

CORRELATION BETWEEN AHLBÄCK CLASSIFICATION AND GONARTHROSIS RISK FACTORS

CORRELAÇÃO ENTRE A CLASSIFICAÇÃO DE AHLBÄCK E FATORES DE RISCO DA GONARTROSE

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ABSTRACT

Objective: To demonstrate whether or not there is a correlation between the risk factors for gonarthrosis and the radiographic classification of Ahlbäck. **Methods:** We studied patients with primary gonarthrosis attended at the knee outpatient clinic of the General Hospital of Vila Penteado during their routine visit. We collected data on patient age (years), weight (kg), height (meters), body mass index (BMI = patient weight/height²), personal history of hypertension or diabetes mellitus (positive or negative), sedentarism (physical activity less than three times per week, 30 minutes per session), functional demand (how many blocks walked weekly), time of onset of symptoms (in years) and laterality or bilaterality. The data were correlated with the Ahlbäck classification applied to the radiographs performed at the time of the consultation. **Results:** A sample of 108 patients was studied. We did not find an association between the Ahlbäck classification and the patient's age, smoking, sedentary lifestyle, laterality, number of blocks walked per week, diabetes mellitus, and sex; however, a positive association was observed in hypertensive patients as well as a weak correlation with height and weight of the patient and moderate correlation with BMI. **Conclusion:** The Ahlbäck classification is unrelated to most of the risk factors for primary gonarthrosis. **Level of evidence III, Case-control study.**

Keywords: Arthropathies. Osteoarthritis. Knee. Radiographic image interpretation, computer-assisted. Radiography.

RESUMO

Objetivo: Demonstrar se existe ou não correlação entre os fatores de risco de gonartrose e a classificação radiográfica de Ahlbäck. **Métodos:** Estudamos pacientes com gonartrose primária, assistidos no ambulatório de joelho do Hospital Geral de Vila Penteado em sua consulta de rotina. Foram coletados dados referentes a idade do paciente (anos), peso do paciente (kg), altura (metros), índice de massa corporal (IMC = peso do paciente/altura²), antecedente pessoal de hipertensão ou diabetes mellitus (positivo ou negativo), sedentarismo (se pratica atividade física menos de três vezes por semana, 30 minutos por sessão), demanda funcional (quantas quadras caminha semanalmente), tempo do início dos sintomas (em anos) e lateralidade ou bilateralidade. Os dados foram correlacionados com a classificação de Ahlbäck aplicada às radiografias realizadas no momento da consulta. **Resultados:** Uma amostra de 108 pacientes foi estudada. Não encontramos associação entre a classificação de Ahlbäck e a idade do paciente, tabagismo, sedentarismo, lateralidade, quantidade de quadras percorridas por semana, diabetes mellitus e sexo do paciente, porém verificou-se associação positiva em pacientes hipertensos e correlação fraca com altura e peso do paciente e correlação moderada com IMC. **Conclusão:** A classificação de Ahlbäck não apresenta relação com a maioria dos fatores de risco de gonartrose primária. **Nível de evidência III, Estudo caso-controle.**

Descritores: Artropatias. Osteoartrite. Joelho. Interpretação de imagem radiográfica assistida por computador. Radiografia.

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INTRODUCTION

Gonarthrosis is a very common and debilitating disease. It is among the main causes of functional deficiency in the elderly and its incidence is growing along with the aging of the population.^{1,2} The most important studied aspects of the disease include risk factors such as age, obesity, smoking, and others. The presence of risk factors contributes to the increased incidence of the disease

in the general population, and correlates with the degree of joint pain experienced by the patient.^{1,2,3}

The Ahlbäck⁴ classification modified by Keys⁵ is among the most frequently used in gonarthrosis. Although its use has been challenged given the low clinical and radiographic correlation of the method,⁶ recent studies seek to validate its use to assist in the treatment of gonarthrosis.⁷

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Since the risk factors produce a higher incidence of disease symptomatology, we question whether the same risk factors are related to more serious radiographic findings. The objective of this study is to demonstrate whether or not there is a correlation between the risk factors for gonarthrosis and the radiographic classification of Ahlbäck.

MATERIALS AND METHODS

Following approval of the Institutional Review Board (CAAE [Ethics Evaluation Submission Certificate]: 73316517.4.00005452), data were collected from patients being monitored in the orthopedic outpatient clinic of the Hospital Geral de Vila Penteadó over a three-month period, and all the study participants signed the Informed Consent Form. Patients were recruited using convenience sampling as they attended annual routine outpatient appointments. Patients with a diagnosis of primary gonarthrosis of any age or sex, with or without previous clinical treatment, were included in the study. We excluded patients who had undergone any type of surgical treatment for gonarthrosis in the past.

The following data were collected at the consultations: patient age (years), patient weight (kg), height (meters), body mass index (BMI = patient weight/height²), personal history of hypertension or diabetes mellitus (positive or negative), sedentary lifestyle (physical activity less than three times a week, 30 minutes per session), functional demand (how many blocks walked weekly), symptom onset time (in years) and laterality or bilaterality.

As per the institution's protocol, all the patients had annual radiographs during the medical consultation to control the progress of their gonarthrosis. The radiographs followed the pattern of the institution in the monopodal-stance frontal view and lateral view with knee at 20 degrees flexion.

The radiographs were processed for assessed using the digital image visualization program PDView (KONICA MINOLTA, INC. V2.20), which allows distances to be measured in scanned images. All radiographs were assessed by a study-blinded investigator who rated all knees according to the Ahlbäck classification. The investigator in question is a specialist surgeon with more than five years of experience in knee surgery.

When a patient presented with bilateral gonarthrosis, the two knees were assessed separately, using the same risk factors present for two knees with different radiographic classification.

All data were submitted to the Kolgomorov normality test and later evaluated with tests compatible with normality. Risk factors were finally assessed along with the results of the Ahlbäck classification to determine whether there was correlation, using the Spearman test. We considered an alpha type error limit of 5%.

RESULTS

A total of 108 patients were studied. The descriptive statistics of the cases divided by the Ahlbäck classification are summarized in Table 1.

Distribution of Weight, Height, and BMI according to the Ahlbäck classification is shown in Figure 1.

We found no significant difference between the Ahlbäck classification and patient age ($p = 0.691$), smoking ($p = 0.306$), sedentary lifestyle ($p = 0.091$), laterality ($p = 0.504$), number of blocks walked per week ($p = 0.179$) diabetes mellitus ($p = 0.064$) and the patient's sex ($p = 0.055$).

We observed a significant difference between the Ahlbäck classification with hypertension ($p = 0.008$), and noted that the presence of hypertension is associated with a higher grade in the classification. We found a weak correlation between the Ahlbäck classification and patient's weight and height, and a moderate correlation between BMI and the Ahlbäck classification. The results are summarized in Table 2.

Age at onset of symptoms showed a significant difference in the Kruskal-Wallis test ($p = 0.015$). The Mann-Whitney post hoc analysis showed that the difference lies in the comparison between groups with Ahlbäck classification 1 and 3 (0.006) and between Ahlbäck 1 and 4 (0.008). The comparison between Ahlbäck 3 and 5 presented $p = 0.058$ while the comparison between Ahlbäck 4 and 5 presented $p = 0.067$. The rest of the compared groups presented $p > 0.1$.

DISCUSSION

Although its validity has been questioned,⁶ the Ahlbäck classification is still the main topic in discussions about gonarthrosis, with recent studies attempting to validate its use.⁷ Even though it is controversial, the Ahlbäck classification is still one of the main criteria of surgical indication and preoperative assessment in gonarthrosis,⁸ and it is therefore important for us to build our knowledge about it. Considering that the presence of risk factors for gonarthrosis

Table 1. Descriptive statistics of the cases studied.

		Ahlbäck 1	Ahlbäck 2	Ahlbäck 3	Ahlbäck 4	Ahlbäck 5
Sex	Male	N= 8 (61.50%)	N= 8 (40.00%)	N= 16 (36.40%)	N= 4 (17.40%)	N= 1 (12.50%)
	Female	N= 5 (38.50%)	N= 12 (60.00%)	N= 28 (63.60%)	N= 19 (82.60%)	N= 7 (87.50%)
Laterality	Unilateral	N= 6 (46.20%)	N= 8 (40.00%)	N= 11 (25.00%)	N= 9 (39.10%)	N= 2 (25.00%)
	Bilateral	N= 7 (53.80%)	N= 12 (60.00%)	N= 33 (75.00%)	N= 14 (60.90%)	N= 6 (75.00%)
Sah	Yes	N= 5 (38.50%)	N= 16 (80.00%)	N= 27 (61.40%)	N= 19 (82.60%)	N= 8 (100.00%)
	No	N= 8 (61.50%)	N= 4 (20.00%)	N= 17 (38.60%)	N= 4 (17.40%)	N= 0 (0.00%)
DM	Yes	N= 7 (53.80%)	N= 7 (35.00%)	N= 18 (40.90%)	N=14 (60.90%)	N= 7 (87.50%)
	No	N= 6 (46.20%)	N= 13 (65.00%)	N= 26 (59.10%)	N= 9 (39.10%)	N= 1 (12.50%)
Smoker	Yes	N= 4 (30.80%)	N= 5 (25.00%)	N=11 (25.00%)	N= 7 (30.40%)	N= 5 (62.50%)
	No	N= 9 (69.20%)	N= 15 (75.00%)	N= 33 (75.00%)	N= 16 (69.60%)	N= 3 (37.50%)
Sedentary lifestyle	Yes	N= 13 (100.00%)	N= 19 (95.00%)	N= 41 (93.20%)	N= 18 (78.30%)	N= 6 (75.00%)
	No	N= 0 (0.00%)	N= 1 (5.00%)	N= 3 (6.80%)	N= 5 (21.70%)	N= 2 (25.00%)
Age		m= 67.85 (SD= 8.54)	M= 66.10 (SD= 7.15)	M= 65.43 (SD= 6.61)	M= 65.09 (SD= 8.35)	M= 60.38 (SD= 11.85)
Onset of symptoms		M= 52.38 (SD=5,69)	M= 49.65 (SD= 8.49)	M= 48.13 (SD= 6.61)	M= 47.43 (SD= 10.28)	M= 52.00 (SD= 8.84)
Number of blocks		M= 30.53 (SD= 18.20)	M= 24.55 (SD= 17.05)	M= 25.06 (SD= 11.66)	M= 19.17 (SD= 11.07)	M= 30.00 SD= 25.66)
Total		N= 13 (100.00%)	N= 20 (100.00%)	N= 44 (100.00%)	N= 23 (100.00%)	N= 8 (100.00%)

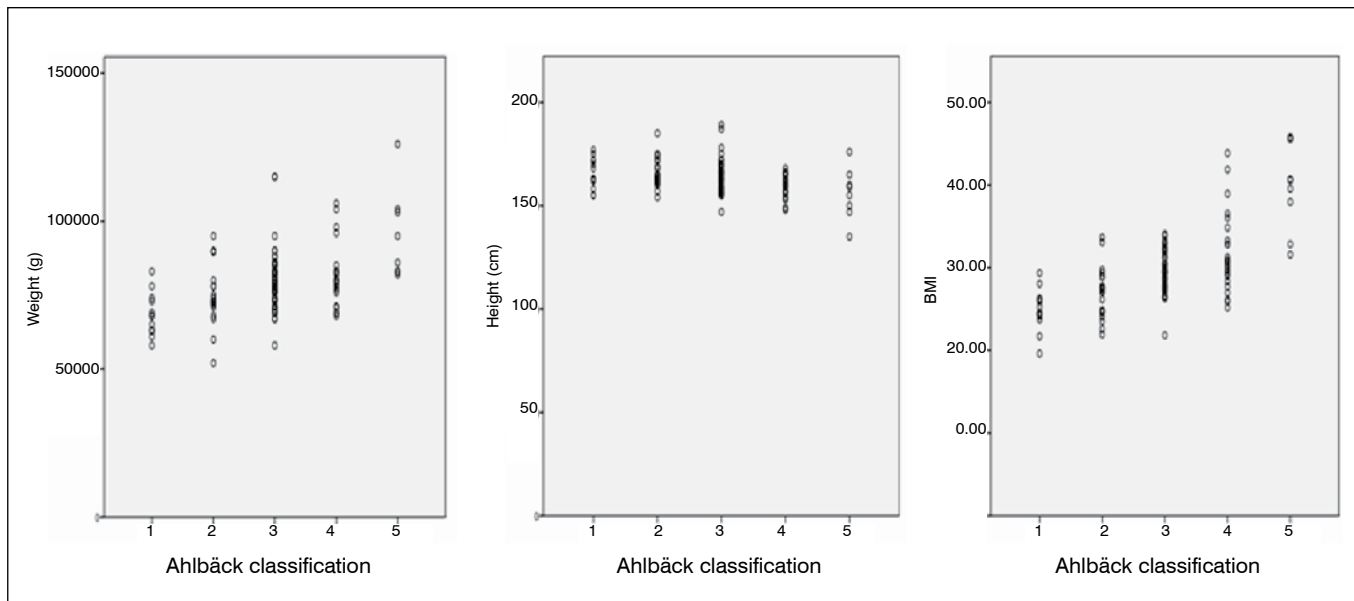


Figure 1. A, B and C. Distribution of Weight, Height and BMI (from left to right respectively) according to the Ahlbäck classification.

Table 2. Correlation between parameters and the Ahlbäck classification.

Parameter	p-value	Spearman's Rho
Weight	<0.000	0.476
Height	0.001	-0.304
BMI	<0.000	0.637

increases the disease symptomatology,^{1,2,3} contributing to the indication of surgery, this study attempts to discover whether the same risk factors influence the radiographic deterioration of the disease, which, at the same time, would also contribute to the indication of surgical treatment.

Our results were very interesting. The patient's age showed no influence on the Ahlbäck classification. This result contradicts the concept that the disease is progressive and demonstrates that the passing of time does not necessarily contribute to radiographic worsening in gonarthrosis. Similarly, smoking, which could contribute to an increase in the injury due to bone perfusion problems, did not appear to be related to the classification. Sedentary lifestyle and the number of blocks walked per week did not prove important either. These factors could have an influence due to the mechanical characteristics of the disease, since not only could sedentary lifestyle provide protection by not increasing the functional demand of the disease, but the number of blocks walked could also produce a more deleterious effect by increasing joint wear. On the other hand, the negative correlation could tell us, for example, that patients with a worse grade on the Ahlbäck scale would tend to be more sedentary or walk fewer blocks per week because they are more symptomatic. Again, we found no positive or negative relationship. Laterality did not appear to be important in influencing the Ahlbäck classification either. We believed that patients with bilateral gonarthrosis could reflect a more serious condition as they manifest the disease more than patients with only one affected knee. Our results showed otherwise.

The presence of diabetes mellitus and the patient's sex had $p > 0.005$. However, the p-value was very close to the significance reference ($p = 0.064$ and $p = 0.055$, respectively), and could be influenced by type II error. In terms of sex, in spite of the borderline

p-value, there tended to be a higher number of female patients with higher grades in the Ahlbäck classification. This trend could possibly be explained by differences in the mechanical axis of the knee between men and women. The presence of diabetes mellitus also presented borderline p-value and a tendency to concentrate patients with a higher grading on the Ahlbäck scale. A possible explanation for this result would be the influence of metabolic syndrome on the genesis of gonarthrosis, a finding supported by the positive relationship found in our study between the presence of hypertension and a higher grade in the Ahlbäck classification. Weight, height and BMI showed correlation with the Ahlbäck scale, with a weak positive correlation for Weight, a weak negative correlation for Height, and a moderate positive correlation for BMI. These findings strengthen, contradicting the other aforementioned findings, the contribution of mechanical overload of the joint to the genesis of the disease. It is possible that these factors act in a way that is still poorly understood in the progress of gonarthrosis, and that there is possibly a hidden bias in our analysis. An example would be patients who walk more blocks. On the one hand, they have a greater joint overload, but on the other hand, they are physically fitter, thereby protecting the joint.

Finally, the age of onset of symptoms. Our study presents positive yet controversial results. We expected a logical correlation pattern in which the earlier the onset of disease symptoms, the worse the radiographic findings. However, we did not find a single pattern. The expected outcome was positive between Ahlbäck classifications 1 and 3 and 1 and 4, with the worst grades occurring in patients with earlier onset of symptoms. Paradoxically, patients with Ahlbäck 5 had a higher mean age of onset of symptoms than patients with Ahlbäck 2, 3 and 4. We expected the opposite, since we would expect cases of gonarthrosis progressing with greater joint destruction to have earlier symptoms. Patients who develop Ahlbäck 5 may have a later onset of symptoms but have faster radiographic progression. These patients might experience slow natural progression of the disease, yet suddenly begin to progress rapidly with radiographic alterations after losing a particular knee stabilizing structure, e.g., a cruciate ligament. Another possibility is that the correlation of symptoms with the Ahlbäck classification is not strong in the group classified as Ahlbäck 5. Although we believe more in the latter hypothesis, this conclusion is beyond the scope of this study.

The set of results leads us to believe that the correlation between risk factors for gonarthrosis and the Ahlbäck classification is, for the most part, weak or negligible. Our study gives more weight to the criticism against the commonplace use of this classification in the management of gonarthrosis, since in addition to presenting a low clinical and radiographic correlation,⁶ it also appears to bear little relationship to the disease-related risk factors.

CONCLUSIONS

The Ahlbäck classification does not present any association with patient age, smoking, sedentary lifestyle, laterality, number of blocks walked per week, diabetes mellitus, and patient sex. On the other hand, it has a positive association with hypertensive patients, a weak correlation with patient height and weight, and a moderate correlation with BMI.

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