

# Preoperative Patient Optimization Before Hip or Knee Arthroplasty: Part 1

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## ABSTRACT

Hip and knee arthroplasties are well-known effective strategies for joint osteoarthritis. Joint replacement reliably improves the quality of life for most patients when conservative measures have failed. However, these are major surgeries that carry significant risks, including the need for revision surgery. The purpose of this article is to discuss the preoperative risk parameters of the patient that can be modified before joint replacement to decrease complication risks. Recent studies have described several modifiable factors that increase the risk of postoperative complications following hip and knee replacement. These include obesity, malnutrition, tobacco use, diabetes, anemia, vitamin D deficiency, opioid use, inflammatory arthropathy, chronic kidney insufficiency, and methicillin-resistant staphylococci colonization. If we achieve preoperative optimization of these conditions, we can minimize the risk of adverse outcomes.

**Keywords:** Optimization - Joint replacement - Hip and Knee Arthroplasty

**Level of Evidence:** IV

## Optimización preoperatoria del paciente antes de una artroplastia de cadera o rodilla: parte 1

## RESUMEN

Las artroplastias de cadera y rodilla son estrategias que han demostrado ser efectivas en el tratamiento de la patología degenerativa articular. El reemplazo articular mejora la calidad de vida de la mayoría de los pacientes cuando el tratamiento conservador falla. Sin embargo, estas son cirugías mayores que conllevan un riesgo significativo de complicaciones, incluyendo la necesidad de una revisión. El propósito de este artículo es analizar los factores de riesgo modificables del paciente antes de la cirugía, a fin de disminuir el riesgo de complicaciones posoperatorias. Estudios recientes han descripto ciertos factores de riesgo modificables, inherentes al paciente y que incrementan la posibilidad de complicaciones posoperatorias luego de un reemplazo articular de cadera o rodilla. Estos incluyen obesidad, malnutrición, tabaquismo, diabetes, anemia, deficiencia de vitamina D, consumo de opioides, artropatías inflamatorias, insuficiencia renal crónica y colonización por estafilococco meticilino-resistente. Si conseguimos optimizar estas condiciones durante el preoperatorio, reduciremos el riesgo de complicaciones posoperatorias.

**Palabras Clave:** Optimización - Reemplazo articular - Artroplastia de cadera o rodilla

**Nivel de Evidencia:** IV

## INTRODUCTION

Hip and knee joint replacements have proven to be effective treatments for advanced degenerative joint pathology; multiple studies have reported good long-term results.<sup>1,2</sup> A study conducted in the USA estimated that by 2030, the number of hip and knee arthroplasties will increase by 174% and 673%, respectively.<sup>3</sup>

Despite their success, we must understand that these are major surgeries that carry the possibility of early complications, such as infections, dislocation, loosening, deep vein thrombosis (DVT), fractures, and even death.<sup>4</sup>

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**How to cite this article:** Perez Alamino L., Tillet F., Bochaty E., Lopreite F. Preoperative Patient Optimization Before Hip or Knee Arthroplasty: Part 1. *Rev Asoc Argent Ortop Traumatol* 2022;87(5):721-727. <https://doi.org/10.15417/issn.1852-7434.2022.87.5.1658>

Regarding the latter, multiple studies have investigated the medium- and long-term mortality rate after joint replacement, and it has been estimated at up to 18%.<sup>5</sup>

Authors such as Sinclair et al.<sup>6</sup> maintain that the most critical time to assess mortality is the first 30 days after surgery, since in this period the bias of deaths from causes unrelated to arthroplasty decreases.

Recent studies have reported that there are modifiable risk factors that can increase the appearance of this type of complication. These include conditions such as obesity, malnutrition, smoking, diabetes, anemia, vitamin D deficiency, opioid use, inflammatory arthropathies, chronic renal failure (CRF) and colonization by methicillin-resistant staphylococcus (MRSA), among the most relevant.<sup>7-9</sup>

The purpose of this update is to analyze these modifiable factors associated with increased complications and to recommend some strategies to optimize the condition of patients before surgery. The first five factors are discussed below.

## Obesity

The World Health Organization (WHO) defines this concept as a body mass index greater than 30 kg/m<sup>2</sup>. In Argentina, 6 out of 10 adults and 30% of children suffer from obesity. This leads to an increased risk of suffering from disorders such as diabetes, high blood pressure (HBP), respiratory, kidney and liver diseases, and even immunosuppression.<sup>10</sup>

In addition, there is recent evidence that obesity increases the probability of requiring a hip or knee joint replacement in comparison to the population that does not suffer from this condition, given the joint overload that it generates on the aforementioned joints.<sup>11</sup>

Recently published systematic reviews found that in patients undergoing arthroplasty, obesity was associated with increased rates of superficial and deep infections, dislocations, reoperations, and readmissions, when compared to non-obese patients.<sup>12,13</sup> The technical difficulties in surgery are also described, which sometimes lead to defective cementation. They can also predispose to poor component placement and orientation, which could lead to early loosening and instability.<sup>14</sup>

In these patients, the association of diabetes and insulin resistance is not uncommon, with the consequent increase in the rate of infection.

Currently, the recommendation of the American Academy of Orthopedic Surgeons (AAOS) is to avoid hip or knee joint replacement in patients with a BMI >40 mg/kg<sup>2</sup>.<sup>15</sup> Although there is no established BMI value to carry out this type of surgery, the ideal is for it to be <35 mg/kg<sup>2</sup>.

We believe that these patients should be evaluated by a dietitian, an endocrinologist and, eventually, by a bariatric surgery team to determine if they can undergo this treatment. In addition, we recommend stationary cycling, swimming, and water exercises to help with physical activity.

## Malnutrition

Malnutrition is another modifiable factor inherent to the patient that we must consider before performing an arthroplasty. In different reports, this condition has been associated with an increased risk of developing periprosthetic infections (PPI) and wound disorders (dehiscence, inflammation, etc.), as a consequence of a lower supply of collagen and fibroblastic proliferation.<sup>16</sup> Although there is no consensus in this regard, most authors agree that malnutrition can be defined based on the following criteria:

- serum albumin levels <3.5 g/dl<sup>17</sup>
- serum transferrin levels <200 mg/dl<sup>18</sup>
- total blood lymphocyte count <1500<sup>19</sup>

There are other anthropometric indicators, such as the circumference of the arm or leg; however, these are not very sensitive to acute deficits, since visible changes may take weeks to appear.<sup>16</sup>

With a basic blood test, we can get a picture of the patient's nutritional profile before surgery and, if necessary, refer them to a specialist.

Special care must be taken with patients who have undergone bariatric surgery with abrupt weight loss, since, despite presenting an apparently normal nutritional phenotype, they may present a deficient nutritional condition, which is why they should be adequately studied.<sup>20</sup>

Elderly patients who are eligible to undergo hip joint replacement due to fracture should also be studied for this condition and the possibility of adding dietary supplements to improve this situation should be evaluated.

### Tobacco use

Tobacco use represents an epidemic that causes the death of more than 40,000 Argentines a year. Data from the Ministry of Health of the Province of Buenos Aires reported that the estimated prevalence of cigarette consumption in the population during 2021 was 23.1%.<sup>21</sup>

This is one of the most analyzed modifiable factors in the literature referring to elective arthroplasty of the hip or knee. Nicotine produces peripheral vasoconstriction, which generates tissue hypoxia. This condition has been associated with an increased risk of wound complications, PPIs, lower respiratory tract infections, myocardial infarction, and even an increased mortality rate.<sup>22-25</sup>

Some randomized studies have shown that quitting smoking 6 to 8 weeks before surgery reduces the rate of complications after hip or knee replacement by up to 65%.<sup>26</sup> It has been reported that, even if smoking cessation occurs up to 4 weeks before surgery, a reduction in complications of up to 20% is achieved compared to patients who continued smoking before the procedure. This should be accompanied by a two-week post-surgery suspension after the healing of the tissue. The intervention (at least temporary) of quitting the smoking habit should be a recommendation in the previous interview with the patient; however, today smoking is not a contraindication.<sup>27</sup> It is important to inform the patient of the risk that this condition generates when undergoing this type of surgery. Prior evaluation by a pulmonologist and the use of nicotine patches can help to stop smoking during the perioperative period.

### Diabetes

The last *Encuesta Nacional de Factores de Riesgo* (ENFR, in Spanish) [National Survey of Risk Factors] carried out in 2018 in our country registered that 12.7% of the population of Argentina suffers from diabetes. If we exclusively consider the Autonomous City of Buenos Aires, this percentage is represented by 8.8%.<sup>28</sup>

Patients with diabetes who plan to undergo hip or knee arthroplasty are at increased risk of both joint-related complications and systemic adverse events; perhaps the most studied is periprosthetic infection. There is evidence that diabetes can increase the risk of developing PPI by 1.74 times.<sup>29</sup> In addition, it has also been associated with worse postoperative functional outcomes.<sup>30,31</sup> In addition to the complications inherent to surgery, patients with diabetes are more likely to have strokes, heart failure, and peripheral vascular disease.<sup>32,33</sup> A diagnosis of diabetes can be reached by meeting one of the following criteria:

- Glycosylated hemoglobin (HbA1c) >6.5% (it is a marker of adherence to treatment in the last three months)
- Fasting blood glucose >126 mg/dl
- Serum glucose > 200 mg/dl

Any value above these cut-off points should be enough to at least defer the procedure. We are aware that glycemic control can sometimes be difficult, which is why a multidisciplinary approach is the most recommended strategy to establish the appropriate hygienic-dietary measures, as well as pharmacological measures, if required by the patient.

### Anemia

The WHO defines anemia as a decrease in blood iron below 12 g/dl in women and 13 g/dl in men; this is a very common condition in the population.<sup>34</sup>

According to some reports, anemia affects almost 25% of the world's population. A study by Marin et al. reported that the prevalence in Argentina is around 26.3%.<sup>35</sup> Although the use of tranexamic acid has substantially changed the number of transfusions, hip and knee replacements are surgeries that involve considerable blood loss.<sup>36</sup> It has been estimated that between 15% and 30% of patients undergoing elective arthroplasty have anemia in preoperative controls.<sup>37</sup> In a recent study by Bailey et al., 5384 primary hip and knee arthroplasties were analyzed, and it was observed that 17% of the patients included presented preoperative values corresponding to anemia.<sup>38</sup> In these patients, the risk of requiring transfusions increased by 4.09 times, the risk of suffering postoperative complications increased by 1.42 times, and that of having a longer hospitalization increased by

19%. On the other hand, this condition has also been associated with a higher risk of developing periprosthetic infections, heart disease and even death.<sup>39,40</sup> In anemic patients, it is advisable to evaluate the possibility of starting iron supplementation before surgery.<sup>41</sup> When oral intake fails to correct serum hemoglobin values or when it is not possible to defer surgery, parenteral iron administration has also been shown to be a safe and effective strategy.<sup>42</sup>

## FINAL CONSIDERATIONS

The five clinical conditions analyzed can be improved preoperatively, in order to reduce the risk of complications in our patients. When indicating hip or knee arthroplasties, it is the surgeon's responsibility to know and take these situations into account.

Conflict of interest: The authors declare no conflicts of interest.

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