



## Original Article

# Asian ethnicity: a risk factor for adhesive capsulitis?☆



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## ABSTRACT

**Objective:** The aim of this study was to evaluate whether Asian ethnicity is a risk factor for the development of adhesive capsulitis. The secondary aim was to describe the distribution of cases of capsulitis by age group.

**Methods:** A cross-sectional study comparing the rate of adhesive capsulitis in individuals of Asian ethnicity with that of other ethnicities. We excluded patients with fractures and those with symptoms not involving the shoulder. The odds ratio was adjusted for confounding factors by binary logistic regression.

**Results:** A total of 1331 patient records were evaluated and after applying the selection criteria, 814 patients remained. We found 134 cases of adhesive capsulitis (15.6%). The peak of incidence was at 60–64 years in the patients of Asian ethnicity and at 55–59 years in the other patients. The unadjusted odds ratio was 4.2 (CI 95%, 2.4–7.4), while the odds ratio adjusted for sex and diabetes mellitus was 3.6 (CI 95%, 2.0–6.5).

**Conclusion:** Patients of Asian ethnicity showed an independent risk factor for the development of adhesive capsulitis, with an adjusted odds ratio of 3.6. Adhesive capsulitis was more common between 55 and 64 years.

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## Etnia Asiática: um fator de risco para a capsulite adesiva?

## RESUMO

**Objetivo:** Avaliar se a etnia asiática é um fator de risco no desenvolvimento da capsulite adesiva. Os objetivos secundários foram descrever a prevalência da capsulite adesiva no ambulatório especializado em ombro e a dispersão dos casos de capsulite por faixa etária.

## Palavras-chave:

Fatores de risco

Capsulite adesiva

☆ Study conducted at Grupo de Ombro e Cotovelo, Instituto de Ortopedia e Traumatologia, Hospital das Clínicas, Faculdade de Medicina, Universidade de São Paulo, São Paulo, SP, Brazil.

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Distribuição por raça ou etnia  
Estudo comparativo  
Ombro  
Etiologia

**Métodos:** Estudo transversal que comparou a taxa de capsulite adesiva na etnia asiática (casos) com outras etnias (controles). Excluímos pacientes com fraturas e sintomatologia que não envolviam o ombro. O risco relativo foi exposto em razão de chance, ajustado para fatores confundidores por uma regressão logística binária.

**Resultados:** Foram avaliados os prontuários de 1.331 pacientes. Após aplicação dos critérios de seleção, restaram 814. Observamos 134 casos de capsulite adesiva (15,6%). O pico de incidência foi aos 60-64 anos na etnia asiática e 55-59 anos nas demais. A razão de chance não ajustada foi de 4,2 (IC 95%, 2,4 a 7,4), enquanto a ajustada para sexo e diabetes mellitus foi de 3,6 (IC 95%, 2,0 a 6,5).

**Conclusão:** A etnia asiática se mostrou um fator de risco independente para o desenvolvimento da capsulite adesiva, com uma razão de chance ajustada de 3,6. O diagnóstico de capsulite adesiva esteve presente em 15,6% da amostra, com pico entre 55 e 64 anos.

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## Introduction

Adhesive capsulitis is a disease affecting 2–5% of the population.<sup>1</sup> Symptoms include pain, which varies according to the phase of the disease,<sup>2</sup> and limited passive and active joint movement.<sup>3</sup> Its cause is unknown,<sup>4</sup> and it mainly affects middle-aged women.<sup>5</sup> Some risk factors have been described in comparative studies, including diabetes mellitus,<sup>4–7</sup> hyperlipidemia,<sup>6</sup> hypothyroidism,<sup>8</sup> hyperthyroidism,<sup>9</sup> genetic predisposition,<sup>10,11</sup> heart disease<sup>12</sup> and Parkinson's Disease.<sup>13</sup> Other predisposing factors cited, but based only on case series or reports, include prolonged immobilization,<sup>14</sup> previous trauma,<sup>15</sup> and HIV infection.<sup>16</sup> The patient's psychological profile, however, is not correlated with the emergence of the disease.<sup>17,18</sup>

The influence of ethnicity as a predictive factor for the development of adhesive capsulitis has been little studied. White ethnicity<sup>19</sup> and being born in the British Isles<sup>4</sup> have been described as risk factors. However, information on the other ethnic groups is lacking in the literature. The clinical impression of the authors is that patients of Asian ethnicity have a higher chance of developing the disease. However, this is merely a supposition, as there are no studies to support this hypothesis.

The primary objective of this study was to evaluate whether Asian ethnicity is a risk factor for the development of adhesive capsulitis. The secondary objectives were to describe the dispersion of capsulitis cases by age group.

## Methods

### Design

A cross-sectional study was conducted, based on the database of two authors attended between January 7, 2015 and May 25, 2016. The work was approved by the Ethics Committee of the institution under number 1195.

### Participants

Patients with adhesive capsulitis (cases) consisted of individuals who, on physical examination, presented restricted passive and active movement, and who did not present significant changes in the X-ray, except for osteopenia or calcific tendinitis, according to a consensus published by Zuckerman and Rokito.<sup>3</sup> In addition, all patients underwent magnetic resonance imaging (MRI) or ultrasound. We excluded patients with fractures or symptoms not involving the shoulder. The controls were patients without a diagnosis of adhesive capsulitis seen at the same outpatient clinic. The sample was stratified by age group (5-year intervals) and only age groups that included patients with adhesive capsulitis were considered.

### Evaluation methods

The database was built using FileMaker (FileMaker Incorporation, Santa Clara, CA, USA). Using this tool, an Excel spreadsheet (Microsoft Corporation, Redmond, WA, USA) was created, with the following data: ethnicity, age, sex, diabetes mellitus, hypothyroidism, heart disease, neurological disease, and diagnosis. Ethnicity was categorized as Asian ethnicity or other ethnicities. Age was recorded in complete years at the time of the first visit, and categorized in 5-year intervals. The diagnosis was recorded as: adhesive capsulitis, rotator cuff tendinopathy, partial rotator cuff tear, complete rotator cuff tear, calcific tendinitis, shoulder instability, SLAP tear, glenohumeral arthrosis, acromioclavicular arthritis, and others. For subsequent analysis of risk factors, the patients were regrouped into adhesive capsulitis or others. The remaining variables were categorized as present or absent.

### Statistical analysis

The data on prevalence of the different shoulder disorders were expressed as absolute values and percentages. The general characteristics of the sample for age, sex and comor-

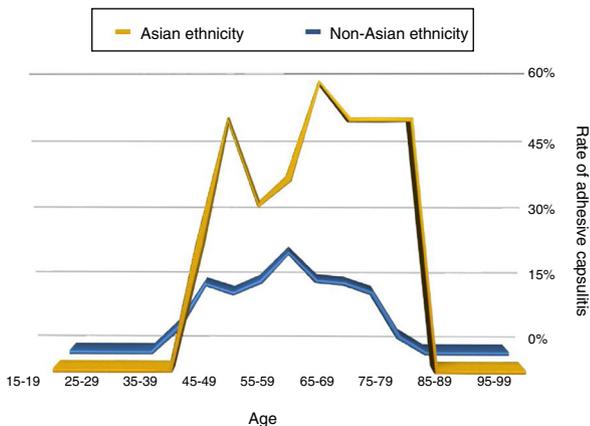
bidities were expressed as averages and standard deviations for the continuous data, and total and percentage values for the categorical data. The continuous data were compared using the Student's t test and Wilcoxon test for parametric and non-parametric data, respectively. The categorical variables were evaluated by the Chi-squared or Fisher's Exact tests. The risk was shown as unadjusted and adjusted odds ratio. The odds ratio was adjusted through binary logistic regression, including possible confounding factors (variables from the baseline with *p* less than 0.2), and the presence or not of adhesive capsulitis as the independent variable. A *p* value of less than 5% was considered significant. The program used for the calculation was SPSS 21.0 (Chicago, IL, USA).

**Results**

The medical records of 1331 patients were evaluated. Of these, 63 were excluded due to shoulder fractures, 33 due to elbow fractures, 158 with orthopedic disorders of the elbow, and 59 with orthopedic disorders in other sites, resulting in 1018 patients with shoulder disorders. There were 187 patients aged below 35 years, and 17 aged above 79 years. They were excluded, as these were the age groups that did not contain any cases of adhesive capsulitis. Thus, a total of 814 patients was obtained.

The distribution of capsulitis cases, according to the age groups, is shown in Fig. 1. The cases of capsulitis were dispersed between 40–79 years in the patients of Asian ethnicity, and 35–79 years for the other ethnicities. The peaks of rate occurred at 60–64 years and 55–59 years for the two groups, respectively. The percentage distribution of the shoulder disorders of the sample studied is shown in Table 1. We found 134 cases of adhesive capsulitis, representing 15.6% of the diagnoses in the patients aged between 35 and 79 years.

In the comparison of the two groups, the demographic variables showed a significant difference for the presence of diabetes (*p* < 0.001), with a higher frequency in the patients of Asian ethnicity. Females were also more prevalent in the patients of Asian ethnicity, but without statistical significance (*p* = 0.191). The other variables presented *p* > 0.200 and were not



**Fig. 1 – Rate of the diagnosis of adhesive capsulitis by age group.**

**Table 1 – Percentage distribution of diagnoses.**

Diagnosis	n	%
Rotator cuff	539	66.2
Rotator cuff tendinopathy	321	39.4
Partial rotator cuff tear	108	13.3
Complete rotator cuff tear	115	14.1
Adhesive capsulitis	134	15.6
Calcific tendinitis	36	4.4
Shoulder instability	26	3.2
SLAP tear	18	2.2
Glenohumeral arthritis	14	1.7
Acromioclavicular arthritis	10	1.2
Other	32	3.9
Total	814	100

**Table 2 – Characteristics of the sample.**

	Asian ethnicity (n = 55)		pOther ethnicities (n = 759)		p
	n	%	n	%	
Sex					
Male	20	36.4	345	45.5	0.191
Female	35	63.6	414	54.5	
Hypothyroidism					
Yes	6	10.9	69	9.1	0.653
No	49	89.1	690	90.9	
Diabetes					
Yes	17	30.9	91	12.0	<0.001
No	38	69.1	668	88.0	
Heart disease					
Yes	1	1.8	12	1.6	0.600
No	54	98.2	747	98.4	
Neurological disease					
Yes	0	0.0	13	1.7	0.400
No	55	100.0	746	98.3	
Age	56.8 (±9.8)		54.4 (±10.7)		0.957

**Table 3 – Distribution of cases by ethnicity and diagnosis of adhesive capsulitis.**

		Asian ethnicity		Total
		Yes	No	
Capsulitis	Yes	23	111	134
	No	32	648	680
	Total	55	759	814

considered confounding factors. Detailed data are shown in Table 2.

The distribution of patients by ethnicity and the presence of adhesive capsulitis is shown in Table 3. The unadjusted odds ratio was 4.2 (CI 95%, 2.4–7.4), while the adjusted odds ratio for the confounding factors was 3.6 (CI 95%, 2.0–6.5) (Table 4).

**Discussion**

Our study demonstrates that Asian ethnicity is a risk factor for the development of adhesive capsulitis, with an adjusted odds ratio of 3.6. This risk is higher than that reported for

**Table 4 – Odds ratio for the risk of Asian ethnicity in the development of adhesive capsulitis.**

	Confidence interval 95%		P
	Lower	Upper	
Unadjusted odds ratio	4.2	2.4	7.4
Adjusted odds ratio <sup>a</sup>	3.6	2.0	6.5 < 0.001

<sup>a</sup> Adjusted for sex and diabetes mellitus.

hypothyroidism<sup>8</sup> and hyperthyroidism.<sup>9</sup> In relation to diabetes mellitus, the risk factor most consistently reported in the literature,<sup>4-7</sup> the value found in our study is higher than that described by Wang et al.<sup>4</sup> (odds ratio: 3.05) and Lo et al.<sup>6</sup> (hazard ratio: 1.67), and lower than that described by Bridgman<sup>5</sup> (odds ratio: 5.04) and Thomas et al.<sup>7</sup> (odds ratio: 9.18). However, only the authors who reported values lower than ours<sup>4,6</sup> performed control of possible confounding factors in their analyses.

In a study conducted in the USA, Rizk and Pinals<sup>19</sup> describe an increased prevalence among Caucasians. Wang et al.<sup>4</sup> observed that individuals born in the British Isles present an adjusted odds ratio of 2.25 of developing the disease. This risk increases to 2.83 when all the grandparents are native to the region. The influence of race has been little studied as a predictive factor for the development of adhesive capsulitis, and this is the first time Asian ethnicity is being evaluated as a possible risk factor.

The rate of adhesive capsulitis in our study was 15.6%. These values are consistent with those reported by other authors, ranging from 11% to 15%.<sup>20,21</sup> However, these studies evaluated the entire adult population, while our data include only the age range with diagnosed cases of adhesive capsulitis, i.e. 35–79 years. Our study demonstrated that all the cases of adhesive capsulitis occurred in this age range, with a peak at 60–64 years for patients of Asian ethnicity, and at 55–59 years for those of other ethnicities. Juel and Natvig<sup>20</sup> described a peak at 50–59 years, and only rare cases below 30 and above 70 years.

It should be emphasized that all the patients were evaluated by one of the two principal investigators, shoulder and elbow surgeons with 10 and 9 years of experience, respectively. Furthermore, in all the cases of adhesive capsulitis, MRI or ultrasound tests were performed in addition to X-ray, to rule out other possible causes of shoulder stiffness. Although our study design did not include paired controls, the logistic regression for possible confounding factors enabled us to define the importance of ethnicity as an isolated factor.

Our study has some limitations. The majority of the patients of Asian ethnicity was comprised of Japanese descendants, and it is possible that the results cannot be extrapolated for other nationalities. Moreover, it was not possible, due to the population characteristics of our country, to analyze the risk factor in isolation in relation to Caucasians and Blacks. The controls consisted symptomatic patients, but without a diagnosis of adhesive capsulitis, originating from the same outpatient department. It is possible that analysis with asymptomatic controls could alter the results. Also, there was not genetic mapping to define Asian ethnicity, and the

results are debatable. Our data showed higher frequency of diabetes in the Asian ethnicity. This fact is in agreement with the observation of other authors. Asian Americans have a significantly higher risk for type 2 diabetes compared to White Americans, despite having substantially lower body mass index,<sup>22</sup> and the prevalence of diabetes in Asian populations has increased rapidly in recent decades.<sup>23</sup> This possible selection bias was adjusted with the logistic regression. Finally, our database also did not allow for the control of all known confounding factors, and we did not confirm the confounding variables through laboratory tests.

We believe further studies are necessary to define the real impact of Asian ethnicity on the development of adhesive capsulitis, including paired groups, prospective cohort design, control of confounding factors. Also, genetic studies are necessary in the attempt to elucidate the physiopathological mechanism of this disease, given that twinhood<sup>10</sup> and genetic polymorphisms<sup>11</sup> have been shown to influence its development. However, based on the data presented, we conclude that Asian ethnicity should be included among the risk factors to be investigated, when faced with a patient with pain and joint stiffness in the shoulder.

## Conclusion

Asian ethnicity proved to be an independent risk factor for the development of adhesive capsulitis, with an adjusted odds ratio of 3.6. Adhesive capsulitis was more common between 55 and 64 years.

## Conflicts of interest

The authors declare no conflicts of interest.

## Acknowledgment

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