



# The incidence of adhesive capsulitis and COVID-19 pandemic effect

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**Background:** There are multiple pieces of evidence in the literature that coronavirus disease 2019 (COVID-19) has a pronounced effect on physiological health. There is little existing literature that has studied the pandemic's impact on adhesive capsulitis (AC) incidence. This study aimed to compare the incidence of primary AC before and during the pandemic.

**Methods:** A retrospective cohort study was done to establish the incidence of primary AC during the COVID-19 pandemic, from March 2020 to March 2021, the pandemic period, and from March 2019 to March 2020, the control period. During these periods, all patients diagnosed with primary AC were included. Patients were also categorized into three different treatment groups according to corticosteroid injection status (none, 1 injection, and 2 injections). The waiting time for the appointment was calculated as a possible confounding factor. Statistical analysis used the chi-square for categorical variables and the Student *t* test for continuous variables.

**Results:** There were 69 patients diagnosed with primary AC out of 704 new referrals during the pandemic. One year earlier, a total of 73 patients were diagnosed with primary AC out of 1148 new referrals. Representing a relative increase of 3.5% ( $P = .086$ ) in the incidence of primary AC. No significant differences were found between the control and the pandemic groups in regard to the distribution of patients per treatment group ( $P = .13$ ), age ( $P = .49$ ), sex ( $P = .21$ ), laterality ( $P = .54$ ), diabetic disease ( $P = .45$ ), and thyroid disease ( $P = .62$ ).

**Conclusion:** There was a nonstatistically significant increase in the incidence of primary AC during the COVID-19 pandemic. No other significant differences were found. Further research is still needed to evaluate the relationship between the COVID-19 pandemic and AC.

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Adhesive capsulitis (AC) or shoulder arthrofibrosis is a pathological process in which an excessive scar or adhesions are formed through the shoulder joint, leading to decreased range of motion (ROM), pain, and loss of function.<sup>14,25</sup> It is a self-limiting condition that completely resolves within three to 10 years, as described by some.<sup>15,24</sup>

AC can be primary (or idiopathic) or secondary. Primary AC usually happens spontaneously without any trauma or any precipitating event. Secondary AC usually happens after a trauma to

the glenohumeral joint like fractures, dislocations, and other severe trauma.<sup>18</sup> It could also happen after shoulder arthroscopy for rotator cuff tear repair, Bankart repair, or shoulder arthroplasty.<sup>4,17,26</sup>

AC presentation generally has three distinct phases.<sup>2,11,17</sup> Freezing, frozen or transitional, and thawing phases, respectively.

The incidence of AC in the general population is almost 3% to 5%, but can increase up to 20% in diabetic patients.<sup>16</sup> Higher hemoglobin A1c increases the incidence in diabetics.<sup>6</sup> The local incidence in Saudi Arabia is approximately around 6.15%.<sup>1</sup> Primary AC usually affects the nondominant shoulder; bilateral shoulder can be affected in up to 50% of cases.<sup>16</sup>

AC has multiple risk factors, which include diabetes mellitus (DM), hypothyroidism, hyperthyroidism, cerebrovascular disease, coronary artery disease, autoimmune diseases, Dupuytren's disease, female gender, over 40 years of age, trauma, positive HLA-B27, and long-term immobilization of the shoulder joint.<sup>10,13,25</sup> A case series of 12 individuals who presented with AC after being infected

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with coronavirus disease 2019 (COVID-19) raised the possibility that the virus's direct or indirect effects may have contributed to the occurrence of AC.<sup>3</sup>

Magnetic resonance imaging (MRI) and magnetic resonance arthrography in AC may reveal thickening of the coraco-humeral ligament, thickening of the capsule in the rotator interval, thickening of pericapsular tissues, loss of axillary recess as well as a contracted glenohumeral joint space, and obliteration of the sub-coracoid fat, which are all characteristic for AC.<sup>19,20</sup> It also helps in ruling out other causes of shoulder dysfunction. The MRI finding usually correlates with the degree of loss of ROM, the intensity of pain, and the clinical phase.<sup>22</sup>

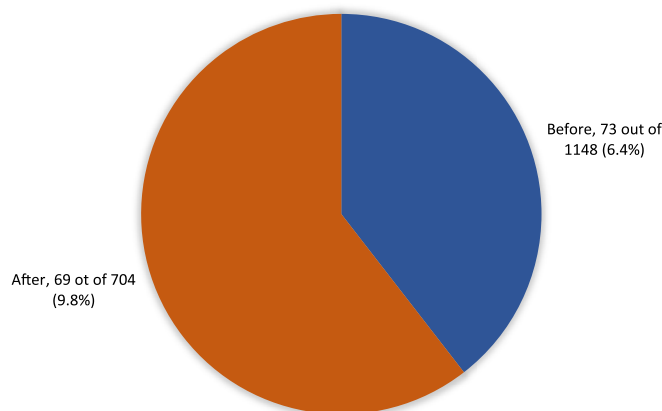
The first case of COVID-19 in the Kingdom of Saudi Arabia was announced on March 2, 2020, and the Kingdom underwent partial lockdown on March 8, 2020, then full lockdown on May 23, 2020. During the COVID-19 pandemic, orthopedic surgeons in our facility developed a sense of an increased incidence of AC patients presenting to our facility. Our aim in this retrospective cohort study was to assess if the COVID-19 pandemic has affected the incidence of idiopathic AC. Our hypothesis was that since the beginning of the pandemic, we have noticed an increasing number of patients with AC presenting to our outpatient clinics compared to the period before the pandemic.

## Materials and methods

All referrals for new shoulder problems from March 2020 to March 2021, the pandemic period, and from March 2019 to March 2020, the control period, before COVID-19 was discovered in the Kingdom of Saudi Arabia, were manually reviewed through electronic medical records. All patients aged 18 years or older with a first-time referral for a new shoulder problem within these 2 specified periods and who are diagnosed with and have MRI-proven idiopathic AC were included. Diagnosis of AC was based on a history of pain and loss of ROM, clinical examination marked by loss of both active and passive ROM, plain radiographs that excluded glenohumeral arthritis, and MRI findings of AC. All patients in our institution with suspected AC underwent MRI to confirm the diagnosis and rule out other causes.

Patients with risk factors such as DM and thyroid disease were considered to have primary AC and were included in this study. Patients with partial-thickness rotator cuff tears, biceps pathology, calcific tendonitis, and minimal radiologic arthritis signs were also included. Our exclusion criteria were secondary AC due to underlying primary pathology (full-thickness rotator cuff tears, fractures, dislocations, avascular necrosis, and tumors) and patients with AC who were seen or referred outside the previously predefined time periods. Risk factors, demographic data, and clinical characteristics were also recorded to compare both groups (age, sex, affected side, DM, thyroid disease, and other risk factors). The incidence of AC was calculated as the number of patients included in each group divided by the total number of first-time referrals for a new shoulder problem within the respective predefined time periods.

After diagnosing AC clinically, an MRI was done to confirm the diagnosis and rule out other causes. Nonsurgical management was provided as a first line with physiotherapy, nonsteroidal anti-inflammatory drugs, and possible image-guided corticosteroid injections through our pain clinic, which can be repeated after 4–6 weeks if a patient is not improving. An arthroscopic circumferential capsular release can be offered in extremely recalcitrant cases, which are rare in our facility. The patients who were included in this study were categorized into three treatment groups (0 injections, 1 injection, and 2 injections), where every “injection” is a set of image-guided injections into the subacromial space and the glenohumeral space through rotator interval.



**Figure 1** Prevalence of adhesive capsulitis among participants before and after COVID-19 pandemic ( $P = .086$ ). COVID-19, coronavirus disease 2019.

Descriptive analysis was done by prescribing frequency distribution and percentage for cases demographic and clinical data as well as received treatment before and after COVID-19 pandemic. Comparisons were done using the Pearson chi-square test for significance and exact probability test if there were small frequency distributions, while a t-test was used for age, which was displayed using mean with standard deviation.

## Results

A total of 142 patients diagnosed with AC were included; 69 out of 704 total patients presented with shoulder complaints (9.8%) during the pandemic. One year earlier, before the pandemic, 73 out of 1148 total patients presented with shoulder complaints (6.3%). This difference represents a relative increase of 3.5% in the incidence of primary AC presenting to our institution ( $P = .086$ ) (Fig. 1). No significant differences were found in regard to age, sex, laterality, diabetic diagnoses, thyroid disease diagnoses, and other risk factors for AC (Table I).

There was no significant difference regarding the distribution of patients among treatment groups between the pandemic group and the control group ( $P = .134$ ) (Table II).

## Discussion

The aim of this retrospective cohort study was to find out if there is an association between AC and COVID-19; our result shows that it is statistically insignificant. Frozen shoulder (FS) could be caused by a state of low-grade inflammation.<sup>13</sup> This could happen in multiple diseases such as thyroid disease, DM, cardiovascular disease, and mental conditions.<sup>21</sup> COVID-19 could have the same impact with its extrapulmonary complication as it would cause a state of low-grade inflammation, which could lead to the development of AC.<sup>12</sup> And this was the reason for this retrospective cohort study. There are multiple studies that have linked COVID-19 to AC with a higher incidence in comparison to our study. One study showed an incidence of more than a third of the patients compared to the pre-COVID-19 era.<sup>9</sup>

DM has long been linked to FS with multiple papers and data showing this association. Bad glycemic control could significantly increase the incidence of FS.<sup>6</sup> Thyroid disorders, especially hypothyroidism and benign thyroid nodules are risk factors significantly associated with FS, increasing the incidence 2.69 times compared to the general population.<sup>7</sup>

There was no significant difference between control and pandemic groups in regard to age, sex, comorbid conditions, and

**Table I**  
Demographic and clinical characteristics of study patients by study phase.

| Factors            | Control        |      | Pandemic       |      | P value          |
|--------------------|----------------|------|----------------|------|------------------|
|                    | No             | %    | No             | %    |                  |
| Age in yr          |                |      |                |      | .49 <sup>*</sup> |
| Mean $\pm$ SD      | 54.5 $\pm$ 9.3 |      | 52.9 $\pm$ 9.8 |      |                  |
| Sex                |                |      |                |      | .214             |
| Male               | 31             | 42.5 | 35             | 50.7 |                  |
| Female             | 42             | 57.5 | 34             | 49.3 |                  |
| Laterality         |                |      |                |      | .54              |
| Right              | 32             | 43.8 | 28             | 40.6 |                  |
| Left               | 41             | 56.2 | 41             | 59.4 |                  |
| DM                 |                |      |                |      | .45              |
| Yes                | 43             | 58.9 | 37             | 53.6 |                  |
| No                 | 30             | 41.1 | 32             | 46.4 |                  |
| Thyroid            |                |      |                |      | .62              |
| Yes                | 8              | 11.0 | 9              | 13.0 |                  |
| No                 | 65             | 89.0 | 60             | 87.0 |                  |
| Other risk factors |                |      |                |      | .11 <sup>†</sup> |
| BPH                | 0              | 0.0  | 1              | 1.4  |                  |
| Breast cancer      | 0              | 0.0  | 2              | 2.9  |                  |
| CAD                | 1              | 1.4  | 0              | 0.0  |                  |
| CKD                | 1              | 1.4  | 0              | 0.0  |                  |
| DLP                | 0              | 0.0  | 2              | 2.9  |                  |
| HF                 | 1              | 1.4  | 0              | 0.0  |                  |
| HTN                | 20             | 27.4 | 10             | 14.5 |                  |
| IHD                | 2              | 2.7  | 2              | 2.9  |                  |
| Liver cirrhosis    | 0              | 0.0  | 1              | 1.4  |                  |
| None               | 47             | 64.4 | 51             | 73.9 |                  |
| RA                 | 1              | 1.4  | 0              | 0.0  |                  |

SD, standard deviation; DM, diabetes mellitus; BPH, benign prostatic hyperplasia; CAD, coronary artery disease; CKD, chronic kidney disease; DLP, dyslipidemia; HF, heart failure; HTN, hypertension; IHD, ischemic heart disease; RA, rheumatoid arthritis.

P: Pearson  $\chi^2$  test.

<sup>\*</sup>Exact probability test.

<sup>†</sup>Independent t-test.

**Table II**  
Treatment of study patients by study phase.

| Treatment                        | Control |      | Pandemic |      | P value |
|----------------------------------|---------|------|----------|------|---------|
|                                  | No      | %    | No       | %    |         |
| Corticosteroid injections number |         |      |          |      | .13     |
| None                             | 59      | 80.8 | 63       | 91.3 |         |
| One                              | 12      | 16.4 | 5        | 7.2  |         |
| Two                              | 2       | 2.7  | 1        | 1.4  |         |

P: Pearson  $\chi^2$  test.

the number of injections. AC may persist for a few years, and at the time of data collection, the follow-up time had only been 1 year since the last inclusion. The short follow-up time may limit multiple variables in this study.

There are multiple reports of FS following COVID-19 infection and vaccines with almost 80% of patients having at least one prior comorbidity. Symptoms started as early as immediately after vaccination in up to 60% of patients.<sup>5,8,23</sup>

The pandemic and lockdown restrictions may have affected the time at which patients sought medical care. To help amend this, the time period between the referral to our clinics and the first appointment was reported as a possible confounding factor. This was a retrospective review; there was no immunologic data available regarding COVID-19 infection or vaccination status, as this data is not available to us.

## Conclusion

During the COVID-19 pandemic, there was an increase of 3.5% in the incidence of AC presented to our clinics. No significant

differences in laterality, comorbidities, sex, or response to treatment were observed. Further research is needed to evaluate the relationship between the COVID-19 pandemic and AC.

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