# Comparison of Posterior and Lateral Surgical Approach in Management of Type III Supracondylar Fractures of the Humerus among the Children

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***Objective:*** *To compare the results between posterior and lateral approaches in surgical treatment of the type III supracondylar humeral fractures in children.*
***Study Design:*** *Retrospective analytical study.*
***Material and Method:*** *Two groups of patients who needed surgical treatment of type lll supracondylar humeral fractures, 52 in posterior approaches and 30 in lateral approaches were followed up for 6 months, in Chaiyaphum Hospital between 2004 and 2007.*
***Results:*** *The posterior approach had a shorter operative time than the lateral approach ($p < 0.001$). The overall scores by Flynn's criteria showed that good and excellent outcomes were 80.7% in the posterior approach group and 80% in the lateral approach group and there was no significant difference of complications.*
***Conclusion:*** *The posterior approach had a shorter operative time than the lateral approach but no significant differences were found in terms of results and complications.*

***Keywords:*** *Supracondylar humeral fracture, Posterior and lateral approach, Children*

***J Med Assoc Thai 2008; 91 (4): 502-6***
***Full text. e-Journal:*** *http://www.medassocthai.org/journal*

Supracondylar humeral fractures are the most common fracture of the elbow region in the first decade of children[1]. Traction, closed reduction and splint, closed reduction and percutaneous pinning, open reduction and k-wire fixation are among the treatment options for these fractures. Regarding The Gartland Classification of supracondylar humeral fractures are the most commonly used. A type III fracture has a circumferential break in the cortex with total displacement (no cortical contact). Closed reduction with percutaneous pinning has gained support as the preferred method of treatment. In situations where closed reduction fails, open reduction and k-wire fixation is applied. The approach for open reduction has been somewhat controversial. Anterior[2], medial[3], lateral[4], posterior[5], and double incision[6] (medial and lateral) approaches have all been recommended.

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The posterior approach through the triceps muscle has been used with excellent results[7-10]. Gennari compared the posterior and anterior approach with the conclusion that the posterior approach is easier but may result in circulatory compromise to the lateral condyle and stiffness[7]. The aim of this retrospective study was to compare the functional results of posterior and lateral approaches in surgical treatment of type III supracondylar humeral fracture in children.

## Material and Method

Between January 2004 and April 2007, 82 patients with severe extension displacement of supracondylar humeral fractures (Type III Gartland Classification) were operated on, by two different approaches. The first category was the posterior approach, and comprised of 52 children (34 boys,18 girls), while the second category underwent the lateral approach, and was composed of 30 children (18 boys, 12 girls). The mean duration before surgery time of the posterior

approach group was 20.1 ± 10.8 hours, which had no statistical significance (p = 0.33), compared with 22.9 ± 15.1 hours in lateral approach group, as shown in Table 1.

After general examination and neurovascular examination, closed reduction and immobilization was attempted for all type III supracondylar humeral fractures. The presence of excessive edema and inadequate reduction led to open reduction and cross k-wire fixation. All operations and evaluated complications were performed by one surgeon.

The type of approach used for surgical treatment of supracondylar humeral fracture was not randomized. Both groups repeated neurovascular examination 1 day after surgery and were followed up at 2 weeks for total stitches off and posterior splint exchange. Four weeks after surgery, both groups had k-wires removed and posterior splint. Then, they were all sent to the physical therapist for advice on how to improve the range motion of the elbow and followed a home care program. For 2, 4, and 6 months after surgery, both groups were followed up to identify radiologic and clinical outcome such as Baumann's angle, the degree of motion loss, the degree of carrying angle loss in comparison to the other elbow and graded overall scores by Flynn's criteria, which were evaluated by the same surgeon. The complications of treatment such as neurovascular injury, pin tract infection, deep infection, myositis ossificans, compartment syndrome, Volkmann's ischemic contracture, and cubitus varus were also recorded. The data was analyzed by SPSS software program for windows with Chi-square and Fisher's Exact test in nominal data and independent t-test in continuous data.

## Results

The mean of operative time in the posterior approach group was 20.46 ± 4.39 minutes, which was highly statistically significant ($p < 0.001$), compared with 24.97 ± 5.95 minutes in the lateral approach group. After 6 months of follow up, there was no significant difference of Baumann's angle between the two groups and when compared with the other elbow. The posterior approach had motion loss and carrying angle loss mean of 6.25 ± 4.56º and 4.98 ± 3.8º respectively. The lateral approach had motion loss and carrying angle loss mean 7.10 ± 3.95º and 6.10 ± 3.42º respectively too, and no significant difference (Table 2).

The results of motion loss showed that there were 61.5% of excellent, 19.2% of good in the posterior approach group and 56.7% and 23.3% in the lateral approach group. There was no statistical significance (p = 0.97), as shown in Table 3.

Table 4 shows the results of carrying angle loss in the posterior and lateral approach groups. There was 65.4% of Excellent, 19.2% of Good, 13.5% of Fair,

**Table 1.** Demographic characteristics data of posterior and lateral approaches

| Characteristic | Posterior approach | Lateral approach | p-value |
|---|---|---|---|
| Mean age ± SD | 7.2 ± 3.2 | 6.04 ± 1.5 | 0.07 |
| Male : female | 34:18 | 18 : 12 | 0.63 |
| Right arm : left arm | 18:34 | 13 : 17 | 0.43 |
| Type of displacement: extension | 52 | 30 | |
| Mean duration before surgery ± SD (hours) | 20.1 ± 10.8 | 22.9 ± 15.1 | 0.33 |
| Mean duration of follow up ± SD (months) | 7.6 ± 2.2 | 7.0 ± 1.2 | 0.16 |

**Table 2.** Results of surgical treatment

| Characteristics | Posterior approach Mean (SD) | Lateral approach Mean (SD) | p-value |
|---|---|---|---|
| Operative time | 20.46 (4.39) | 24.97 (5.95) | <0.001 |
| Baumann's angle of injured elbow | 80.00 (5.19) | 81.47 (6.12) | 0.25 |
| Baumann's angle of normal elbow | 77.25 (2.22) | 77.63 (2.19) | 0.45 |
| Motion loss | 6.25 (4.56) | 7.10 (3.95) | 0.40 |
| Carrying angle loss | 4.98 (3.80) | 6.10 (6.42) | 0.19 |

and 1.9% of Poor in the posterior approach group and 60% of Excellent, 20% of Good, 16.7% of Fair, and 3.3% of Poor in the lateral approach with no significant difference (p = 0.94).

The assessment overall score of motion loss and carrying loss based on Flynn's criteria, there were 61.5% of Excellent, 19.2% of Good, 15.4% of Fair, and 3.8% of Poor in the posterior approach group, and 56.7% of Excellent, 23.3% of Good, 16.7% of Fair, and 3.3% of Poor in the lateral approach, as shown in Table 5. There was no statistical significance (p = 0.97).

No serious complications had been reported in both groups of intervention. However, unavoidable complications were encountered in both groups. Early complications were 5.77% of pin tract infection, 1.92% of ulnar nerve injury in posterior approach, lateral approach had 16.67% of pin tract infection, 6.67% of ulnar nerve injury and 3.3% of radial nerve injury. There was no statistical significance. Everyone who had pin tract infection was eventually healed after dressing and oral antibiotics and completed recovery. Postoperative late complication was 11.54% of cubitus varus in the posterior approach group and 13.33% in the lateral approach group with no statistical significance (p-value = 0.53), as shown in Table 6.

**Table 3.** Loss of motion in posterior and lateral approach groups

| Result of motion loss | Posterior approach (n = 52) | Lateral approach (n = 30) | p-value |
|---|---|---|---|
| Excellent (0º-5º) | 32 (61.5) | 17 (56.7) | 0.97 |
| Good (6º-10º) | 10 (19.2) | 7 (23.3) | |
| Fair (11º-15º) | 8 (15.4) | 5 (16.7) | |
| Poor (> 15º) | 2 (3.8) | 1 (3.3) | |

**Table 4.** Loss of carrying angle in posterior and lateral approach groups

| Result of carrying angle loss | Posterior approach (n = 52) | Lateral approach (n = 30) | p-value |
|---|---|---|---|
| Excellent (0º-5º) | 34 (65.4) | 18 (60.0) | 0.94 |
| Good (6º-10º) | 10 (19.2) | 6 (20.0) | |
| Fair (11º-15º) | 7 (13.5) | 5 (16.7) | |
| Poor (> 15º) | 1 (1.9) | 1 (3.3) | |

**Table 5.** Assessment based on Flynn's criteria

| Result | Posterior approach | Lateral approach | p-value |
|---|---|---|---|
| Excellent | 32 (61.5) | 17 (56.7) | 0.97 |
| Good | 10 (19.2) | 7 (23.3) | |
| Fair | 8 (15.4) | 5 (16.7) | |
| Poor | 2 (3.8) | 1 (3.3) | |

**Table 6.** Distribution of postoperative complications

| Complications | Posterior approach (n = 52) | Lateral approach (n = 30) | p-value |
|---|---|---|---|
| Early complication | | | |
| Pin tract infection | 3 (5.77) | 5 (16.67) | 0.11 |
| Ulnar nerve injury | 1 (1.92) | 2 (6.67) | 0.30 |
| Radial nerve injury | 0 | 1 (3.30) | 0.37 |
| Late complication | | | |
| Cubitus varus | 6 (11.54) | 4 (13.33) | 0.53 |

## Discussion

Supracondylar humeral fractures account for 70% of the elbow fractures in children and 97% of these fractures are extension type[11]. Many authors consider closed reduction and percutaneous pinning is the treatment of choice[12]. In approximately 25% of the cases, closed reduction fails because of muscle interposition with a varus malposition[13]. Open reduction is indicated if closed reduction fails and in cases with vascular or neurological damage[14]. A lateral, medial, even an anterior approach[15] to the fracture can be used. However, these approaches afford only a partial view of the fracture. As a result, a lateral incision is often combined with a medial incision to improve the view of fracture, and vice versa[10]. The posterior approach through the triceps muscle has been used with an excellent result[7-10].

By comparing the different surgical approaches, the result of the present study shows the posterior approach has several advantages[16], although not statistically significant over the lateral approach. It is short, direct, safe, simple and easy to perform. Because of the posterior approach, both medial and lateral fracture surface are visualized, a perfect reduction can be obtained. Furthermore, this approach gives the surgeon a good view and sense of positioning during placement of the k-wires. Likewise, there is no risk of neurovascular injury and joint

contractures. The most satisfactory results were Excellent and Good (61.5% and 19.2%) in the posterior approach the same as the lateral approach (56.7% and 23.3%), and no statistical significance in terms of complications.

In conclusion, the preliminary results show that the posterior approach was the one of the useful and alternative helpful approaches in the management of type III supracondylar humeral fracture among the children with shorter operative time. No significant differences were found when compared to the lateral approach in terms of functional results and complications.

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## *การศึกษาเปรียบเทียบผลการผ่าตัดกระดูกต้นแขนบริเวณเหนือข้อศอกในเด็กระหว่างการผ่าตัดเข้าทางด้านหลัง และผ่าตัดเข้าทางด้านข้างนอกของข้อศอก*

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***วัตถุประสงค์**: เพื่อเปรียบเทียบผลการรักษา ด้วยวิธีผ่าตัดกระดูกต้นแขนบริเวณเหนือข้อศอกในเด็ก ระหว่างการผ่าตัดเข้าทางด้านหลัง และผ่าตัดเข้าทางด้านข้างนอกของข้อศอก*

***การออกแบบการศึกษา**: เป็นการศึกษาเชิงวิเคราะห์เปรียบเทียบแบบย้อนหลัง*

***วัสดุและวิธีการ**: ศึกษาที่โรงพยาบาลชัยภูมิปี พ.ศ. 2547 ถึง พ.ศ. 2550 ในกลุ่มผู้ป่วยกระดูกต้นแขนหักในเด็กที่รักษาโดยการผ่าตัดเข้าทางด้านหลัง 52 ราย และผ่าตัดเข้าทางด้านนอก ข้างข้อศอก 30 ราย ติดตามผลการรักษาและภาวะแทรกซ้อน ต่อเนื่อง 6 เดือน*

***ผลการศึกษา**: ผู้ป่วยกลุ่มที่ได้รับการผ่าตัดทางด้านหลังใช้ระยะเวลาการผ่าตัดสั้นกว่ากลุ่มที่ผ่าตัดเข้าทางด้านข้างนอกของข้อศอกอย่างมีนัยสำคัญทางสถิติ ($p < 0.001$) ผลการผ่าตัดที่ประเมินด้วย Flynn's criteria พบว่าได้ผลดีถึงดีมากร้อยละ 80.7 ในกลุ่มที่ผ่าตัดเข้าทางด้านหลัง และในกลุ่มที่ผ่าตัดเข้าทางด้านข้างนอกของข้อศอกได้ผลดีถึงดีมากร้อยละ 80 ส่วนภาวะแทรกซ้อนของทั้งสองกลุ่มไม่มีความแตกต่างกันทางสถิติ*

***สรุป**: ผลการรักษากระดูกต้นแขนหัก บริเวณเหนือข้อศอกในเด็กด้วยวิธีการผ่าตัดเข้าทางด้านหลังใช้เวลาผ่าตัดสั้นกว่าวิธีการผ่าตัดเข้าทางด้านข้างนอกของข้อศอก แต่ผลการผ่าตัดและภาวะแทรกซ้อนไม่แตกต่างกันทางสถิติ*