EPIDEMIOLOGY OF FRACTURES AND DISLOCATIONS IN CHILDREN

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ABSTRAK

Fraktur adalah kejadian yang cukup banyak terdapat pada kelompok usia anak-anak dengan berbagai variasi epidemiologi di seluruh dunia, oleh karenanya bisa dianggap sebagai suatu masalah utama dalam bidang kesehatan. Studi retrospektif dari semua fraktur anak yang datang ke Rumah Sakit Umum Dr. Soegiri Lamongan, Indonesia pada tahun 2015 menunjukkan bahwa 79,5% dari fraktur anak terjadi pada laki-laki dan 86,76% didapatkan sebagai fraktur tunggal, sementara dislokasi siku adalah dislokasi yang paling sering didapatkan dalam penelitian ini. Analisis fraktur anak menunjukkan adanya pola distribusi trimodal pada fraktur tunggal dengan usia, dengan fraktur radius/ulna distal sebagai fraktur yang paling sering terjadi. Penyebab paling umum dari fraktur tunggal adalah kecelakaan lalu lintas di jalan, dan mayoritas melibatkan ekstremitas atas. Oleh karenanya, disarankan harus adanya perhatian lebih terutama dalam hal keselamatan lalu lintas di Indonesia. ***(FMI 2017;53:81-85)***

Kata kunci: *anak, fraktur, epidemiologi, Indonesia*

ABSTRACT

Fracture is quite a common occurrence in the age group of children, with a fairly wide variety of epidemiology throughout the world, hence it could be considered as a major health problem. A retrospective study of all pediatric fractures presenting to Dr. Soegiri General Hospital Lamongan, Indonesiain 2015 was undertaken. It showed that 79.5% of children's fractures occurred in males and that 86.76% presented as a single fracture, whileelbow dislocation is the most prevalent dislocation in this study.Analysis of pediatric fractures shows that there is a trimodal distribution of single fracture with age, withdistal radius/ulna fracture as the most prevalent single fracture.The commonest cause of single fracture are road traffic accident, and the majority involve the upper limb. Those suggested that there should be more concern about road safety program in Indonesia. ***(FMI 2017;53:81-85)***
Keywords: *pediatric, fracture, epidemiology, Indonesia*

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INTRODUCTION

Fractures are most common in youth and in old age when the skeleton is porous, with weak points at the physes and metaphyses, respectively. Indonesian national basic health research in 2013 shows that the prevalence of injuries in East Java provinceis 9.3%, higher than national average of 8.2%.It has been shown that fractures account for 1.9% - 11.7% of childhood and adolescent injuries and that the effects of pediatric fractures are considerable with significant restriction of activity (Riskesdas 2013). Around one-third of all children suffer at least one fracture before the age of 17 (Cooper et al. 2004).Despite this, the epidemiology of pediatric injuries is poorly understood since there is a wide epidemiological variation and debates about the incidence of fractures in children (Landin 1983; Landin, 1987; Walsh et al. 1996; Lyons et al. 1999; Lyons et al. 2000; Rennie et al. 2007; Hedström et al. 2010; Hedström & Waernbaum 2014). We analyzed all pediatric fractures and dislocations presenting to Dr. SoegiriGeneral Hospital Lamongan, Indonesiain 2015 to examine the distribution, demonstrate which were the most common, and investigate the causes of fracture in different age groups.

MATERIALS AND METHODS

All children below the age of 18 years who presented to Dr. SoegiriGeneral Hospital with a diagnosis of fracture or dislocation between January 2015 and December 2015 (12 months) were enrolled for this cross sectional study. Approval from the ethical committee of the institution was obtained. We reviewed the medical records of the relevant children from outpatient clinic, emergency department, and inpatient ward. Parameters that were recorded are age, gender, mechanism of injury, site of fracture, and type of fracture. The site of fracture and dislocation was recorded using standard anatomical sites, with all fractures and dislocations listed individually and multiple fractures recorded separately. The population was divided into four age ranges. These were infants (0-1 years), pre-school chil-

dren (2-4 years), school children (5-11 years) and adolescents (12-17 years). Five basic mechanisms of injury were recorded. These were road traffic accidents, falls from below 1 meter, falls from above 1 meter, blunt trauma, and others. Data was calculated using Excel spread sheets.

RESULTS

A total of 171 children presented with either dislocation or fracture during the study period. There were 136 boys (79.5%) and 35 girls (20.5%) giving a male to female ratio of 3.87:1. Eleven patients presented with more than one fractures, 7 patients sustained 2 fractures and 4 patients had 3 fractures.A review of dislocation location showed that 7 were in the upper limb and 3 were in the lower limb, while single fracture location showed that 106 (70.67%) were in the upper limb, 35 (23.33%) were in the lower limb, and 9 (6%) were in the pelvis, spine, or skull.

As shown in table 2, dislocations were occurred due to road traffic accidents in 4 children (40%), due to falls below 1 meter in 4 children (40%), due to falls above 1 meter in a child (10%), and due to blunt trauma in a child (10%). Road traffic accidents were also the dominant mechanism in both multiple fractures (72.7%) and single fractures (50.7%).

Table 1. Distribution of injuries with sex

	Single Fracture	2 Fractures	3 Fractures	Dislocation	Total
Male	118 (78.7%)	6 (85.7%)	4 (100%)	8 (80%)	136 (79.5%)
Female	32 (21.3%)	1 (14.3%)	0 (0%)	2 (20%)	35 (20.5%)

Table 2. Distribution of mode of injury in dislocations

Mode of Injury		%
Road traffic accidents	4	40
Falls below 1 meter	1	10
Falls above 1 meter	4	40
Blunt trauma	1	10

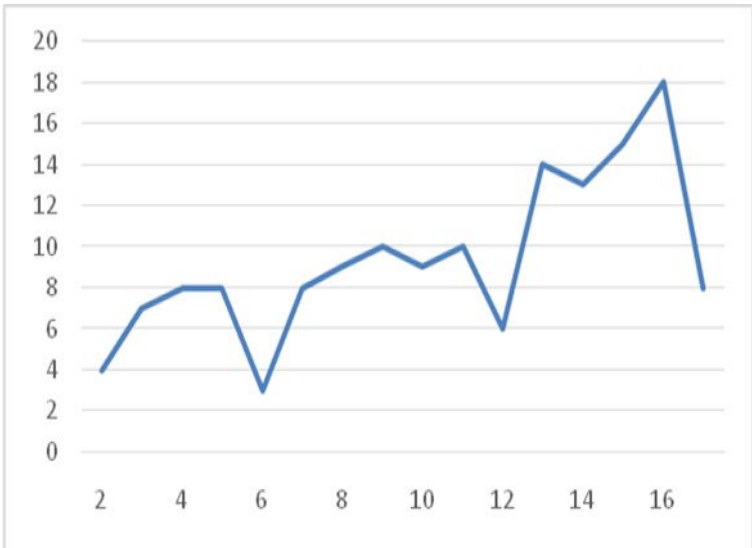

Figure 1. Age distribution of all single fractures during the study period

Table 3. Basic epidemiology of single pediatric fracture

Fracture	Incidence	%	Age (year)	Male: female (%)
Parietal	1	0.7	5.0	0 : 1
Nasal	4	2.7	10.8	3 : 1
Mandible	2	1.3	10.5	0 : 2
Vertebrae (cervical)	1	0.7	16.0	1 : 0
Clavicle	9	6.0	11.1	6 : 3
Proximal humerus	4	2.7	10.8	2 : 2
Diaphysishumerus	1	0.7	16.0	1 : 0
Distalhumerus	3	2.0	10.3	2 : 1
Supracondylarhumerus	27	18.0	7.8	19 : 8
Olecranon	1	0.7	16.0	1 : 0
Proximal radius / ulna	3	2.0	12.3	3 : 0
Diaphysis radius / ulna	21	14.0	11.2	18 : 3
Distal radius / ulna	30	20.0	12.4	26 : 4
Metacarpal	4	2.7	14.0	4 : 0
Hand phalanx	3	2.0	12.0	2 : 1
Pubis	1	0.7	7.0	0 : 1
Proximal femur	3	2.0	10.3	3 : 0
Diaphysis femur	5	3.3	16.2	3 : 2
Supracondylar femur	1	0.7	4.0	1 : 0
Proximal tibia / fibula	3	2.0	9.7	3 : 0
Diaphysis tibia / fibula	14	9.3	10.6	13 : 1
Distal tibia / fibula	5	3.3	7.6	4 : 1
Calcaneus	1	0.7	16.0	1 : 0
Metatarsal	1	0.7	15.0	0 : 1
Toe phalanx	2	1.3	7.5	2 : 0

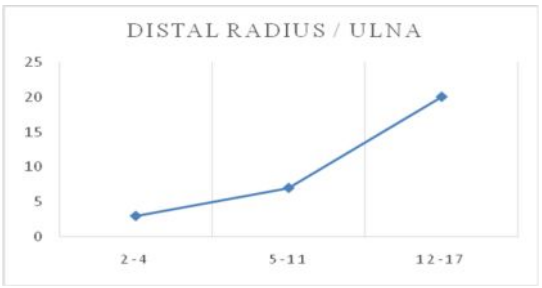

Fig. 2. Diagrammatic representations of distal radius/ulna fracture with age group

The overall single fracture distribution curves, shown in Fig. 1, demonstrate that single fracture has a trimodal distribution with first peak at 4-5 years, second peak at 8-11 years, and last peak at 16 years. The prevalence of the different single fracture types together with the average and gender distribution of the patients is shown in table 3. This demonstrates that fractures of the distal radius/ulna is the most prevalent incidence in single fracture (20%), followed by supracondylar humerus fracture (18%) and diaphysis radius/ulna (14%). Figure 3 shows the different epidemiological prevalence of those 3 most common single fracture compared to age group.

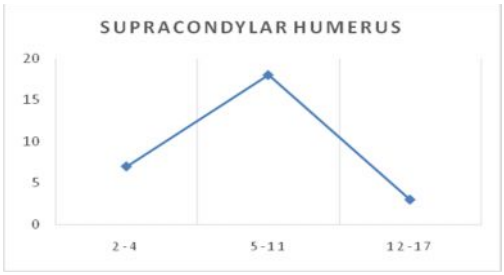

Fig. 3. Diagrammatic representations of supracondylar humerus fracture with age group

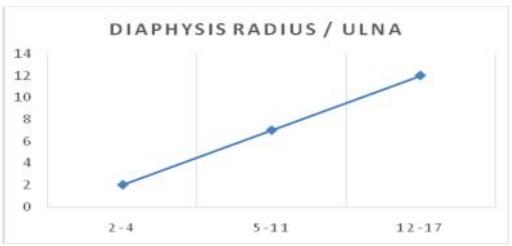

Fig. 4. Diagrammatic representations of diaphysis radius/ulna fracture with age group

There are 119 cases (79.93%) of simple fracture type in single fracture, made it the most common type of fracture. The other type found were compound fracture (9.33%), greenstick fracture (4.67%), epiphysiolysis (4.00%), as well as comminuted fracture (1.33%). There is also a pathological fractures and crush injury, each only numbered 1 case (0.67%).

Aside of road traffic accidents which was the predominant cause of single fracture (50.7%), the other recorded cause were falls below 1 meter (34%), falls above 1 meter (8%), blunt trauma (6%). Upper extremity sustained single fracture in 11 cases (91.67%) due to a falls above 1 meter, 43 cases(84.31%) due to a falls below 1 meter, and 37 cases (48.68%) due to road traffic accidents. Table 6 shown that 56 boys (47.46%) and 23 girls (71.88%) sustained single fractures on the road. Boys were more often to sustain single fracture on the playground (23.73%) than girls (9.37%), while girls are more frequent to sustain single fracture at home (18.75%) than boys (10.17%).

Table 4. Distribution of fracture type with sex

Fracture type	M	F	Total	%
Greenstick	5	2	7	4.67
Simple	93	26	119	79.93
Compound	12	2	14	9.33
Comminuted	1	1	2	1.33
Epiphysiolysis	5	1	6	4
Crush Injury	1	0	1	0.67
Pathologic	1	0	1	0.67

Table 5. Distribution of mechanism of injury with sex, age, and extremity involved

Mode of Injury	Male	Female	%	Age (year)	Extremity	
					Upper	Lower
Road traffic accidents	54	22	50.7	11.7	37	23
Falls below 1 meter	10	2	8.0	10.6	11	1
Falls above 1 meter	43	8	34.0	9.1	43	6
Blunt trauma	9	0	6.0	12.9	5	4
Others	2	0	1.3	12.0	1	1

Table 6. Distribution of place of injury with sex

Place of Injury	Male	%	Female	%
Home	12	10.17	6	18.75
School	9	7.63	0	-
Park / playground	28	23.73	3	9.37
Sports	13	11.01	0	-
Road	56	47.46	23	71.88

DISCUSSION

Our study showed that boys outnumbered girls by about 4 times in overall number of pediatric fracture and dislocation. Most studies reported male predominance and attribute this to physiological influence of hormones at puberty (Landin 1983;Rennie et al. 2007), where boys would be more adventurous and would be more likely to participate in risky physical activities.This is supported by their findings where higher rate of fracture and dislocation over the girls only become obvious during the adolescence (Landin1983; Hedström et al. 2010). In the Asian community, cultural and social values may have exerted its influence at a younger age, and girls are expected to display more feminine behavior as early as lower primary schools. This differs from adult fractures in which the gender difference did not affect the fracture or dislocation incidence.(Rennie et al. 2007; Solomon et al. 2010). This study also showed that elbow dislocation is the most common dislocation, as also as reported by Rockwood CA and his colleagues (Rockwood et al. 1996). This is different to adults as a dislocated elbow dislocation ranks as the second most common after shoulder dislocation (Kuhn & Ross, 2008; Helmi 2011; Salter 1999; Solomon et al. 2010). Besides elbow dislocation, this study also found radioulna, inter-phalangeal, and femur dislocations.

Unlike the British study in 2007 which found a bimodal distribution (Rennie et al. 2007), this study showed a trimodal distribution of single fractures with age. Radius/ulna distal is the most common single fracture found in this study, followed by supracondylar humerus fracture and radius/ulna diaphysis fracture. Other studies (Rennie et al. 2007; Mohamed et al. 2012; Barr 2014) also showed that radius/ulna distal fracture is the most common, but not with supracondyler humerus fracture and fracture of the radius/ulna diaphysis. Only 5.4% of children in the UK who sustained radius/ulna diaphysis fracture, much less than the results of this study (14%). Similarly to the case of supracondylar humerus fractures in this study, which reached 27%, higher than similar cases in the UK that only around 15%. This occurrence might be attributed to the related mechanism of injuries.

Road was the place of injury for about half (50.7%) ofour single fractures (Table 6), and also the predo-minant place in both multiple fractures (72.7%) and dislocation (40%). This is still relatively higher than the result of Indonesian national basic health research in 2013 which showed that road traffic accident accounted for 42.1% of injuries in East Java province, (Riskedas 2013) but is in contrast with figures reported by Rennie and his colleagues in the UK where only 6.7% of all fractures were related to road traffic accidents (Rennie et al. 2007) and also by Tandonand his colleagues (25.0%) in urban India (Tandon et al. 2007). Further study on the design of road safety programs and protective gears for children should be conducted in order to ensure that they are able to effectively reduce the risk of fractures or dislocations in Indonesian pediatric age group.

Public facilities like playgrounds or parks are not well developed in many developing countries, hence it is quite logical to question their safety as well. Without proper facilities, boys were more often to make their own physical activities which could be adventurous and risky, hence they sustain single fracture on the playground (23.73%) more than girls (9.37%). Girls would be more likely to spend their nonschooling time

at home, hence they are more frequent to sustain single fracture at home (18.75%) than boys (10.17%). Measures to improve safety awareness at playgrounds and home environment should be carried out to reduce the risk of fractures as a whole. These figures were still lower than other published studies in Malaysia, India, and USA (Tandon et al. 2007; Mohamed et al. 2012; Goulding 2007; Barr 2014), maybe because of the soaring stature of road traffic accidents in Indonesia which plummeted the percentage of other causes. The very same explanation might also attributed to fall from a low height in which is the most common mechanism of injury reported by other studies (Rennie et al. 2007; Mohamed et al. 2012), yet comes only second in this study (Table 2). The main limitation of this study is the sample population is limited to admissions and referrals to a single institution.

CONCLUSION

In Indonesia, measures to improve safety awareness at playgrounds and home environment should be carried out to reduce the risk of fractures as a whole. Further study on the design of road safety programs and protective gears for children should also be conducted in order to ensure that they are able to effectively reduce the risk of fractures or dislocations in Indonesian pediatric age group, since pediatric fractures in Indonesia most commonly happened due to road traffic accidents.

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