The Incidence of Common Orthopaedic Problems in Newborn at Siriraj Hospital

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Background: *The congenital orthopaedic anomalies in Thai population had a limited data and the previously studies are based on only hospital chart records.*
Objective: *To determine the incidence of common congenital orthopedic problems by physical examination in newborn at Siriraj Hospital.*
Material and Method: *A prospective study was conducted by physical examination of 3,396 newborns from June 2009 to September 2009. All orthopaedic abnormalities of newborns were recorded along with maternal age, obstetric history of mother, complications during pregnancy, complications in labour stage, mode of delivery and presentation. Sex of newborn, birth weight, body length and APGAR score were recorded.*
Results: *Incidence of calcaneovalgus was found in 60: 1,000 live births following by metatarsus adductus in 7.6: 1,000, polydactyly or syndactyly in 2.6: 1,000, talipes equninovarus in 2.4: 1,000, brachial plexus injury in 1.5: 1,000, developmental dysplasia of hip in 0.6:1,000, osteogenesis imperfecta in 0.6:1,000, skeketal dysplasia in 0.6:1,000, congenital vertical talus in 0.3: 1,000 and fracture clavicle at birth in 0.3: 1,000.*
Conclusion: *In the present study, the calcaneovalgus was the most common orthopaedic problem followed by metatasus adductus, polydactyly or syndactyly.*

Keywords: *Congenital orthopaedic anomalies, Calcaneovalgus, Metatarsus adductus, Polysyndactyly, Clubfoot, Brachial plexopathy, Developmental dysplasia of the hip, Osteogenesis imperfecta, Skeketal dysplasia, Congenital vertical talus, Fracture clavicle at birth*

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Orthopaedic problems constitute a significant proportion of congenital anomalies. Awareness of this problem can produce an early detection and good prognosis for any patients. However, few studies are available on the incidence of congenital orthopaedic anomalies in Thai population[1-3].

As nearly all the previously reported studies are based on hospital records or patients' data. These series probably do not represent the true incidence of congenital orthopaedic anomalies in detail. Many authors reported that the common orthopaedic problem in newborn are clubfoot, developmental dysplasia of the hip and polysyndactyly that have incidence about 1:1,000 live births and easily be found in physical examination of newborn[1-6].

The purpose of the present study was to determine the incidence of congenital orthopaedic anomalies in Thai population with the use of a universal screening program in newborn at Siriraj Hospital, which is the largest tertiary care center in Thailand and take cares of newborn about 9,000-10,000 live birth per year.

Material and Method

The authors conducted the prospective descriptive study. Sample size was calculated from confidence interval for probability of observing a rare event at a one-sided significant level of 0.05, use of incidence of common orthopaedic problems are 0.001, then the estimated sample size was 2,995 (Table 1).

From June 2009 until September 2009, three thousand four hundred and three consecutive newborns in Siriraj Hospital were collected during a general orthopaedic screening. Seven newborns were excluded due to incomplete consent form of parents. Then 3,396

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infants, 1,768 were males, 1,628 were females all are Thai.

In addition to the general examination of the patients, a general orthopaedic screening was performed on each child. All abnormalities were recorded. Maternal age, obstetric history of mother, complications during pregnancy, complications in labour stage, mode of delivery and presentation were recorded. Sex of newborn, birth weight, body length and APGAR score were recorded.

Both feet of newborn were examined and assessed based on pathology of feet. The authors used Dimeglio's classification for the evaluation of club foot[7,8]. The deformity of feet were recorded such as calcaneovalgus, talipes equinovarus, metatarsus adductus.

Ortolani and Barlow test was performed in all newborn to evaluate the developmental dysplasia of the hips[9,10]. Deformities of fingers and toes were examined to find syndactyly or polydactyly abnormality. Movement of upper extremities were observed to evaluate brachial plexus status and other deformities were screen. Newborn having orthopaedic problems would be seen by the pediatric orthopaedic surgeons.

Results

Three thousand three hundred and ninety-six newborns were studied. Of these patients, one thousand seven hundred and sixty eight were male (52.1%) and 1,628 were female (47.9%). Mean birth weight was 2,989.67 (680-5,020 gm). Mean body length was 48.96 (31-57 cm). Concerning the mode of delivery, there were 1,903 (56%) normal labour, 1,452 (42.8%) caesarian section, 10 (0.3%) forceps extraction and 31 (0.9%) vacuum extraction.

Mean maternal age was 28.6 years (14-48). One thousand and five hundred were first pregnancy (44.2%), 1,139 were second gestation (33.5%), 757 were more than second gestation (22.3%) and mean gestational age was 38.12 weeks (24-43). Body weight was shown as Table 2. Sex, length, APGAR scores and cephalic presentations were shown as Table 3. Maternal data of newborn was shown as Table 4. Incidence of orthopaedic problems was shown as Table 5.

Two hundred and three newborns (6%), 98 boys (48%) and 105 girls (52%), had talipes calcaneovalgus (Table 6, 7).

The metatarsus adductus was found in 26 newborns (0.76%) (Table 8). One hundred and thirteen newborns (3%) had talipes equinovarus or clubfoot (Table 9). One hundred and five of them (18 (8.7%) involving right, 62 (24.8%) involving left and 125 (61%) involving bilateral sides) are postural clubfoot. Eight of 113 patients had idiopathic clubfoot. One of eight was syndromic clubfoot. In idiopathic clubfoot, 4 patients (50%) were boys and 4 patients (50%) were girls. Dimeglio classification was used for severity assessment and evaluation (Table 10).

Polydactyly was found in 6 patients (0.17%), involved hand in 4 pateints (0.11%) which were right hand in 1 patients (25%), left hand in 2 pateints (50%) and bilateral in 1 patients (25%), 2 pateints (50%) were preaxial type and 2 patients (50%) were postaxial type. Bilateral polydactyly involved in symmetrical postaxial type appearance.

Polydactyly was found at foot in 2 patients (0.06%), all patients involved left foot with postaxial type. One patient involving left hand postaxial type with polydactyly had foot involvement in the same side and same appearance. Five patients (83%) were boys and 1 patient involving foot was girls.

Syndactyly was found in 3 patients (0.09%). One patient involved right hand in first web space. Two patients was found at foot. One patient was syndactyly at 3rd and 4th toe of right foot and the other was syndactyly at 2nd and 3rd toe of left foot. Both of them involved in second web space. All patients were boys.

Brachial plexus injury was found in 5 patients (0.15%) by involving in right arm in 2 patients (40%) and involving in left arm in 3 patients (60%). Three patients involving left arm were upper arm type and 2 patients involving right arm were total arm type. One patient involving left upper arm type had vacuum

Table 1. confidence interval for probability of observing a rare event

Chance of observing ≥1 event, p	0.950
Actual probability of event	0.001
n	2,995

Table 2. Birth weight of newborn

Birth weight		Cases	%
≤ 1,000	Extremely LBW	8	0.24
1,001-1,500	Very LBW	37	1.09
1,501-2,500	LBW	414	12.19
2,501-4,000	Normal birth weight	2,884	84.92
> 4,000	High birth weight	53	1.56
	Total	3,396	100

Table 3. Data of newborn at Siriraj Hospital

	Case	%
Sex		
Male	1,768	52.1
Female	1,628	47.9
Total	3,396	100.0
Length		
<48cm	731	21.5
48-52cm	2,492	73.4
>52cm	173	5.1
Total	3,396	100
APGAR at 1 min		
1	15	0.4
2	6	0.2
3	15	0.4
4	31	0.9
5	45	1.3
6	57	1.7
7	111	3.3
8	615	18.1
9	1,664	49.0
10	837	24.6
Total	3,396	100.0
APGAR at 5 min		
1	5	0.1
2	3	0.1
3	3	0.1
4	4	0.1
5	5	0.1
6	6	0.2
7	19	0.6
8	41	1.2
9	179	5.3
10	3,131	92.2
Total	3,396	100.0
Delivery		
Normal labour	1,903	56.0
Cesarian section	1,452	42.8
Vacuum extraction	31	0.9
Forcep extraction	10	0.3
Total	3,396	100.0
Presentation		
Cephalic	3,289	96.84
Breech	85	2.51
Hand	1	0.03
Foot	1	0.03
Transverse	20	0.59
Total	3,396	100.0

Table 4. Maternal's data of newborn at Siriraj Hospital

	Case	%
Maternal age		
< 20	284	8.4
20-25	802	23.6
26-30	998	29.4
31-35	824	24.2
36-40	408	12.0
>40	80	2.4
Total	3,396	100
Gestation		
1	1,500	44.2
2	1,139	33.5
3	539	15.9
4	152	4.5
5	49	1.4
6	11	. 3
7	5	0.1
8	1	0.0
Total	3,396	100.0
Parity		
0	1,848	54.4
1	1,132	33.3
2	340	10.0
3	61	1.8
4	10	0.3
5	3	0.1
6	2	0.1
Total	3,396	100.0
Abortion		
0	2,663	78.4
1	603	17.8
2	107	3.2
3	16	0.5
4	4	0.1
5	3	0.1
Total	3,396	100.0
Gestational age		
< 28 weeks	6	0.2
28-31 weeks	42	1.2
32-35 weeks	220	6.5
36-40 weeks	2,956	87.0
> 40 weeks	172	5.1
Total	3,396	100.0
Perinatal complications		
None	2,218	65.3
Premature rupture of membrane	39	1.1
CPD	381	11.2
Fetal distress	113	3.3
Cord around neck	8	0.2
Oligohydramnios	23	0.7
Preterm labour	164	4.8
Shoulder dystocia	3	0.1
Previous cesarian	331	9.7
Other	116	3.4
Total	3,396	100.0

extraction delivery. All patients were cephalic presentation. Shoulder dystocia during 2nd stage of labour was found in 2 patients having brachial plexus injury. One patient was right total arm type and the other was left upper arm type. None of them had high birth weight comparing with gestational age (2,800-3,800 g).

Ortolani and Barlow test was positive in 2 infants in the present study. All were bilateral involvement. Surprisingly in the present study, one patient had right radial clubhand and the other was

Table 5. Incidence of common orthopaedic problem in newborn at Siriraj Hospital

Orthopaedic problems	n	%	Incidence per 1,000 live births
Calcaneovalgus	203	6	60
Metatarsus adductus	26	0.76	7.6
Clubfoot	8	0.24	2.4
Polydactyly	6	0.17	1.7
Syndactyly	3	0.09	0.9
DDH	2	0.06	0.6
BPI	5	0.15	1.5
Osteogenic imperfecta	2	0.06	0.6
Congenital vertical talus	1	0.03	0.3
Fracture clavicle	1	0.03	0.3
Skeletal dysplasia	2	0.06	0.6
Others syndrome	4	0.12	1.2

Table 6. Relation between gender and side of calcaneovalgus

	Sex			
	Male	Female	Total	%
Side of calcaneovalgus				
Right	27	30	57	27.9
Left	19	22	41	20.6
Both	52	53	105	51.5
Total	98	105	203	100
%	48	52	100	

Table 7. Relation between type and gestation of calcaneovalgus

	Number of Calcaneovalgus	%
Gestation		
1	100	49.2
2	71	34.9
3	20	9.8
4	10	4.9
5	2	0.9
6	0	0
7	0	0
8	0	0
Total	203	100

diagnosed as VACTREL syndrome.

Others abnormalities in the present study. The authors found right radial clubhand in 1 patient, absent hand in 1 patient, osteogenic imperfecta in 2 patients, VACTREL in 1 patient, Patau syndrome in 1 patient, skeletal dysplasia in 2 patients and fracture clavicle in 1 patient. In Patau syndrome patient, the authors found postaxial polydactyly of both hands. In right clubhand patient, the authors found bilaterally clubfeet and bilaterally developmental dysplasia of the hip. In VACTREL patient, the authors found preaxial polydactyly in left hand, syndactyly in right hand, congenital scoliosis and bilaterally developmental dysplasia of the hips.

Discussion

Generally, incidence of congenital common orthopaedic problems, such as calcaneovalgus, metatarsus adductus or clubfoot, was reported about 1: 1,000 from many studies[5,6,11-16]. Mittal, in a study of 50,055 indian infants[5] and other authors[4,6,11,17,18], concluded that clubfoot is the most common congenital anomalies at 0.9-3: 1,000, followed by polydactyly or syndactyly. But another anomalies such as calcaneo-

Table 8. Relation between gender and side of metatarsus adductus

	Sex		Total	%
	Male	Female		
Side of metatarsus adductus				
Right	2	0	2	7.7
Left	3	3	6	23.1
Both	10	8	18	69.2
Total	15	11	26	100
%	57.7	42.3	100	

Table 9. Relation between type and gestation of clubfoot

		Type of clubfoot			Total	%
		Postural	Idiopathic	Syndrome		
Gestation	1	44	2	1	47	41.84
	2	38	3	0	41	36.36
	3	15	2	0	17	15.22
	4	5	0	0	5	4.38
	5	2	0	0	2	1.64
	6	1	0	0	1	0.34
	7	0	0	0	0	100
Total	105	7	1	113	121	

Table 10. Severity of clubfoot

Classification grade	Type	Score	Patient
I	Benign	< 5	3
II	Moderate	5-9	2
III	Severe	10-14	2
IV	Very severe	≥ 15	1

valgus, metatarsus adductus and developmental dysplasia of the hip are the common congenital anomalies in many studies[1-3,6,11].

In the present study, the most common orthopaedic problems was calcaneovalgus (60: 1,000 live births) Wynne-davies[4,11,14] reported that incidence of calcaneovalgus is 1: 1,000 live births while Wetzenstein[12] informed up to 30-40% of live births. It's more common in girls and first newborn. In the present study, calcalneovalgus was found in fist newborn almost 50% whereas female was found just a little higher than male.

Wynne-davies[4,11,14] reported that the incidence of metatarsus adductus is 1: 1,000 live births whereas Hunziker[19] stated incidence of metatarsus adductus up to 12%. In the present study, the incidence of metatarsus adductus is 7.6: 1,000 live births.

In the present study, incidence of clubfoot (2.4: 1,000 live births) is the 3rd most common of orthopaedic problems. Wynne-davies[4,11,14] reported that the incidence of the clubfoot is 1.24: 1,000 in English patients and 0.64: 1,000 in Scottish patients. Danielsson[6] found that the incidence of clubfoot is 0.93: 1,000. Boo and Ong[17], in a study of 8,369 Malaysian lived infants, collected from patients' records and found that the incidence of clubfoot is 4.5: 1,000. Ching[20], in a study of 160,071 lived infants, collected from multiple centers and found that the incidence of clubfoot is 1.12: 1,000 in Caucasian, 6.8: 1,000 in Hawaiian and 0.57: 1,000 in Oriental. Ratanasiri[3] reported that the incidence of clubfoot is 1: 1,000.

The published incidence of clubfoot varies to ethnic factors and collecting of the basic data. The incidence seems higher among Hawaiian, Polynesian and Maoris than Caucasian and Negro and low in Chinese population and approximately bilateral involvement in 50%. It is more common in male 2 times more

than female[6,7,11,17,18,20-22]. However, the authors found the incidence is 2.4:1,000 living Thai infants. The incidence are equal between boys and girls and bilateral involvement were 74%.

The incidence of polydactyly is 1.3-3.6 per 1,000 live births and the incidence of syndactyly is 0.4-0.5 per 1,000 live births[13,23]. Fifty percent of cases are bilateral which are symmetric in 62% of patients. Thirty-four percentages of feet polydactyly patients have hand involvement. It is more common in male than in female[13,23]. The present study found that the incidence of polysyndactyly was 2.6: 1,000 live births. The polydactyly was 1.7: 1,000 and the syndactyly was 0.9: 1,000. These were found in male more than female as previous studies; however, the present study found that the bilateral involvement was just 17%.

The incidence of brachial plexus injury is 1-4 per 1,000 live births[24,25]. The present study revealed that the incidence of brachial plexus injury was 1.5: 1,000. Perinatal risk factors include: infants who are large for gestational age; prolonged labor; difficult delivery, including extraction techniques; and fetal distress. Shoulder dystocia is the mechanical factor that leads to an upper-trunk lesion in the difficult vertex delivery. Difficult arm extraction in a breech delivery may result in an avulsion injury of the upper trunk.

The incidence of developmental dysplasia of the hip interestingly varies 0-50% live births depending on ethnic factors, how to screening program including routinely using hip ultrasound[26-28]. Many authors reported incidence in Caucasian between in 1990s range 3-5% live births by ultrasound screening[15,28-34]. The incidence is low in the southern Chinese and black population[16,35,36]. In the present study the incidence was 0.6: 1,000 by routine physical examination screening.

The congenital anomalies can be associated with a variety of syndromes. The present study could identify syndrome involving the congenital anolmalies such as VACTREL and Patau syndrome.

In VACTREL patient, the authors found preaxial polydactyly in left hand, syndactyly in right hand, congenital scoliosis and bilaterally developmental dysplasia of the hips. In Patau syndrome patient, the authors found bilateral postaxial polydactyly of hands.

Conclusion

The report of the incidence of common orthopedic problems in newborn is vary due to ethnic factors and in collecting of the basic data. The prospective study by using physical examination of every newborn cases at Siriraj hospital was performed. Then the orthopaedic problems were recorded.

The most common orthopaedic problems in newborn was calcaneovalgus in 60: 1,000 live births, followed by metatarsus adductus in 7.6: 1,000, polydactyly or syndactyly in 2.6: 1,000, talipes equinovarus in 2.4: 1,000, brachial plexus injury in 1.5: 1,000, developmental dysplasia in 0.6: 1,000, osteogenesis imperfecta in 0.6:1,000 skeketal dysplasia in 0.6: 1,000, congenital vertical talus in 0.3: 1,000 and fracture clavicle in 0.3: 1,000.

Potential conflicts of interest

None.

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อุบัติการณ์ของโรคกระดูกและข้อที่พบบ่อยในเด็กแรกเกิดของโรงพยาบาลศิริราช

จตุพร โชติกวณิชย์, ปณต เลื่อมสำราญ, ศัลยพงศ์ สรรพกิจ, พีระจิตร เอี่ยมโสภณา, กมลพร แก้วพรสวรรค์

ภูมิหลัง: *ปัจจุบันข้อมูลความผิดปกติของกระดูกและข้อแต่กำเนิด ในประชากรไทยยังมีค่อนข้างน้อยและมักจะเป็นการเก็บข้อมูลจากแฟ้มประวัติของผู้ป่วยเป็นส่วนใหญ่ การศึกษานี้จึงมุ่งเน้นศึกษาอุบัติการณ์ของทารก ที่มีความพิการแต่กำเนิดในโรงพยาบาลศิริราช โดยการตรวจร่างกายผู้ป่วยโดยตรง*

วัตถุประสงค์: *ศึกษาอุบัติการณ์ของทารก ที่มีความพิการทางกระดูกและข้อแต่กำเนิดในโรงพยาบาลศิริราช โดยการตรวจร่างกายผู้ป่วยโดยตรง*

วัสดุและวิธีการ: *การศึกษาเชิงพรรณนาโดยการเก็บข้อมูลแบบไปข้างหน้าในทารกแรกเกิด 3,396 ราย บันทึกความผิดปกติที่พบร่วมกับ เพศ น้ำหนักแรกเกิด ความยาวลำตัว คะแนนชี้วัดแรกเกิด รวมถึงอายุของมารดา ประวัติการตั้งครรภ์ ปัญหาที่เกิดระหว่างการตั้งครรภ์และระหว่างคลอดบุตร วิธีการคลอดและส่วนนำของทารก*

ผลการศึกษา: *พบอุบัติการณ์การเกิดภาวะเท้าแปมากที่สุดคือ 60: 1,000 ของประชากรแรกคลอด รองลงมาคือปลายเท้าเอียงเข้าในพบ 7.6: 1,000 อันดับต่อมาคือนิ้วติดหรือนิ้วเกินพบ 2.6: 1,000 เท้าปุกพบ 2.4: 1,000 ผู้ป่วยที่มีการบาดเจ็บเส้นประสาทของรยางค์ส่วนบนพบ 1.5: 1,000 เบ้าสะโพกเจริญผิดปกติพบ 0.6: 1,000 โรคกระดูกเปราะและหักง่ายพบ 0.6: 1,000 โรคกระดูกเจริญผิดปกติพบ 0.6: 1,000 กระดูกเท้าอยู่ในแนวดิ่งผิดรูปแต่กำเนิดพบ 0.3: 1,000 และกระดูกไหปลาร้าหักแต่กำเนิดพบ 0.3: 1,000*

สรุป: *ข้อมูลการศึกษาในอดีตนั้นให้ผลการศึกษาอุบัติการณ์การเกิดความผิดปกติของกระดูกและข้อ ในทารกแรกเกิดไว้ค่อนข้างหลากหลาย แต่ในการนี้เป็นอุบัติการณ์ในคนไทย ซึ่งคลอดที่โรงพยาบาลศิริราช ซึ่งการศึกษาครั้งนี้พบอุบัติการณ์การเกิดภาวะเท้าแปมากที่สุด รองลงมาคือปลายเท้าบิดเข้าใน และตามมาด้วยภาวะนิ้วเกินหรือนิ้วติดกัน*