methodology**: scoping review guided by the Joanna Briggs Institute methodology. Time limit applied from 2018 to 2024, based on a review identified on this topic. **Results**: 27 articles were included in the review, and modifiable and non-modifiable risk factors in the perioperative period were identified. The advanced skills of the specialist nurse to minimize/eliminate the risk of SSI are fundamental, especially in modifiable risk factors. **Conclusion**: risk factors are present in the perioperative period, some being intrinsic to the person themselves and others resulting from the practices of health professionals themselves, putting surgical safety at risk.

**Keyword**s: knee replacement arthroplasty; risk factors; surgical wound infection

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**RESUMO**

**Enquadramento**: os fatores de risco de infeção do local cirúrgico (ILC) após Artroplastia do Joelho têm impacto na segurança e qualidade de vida da pessoa em situação perioperatória e no aumento de custos para as unidades de saúde. Verifica-se que este tema é maioritariamente estudado conjuntamente com os fatores de risco de ILC após artroplastia da anca. É imprescindível abordá-lo de forma isolada, para criar instrumentos de identificação de risco que permitam identificar as pessoas mais vulneráveis às infeções do local cirúrgico nesta cirurgia. **Objetivos**: mapear a evidência sobre os fatores de risco de ILC nas pessoas submetidas a Artoplastia do Joelho. **Metodologia**: revisão scoping orientada pela metodologia do Joanna Briggs Institute. Aplicado limite temporal 2018 a 2024, a partir de uma revisão identificada sobre essa temática. **Resultados**: foram incluídos 27 artigos na revisão, e identificados fatores de risco modificáveis e não modificáveis no período perioperatório. As competências avançadas do enfermeiro especialista para minimizar/eliminar o risco da ILC são fundamentais principalmente nos fatores de risco modificáveis. **Conclusão**: os fatores de risco estão presentes no período perioperatório, sendo alguns intrínsecos à própria pessoa e outros decorrentes das práticas dos próprios profissionais de saúde colocando em risco a segurança cirúrgica

**Palavras-chave**: artroplastia do joelho; fatores de risco; infecção da ferida cirúrgica.

**RESUMEN**

**Marco Contextual**: los factores de riesgo de infección del sitio quirúrgico (ISQ) después de la Artroplastia de Reemplazo de Rodilla tienen un impacto en la seguridad y calidad de vida de la persona en la situación perioperatoria y en el aumento de costos para las unidades de salud. Parece que este tema se estudia principalmente junto con los factores de riesgo de ISQ después de una artroplastia de cadera. Es fundamental abordarlo de forma aislada, para crear herramientas de identificación de riesgos que permitan identificar a las personas más vulnerables a infecciones del sitio quirúrgico en esta cirugía. **Objetivos**: Mapear la evidencia sobre los factores de riesgo de ISQ en personas sometidas a Artroplastia de Reemplazo de Rodilla. **Metodología**: Revisión del alcance guiada por la metodología del Instituto Joanna Briggs. Límite de tiempo aplicado de 2018 a 2024, con base en una revisión identificada sobre este tema. **Resultados**: Se incluyeron 27 artículos en la revisión y se identificaron factores de riesgo modificables y no modificables en el período perioperatorio. Las habilidades avanzadas de la enfermera especialista para minimizar/eliminar el riesgo de ISQ son fundamentales, especialmente en factores de riesgo modificables. **Conclusión**: Los factores de riesgo están presentes en el período perioperatorio, siendo algunos intrínsecos a la propia persona y otros derivados de la práctica de los propios profesionales de la salud, poniendo en riesgo la seguridad quirúrgica.

**Palabra clave**: artroplastia de reemplazo de rodilla; factores de riesgo; infección de la herida quirúrgica

**INTRODUCTION**

In Portugal, there is a growing trend towards demographic ageing as a result of low birth rates and increased longevity, which is likely to be very significant in the coming decades (Instituto Nacional de Estatística, 2023).

Ageing is accompanied by the emergence of acute and chronic comorbidities, such as knee osteoarthritis, which is characterized by its chronicity, accompanied by pain, dependency and reduced quality of life. In 2019, 528 million people lived with this condition, an increase of 113% since 1990 worldwide, with moderate to severe levels of severity (World Health Organization [WHO], 2023).

In Portugal, the EpiReumaPt (Epidemiological Study of Rheumatic Diseases in Portugal) reported that in 2015, rheumatic and musculoskeletal diseases were the most common diseases among the population, with knee osteoarthritis ranking third in prevalence (Branco et al., 2016).

Chronic knee pain and loss of motor function give rise to a vicious cycle with a negative impact on a person's activities of daily living, causing a significant reduction in quality of life (WHO, 2023).

Total Knee Arthroplasty (TKA) is a surgical intervention performed with the aim of reducing pain, correcting deformities and restoring a functional range of movement, preserving the stability and functionality of the joint, allowing daily activities to be carried out (Bhave & Baker, 2015).

However, surgical interventions are associated with the risk of healthcare-associated infections (HAIs), with surgical Site infection (SSI) being the most common. The incidence of SSIs remains a public health concern due to their impact on morbidity, mortality and hospital costs (European Centre for Disease Prevention and Control [ECDC], 2019).

According to the same source, SSI is characterized as an infection that manifests up to 30 days after surgery or up to 90 days after surgery in patients who have received implantable material, affecting the superficial area of the incision or the deeper tissues in the surgical region. According to its 2018-2020 annual epidemiological report published in 2023, of the 1,255,958 surgical procedures recorded in Europe, there were 19,680 surgical site infections, with 0.6% referring to Knee Arthroplasty, highlighting the decrease in the SSI rate in 2020, due to the lower number of surgeries reported due to the Covid-19 epidemic.

In Portugal, the 2021 report of the Programme for the Prevention and Control of Infections and Antimicrobial Resistance (PPCIAR) highlights an increase in SSI in Knee Arthroplasty (by 14.3%), highlighting the fact that fewer elective surgical procedures were carried out and analyzed due to the pandemic in 2020 (Direção-Geral da Saúde [DGS], 2022a).

In order to overcome this challenge, the importance of the use of guidelines and standards by the DGS was reinforced, with the aim of preventing SSI through the implementation of evidence-based practices and the implementation of “bundles of interventions” (DGS, 2022b).

The DGS implemented Standard 020/2015 on 15/12/2015, which was subsequently updated on 17/11/2022 (DGS, 2022b). This standard covers a series of preventive measures, such as the integrated application of “bundles of interventions” as a fundamental element for successful prevention. It is part of the Strategic Objective ‘5.3 Reduce Healthcare-Associated Infections (HAIs) and Antimicrobial Resistance (RAM)’ of Pillar 5 ‘Safe Practices in Safe Environments’ of the National Patient Safety Plan (PNSD) 2021-2026 (Order no. 9390/2021 of 24 September), reinforcing the importance of standardizing procedures based on surgical evidence and the involvement of the entire team.

However, the need to deepen our knowledge of the risk factors for SSI after knee arthroplasty is evident, especially considering the constant evolution in the healthcare field. This study aims to map the scientific evidence on the risk factors for SSI in adults undergoing knee arthroplasty. In order to achieve this objective, a scoping review will be carried out, guided by the methodology of the Joanna Briggs Institute (JBI). The review protocol was registered in the Open Science Framework database (OSFHOMEhttps://osf.io/4xayj). Identifying these risk factors is fundamental to developing more effective prevention strategies, improving results and ensuring the safety of people undergoing knee arthroplasty.

**METHODOLOGICAL REVIEW PROCEDURES**

 According to Peters et al. (2020) the JBI recommends that for scoping reviews the PCC mnemonic (population, concept and context) be used to define the review question “What are the risk factors for surgical site infection after Knee Arthroplasty?”, as shown in Table 1.

Bord 1

Components of the review question

|  |  |
| --- | --- |
| POPULATION (P) | Adults, 18 years or older, undergoing Knee Arthroplasty |
| CONCEPT (C) | Risk factors for surgical site infection |
| CONTEXT (C) | Hospital and Community |

Studies whose participants were adults who underwent knee arthroplasty were included; whose objective focuses on the risk factors of SSI; performed in a hospital and community context, since SSI can occur up to 90 days after surgical intervention, in the case of prosthesis implantation. Primary and secondary research studies, qualitative, quantitative or mixed, published with or without peer review and grey literature were included. Conference abstracts, oral communications or posters are excluded. The time limit 2018 to 2024 was applied, by identifying a review that included studies up to the end of the year 2017. The search strategy comprised an initial limited search, using terms related to the research question, in the Medical Literature Analysis and Retrieval System Online (MEDLINE), via EBSCOhost. The text words, titles, abstracts and MeSH terms used to describe the article were analyzed. Next, in the DeCS search, at https://decs.bvsalud.org/, it is important to note that: when searching for the term Knee Arthroplasty, 1 descriptor appeared, “Arthrosplasty, Replacement, Knee”; the term risk factors produced 6 descriptors, with descriptor 1, “Risk Factors”, being chosen; the term Surgical Site Infection did not produce any descriptors, opting for the term Surgical Wound Infection, having only 1 result, the descriptor “Surgical Wound Infection”. A complete search strategy was developed, through the definition of the Boolean phrase (“Arthroplasty, Replacement, Knee”) AND (“Risk Factors”) AND (“Surgical Wound Infection”) in the databases: MEDLINE (via Pubmed), CINAHL, SciELO, Scopus, LILACS, Cochrane Database of Systematic Reviews, in their adaptations to the different scientific databases, that is, using the selected terms as indexed terms or as natural terms. Grey literature was searched in RCAAP (Portuguese Open Access Scientific Repository), DART- Europe and OpenGrey. The bibliographic references included in all articles were analyzed, with the aim of identifying additional studies.

The selection result is shown in Figure 1 according to PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-analyses extension for scoping review) (Tricco et al., 2018).



Figure 1

Article selection flow diagram (adapted from PRISMA-ScR) (Tricco et al., 2018)

Table 1

Selected studies

|  |  |  |  |
| --- | --- | --- | --- |
| **Studies (E)** | **Title Author(s)** | **Author(s)** | **Country** |
| E1 | *“Age as a risk factor for surgical site infections: German surveillance data on total hip replacement and total knee replacement procedures 2009 to 2018”* | (Bischoff et al, 2023) | Germany |
| E2 | *“Albumin, Prealbumin, and Transferrin May Be Predictive of Wound Complications following Total Knee Arthroplasty”* | (Roche et al, 2018) | United States of America (USA) |
| E3 | *“Assessment of Predictors of Infection in Primary Knee and Hip Arthroplasty: A Case-control Study”* | (Falótico et al, 2022) | Brazil |
| E4 | *“Better Operating Room Ventilation as Determined by a Novel Ventilation Index is Associated with Lower Rates of Surgical Site Infections”* | (Surial et al, 2022) | Switzerland |
| E5 | *“Central sensitization is a risk factor for wound complications after primary total knee arthroplasty”* | (Kim et al, 2018) | South Korea |
| E6 | *“History of Diabetic Foot Ulcer is Associated with Increased Risk of Prosthetic Joint Infection and Sepsis After Total Joint Arthroplasty”* | (Magruder et al, 2024) | Indiana (USA) |
| E7 | *“Impact of Operative Time on Adverse Events Following Primary Total Joint Arthroplasty”* | (Bohl et al, 2018) | USA |
| E8 | *“Impact of patient comorbidities on surgical site infection within 90 days of primary and revision joint (hip and knee) replacement”* | (Edmiston Jr. et al, 2019) | USA |
| E9 | *“Impact of Perioperative Urinary Tract Infection on Surgical Site Infection in Patients Undergoing Primary Hip and Knee Arthroplasty”* | (Schmitt et al, 2020) | USA |
| E10 | *“Incidence and Risk Factors of 30-Day Surgical Site Infection after Primary Total Joint Arthroplasty in a Middle-Income Country: A Single-Center Experience”* | (Marusic et al, 2021) | Serbia |
| E11 | *“Incidence and risk factors of surgical site infection after total knee arthroplasty: Results of a retrospective cohort study”* | (Baier et al, 2019) | Germany |
| E12 | *“Intraoperative bacterial contamination in total hip and knee arthroplasty is associated with operative duration and peeling of the iodine-containing drape from skin”* | (Hanada et al, 2020) | Japan |
| E13 | *“Is Operative Time a Predictor for Post-Operative Infection in Primary Total Knee Arthroplasty?”* | (Anis et al, 2019) | USA |
| E14 | *“Longer Operative Time Results in a Higher Rate of Subsequent Periprosthetic Joint Infection in Patients Undergoing Primary Joint Arthroplasty”* | (Wang et al, 2019) | USA |
| E15 | *“Non-compliance with clinical guidelines increases the risk of complications after primary total hip and knee joint replacement surgery”* | (Badge et al, 2021) | Australia |
| E16 | *“Patients with musculoskeletal dysplasia undergoing total joint arthroplasty are at increased risk of surgical site Infection”* | (Patel et al, 2019) | USA |
| E17 | *“Perioperative Allogeneic Red Blood-Cell Transfusion Associated with Surgical Site Infection After Total Hip and Knee Arthroplasty”* | (Everhart et al, 2018) | USA |
| E18 | *“Peritoneal Dialysis Does Not Carry the Same Risk as Hemodialysis in Patients Undergoing Hip or Knee Arthroplasty”* | (Browne et al, 2019) | USA |
| E19 | *“Prediction of Complications, Readmission, and Revision Surgery Based on Duration of Preoperative Opioid Use: Analysis of Major Joint Replacement and Lumbar Fusion”* | (Jain et al, 2019) | USA |
| E20 | *“Risk factors for infection, revision, death, blood transfusion and longer hospital stay 3 months and 1 year after primary total hip or knee arthroplasty”* | (Rhee et al, 2018) | Canada |
| E21 | *“Risk Factors for Surgical Site Infection Following Lower Limb Arthroplasty: A Retrospective Cohort Analysis of 3932 Lower Limb Arthroplasty Procedures in a High-Volume Arthroplasty Unit”* | (Almustafa et al, 2018) | United Kingdom |
| E22 | *“Risk factors of postoperative complications following total knee arthroplasty in Korea: A nationwide retrospective cohort study”* | (Ko et al, 2021) | South Korea |
| E23 | *“Surgical site infection incidence and risk factors in knee arthroplasty: A 9-year prospective cohort study at a university teaching hospital in Spain”* | (Hijas-Gómez et al, 2018) | Spain |
| E24 | *“Surgical site infection after primary total knee arthroplasty is associated with a longer duration of surgery”* | (Teo et al, 2018) | Singapore |
| E25 | *“The Radiographic Prepatellar Fat Thickness Ratio Correlates with Infection Risk After Total Knee Arthroplasty”* | (Wagner et al, 2018) | USA |
| E26 | *“The Seasonal Variability of Surgical Site Infections in Knee and Hip Arthroplasty”* | (Anthony et al, 2018) | USA |
| E27 | *“What Are Risk Factors for Infection after Primary or Revision Total Joint Arthroplasty in Patients Older Than 80 Years?”* | (Sodhi et al, 2020) | USA |

**RESULTS**

Data extracted from the articles were analyzed by two independent reviewers using a tabulated data extraction instrument developed to summarize key findings relevant to the review question.

The results were presented in a continuous and schematic text (Tables 2 and 3).

Table 2

Non-modifiable SSIs risk factors

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| FACTORS | PREOPERATIVE | INTRAOPERATIVE | POSTOPERATIVE | STUDY AUTHORS |
| Demographics | Gender Male | (Bischoff et al, 2023; Baier et al, 2019; Ko et al, 2021; Sodhi et al, 2020) |
| Age ≥ 80 years | (Bischoff et al, 2023) |
| American Society of Anesthesiology (ASA) Classification | >ASA II |  | (Bischoff et al, 2023) |
| Pain Sensitivity | Increased central sensitization | (Kim et al, 2018) |
| Economics | Countries with low socioeconomic development | (Marusic et al, 2021) |
| Analytical | Serum neutrophilia | (Almustafa et al, 2018) |
| Comorbidities | Rheumatoid arthritis | (Sodhi et al, 2020) |
| Musculoskeletal dysplasia | (Patel et al, 2019) |
| Renal failure on dialysis | (Browne et al, 2019) |
| Congestive heart failure | (Edmiston Jr. et al, 2019) |
| Coagulopathy | (Edmiston Jr. et al, 2019) |
| Liver disease | (Rhee et al, 2018) |
| Diabetes | (Edmiston Jr. et al, 2019; Almustafa et al, 2018) |
| Hypertension | (Almustafa et al, 2018) |
|  | Peripheral venous disease | (Marusic et al, 2021) |
| Depression | (Sodhi et al, 2020) |
| Seasonality | Summer | (Bischoff et al, 2023; Anthony et al, 2018) |
| Healing | Ahlbäck disease | (Baier et al, 2019) |

Table 3

Modifiable SSIs risk factors

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| FACTORS | PREOPERATIVE | INTRAOPERATIVE | POSTOPERATIVE | STUDY AUTHORS |
| Obesity | BMI>25 | (Sodhi et al, 2020) |
| BMI≥30 | (Baier et al, 2019) |
| Pre-Patellite Fat | (Wagner et al, 2018) |
| 50-55 years | (Bischoff et al, 2023) |
| Surgery Duration |  | >Duration |  | (Bischoff et al, 2023; Bohl et al, 2018; Hanada et al, 2020; Anis et al, 2019; Teo et al, 2018) |
|  | >90 minutes |  | (Wang et al, 2019) |
|  | >120 minutes |  | (Falótico et al, 2022) |
|  | >180 minutes |  | (Baier et al, 2019) |
|  | ATJ Bilateral and Review |  | (Ko et al, 2021) |
|  |  | Internment> 35 days | (Ko et al, 2021) |
| Nutritional status | Desnutrição | (Roche et al, 2018) |
| Analyticals | Low Albumin Value |  |  | (Roche et al, 2018) |
| Low Mean Corpuscular Volume (MCV) |  |  | (Almustafa et al, 2018) |
| Bleeding |  |  | Blood transfusion | (Rhee et al, 2018) |
|  |  | Prolonged storage of blood prior to infusion  | (Almustafa et al, 2018) |
| Environmental | Low ventilation quality | (Surial et al, 2022) |
| Healing | Diabetic Foot Ulcer |  | Healing Disorders | (Magruder et al, 2024; Baier et al, 2019) |
| Peripheral Venous Disease | (Marusic et al, 2021) |
| Infections |  |  | Urinary Tract Infection | (Schmitt et al, 2020) |
| *Guidelines* | Non-compliance (Antibiotic Therapy and Venous Thromboembolism Prophylaxis) | Non-compliance (Antibiotic therapy) | (Badge et al, 2021; Almustafa et al, 2018) |
| Trichotomy |  |  | (Hijas-Gómez et al, 2018) |
| Medication | Opioid medication >6 months |  |  | (Jain et al, 2019) |
| Warfarin or Rivaroxaban |  |  | (Almustafa et al, 2018) |
| Analytical | Iron deficiency anemia | (Sodhi et al, 2020) |
| Electrolyte imbalance | (Sodhi et al, 2020) |
| Wound Closure |  | Cyanoacrylate Skin Glue |  | (Almustafa et al, 2018) |

**DISCUSSION**

The present review aims to answer the question “What are the risk factors for SSI after knee arthroplasty?”. The most used methodology in the 27 included studies was retrospective.

With the increase in average life expectancy in recent years, health care for the elderly population is considered a major challenge in the near future, as this age group is more vulnerable to adverse events, including infections.

Knee arthroplasty is recognized as one of the most performed types of surgery in the world, and mainly involves elderly people, with the rate of SSIs expected to increase in the same proportion, and it has been possible to identify the risk factors for SSIs (modifiable and non-modifiable) in the pre, intra and post-operative period.

A systematic review and meta-analysis from 2018 was identified, where studies up to 2017 were included, revealing it to be pertinent that this ScR had its starting point in this review, in order to map the most recent scientific evidence.

Resende et al. (2018), authors of the systematic review and meta-analysis identified, aimed to identify the main risk factors for infection in the periprosthetic joint in patients undergoing total hip arthroplasty (THA) and knee arthroplasty. This study resulted in the mapping of risk factors for SSI after knee arthroplasty, such as: Male Gender; Diabetes Mellitus; Congestive Heart Disease; Chronic Lung Disease; Coagulopathy; Arterial Hypertension; Rheumatoid arthritis; Immunosuppression Therapy; Malnutrition, Alcoholic Habits; Urinary Tract Infection, ASA ≥3 The risk factors after TKA and THA simultaneously are also mentioned, since most of the risks identified are the same for both types of surgical intervention, highlighting only the differences. He considered advanced age as a protective factor against infections, recognizing that the literature shows exactly the opposite. However, the author mentions that only studies that included the average age were included.

In this ScR, risk factors were mapped from 2018 onwards, and some identical ones were confirmed, such as: Male Gender; Coagulopathy; Diabetes Mellitus; Obesity; Arterial Hypertension, Immunosuppressive Therapy; Corticosteroids; Rheumatoid arthritis; Postoperative Urinary Tract Infection, Congestive Heart Failure, others were considered in conflict, such as Osteoarthritis, Blood Transfusion and ASA ≥3. New SSIs risk factors were also identified after TKA that should be considered in nursing interventions to the perioperative person, such as increased central sensitization, countries with lower socioeconomic development, serum neutrophilia, renal impairment in dialysis, postoperative peripheral disease, depression, seasonality (summer), Ahlbäck Disease, high-prepatellar fat. Extended surgery duration, bilateral and revision procedure, malnutrition, low albumin and low MCV values, low quality ventilation, non-compliance with guidelines (perioperative antibiotic therapy, venous thromboembolism and preoperative trichotomy), use of pre-operative opioids greater than 6 months, musculoskeletal dysplasia, liver disease, hospitalization of 35 days, prolonged storage of blood prior to infusion, high BMI, preoperative diabetic foot ulcer, healing, use of preoperative varfarin or rivaroxaban, iron deficiency anemia and perioperative electrolyte imbalance and use of cyanoacrylate cutaneous glue at the closing of the operative wound.

In the non-modifiable SSIs risk factors (Table 2), it was found that the male gender is highlighted in several studies, since it is associated with the occurrence of road accidents and heavy work more frequently, with joint wear and consequent need for surgical intervention (Silva et al., 2021).

Advanced age, greater or equal than 80 years, is also identified as a risk factor, due to its vulnerability to infections, as Tavares et al. (2022) states, there is a decrease in immunity, as well as an increase in the healing period, contributing to the increased risk. However, the literature suggests that the presence of a greater number of comorbidities appears to be more relevant than the age alone (Sousa et al, 2021). Another author corroborates his study, stating that elderly people have a higher risk of SSI, not only due to adjacent comorbidities, but due to limitations in maintaining normothermia, hydroelectrolytic balance, vascularization and lung capacity or function (Martins & Fernandes, 2019). Kaye et al. (2005), attributes it to a “resistant survivor” effect, that is, the tendency for people who survive to a more advanced age to have a genetic composition that allows them greater resistance to health threats compared to the general population. The age of 50-55 years was also cited as a non-modifiable risk factor for SSI, not exactly due to age, but due to increased BMI and bone wear.

The most cited comorbidities were Rheumatoid Arthritis, Renal Failure and Depression, Musculoskeletal Dysplasia, Congestive Heart Failure and Coagulopathy, Liver Disease, Diabetes Mellitus, Arterial Hypertension and Peripheral Venous Disease, causing concern throughout the perioperative period, with the exception of peripheral venous disease, which will require greater surveillance in the postoperative period. A Charlson Comorbidity Index score of at least 3 increased the risk of SSI. The presence of these factors in TKA as being associated with the risk of SSI are strongly cited in other studies such as that by Yang et al. (2020). The development of infections is due to changes in vascularization, sensitivity and glycemic control, impacting the inhibition of the healing process and the consequent immune function (Helito et al., 2020; Júnior et al., 2021; Silva et al., 2021).

Congestive Heart Failure and Coagulopathy were referenced in only one study, representing, in addition to the risk of SSI, an increased risk of mortality. They are also associated with a risk of Postoperative Hemorrhage and Infection, and this evidence is supported by several other authors. (Bachoura et al., 2011; Bozic et al., 2012; Fernandes, 2022).

Liver disease is also a non-modifiable risk factor, as the presence of hepatitis, markers of active hepatitis, thrombocytopenia and liver fibrosis is associated with an increased rate of infection. Nunes (2014) states that the liver ensures hemostasis, as it is where the synthesis of coagulation factors, anticoagulant proteins and proteins related to fibrinolysis occurs and is responsible for drug metabolism. This pathology increases the risk of bleeding, interfering with the healing process. According to this article, the preoperative laboratory study assumes a point of interest in the person who will undergo TKA.

The American Society of Anesthesiology (ASA) system upper to II was also identified, however for other authors, such as Resende et al. (2018), this assessment of surgical risk and the patient's physical condition should only be considered relevant from ASA ≥3, since this index is directly related to the presence of comorbidities, evidenced mainly in the elderly (Yang et al., 2020). Once again, evidence shows that investing in strategies that promote the management of chronic diseases is a priority, as a way of preventing future SSIs (Carvalho et al., 2017).

Seasonality is also considered a risk factor for SSI, as it was found that the risk of infection was higher in surgeries performed in summer compared to those in winter. This fact is explained due to the colonization of the epidermis, as climatic patterns are responsible for the increase in bacterial proliferation in certain anatomical regions (Anthony et al., 2017).

Another non-modifiable risk factor for SSI identified was Ahlbäck's disease, in only one study. Its diagnosis is difficult, consisting of an alteration in revascularization that can cause a delay in tissue healing (Jadhav et al., 2023).

Regarding the factor of Renal Failure in Hemodialysis, it was demonstrated that the technique to be used must be considered, since patients on Hemodialysis have a greater risk of bacteremia and hematogenous dissemination, due to the type of vascular access, compared to those on Peritoneal Dialysis. In the literature, authors such as Bozic et al. (2012) recognize Renal Insufficiency as a risk factor for SSI, however the distinction of the technique used is not addressed.

Although the association of the Diabetes Mellitus risk factor is admitted, studies do not present an explanation, still recognizing its impact on the healing of the surgical site. Although these authors consider it a non-modifiable risk factor, since the patient will not cease to be diabetic, the Clinical Standard: 020/2015 of December 15 "Bundle of Interventions" for the Prevention of Surgical Site Infection, updated on November 17, 2022 by the DGS (2022b), considers it a modifiable risk factor, since it is possible to intervene by maintaining blood glucose levels. Silva et al. (2021), states that Diabetes Mellitus is associated with increased pain and local edema, tripling this risk, especially in orthopedic surgeries. Ji et al. (2019) and Yang et al. (2020) report that both Diabetes Mellitus and High Blood Pressure (HBP) are related to the risk of SSI due to changes in the vascularization process, sensitivity and glycemic imbalance that inhibit the healing process, impairing immune function, giving rise to infections (Júnior et al., 2021).

Fernandes (2022), contrary to the present study, considers that the comorbidities mentioned have no statistical significance, since patients are previously monitored through regular consultations, keeping these pathologies under control, minimizing possible future complications. To increase surgical safety, the need for rigorous monitoring of patients with these clinical histories should be reinforced (Silva et al., 2021).

Complications arising from Rheumatoid Arthritis have also been identified as associated with SSI, due to Immunosuppression, Corticosteroid Therapy and Deficiency Nutrition. These are also considered risk factors and, when interconnected, may be the basis for the appearance of HBP and Diabetes Mellitus. This evidence is also supported by Ji et al. (2019), considering them as associated risk factors.

High levels of preoperative pain and low pain thresholds are related to Core Awareness and pre and postoperative pain intensity, with an impact on wound healing speed (Kong et al., 2016; Latremoliere & Woolf, 2009). It is recommended to make these patients aware of the increased risk of SSI, as well as the need to optimize intraoperative soft tissue and postoperative wound management.

At an analytical level, Serum Neutrophilia appears as a non-modifiable risk factor, as it is associated with acute inflammation. This marker may subclinically indicate the presence of infection, but it may also be elevated in other pathologies, such as Rheumatoid Arthritis, making it non-specific. Despite the recognized importance of serum markers in the diagnosis of infection, there is little literature on their preoperative relevance in SSI.

Countries with lower socioeconomic levels are risk factors, due to lack of resources, ineffective ventilation in operating rooms and disabled or non-compliance with infection prevention and control measures (Badge et al., 2021; Surial et al., 2022).

Regarding modifiable risk factors (Table 3) Prolonged Surgery Duration is highlighted. Although there is consensus on this topic within the studies, some establish the lower limit from which it becomes potentially problematic regarding the duration of the surgery. It was found that one of the studies refers to a duration greater than 90 minutes as a risk factor, while another considers it greater than 120 minutes and yet another refers to a duration greater than 180 minutes. The longer this time, the greater the exposure of the surgical site to the environment, increasing the risk of infection (Carvalho et al., 2017; Oliveira et al., 2023). Ensuring that surgeries are performed in the shortest possible time is a key point in the infections fight (Fernandes, 2022).

The Bilateral and Revision Procedure requires an extension of the surgical time and consequent Hospitalization of more than 35 days, increasing the possibility of hospital bacterial colonization through opportunistic nosocomial infections (Silva et al., 2021).

Low quality ventilation in the operating room is a risk factor, as the presence of laminar flow systems is considered crucial for reducing air contamination (Knudsen et al., 2021).

Obesity appears in several studies, although there is no consensus on which BMI value is considered a risk factor. While malnutrition is seen as a potential problem, as it is associated with poor wound healing and an increased risk of joint prosthesis infections, the opposite is also a concern. Malnutrition contributes to the imbalance of blood coagulation mechanisms, changes in healing and increased electrolyte imbalances, and on the other hand, obesity makes it difficult the vascularization and prolongs surgery time, due to the increased thickness of adipose tissue (Fernandes, 2022; Ji et al., 2019; Santos et al., 2018; Yang et al., 2020).

Despite recognizing that increased BMI is associated with increased risk of SSI, there is reference to the fact that there is no difference between patients with increased adipose tissue at the surgical site and those with truncal obesity. This study introduces the term prepatellar fat thickness ratio, which is obtained from preoperative lateral knee radiographs, allowing precise incision of adipose tissue at the surgical site. This tool is considered promising for preoperative risk assessment in obese patients, but still requires further research in order to be applied to the general population.

It is also worth noting that the patient's nutritional status can be analytically assessed through the use of serum markers of visceral proteins, such as albumin, mean corpuscular volume and iron deficiency anemia. These studies reinforce the importance of preoperative assessment of the patient's nutritional status and implementation of appropriate corrective measures to avoid the risk of SSI after TKA. The decreased albumin value is recognized by another author as being associated with malnutrition and as a potential enhancer of SSI due to the proliferation of fibroblasts and decreased collagen synthesis, also depressing the immune system (Yang et al., 2020).

The Mean Corpuscular Volume parameter, when found to be decreased, may be indicative of anemia, such as iron deficiency anemia, with these patients being more likely to require blood transfusion in the postoperative period, with complications arising from its handling and storage, which in itself is understood as an increased risk of SSI, as corroborated by Bakri et al. (2021) and by Coutinho et al. (2022).

Regarding surgical wound healing, Diabetic Foot Ulcer was identified as a antecedent, post-operative Healing Disorders and the presence of Peripheral Venous Disease. It is also added that patients who have a history of diabetic foot ulcers have an increased risk of SSI and other additional complications, in addition to having postoperative healing disorders and peripheral venous disease resulting from diabetes mellitus (Pitocco et al., 2019).

The use of opioids for more than 6 months preoperatively is identified as a modifiable risk factor. These studies report that it is common for patients undergoing TKA as a form of pain control to use opioids preoperatively, often in an unsupervised manner, which is associated with an increased possibility of surgical wound dehiscence and SSI and hospital readmission due to hyperalgesia due to nociceptive modulation, increasing the risk of falls and fractures due to cognitive impairment, as well as the risk of infection due to immunosuppression. In a study carried out in 2021, in addition to supporting this evidence, the authors also addressed the topic of drug interactions (Silva et al., 2021).

The association of Urinary Tract Infection with SSI is included in a study, based on non-consensual evidence, which leads to the continuous postponement of surgeries. Punjani et al. (2018) states that pre and intraoperative urinary tract infection does not constitute an increased risk of SSI, unlike that which occurs post-operatively, and that this urinary infection in the preoperative period is not an impediment to performing surgery, although they consider it prudent to start adequate antibiotic therapy.

Cyanoacrylate Skin Glue in the closure of the surgical wound is also indicated as a modifiable risk factor, justified by the increase in exudate from the surgical wound, due to the barrier formed by the glue on the skin, preventing drainage of the wound in the immediate postoperative period, accumulating fluids, potentiating SSI, and due to the increased tension of the wound tissues, it makes the skin irregular, causing damage and an access route for microbial agents. Filho et al. (2021) states that it can be safely used as an alternative in surgeries, due to its ease of application and increased healing efficiency. However, these authors emphasize that this suturing method should be used specifically in plastic, ophthalmic and cardiac surgeries, in line with the present ScR.

Finally, non-compliance with the protocol guidelines was identified as a modifiable risk of SSI after TKA, referring to the guidelines regarding antibiotic therapy in the perioperative period, preoperative trichotomy and venous thromboembolism prophylaxis. In the latter, the use of warfarin or rivaroxaban increases the risk of SSI in relation to the use of aspirin or dalteparin, although the authors acknowledge the lack of consensus. Other studies recognize that adherence to guidelines contributes to reducing the risk of SSI, as it requires professionals to ensure that all interventions are performed correctly (DGS, 2022b; Fernandes, 2022; Martins & Fernandes, 2019).

**CONCLUSION**

The risk factors for SSI is multifactorial and is present throughout the perioperative period, or in a single phase, and are classified as modifiable and non-modifiable. It is important to identify and recognize SSIs risk factors in order to implement prevention and control measures. This study may be the impetus for carrying out prospective observational studies, with a view to measuring the weight of each risk factor in the emergence of SSI and creating predictive models. It will also help to reduce costs for people in perioperative situations and healthcare units. The identification of Modifiable Risk Factors allows the Specialist Nurse to plan interventions in a timely manner, minimizing the risks of SSI. The early identification of Non-Modifiable Risk Factors allows the creation of case study programs for monitoring and surveillance.

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