Analyses of possible risk factors for subacromial impingement syndrome

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Abstract

AIM: To evaluate the association between various risk factors, including sleeping position, and impingement syndrome. Impingement syndrome is the most common cause of shoulder problems. The pathogenesis of this problem is still debated these days.

METHODS: This was a case control study conducted at the outpatient clinic of Songkla-kanarind hospital. Data regarding history, physical examination and radiographic evaluations using supraspinatus outlet views were obtained from all patients with clinically suspected impingement syndrome. The diagnoses of impingement syndrome were confirmed by a xylocaine subacromial injection test. All patients were interviewed concerning their usual sleeping position, which was categorized into supine, decubitus, prone and undetermined. Radiographs were evaluated to determine the shape of the acromion, which was divided into 3 types: flat, curved and hook. We used logistic regression analysis to determine the association between risk factors and outcome.

RESULTS: The study group included 111 patients with impingement syndrome and 191 healthy volunteers as a control group. The mean age was about 50 years with a body mass index (BMI) of 24 kg/m² in both groups. The most common shape of the acromion was flat (84.5%), followed by curved (10.7%) and hook (4.8%). We found the 4 independent risk factors affecting impingement syndrome were smoking status, occupation, acromion shape and sleeping position. Patients who currently smoked had a 6.8 times greater risk of impingement syndrome compared to non-smokers (OR 6.8, 95% CI: 1.2-39) and government officers had a 6.3 times increased risk compared to rubber tappers (OR 6.3, 95% CI: 1.3-30.3). Patients with a hook type acromion had 6.2 times the risk of flat type (OR 6.2, 95% CI: 1.1-35) and patients who slept in the decubitus position had 3.7 times the risk of those who slept in the supine position (OR 3.7, 95% CI: 1.2-11.6). No significant associations were found between age, sex, BMI, sports activity and impingement syndrome.

CONCLUSION: Independent risk factors affecting impingement syndrome are current smoker, government officer, a hook-type acromion and the decubitus sleeping position.

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Key words: Smoking; Decubitus; Impingement syndrome

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INTRODUCTION
Impingement syndrome is the most common cause of shoulder pain. The pathogenesis of impingement remains unknown. Both intrinsic and extrinsic factors have been claimed to be involved. The most significant previously reported factor associated with this condition was a hook type acromion. A previous study reported a significantly higher incidence of a hook type acromion in cadavers with a rotator cuff problem. Other mechanical factors that might be related are repetitive overhead activities from work, such as working in a slaughterhouse, mechanics or painters, and sports such as volleyball, badminton or tennis have also been associated with it. However, most previous studies have been descriptive studies. In addition, in our experience, we have observed that most patients complained that their symptoms were worse when they slept in the decubitus position. In addition, few previous studies have investigated the association between factors such as age, sex, body mass index or smoking status with this condition. We hypothesized that these factors might be associated with impingement syndrome. The objective of this study was to identify factors associated with impingement syndrome.

MATERIALS AND METHODS
This was a case control study. It was in compliance with the Helsinki Declaration and was approved by the ethics committee, Prince of Songkla University. All patients signed informed consent before participation. The setting was the outpatient clinic at Songklanagarind hospital during February 2008 to March 2009. The cases were patients aged between 30-60 years diagnosed with impingement syndrome, while the control group was healthy volunteers who were working in Songkla province, aged between 30-60 years old without shoulder pain. The eligible patients all had at least a 6 wk history of shoulder pain, which occurred or increased during flexion and/or abduction, and with a positive Hawkins sign. Patients with a history of trauma, previous surgery or pregnancy were excluded. Clinically suspected patients were given a subacromion lidocaine injection test by one orthopedist to confirm the diagnosis. Diagnosis was established if shoulder pain improved by at least 50%. All included participants were interviewed by 1 orthopedist to ascertain basic demographic data, plus history of trauma, sports activity, smoking status and usual sleeping position. Factors associated with impingement syndrome, including smoking, occupation and sleeping position were summarized. Univariate analysis using the Chi-squared test was used to identify potential factors for multivariable analysis. Factors having a p-value less than 0.2, including smoking position, were included for multivariable analysis using logistic regression analysis. Backward elimination technique was used to identify independent factors affecting impingement syndrome.

RESULTS
Among the eligible patients with a confirmed diagnosis using an injection test, 82% agreed to participate in the study. There were 111 cases and 191 controls included in the study. The mean age was about 50 years with a body mass index (BMI) of 24 kg/m2 in both groups. Most patients in this study were non-smokers. The most common sleeping position was decubitus (55.1%), followed by supine (36.6%), with only 2 patients in this study sleeping in the prone position. The most common type of acromion was flat (84.5%), followed by curved (10.7%) and hooked (4.6%) (Table 1).

The study found several factors significantly associated with impingement syndrome in univariate analysis, including sex, smoking, occupation and sleeping position (Table 2).

Independent risk factors affecting impingement syndrome were smoking status, occupation, the acromion shape and sleeping position. Patients who currently smoked had 6.8 times greater risk of impingement syndrome than non-smokers (OR 6.8, 95% CI: 1.2-39.8) and government officers had 6.3 times the risk of rubber tappers (OR 6.3, 95% CI: 1.3-30.3). Patients with a hook type acromion had 6.2 times higher risk than flat type (OR 6.2, 95% CI: 1.1-34.9) and patients who slept in the decubitus position had 3.7 times the risk of those who slept supine (OR 3.7, 95% CI: 1.2-11.6). No significant association was found between age, sex, BMI, sports activity and impingement syndrome (Table 3).

DISCUSSION
Four independent risk factors were found to be associated with impingement syndrome, including smoking, sleeping position, acromion shape and occupation.

Smoking has been proven to be a preventable risk factor associated with several health conditions, such as chronic lung disease, cardiovascular disease, malignancy and low back pain. Our study demonstrated that participants who currently smoked had about 7 times the risk for shoulder impingement syndrome of nonsmokers. This could be related to the fact that nicotine can affect sensory thresholds, impair vasculature to tendons and disturb tendon healing capacity. This tends to be con-
Table 1 Patient characteristics of cases and controls

| Characteristics          | Cases  | Controls | P-value |
|--------------------------|--------|----------|---------|
| n = 111 (%)              | n = 191 (%) |         |         |
| Mean age, yr (SD)        | 49.8 (7.7) | 43.0 (6.2) | 0.435   |
| Gender, male (%)         | 49 (44%) | 101 (53%) | 0.03    |
| Mean BMI (kg/m²) (SD)    | 24.1 (3.8) | 24.4 (3.6) | 0.386   |
| Smoking status (%)       |         | < 0.05   |         |
| Never                    | 93 (83.8) | 183 (95.8) |         |
| Current                  | 15 (13.5%) | 4 (2.1) |         |
| Ex-smoker                | 3 (2.7) | 4 (2.1) |         |
| History of trauma        |         | < 0.05   |         |
| No                       | 104 (93.7) | 191 (100) |         |
| Yes                      | 7 (6.3) | 0 (0%) |         |
| Occupation               |         | < 0.05   |         |
| Rubber tapper            | 11 (9.9) | 20 (10.5) |         |
| Teacher/nurse            | 30 (27.0) | 34 (17.8) |         |
| Farmer                   | 9 (8.1) | 14 (7.3) |         |
| Officer/others           | 61 (55.0%) | 123 (64.4) |         |
| Sports                   |         | 0.264    |         |
| None                     | 100 (90.1) | 180 (94.2) |         |
| Football                 | 1 (0.9) | 4 (2.1) |         |
| Jogging                  | 3 (2.7) | 0 (0%) |         |
| Others                   | 7 (6.3) | 8 (4.2) |         |
| Sleeping position        |         | 0.029    |         |
| Supine                   | 85 (44.5) | 32 (52.5) |         |
| Decubitus                | 90 (47.1) | 20 (32.8) |         |
| Prone                    | 2 (1.1) | 0 (0%) |         |
| Undetermined             | 14 (7.3) | 9 (14.7) |         |
| Type of acromion         |         | 0.082    |         |
| Type I, Flat             | 89 (81.7) | 166 (86.9) |         |
| Type II, Curved          | 12 (11.0) | 21 (11.0) |         |
| Type II, Hooked          | 8 (7.3) | 4 (2.1) |         |

Table 2 Univariate analysis of factors affecting impingement syndrome

| Characteristics | Proportion of case n (%) | $\chi^2$ (df) | P-value |
|-----------------|--------------------------|---------------|---------|
| Age, yr         |                         | 1.83 (1)      | 0.175   |
| < 50            | 25 (26.6)                |               |         |
| 50              | 69 (73.4)                |               |         |
| Sex             |                         | 7.55 (1)      | 0.033   |
| Male            | 44 (39.6)                |               |         |
| Female          | 67 (60.4)                |               |         |
| Smoking status  |                         | 15.77 (< 0.001) |         |
| Never           | 93 (83.7)                |               |         |
| Current         | 3 (42.9)                 |               |         |
| Ex-smoker       | 15 (78.9)                |               |         |
| Occupation      |                         | 19.36 (6)     | 0.004   |
| Rubber tapper   | 11 (35.5)                |               |         |
| Teacher/nurse   | 30 (48.4)                |               |         |
| Farmer          | 9 (9.1)                  |               |         |
| Officer/others  | 61 (73.3)                |               |         |
| Sports          |                         | 5.23 (4)      | 0.264   |
| None            | 100 (55.7)               |               |         |
| Football        | 1 (20.0)                 |               |         |
| Jogging         | 3 (50.0)                 |               |         |
| Others          | 111 (60.0)               |               |         |
| Sleeping position |                       | 9.038        | 0.029   |
| Supine          | 32 (27.4)                |               |         |
| Decubitus       | 70 (43.7)                |               |         |
| Prone           | 0 (0%)                   |               |         |
| Undetermined    | 9 (57.1)                 |               |         |
| Type of acromion|                         | 4.99         | 0.082   |
| Type I, flat    | 89 (34.9)                |               |         |
| Type II, curved | 12 (36.4)                |               |         |
| Type II, hooked | 8 (66.7)                 |               |         |
| BMI (kg/m²)     |                         | 0.489         | 0.783   |
| < 25            | 68 (61.3)                |               |         |
| 25-29.9         | 35 (31.5)                |               |         |
| ≥ 30            | 8 (7.21)                 |               |         |

BMI: Body mass index.

firmed by the fact that participants who had previously smoked but had quit prior to the study had essentially the same risk as nonsmokers.

Sleeping position is also a new risk factor we discovered from this study. Sleeping in the decubitus position showed a 3.7 times greater risk compared with sleeping in the supine position. The position of the shoulder while sleeping in the decubitus position is nearly similar to the position of the Hawkins provocative test, in which the shoulder in the forward flexion position can aggravate the impingement process. It is fair to hypothesize that repetitive overload from body weight during sleeping might cause the impingement of the tendon against the acromion arch, resulting in tendon degeneration and inflammation. The finding that the undetermined sleep position also indicated increased risk might also be explained by this, in that this group of patients indicated no predominant sleeping position, meaning they changed from one position to another during sleep, resulting in a lower risk than in patients who used the decubitus position predominately. We believe that the association found in our study might not be a spurious association or reverse causality, because the sleeping position reported was their common sleeping position be-

fore developing their shoulder problem. However, recall bias can not be totally obviated since participants who perceived their use of the decubitus sleeping position to be a causal factor might be more inclined to report this position.

Acromion shape has been blamed as a major cause for impingement syndrome without any good studies having been done to confirm this. All previous reports have only been descriptive studies[13-15]. Such studies have reported, for instance, a higher incidence of rotator cuff problems in a hook type acromion without statistical analysis. Our study did confirm this earlier observation. The magnitude of association between acromion shape and impingement was found to be as strong as the association between smoking and occupation and the presence of disease. However, the proportion of hook types in our study was lower than in previous reports, which could be explained from the different characteristics of the study populations.

There are a number of occupations associated with impingement syndrome, such as a slaughterhouse worker,
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