CHAPTER IV

RESULTS OF THE STUDY

There were 20 patients in this study, 10 patients in group A and 10 patients in group B, no drop out, no infection and 100% union. The average follow up time was 12 weeks.

All variables in age, sex, side, displacement, Baumann's angle, satisfaction and range of motion were shown in Table 4.1.

The mean age were around 6 years old. The male sex, the left side, the posteromedial displacement were predominant in this study.

The comparison of this characteristic of the patients, both groups had no statistical significant difference in all variables (Table 4.2).

Nerve injury in group A was radial nerve preoperatively in only one patient. In group B there were two patients who had anterior interosseous nerve injury preoperatively. All cases resolved completely.

The table 4.3 shows the result of 7 outcome variables compared between group A and B. The range of motion, the union rate and infection rate were all the same. Every case healed without infection and with good range of motion.

The ulnar nerve injury in group A (closed reduction and pinning) happened in first 2 cases and resolved completely within 1 month in first case, 2

2 months in second case. There was no statistical difference between group (P = 0.473).

Both groups had 100% good results without any deformity because the Baumann's angle difference compared between injured and uninjured was very small (Mean = 2.53^0 in gr A, 2.09° in gr B) without statistical difference (P = 0.44).

The satisfaction score in both groups were high because of no deformity occurred after treatment. In group B the scores were a little bit lower because some parents disliked the scare of the wound from open reduction and wanted it to be corrected in 1 case. Both group had no statistical difference in score (P > 0.05).

The range of motion in flexion and extension had no statistical significant difference between groups(P = 0.35) .Both group had good range of motion.

There were statistical significant differences in total cost of provider's perspective and the parents' perspective because in group B two operations were performed with two hospitalizations(Mean = 4,466.125in gr.A,5,876.04 in gr.B,P = 0.029 for provider's perspective and mean =5,640 in gr. A,9,065 in gr.B,P<0.001 for parents' perspective)

Two cases in group A (20%) were changed to be treated by an open reduction because of failure of closed reduction, the results of this.Two cases were good and comparable with the whole group A and group B (table 4.4)

Table 4.1 General outcome variables of the patients

Cases no.	Group	Sex	Age (year)	Side	Displacement	Baumann angle (°)		satisfaction score		Range of motion (°)			
						normal	fracture	blind eval	parent	normal side		fracture side	
										flex	extend	flex	extend
1.	A	F	10	L	PM	59.5	58.5	10	10	136	8	132	6
2.	A	F	11	L	PM	70.5	66.7	9	9	130	10	128	10
3.	A	M	4	R	PM	78.0	79.0	9.5	9	132	5	130	2
4.	A	M	9	L	PM	66.2	63.2	10	9	140	10	136	5
5.	A	F	1	L	PM	83.0	85.0	9	9	128	6	125	5
6.	A	F	8	R	PM	69.0	75.5	10	9	135	8	138	5
7.	A	M	9	L	PL	70.5	68.0	9	9	132	4	130	5
8.	A	M	6	R	PM	71.5	69.0	9	8	140	0	138	0
9.	A	F	6	L	PM	79.0	76.0	10	10	130	5	130	5
10.	A	M	7	L	PL	70.0	70.0	10	10	138	8	134	6
11.	B	F	2	L	PM	84.0	83.5	10	9	130	2	130	0
12.	B	M	7	L	PM	67.3	67.0	9	7.5	135	0	130	0
13.	B	M	3	L	PM	68.5	68.5	10	10	126	5	124	2
14.	B	M	6	R	PL	62.5	65.3	9	8	135	0	130	0
15.	B	M	12	L	PM	69.5	67.7	8.5	7	140	5	135	5
16.	B	M	6	L	PM	64.7	62.7	10	10	130	8	130	5
17.	B	M	6	L	PM	64.5	70.0	9	9	134	0	130	0
18.	B	F	5	R	PL	80.0	78.0	9	9	132	4	130	4
19.	B	M	7	L	PM	58.0	56.0	9	8	134	6	130	4
20.	B	M	9	L	PM	68.0	64.0	9	8	130	0	126	0

Note

1. Groups A = closed reduction and pinning groups B = open reduction and pinning.
2. F = Female, M = Male, L = left, R = right, PM = posteromedial, PL = posterolateral.
3. Flex = flexion of the elbow from zero position, Extend = extension of the elbow from zero position.

Table 4.2 Comparison of characteristic of patients between group A and B

Variables	group A (n = 10)	group B (n = 10)	P-value	95% CI for difference in A, B
Age (years)	6.9 ± 3.1	6.3 ± 2.8	0.66	-2.2, 3.4
Sex (male/female) (%)	50%/50%	80%/20%	0.35	-0.69,0.09
Side (Right/Left) (%)	30%/70%	20%/80%	1.0	-0.28,0.48
Displacement (%) Posteromedial/Posterolateral	80%/20%	70%/30%	1.0	-0.28,0.48
Nerve injury preop (%)	10%	20%	1.0	-0.41, 0.21

Table 4.3 Comparison of the outcome variables between group A and B

No	Variable	gr A	Gr B	P - value	95% CI for difference
1	Baumann' angle difference (mean ± S.D.)	2.53 ± 1.8	2.09 ± 1.7	0.44	-1.2, 2.08
2	Satisfaction (mean ± S.D.)				
	Parents	9.2 ± 0.6	8.5 ± 1	0.10	-0.143, 1.4
	Blind	9.5 ± 0.5	9.2 ± 0.5	0.2	-0.18, 0.78
3	Total Cost (mean ± S.D.)				
	Provider	4,466.125± 1,011.2	5,876.04 ± 1,579.6	0.029	-2,656.02,-163.8
	Parents	5,640 ± 478.88	9,065 ± 1,865.05	<0.001	-4,706.8, -2,143.1
4	Range of motion (Flextion/ Extension) (mean ± S.D.)	2.6±1.2/ 1.7±1.6	3.1±1.96/ 1±1.3	0.35/ 0.35	-
5	The union rate (Percentage)	100%	100%	1.0	0,0
6	The infection rate (Percentage)	0%	0%	1.0	0,0
7	The nerve injury after operation (ulnar nerve) (Percentage)	20%	0%	0.473	-.05, 0.45

Table 4.4 Characteristic of failed closed reduction

characteristic of failed closed reduction	
number of cases	**2 cases (20% of group A)**
Age (mean)	4.5 years
Sex	male both cases
Side	right both cases
displacement	posteromedial both cases
nerve injury pre-op	radial nerve injury in one case
nerve injury post-op	none
Baumann angle Difference (mean)	1.75
Satisfaction score (mean)	
Blind evaluator	9.25
Parents	8.5
Total Cost (baht) mean/case	
Provider	6,377.45
Parents	5,680

Total Cost Calculation

Total cost calculation divided in

1. Provider's perspective

2. Parent's perspective

From Table 4.5 it showed the data collected from the operating time, the day of admission, the numbers of day follow up and loss of work then the total cost calculation was calculated using the formula in table 4.6, 4.7.

The calculation included direct and indirect cost which had only tangible cost. The cost was calculated in state of management.

1. Before operation : CBC = 40 baht, Chest radiograph (CXR) and two X-ray elbow radiograph, plinting = 200 baht.

2. In operating room : the Fluroscopy was calculated only in group A (detials in page 41), the operating room was calculated in 8 hr. working/day in 20 days working/month, the renting rate = 800 baht/sq.m/month, 40 sq.m./ room, the surgeon salary = 20,000/month the average surgeon salary = 125 baht/hr. the nurse salary = 16,000/month, the average nurse salary = 100 baht/hr. etc.

3. In operating room for second operation to remove the pin only in open reduction cases.

4. Hospitalization.

5. Loss of work and transportation only in parents' perspective.

Table 4.5 Total cost calculation

Case no.	First operation				Second operation				Total cost provider (baht)	Total cost parents (baht)
	op.time (min)	day Admission	day loss	day Fu	op.time (min)	day Admission	day loss	day Fu		
1	70	1	5	5	-	-	-	-	4,103.1	5,280
2	60	1	6	6	-	-	-	-	4,019.6	5,680
3	120	1	3	3	24	1	4	4	6,398.3	6,080
4	40	1	8	8	-	-	-	-	3,852.6	6,480
5	60	1	4	4	-	-	-	-	4,019.6	4,880
6	70	1	5	5	-	-	-	-	4,103.1	5,280
7	60	1	6	6	-	-	-	-	4,019.6	5,680
8	110	1	2	2	30	1	3	3	6,356.6	5,280
9	40	1	7	7	-	-	-	-	3,852.6	6,080
10	50	1	6	6	-	-	-	-	3,936.1	5,680
11	68	1	3	3	16	1	4	4	5,268.0	8,480
12	65	1	3	3	19	1	3	3	5,268	8,080
13	70	1	3	3	30	1	4	4	5,361.5	8,480
14	78	1	3	3	20	1	4	4	5,351.5	8,480
15	82	1	10	10	18	1	6	6	10,361.5	14,330
16	70	1	3	3	15	1	4	4	5,242.95	8,480
17	80	1	3	3	28	1	3	3	5,435.0	8,080
18	85	1	3	3	23	1	4	4	5,435.0	8,480
19	83	1	3	3	25	1	5	5	5,435.0	8,880
20	84	1	3	3	34	1	5	5	5,602	8,880

Note 1. Case no 1-10 = closed reduction group, Case 3 and 8 = failed closed, proceed to open reduction

2. Case no 11-20 = open reduction group

Table 4.6 Calculation in Total Cost Provider's perspective (baht)

	cost gr A (baht)	cost gr B (baht)
1. Before operation		
CBC, CXR, X-ray elbow splint	540	540
First operation		
2. In operating room		
Fluroscopy	658.6	-
Operating room	200/hr	200/hr
Instrument, solution	200	200
Surgeon	125/hr	125/hr
Nurse	100/hr	100/hr
Nurse aid	76/hr	76/hr
Kirschner Wire	450	450
Vicryl Rapide	70	70
Casting	200	200
Anaesthesiologist and machine	700	700
3. Hospitalization		
Room (bed, food)	300/day	300/day
Drug	200	200
Nurse and Nurse aid	200/day	200/day

Table 4.6 Calculation in Total Cost Provider's perspective (continued)

	cost gr A (baht)	cost gr B (baht)
Second operation		
4. In operating room		
Operating room	-	200/hr
Instrument,Solution	-	200
Surgeon	-	125/hr
Nurse	-	100/hr
Nurse aid	-	76/hr
Vicryl Rapide	-	70
Anaesthesiologist and machine	-	700
5. Hospitalization		
Room (bed, food)	-	300/day
Drug	-	200
Nurse and nurse aid	-	200/day

Table 4.7 Calculation in Total Cost Parent's perspective

	Cost gr A (baht)	Cost gr B (baht)
1. Before operation	380	380
First operation		
2. Operation cost	2,700	2,700
3. Hospitalization	250/day	250/day
4. Drug	200	200
5. Loss of Work	200/day	200/day
6. Transportation, food etc.	200/day	200/day
Second operation		
7. Operating cost	-	1,700
8. Hospitalization	-	250/day
9. Drug	-	200
10. Loss of Work	-	200/day
11. Transportation, Food etc.	-	200/day

1. Providers's Perspective

1.1 Closed reduction (hr. = 1 hour of operation time),(Baht)

Total Cost = 540 + 658.6 + 200/hr.+200
+125/hr. + 100/hr. + 76/hr. + 450
+200/day
= 2,958.6 + 501/hr. + 500/day admission

Example

If 1 hour operation, 1 day admission

Total Cost = 4,019.6 baht

1.2 Open reduction ,(Baht)

Total Cost = total cost fisrt operation
+ total cost second operation

Total Cost fisrt op. = 540 + 200/hr. + 200 + 125/hr.
+ 100/hr. + 76/hr. + 450+70
+ 200 + 700 + 300/day + 200
= 2,306 + 501/hr. + 500/day admission

Total Cost second op. = 200/hr. + 200 + 125/hr. + 100hr.

+76hr. + 70+700+300/day

+200 + 200/day

= 1,170 +501/hr. + 500/day admission

1.3. Failed closed reduction total cost

Total cost of open reduction + 1 usage of fluoroscopy cost (658.6 baht)

2. Parents' Perspective

2.1 Closed reduction group

Total Cost = 380 + 2,700 + 250/day admission + 200

+ 200/day loss of work + 200 day follow up

= 3,280 + 250/day admission + 200/day loss

+ 200/day follow up

Siriraj hospital does not count the cost of the fluoroscopy for the patients.

2.2 <u>open reduction group</u>

Total Cost	=	total cost first op.
		+ total cost second op.
Total Cost first op.	=	380+2,700+250/day admission
		+200+200/day loss of work
		+200/day follow up
	=	3,280+250/day admission
		+200/day loss of work
		+200/day follow up
Total Cost second op.	=	1,700+250/say admission
		+200+200/day loss of work
		+200/day follow up
	=	1,900+250/day admission
		+200/day loss of work
		+200/day follow up

Cost Minimization Analysis

Considering that the effect is equal because the mean Baumann's angle difference of both group which are the primary outcome had no statistical and clinical significance ($P > 0.05$). Both group had good results. We can use cost minization analysis to compare the results of treatment between closed and open reduction

Table 4.8 Total Cost Difference (Baht)

Total Cost (baht)	gr A	gr B	Difference
Provider's perspective	4,466.125	5,876.045	1,409.92
Parents's perspective	5,640	9065	3425

From Table 4.8 the total cost in group B was higher than group A in both Provider's perspective (1,409.92 Baht) and Parents' perspective (3,425 Baht).

Sensitivity Analysis in Fluoroscopy

The cost of fluoroscopy was calculated by using the equivalent annual cost (E) for 10 years period of usage by this formula.

$K = E + E/(1+r) + E/(1+r)^2 + \ldots + E(1+r)^n$

= (1+annuity factor, n period, interest I)

K = The cost of machines = 4,000,000 baht

I = Interest rate = 5%

n = number of year used = 10 years

Annuity factor = 7.7217 (from the table if n = 10, I =5)

E = K/(1+ annuity factor) = 4,000,000/(17.7217) = 458,626.1853 baht

The equivalent annual cost per year for fluoroscopy = 458,626.2 baht

The maintenance cost and variable cost per year = 200,000 baht

(Philip Company maintenance cost)

Total cost per year for fluoroscopy = 658,626.2 baht

The usage per year = 1,000 times

Total cost for 1 time usage = 658,626.2/1,000 = 658.6 baht/time

1. **Change in usage time/year**

If the time of usage	≤ 318.4 time/year
The total cost of gr A	≥ gr B, (Provider's perspective)

2. Change in interest rate

The interest rate can be varies around 5% -10% depends on many factor such as inflation rate, GDP, bond and policy. If the interest rate increase the cost of fluoroscopy will be increase too from the formula above.

if	I	= 5%	one usage cost	= 658.6 baht
	I	= 10%	one usage cost	= 759.86 baht
	I	= 20%	one usage cost	= 970.34 baht
	I	= 32%	one usage cost	= 1,568.52

The total cost of gr A = gr B (provider's perspective) if I = 32% that is too high for normal interest rate.