Assessment of Approximate Glenoid Size in Thai People

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Background: The loosening of the glenoid baseplate component is one of the most common complications after reverse total shoulder arthroplasty. The mismatch between size of baseplate and glenoid in Thai People may result in improper baseplate screw fixation and lead to early loosening of the glenoid component. Knowing of the glenoid size will guide the surgeon in placing or choosing the proper size glenoid baseplate to improve screw fixation strength.

Objective: Study the size of glenoid in Thai people and compare with previous studies.

Material and Method: The authors measured the glenoid size in anteroposterior and superoinferior directions, the data were recorded in term of mean and standard deviation. The present data were then compared with the previous glenoid studies to identify the differences in size between Thai people and others.

Results: Among 160 patients with the mean age of 58.2±14.2 years, the overall glenoid size for the entire study group were 32.3±3.2 mm and 24.4±3.2 mm in superoinferior (SI) and anteroposterior (AP) directions, respectively. The male glenoid size were 35.6±2.6 mm and 26.7±2.5 mm in SI and AP directions, respectively. The female glenoid SI diameter were 31.0±1.9 mm and in AP diameter were 22.0±1.7 mm. The glenoid size in Thai people was significantly smaller than the glenoid size from previous studies in Caucasians.

Conclusion: The overall glenoid size in Thai people was significantly smaller than the previous studies in Caucasians. The female glenoid was also smaller than with the male. These findings alert surgeons to choose the proper glenoid baseplate design to avoid an overhang problem and improve screw fixation, especially in Thai female patients.

Keywords: Glenoid, Reverse total shoulder arthroplasty, Thai glenoid size

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Reverse total shoulder arthroplasty (RTSA) was initially used to manage massive rotator cuff tear and rotator cuff tear arthropathy. The indications have been expanded to more complex shoulder problem such as failed shoulder arthroplasty and proximal humeral fracture sequelae.

The rising in number of RTSA may lead to complications unique to the procedure. The mechanical glenoid baseplate failure is one of the common problems after RTSA. The loosening of glenoid component can be prevented by placing the baseplate at the lower part of glenoid bone so that the inferior screw will achieve the strongest pull-out strength, enough to resist the pull-out force of the glenoid component(1). The glenoid component from western manufacturers may cause an overhang on the glenoid in Thai patients, and then lead to screw misplacement and result in the early loosening of the component.

Knowing the glenoid size in Thai patients will aid the surgeon in placing the glenoid baseplate more properly to improve the fixation strength and better choose the proper size of the glenoid baseplate to avoid the overhang of the component.

Moreover, these average “normal” glenoid size can be used as a reference data in calculate the percentage of glenoid bone loss in patients with recurrent shoulder dislocation and glenoid bone loss in arthritic shoulder patient that may result in changing the treatment plan in these groups of patients.

To date, there are no data about the average glenoid size of Thai people and no comparative studies between Thai glenoid size and others. The hypothesis of the presence study is that average glenoid sizes in Thai people are smaller than those of Caucasians.

Material and Method

The authors collected the data from the patients who had undergone chest or shoulder computer tomographic imaging at the Department of Radiology, Phramongkutklao Hospital between March and July 2012. The CT images then had been
reconstructed into 3D image. The authors rotated the
reconstructed glenoid to the so-called En face view. The
bare spot was used as a reference for centering the
imagine circle. The circle was then drawn at the same
time trying to keep the circumference of the circle parallel
with the inferior edge of glenoid as possible. Then the
glenoid was measured in both anteroposterior and
superoinferior directions in millimeters by using the
landmark from the bare spot of the glenoid as a
reference(2) (Fig. 1).

Patients with the history of glenoid fracture,
shoulder instability or osteoarthritis were excluded from
the study.

The sample size was calculated according to
a study by Churchill RD et al(3), the present study was
to enroll at least 73 patients to provide statistically
significance. In the present study, the authors enrolled
160 patients divided equally into both genders.

The baseline characteristics such as gender,
age, underlying diseases were recorded in the
registration forms. The measurement of the glenoid size
in anteroposterior and superoinferior directions in
millimeters were also collected and were presented as
mean and standard deviation to be compared with the
previous international studies by independent t-test
using the SPSS statistical software (release 20.0). A
p-value less than 0.05 was considered statistically
significant. All measurements were carried out by the
same observer for two periods and then repeated after
at least 2 weeks.

Results

Among 160 patients (age 22-88 years) with
the mean age of 58.2±14.2 years, were 80 male and
80 female. The overall glenoid size for the entire
study group were 32.3±3.2 mm and 24.4±3.2 mm in
superoinferior and anteroposterior directions
respectively. The average male glenoid size were
35.6±2.6 mm and 26.7±2.5 mm in superoinferior and
anteroposterior directions respectively. The female
glenoid size in superoinferior was 31.0±1.9 mm and
in anteroposterior were 22.0±1.7 mm (Table 1).

The average glenoid size in Thai people then
had been compared to the previous studies(4-6) and the
comparing data between genders also performed as
shown in Table 2.

Von Schroeder et al and Iannotti et al found
the overall glenoid sizes in Thai statistically smaller
than the previous glenoid studies. Moreover, when
comparing between gender, the average Thai male and
female glenoid sizes were also significantly smaller than
previous study of Caucasians(3) (Table 2).

However, when comparing with the
Korean glenoid size(6) (Table 2), there was no
significantly difference in both superoinferior and
anteroposterior directions (p-value = 0.11 and p-value
= 0.01, respectively).

Discussion

One of the most common complications after
reverse total shoulder arthroplasty is loosening of
glenoid baseplate; the sizes of glenoid baseplates from
western manufacturers were claimed to be larger than
in Asian or Thai glenoid patients.

These mismatches between sizes may have
been caused by inappropriate purchases of glenoid
baseplate screws and could lead to early loosening of
the component.

The average AP glenoid diameter in Thai
people is 24.4±3.2 mm and the mean SI diameter is
32.3±3.2 mm. These present data show the overall
glenoid size in Thai people were significantly smaller
than the previous studies in Caucasians(35) (p-value
<0.01).

Interestingly, the subgroup analysis
comparing gender, the glenoid size of Thai male were
statistically larger than Thai female. The mean AP
diameter in male and female were 26.7±2.5 mm and
22.0±1.7 mm (p-value <0.01), respectively. The mean SI
diameter of male and female were 35.6±2.6 mm and
31.0±1.9 mm, which also show statistical difference
(p-value <0.01). These findings correspond with the
previous Korean (6) and Caucasian(3) studies that the
male glenoid is bigger than female. This data will alert
the surgeon when dealing with Thai-female glenoid.

When compared with Korean glenoid(6), the
overall glenoid diameters are not statistical different

Fig. 1 Computed tomographic imaging of the glenoid. (A)
The bare spot was identified and used as a reference for
the center of circle. Try to keep the circumference of circle parallel to inferior part of glenoid as possible. (B) The glenoid was measured in both anteroposterior and superoinferior directions by used the landmark from the bare spot as a reference.
with both also smaller than the Caucasian glenoid. These findings also confirm that race and gender have an effect on glenoid diameter.

For clinical application, the data of average glenoid size can be used to improve the RTSA surgical outcome and also being used as a reference number for calculation of percent of glenoid bone loss in recurrent shoulder instability patients.

The glenoid baseplate that we use in RTSA have just only one size (8) (28.0 mm in diameter). Therefore, to avoid overhanging of the glenoid baseplate, the patient with the glenoid size larger than 28.0 mm in the AP direction will be considered safe for this type of glenoid baseplate that were designed for the western people.

The present study found that only 26 persons or 32.5 percent of male are considered suitable for this size of baseplate. Hence, more obviously in the female group, just only 1 person or 1.3 percent of female group are proper for the western design glenoid baseplate as shown in Fig. 2. The glenoid AP diameter that smaller than 28.0 mm can cause overhanging and effect the screw purchase that could lead to loosening later.

For the patients with recurrent shoulder dislocation, thirty percent of glenoid bone loss is the consensus number among surgeons for changing from arthroscopic treatment to open coracoid or bone graft transfer. According to the present data, the loss of glenoid bone in the anteroposterior direction about 8.0 mm in male and 6.6 mm in female would correspond to 30.0 percent. On the other hand, if we found an 18.7 millimeter glenoid bone left in male and 15.4 millimeters left in female will alert the surgeon to change treatment plan to open bone graft or coracoid transfer.

**Conclusion**

The overall glenoid size in Thai people was found significantly smaller than the previous studies.
The female glenoid was also found to be smaller than that of the male. These findings alert surgeons to choose the proper glenoid base plate design to avoid an overhang problem and improve screw fixation especially in Thai female patients.

**Fig 2.** The average AP glenoid diameter and number of patients. A, B) The graph between the AP diameter of the glenoid and number of patients in male and female. Only 32.5 percent in male population and 1.3 percent in female population (white area under the curve) were suitable for the glenoid baseplate.

Potential conflicts of interest
None.

References
การศึกษาการแยกรบลูคสะบัดในคนไทย

สาหรัฐ ผลกิจ, ณัฐภูมิ ฤดิกรณ์

กลุ่มตัวอย่าง ปัจจุบันมีการแยกรบลูคสะบัดในคนไทยในวงกว้าง รวมถึงกลุ่มตัวอย่างผู้ที่มีการแยกรบลูคสะบัด การศึกษาโดยเป็นการศึกษาแบบ Reverse total shoulder arthroplasty ในกลุ่มตัวอย่างมีภาวะชาติไทยได้ส่งเส้นหรือตัวอย่างในลักษณะเดียวกัน ทำให้กลุ่มตัวอย่างมีภาวะชาติไทยส่งเส้นหรือตัวอย่างในลักษณะเดียวกัน มีการศึกษาด้วยการทดสอบในแม่พิมพ์ความคืบหน้าในการแยกรบลูคสะบัด เพราะสามารถผลิตข้อมูลจากการศึกษาได้ สำหรับตัวอย่างที่มีภาวะชาติไทยส่งเส้นหรือตัวอย่างในลักษณะเดียวกัน ปัจจุบันไม่มีการศึกษาด้วยการทดสอบในแม่พิมพ์ความคืบหน้าในการแยกรบลูคสะบัดในคนไทย

วัตถุประสงค์: เพื่อศึกษาภาวะชาติไทยแยกรบลูคสะบัดในคนไทยและความแตกต่างระหว่างคนไทยที่เป็นประชากรชนชาติอื่น

วิธีการ: การศึกษาโดยจำแนกการแยกรบลูคสะบัดที่เป็นโรคในกลุ่มตัวอย่างผู้ป่วยจำนวน 160 ราย เบื้องหน้า 80 รายและหลังศูนย์ 80 ราย ทำการวัดการแยกรบลูคสะบัดในแนวขอบศรี (superoinferior directions) และแนวขอบหลัง (anteroposterior directions) น้ำหนักที่มีการแยกรบลูคสะบัดของผู้ที่เป็นโรคในกลุ่มตัวอย่าง เกี่ยวกับภาวะชาติไทยที่มีความแตกต่างทางสถิติโดยใช้ independent t-test

ผลการศึกษา: จากการศึกษาพบว่ามีการแยกรบลูคสะบัดในแนวขอบศรีที่มีผลศูนย์ (32.3±3.2 มิลลิเมตร) และมีผลศูนย์ (24.4±3.2 มิลลิเมตร) ในแนวขอบหลัง ซึ่งมีผลศูนย์ (36.4±2.6 มิลลิเมตร) มีผลศูนย์ (26.6±2.5 มิลลิเมตร) ในแนวขอบหลัง ซึ่งมีผลศูนย์ (31.0±1.9 มิลลิเมตร) มีผลศูนย์ (22.0±1.7 มิลลิเมตร) น้ำหนักที่ไม่ได้จากการศึกษาที่มีการแยกรบลูคสะบัดในแนวขอบศรีและแนวขอบหลัง ซึ่งมีผลศูนย์ (32.3±3.2 มิลลิเมตร) และมีผลศูนย์ (24.4±3.2 มิลลิเมตร มีผลศูนย์ (36.4±2.6 มิลลิเมตร) มีผลศูนย์ (26.6±2.5 มิลลิเมตร) มีผลศูนย์ (31.0±1.9 มิลลิเมตร) มีผลศูนย์ (22.0±1.7 มิลลิเมตร) ไม่มีผลศูนย์ (p-value <0.01)

สรุป: ภาวะชาติไทยมีการแยกรบลูคสะบัดมีการแยกรบลูคสะบัดในแนวขอบศรีและแนวขอบหลัง ซึ่งมีผลศูนย์ (32.3±3.2 มิลลิเมตร) และมีผลศูนย์ (24.4±3.2 มิลลิเมตร) ซึ่งมีผลศูนย์ (36.4±2.6 มิลลิเมตร) มีผลศูนย์ (26.6±2.5 มิลลิเมตร) มีผลศูนย์ (31.0±1.9 มิลลิเมตร) มีผลศูนย์ (22.0±1.7 มิลลิเมตร) ไม่มีผลศูนย์ (p-value <0.01)