Prone versus supine position during surgery for supracondylar humeral fractures

Olcay Guler,[1] Serhat Mutlu,[2] Mehmet Isyar,[1] Harun Mutlu,[3] Halis Cerci,[4] Mahir Mahirogulları[1]

[1] Department of Orthopedics and Traumatology, Medipol University, Medical Faculty, Istanbul, Turkey
[2] Orthopedics and Traumatology Department, Kanuni Sultan Suleyman Training Hospital, Istanbul, Turkey
[3] Orthopedics and Traumatology Department, Gaziosmanpaşa Taksim Training Hospital, Istanbul, Turkey
[4] Department of Orthopedics and Traumatology, Nisa Hospital, Istanbul, Turkey

ABSTRACT

Purpose. To compare the supine versus prone position in closed reduction and percutaneous pinning for supracondylar humeral fractures in children in terms of patient characteristics and outcome.

Methods. Records of 25 girls and 31 boys aged 4 to 9 (mean, 6.7) years who underwent closed reduction and percutaneous pinning in the prone (n=27) or supine (n=29) position each by one experienced surgeon for supracondylar extension type-3 humeral fractures were reviewed.

Results. The prone and supine groups were comparable in terms of patient characteristics and outcome, except that anaesthesia duration was shorter in surgery performed in the supine position (46.7 vs. 37.2 minutes, p<0.001).

Conclusion. In surgery for supracondylar humeral fractures in children, patient position affected only the duration of anaesthesia.

INTRODUCTION

Supracondylar humeral fracture in children is best treated with closed reduction and percutaneous pinning with Kirschner wires. Attention should be paid to the ulnar nerve during insertion of the medial pins to avoid iatrogenic injury.[1,2] Surgery is usually performed with the patient in the supine position.[3,4] Nonetheless, the prone position facilitates fracture reduction and safe placement of pins without hyperflexing the elbow.[1,2] Gravity can help maintain the reduction without hyperflexing the elbow or the need for an assistant. Limb perfusion improves and the risk of ulnar nerve injury decreases unless the elbow is hyperflexed. Nonetheless, the prone position is associated with difficulties in airway management by the anaesthetist and treatment of co-existing injuries.[1,2,5] This study compared the

Address correspondence and reprint requests to: Olcay Guler, Orthopedics and Traumatology Department, Medipol University, Medical Faculty, Atatürk Bulvarı No: 27 Unkapanı, 34083, Fatih, Istanbul, Turkey. Email: olcayguler77@gmail.com

supine versus prone position in closed reduction and percutaneous pinning for supracondylar humeral fractures in children in terms of patient characteristics and outcome.

MATERIALS AND METHODS

This study was approved by the local institutional review board. Records of 25 girls and 31 boys aged 4 to 9 (mean, 6.7) years who underwent closed reduction and percutaneous pinning in the prone (n=27) or supine (n=29) position each by one experienced surgeon for supracondylar extension type-3 humeral fractures between 2012 and 2014 in our hospital were reviewed. Patients with open or flexion-type or type-2 extension fractures or with concomitant neurovascular injury were excluded.

Fractures were classified based on the Gartland-Wilkins classification.[6,7] Outcome was evaluated based on the Flynn criteria. The Baumann and lateral humerocapitaller angles were measured on radiographs.[8]

For surgery in the prone position, the shoulder was abducted 90º. The hyperflexed proximal humerus was supported by folded towels; the elbow was flexed at 90°; and the distal humerus hung freely. The fluoroscopy arm was turned to control the reduction in the anteroposterior and lateral views to avoid disrupting the reduction by rotational force. If the reduction failed, traction was applied at 60° of flexion, and pressure was applied from the posterior to the anterior axis. After reduction, fixation was achieved using 2 Kirschner wires in parallel or crossing lines bicortically, with the elbow placed in maximal flexion.

For surgery in the supine position, traction was applied on the upper and proximal humerus by an assistant, and opposite traction was applied on the forearm by the surgeon. A varus-valgus correction was achieved on the frontal plane. The distal fragment was reduced with pressure applied from posterior to anterior. After reduction, fixation was achieved using 2 Kirschner wires in parallel or crossing lines bicortically, with the elbow hyperflexed and the forearm pronated.

Postoperatively, a 90º long-arm cast was applied. Patients were followed up weekly and then at 2, 6, and 12 months and annually thereafter. Elbow movement was allowed after removing the cast and Kirschner wires at 4 weeks.

The 2 groups were compared using the Chi-squared test for qualitative variables, Student's *t* test for normally distributed variables, or Mann-Whitney *U* test for non-normally distributed variables. A p value of <0.05 was considered statistically significant.

RESULTS

The prone and supine groups were comparable in terms of patient age, sex distribution, fracture type, side involved, operating time, number of times

Table
Patient characteristics and outcome*

Variable	Prone position (n=27)	Supine position (n=29)	p Value
Age (years)	6.9±1.5	6.6±1.4	0.44
Male:female	15:12	16:13	0.98
Right:left side involved	14:13	13:16	0.56
Gartland-Wilkins classification			0.55
3A	16 (59.3)	15 (51.7)	
3B	5 (18.5)	9 (31)	
3C	6 (22.2)	5 (17.3)	
Anaesthesia duration (minutes)	46.7±7.6	37.2±5.9	<0.001
Operating time (minutes)	26.6±4.7	27.0±4.4	0.72
No. of times fluoroscopy used	40.2±8.5	39.1±6.4	0.64
No. of reduction attempts	3.1±1.4	3.7±1.2	0.09
No. of pinning attempts	4.1±0.9	4.2±1.2	0.69
Hospitalisation (days)	3.4±1.1	3.3±1.3	0.62
Follow-up (months)	22.8±9.9	23.3±8.2	0.60
Outcome based on Flynn criteria (very good:good)	23:4	24:5	1.00
Time from trauma to surgery (days)	2.2±1.1	2.4±1.2	0.75
Baumann angle	73.1°±3.5°	73.5°±4.0°	0.66
Lateral radiocapitaller angle	41.7°±4.2°	41.8°±4.6°	0.94

* Data are presented as mean±SD, no., or no. (%) of patients

fluoroscopy used, time from fracture to surgery, number of reduction attempts, number of pinning attempts, hospitalisation, follow-up, outcome based on Flynn criteria, the Baumann angle, and the lateral radiocapitaller angle (Table). Duration of anaesthesia was shorter when surgery was performed in the supine position (46.7±7.6 vs. 37.2±5.9 minutes, p<0.001, Table).

DISCUSSION

When the patient is in the supine position, it is difficult to maintain the reduction while inserting the Kirschner wires and to place the C-arm to obtain an anteroposterior view, and extreme external rotation of the arm may result in loss of reduction.[5] The prone position is associated with difficulties in airway control by the anaesthetist and treatment of concurrent injuries.[1]

Iatrogenic ulnar nerve injury during treatment for supracondylar humeral fracture has been reported.[3,4] In children, the ulnar nerve is hypermobile and may be readily dislocated if the elbow is hyperflexed.[4] The risk of ulnar nerve injury during percutaneous pinning is 0 to 8%.[3] Elbow flexion >90° can result in increased pressure on the deep volar compartment of the forearm and ischaemia of the fracture site.[3,4] In the prone position, the elbow does not need to flex >90°, which prevents possible neurovascular complications.[1] In our study, both the prone and supine position enabled safe exposure and treatment because surgeon experience is a more important factor for complications.

Surgery should be performed as soon as possible after the trauma to reduce the risk of complications.[9,10] Surgery within 8 hours of injury reduces the risk of neurovascular complications.[11] In our study, all patients had very good or good outcome despite the time from trauma to surgery being 2 to 3 days.

One limitation of this study was its retrospective nature and small sample size.

CONCLUSION

In surgery for supracondylar humeral fractures in children, patient position affected only the duration of anaesthesia.

DISCLOSURE

No conflicts of interest were declared by the authors.

REFERENCES

1. Fowler TP, Marsh JL. Reduction and pinning of pediatric supracondylar humerus fractures in the prone position. J Orthop Trauma 2006;20:277–81.
2. Pescatori E, Memeo A, Brivio A, Trapletti A, Camurri S, Pedretti L, et al. Supracondylar humerus fractures in children: comparison of experiences. J Pediatr Orthop B 2012;21:505–13.
3. Skaggs DL, Hale JM, Bassett J, Kaminsky C, Kay RM, Tolo VT. Operative treatment of supracondylar fractures of the humerus in children. The consequences of pin placement. J Bone Joint Surg Am 2001;83:735–40.
4. Lyons JP, Ashley E, Hoffer MM. Ulnar nerve palsies after percutaneous cross-pinning of supracondylar fractures in children's elbows. J Pediatr Orthop 1998;18:43–5.
5. Havlas V, Trc T, Gaheer R, Schejbalova A. Manipulation of pediatric supracondylar fractures of humerus in prone position under general anesthesia. J Pediatr Orthop 2008;28:660–4.
6. Gartland JJ. Management of supracondylar fractures of the humerus in children. Surg Gynecol Obstet 1959;109:145–54.
7. Wilkins KE. Supracondylar fractures: what's new? J Pediatr Orthop B 1997;6:110–6.
8. Flynn JC, Matthews JG, Benoit RL. Blind pinning of displaced supracondylar fractures of the humerus in children. Sixteen years' experience with long-term follow-up. J Bone Joint Surg Am 1974;56:263–72.
9. Carmichael KD, Joyner K. Quality of reduction versus timing of surgical intervention for pediatric supracondylar humerus fractures. Orthopedics 2006;29:628–32.
10. Sibinski M, Sharma H, Bennet GC. Early versus delayed treatment of extension type-3 supracondylar fractures of the humerus in children. J Bone Joint Surg Br 2006;88:380–1.
11. Walmsley PJ, Kelly MB, Robb JE, Annan IH, Porter DE. Delay increases the need for open reduction of type-III supracondylar fractures of the humerus. J Bone Joint Surg Br 2006;88:528–30.