Factors Associated with the Development of Early Complications after Total Knee Arthroplasty

Fatores associados ao desenvolvimento de complicações precoces após artroplastia total do joelho

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Abstract

Objective   To diagnose risk factors for the development of local or medical postoperative complications up to 30 days after surgery in patients undergoing total knee arthroplasty

Methods   The present analysis included all patients who underwent knee arthroplasty performed in this hospital during the study period, based on data from medical records of the patients, with the aim of investigating factors related to the occurrence of local or medical complications during hospitalization and up to 30 days after the procedure, if they needed any additional intervention.

Results   Out of the 157 patients included in the study, 17.1% had some complication. The most prevalent were arthrofibrosis (6.4%), deep infection (4.4%), and superficial infection (2.5%), among others. Older patients and a greater number of previous comorbidities were associated with a higher risk of postoperative complications.

Conclusions   Older patients and a greater number of comorbidities were related to an increased risk of postoperative complications. The American Society of Anesthesiologists (ASA) score proved to be insufficient to assess the occurrence of complications after knee arthroplasty and new tools should be used for this purpose.

Keywords
► arthroplasty
► arthroplasty, replacement, knee
► comorbidities
► complications
► knee

Resumo

Objetivo   Identificar fatores de risco para o desenvolvimento de complicações pós-operatórias locais ou clínicas ocorridas até 30 dias após a cirurgia em pacientes submetidos a artroplastia total do joelho.

Métodos   Todos os pacientes submetidos a artroplastia de joelho realizada neste hospital no período do estudo foram incluídos na análise, baseada em dados dos prontuários dos pacientes, para investigar os fatores associados à ocorrência de complicações locais ou clínicas durante o internamento até 30 dias após o procedimento que necessitaram de alguma intervenção.

Resultados   Dos 157 pacientes incluídos no estudo, 17,1% cursaram com alguma complicação. As mais prevalentes foram artrofibrose (6,4%), infecção profunda (4,4%) e infecção superficial (2,5%), dentre outras. A maior idade e maior número de comorbidades prévias foram relacionadas com maior risco de complicações pós-operatórias.

Conclusões   A maior idade e maior número de comorbidades foram relacionados a um risco aumentado de complicações pós-operatórias. O escore Sociedade Americana de Anestesiologistas (ASA, na sigla em inglês) se mostrou insuficiente para avaliar a ocorrência de complicações pós artroplastia de joelho e novas ferramentas devem ser empregadas para este fim

Palavras-chave

► artroplastia
► artroplastia do joelho
► comorbidades
► complicações
► joelho

Introduction

With the increase in the life expectancy of the population, osteoarticular degenerative diseases are becoming more prevalent and the demand for replacement arthroplasties is growing and may reach 1.3 million arthroplasties per year in 2030 in the United States.[1] The advances in surgical techniques, the development of new materials, the incremental improvements in patient choice, and the rehabilitation procedures have allowed knee arthroplasties to present better functional results and a better quality of life after surgery, as well as shorter hospital stays.[1–3]

Complications after total knee arthroplasty (TKA) are associated with greater morbidity, in addition to an increase in hospital stay, treatment costs, and a worse functional outcome. Early complications are defined as events occurring up to 30 days after the initial procedure and requiring readmission, prolonged hospitalization, or specific therapies. The complications in arthroplasty surgeries are diverse and many of them are less serious and do not delay hospital discharge. The surgeries that did not require specific intervention were not considered.[4] Among the postoperative complications, infections that can be devastating, especially deep infections, causing prolonged hospitalizations and new procedures or revision surgeries.[5] In addition to these, aseptic loosening, arthrofibrosis, venous thromboembolism, and cardiovascular events triggered by surgical trauma can occur, in adition to those leading to hospital admission.[6]

Parameters and scores are often used to identify patients at higher risk for complications after surgical treatment, such as the American Society of Anesthesiologists (ASA) score. The medical comorbidities, estimates of surgical time, age, and body mass index (BMI) are also evaluated.[4,7–9] However, new studies may improve the ability of the surgeon to identify patients at higher risk of postoperative complications so that they are properly managed using different techniques and strategies.[10]

The primary objective of the present study was to identify risk factors for the development of early postoperative complications (up to 30 days after surgery) in patients undergoing TKA.

Method

In the present retrospective observational cohort study, the medical records of patients undergoing total knee arthroplasty in our hospital were analyzed. The present study was approved by the research ethics committee. All patients who underwent TKA in the period between October 1, 2016, and August 31, 2018 and had complete data in their medical records were included. The patients initially operated on in other hospitals who required revision surgery due to complications were excluded from the present study. Demographic data such as gender and age were analyzed, as well as the following treatment-related factors: length of stay, surgery laterality, type of implant, previous medical comorbidities, presurgical ASA score,[11] radiographic grading of gonarthrosis,[12] initial deformity, use of suction drain, medical complications such as urinary tract infections, venous thromboembolism, acute kidney injury, and cardiovascular events. Local surgical complications such as arthrofibrosis, superficial and deep infections that required debridement or revision surgery, and refractory pain in the first 30 days after surgery were also observed.[4] Refractory pain is defined when it delays discharge from the hospital or affects physical therapy recovery within the first 30 days after surgery. Cases of arthrofibrosis are defined in patients with stiffness, active flexion range of motion $< 90°$, and flexion contracture $> 10°$, requiring hospitalization for joint manipulation under

anesthesia.[13] Complications that occurred > 30 days after surgery were considered late and excluded from the present study. Minor complications that did not require intervention and did not delay patient discharge were not included in the study.

The severity of gonarthrosis was classified according to the Ahlback radiographic grading for knee osteoarthritis.

Results

A total of 157 patients were selected for the study. Of these, 35 (22.3%) were male. The age of the patients ranged between 35 and 84 years old (mean 66.3; σ = 8.03). Most patients were in the ASA II group and only 33 (21%) of the patients had no prior comorbidities. The most prevalent comorbidity was systemic arterial hypertension, followed by diabetes mellitus and rheumatoid arthritis, as shown in ►Table 1. All knees had some degree of mechanical axis deformity, with varus deformity being the most frequent (89.2%; n = 140) and valgus knees totaling 10.8% (n = 17). The

severity of osteoarthritis was allocated according to the Ahlback classification and grade III included 3.2% (n = 5), grade IV 59.9% (n = 54) and grade V 36.9% (n = 58) of the patients. The total number of bilateral gonarthrosis cases was 88 patients (56.1%). In cases of unilateral gonarthrosis, there was no significant difference in surgery laterality as shown in ►Table 2. Patients were hospitalized for 2 to 98 days (mean 5.38; σ = 7.62) and patients with more comorbidities required longer hospital stays (p = 0.026).

Of the 157 arthroplasties performed during the study period, 17.1% (n = 27) had some postoperative complications (►Table 3). The most frequent complication was arthrofibrosis (n = 10, 6.4%), followed by deep infection (n = 7; 4.4%).

The patients had an average of 1.18 comorbidities (σ = 0.84) and the number of comorbidities was related to the development of complications. The group that presented postoperative complications had more previous comorbidities (mean of 1.5) compared with the group without complications (mean of 1.1) (p = 0.04). Older patients had more

Table 1 Descriptive statistics and patient profiles

Variables		n	%	Complications (%)		No complications (%)		p-value significance
Gender	Female	122	77.7	101	(82.8%)	21	(17.2%)	0.992[a]
	Male	35	22.3	29	(82.9%)	6	(17.1%)	
Age	< 70 years	65	41.4	0	(0.0%)	65	(100.0%)	<0.001[c]
	≥ 70 years	92	58.5	27	(29.3%)	65	(70.7%)	
ASA Score	I	32	20.4	28	(87.5%)	4	(12.5%)	0.881[a]
	II	105	66.9	86	(81.9%)	19	(18.1%)	
	III	19	12.1	15	(78.9%)	4	(21.1%)	
	IV	1	0.6	1	(100.0%)	0	(0.0%)	
Number of comorbidities	None	33	21	29	(87.9%)	4	(12.1%)	0.045[b]
	1	73	46.5	62	(84.9%)	11	(15.1%)	
	2	42	26.8	34	(81.0%)	8	(19.0%)	
	3	8	5.1	5	(62.5%)	3	(37.5%)	
	4	1	0.6	0	(0.0%)	1	(100.0%)	
Arterial hypertension		111	71.3	91	(82.0%)	21	(18.9%)	0.416[a]
Diabetes mellitus		36	22.9	26	(72.2%)	10	(27.8%)	0.055[a]
Heart disease		6	3.8	4	(66.7%)	2	(33.3%)	0.286[a]
Rheumatoid arthritis		8	5.1	6	(75.0%)	2	(25.0%)	0.414[a]
Obesity		4	2.5	4	(100.0%)	0	(0.0%)	0.466[a]
Hypothyroidism		4	2.5	3	(75.0%)	1	(25.0%)	0.675[a]
Psychiatric disorder		4	2.5	4	(100.0%)	0	(0.0%)	0.356[a]
Renal insufficiency		2	1.3	1	(50.0%)	1	(50.0%)	0.216[a]
Asthma		2	1.3	1	(50.0%)	1	(50.0%)	0.216[a]
Hepatitis C		1	0.6	1	(100.0%)	0	(0.0%)	0.648[a]

Abbreviation: ASA, American Society of Anesthesiologists.
[a]Fisher exact test
[b]Kendall tau-b test
[c]Student t-test

Table 2 Descriptive statistics of observed comorbidities and the treatment performed

Variables		n	%	Complications (%)		No complications (%)		p-value significance
Gonarthrosis	Bilateral	88	56.1	75	(85.20%)	13	(14.80%)	0.366
	Unilateral	69	43.9	55	(79.70%)	14	(20.30%)	
Ahlbäck grading	III	5	3.2	3	(60.00%)	2	(40.00%)	0.258
	IV	94	59.9	83	(88.30%)	11	(11.70%)	
	V	58	36.9	44	(75.90%)	14	(24.10%)	
Deformity	Varus	140	89.2	116	(82.90%)	24	(17.10%)	0.959
	Valgus	17	10.8	14	(82.40%)	3	(17.60%)	
Prosthesis	Primary	149	94.9	123	(82.60%)	26	(17.40%)	0.72
	Revision	8	5.1	7	(87.50%)	1	(12.50%)	
Surgery laterality	Left	86	54.8	71	(82.60%)	15	(17.40%)	0.929
	Right	71	45.2	59	(83.10%)	12	(16.90%)	
Suction drain	Used	140	89.2	27	(19.30%)	113	(80.70%)	0.047
	Not Used	17	10.8	0	(0.00%)	17	(100.00%)	

Table 3 Frequency of acute postoperative complications

Complications	Frequency	Percentage
No complications	130	82.8
Arthrofibrosis	10	6.4
Deep infection	7	4.4
Superficial infection	4	2.5
Persistent pain	3	0.6
Periprosthetic fracture	1	0.6
Acute Kidney injury	1	0.6
Urinary Tract infection	1	0.6
Total	157	100.0

Fig. 1 Comparison between the number of comorbidities and the average number of days hospitalized, according to each group of complications.
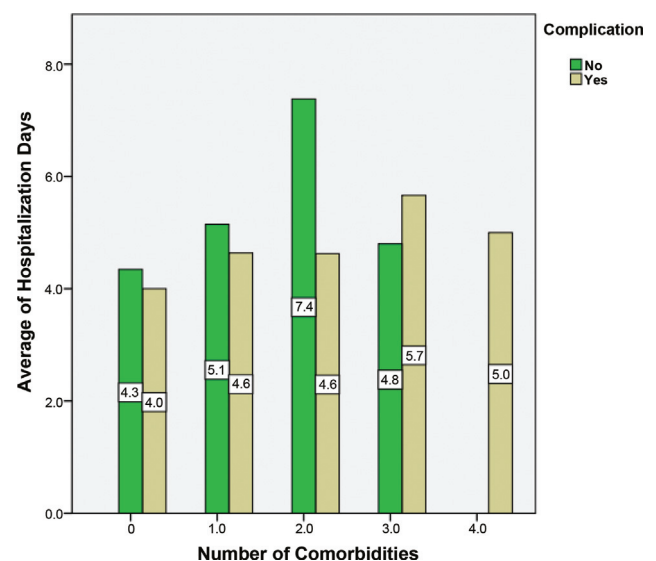
comorbidities ($p < 0.001$) and had more complications ($p = 0.045$). Patients with more comorbidities required longer hospital stays and had more complications, as can be seen in ►**Fig. 1**. Although diabetic patients had more postoperative complications (odds ratio [OR] = 2.35), the correlation was not significant ($p = 0.055$).

In the majority of the surgeries (89.2%, $n = 140$), a suction drain was used. In the group that was not using it (10.8%; $n = 17$), none had postoperative complications, and this difference was statistically significant ($p = 0.047$; OR = 8.48).

The type of implant, ASA score, deformity, grading of gonarthrosis, length of stay, and gender were not statistically significant for the development of complications.

Discussion

Several authors stratify patients by ASA score. Although patients graded as ASA 3 or more have a higher risk of complications, most patients are classified as ASA 2, de-

creasing the relevance of the score, as it does not include the number of comorbidities. It was observed that the number of comorbidities increased the risk of complications, and this data should be considered in the preoperative assessment of the patient.[1,6–8,14] Older patients tend to have more complications, and up to date studies show that patients > 80 years old are at higher risk for the occurrence of complications. However, the literature suggests that the presence of comorbidities seems to be more relevant than age alone.[10] Among the comorbidities, it is worth noting that patients with diabetes mellitus had more complications in general, according to literature data, especially complications related to wound dehiscence and

infections.[15,16] It was observed in the present study that patients with heart condition had a higher risk of developing arthrofibrosis, probably due to the difficulty in performing adequate rehabilitation, but further studies should be carried out to research this association.[3,13] No other comorbidity was able to independently change the overall risk of complications with statistical significance, probably due to the small sample size of the subgroups of those pathologies in the observed sample.

None of the patients within the group where the suction drain was placed presented complication, being a statistically significant fact. It is impossible to mention with the present study if the drain may be a risk factor or if this resource was not used when the surgeon felt comfortable to not put the device due to good hemostasis obtained and, therefore, the short surgical time in patients without significant comorbidities. These findings should be considered cautiously. The literature suggests that prolonged surgical time increases the prospect of infection and surgeries of greater morbidity increase postoperative pain, making it difficult to rehabilitate.[3]

The most frequent complication was arthrofibrosis, which is consistent with observations by other authors. Its incidence could also be associated with poor quality rehabilitation and poor postoperative analgesia, as these factors are classically related to the genesis of this pathology. The treatment of arthrofibrosis requires aggressive physical therapy rehabilitation and multimodal analgesia in the early stages, requiring a readmission for joint manipulation or even revision surgery in refractory cases. New studies are needed to elucidate whether patients cared for by the Brazilian public health system (SUS, in the Portuguese acronym) have difficulty in accessing adequate physical therapy rehabilitation and multimodal analgesia.[3,13]

There was no significant correlation between the occurrence of acute complications and obesity, but literature data indicate that obese patients, especially those with a BMI $\geq$ 40, are more susceptible to complications such as wound dehiscence and difficulty in rehabilitation.[2] The radiographic grading, deformities, and use of revision prostheses were not significant for the development of complications in the studied sample, but the literature suggests that the prolonged surgical time, in cases of more severe arthrosis with bone defects or revision surgeries, negatively influence the results, mainly raising the risk of infection.[14]

The length of stay was a mean of 5.3 days. However, there is a worldwide trend to urge a shorter hospital length with the aim to reduce the cost of hospitalization and complications associated with bacterial colonization in the hospital. Recent studies show this progressive decrease in hospital stay within the international literature.[1] There is still no consensus on whether performing the procedure on an outpatient basis will reduce the occurrence of complications.[17–19] Well-defined rehabilitation and analgesia protocols, in addition to a specialized multidisciplinary team, seem to be crucial for the success of the procedure on an outpatient basis.

The present study presents limitations, especially for being unicentric and retrospective based on medical records. The small number of individuals in specific subgroups hinders statistical analysis. Another possible limitation is that because it is a high complexity orthopedic reference center, cases of more severe deformities and patients with significant medical comorbidities are referenced to it. This fact should be considered since it indirectly increases the risk of complications and the average length of hospital stay.

Conclusion

Age and, therefore, the number of comorbidities increased the risk of postoperative complications within the population studied. New studies are needed to elucidate whether comorbidities influence the results more than the age of patients alone, as older patients tend to have a greater number of comorbidities, which makes it difficult to analyze the results. The ASA score, widely used to assess the surgical risk of patients, is insufficient to stratify the risk of complications for patients, as it does not include the number of medical comorbidities or age in its assessment. More comprehensive scores such as the SF-36 or other tools may prove to be more reliable to estimate the risk of complications after knee arthroplasties, but further studies are needed to clarify this question.

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