

Early Detection of Potential Scoliosis in Elementary School Student of Banjarmasin: Result of Three Examination Models

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ABSTRACT

Scoliosis is the most common spinal disorder. Early detection of potential scoliosis has an important role in preventing damage and spinal disorders that worsen. Early detection of scoliosis for children is very important in order to prevent progressivity of the scoliosis curves. This study aims to determine the number of potential scoliosis in fifth and sixth-grade primary school students in Banjarmasin using three different examinations. The method of this study is using observational descriptive. Data were obtained using Scoliometer, Visual Inspection Physical Examination, and C7 Plumb Line Test on 127 students. The results showed that the number of students who have potential scoliosis was 33 students (25.98%) with scoliometer, 12 students (9.44%) with direct visual inspection physical examination, and nothing with C7 plumb line test. Students aged > 10 years have a greater percentage of potential scoliosis (27.5%) than students aged ≤ 10 years (25.3%) in scoliometer measurement, but vice versa in visual inspection. Female students have a greater percentage of potential scoliosis (36.73% with scoliometer and 16.33% with visual inspection) than in male students (19.23% and 5.13%).

Keywords: early detection, scoliosis, scoliometer, visual inspection, C7 plumb line test

INTRODUCTION

Scoliosis is the most commonly found spinal abnormality.¹ Scoliosis is defined as the lateral curvature of the spine with a curve angle of greater than 10 degrees.² When the body is viewed from the rear of the scoliosis patient, an abnormal curvature of the bone back toward the lateral shape like the letter "C" or the curve from side to side shaped like the letter "S".³

Prevalence of scoliosis worldwide reaches 1% of the population.⁴ Scoliosis affects 2-3% of the population in the United States or about 7 million people.⁴ Most scoliosis is diagnosed in children with an age range of 10 to 15 years.⁵ Scoliosis is most often found is idiopathic scoliosis of 85-90% of cases of scoliosis.⁶ In the Asian

Continent alone, detectable scoliosis at screening / early detection of scoliosis has a prevalence of 0.4-7% .⁷

Early detection of scoliosis for children is very important in order to prevent progressivity of the scoliosis curves and could be expected to worsen damage over the long-term. This is because the children's skeletal system that still easy to change and its bad posture will be more easily repair and provide a better prognosis of the small curvature abnormality.⁸ If it left unchecked, it may develop to be severe scoliosis that will affect respiratory function and may affect to the patient's psychological condition thus increasing probability on surgical intervention.⁷

The American Academy of Orthopaedic Surgeons, The Scoliosis Research Society, the Pediatric Orthopaedic Society of North America, and The American Academic of Pediatrics recommend early detection of scoliosis.⁹ Early detection of scoliosis is not designed as a diagnostic method.¹⁰ The primary purpose of early detection is to find children with a high probability or potency rate for

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scoliosis events.¹⁰ The basic method of early detection of scoliosis in schools is a forward-bending examination of bent positions forward using a scoliometer (quantitative assessment).¹⁰ Qualitative assessment is chosen for this study as visual inspection physical examination.

Another examination in this study is by c7 plumb line test. This examination is done with a tool called plumb bob. Plumb bob is a conical tool made of iron and bonded with a rope. This tool works with the force of gravity. This tool is usually used by construction workers to see the slope of a building.¹¹

MATERIALS AND METHOD

This research uses the descriptive observational method, that research subject observed and measured. The population of this research is all students of a fifth and sixth-grade student in Muhammadiyah 8 and 10 primary schools Banjarmasin. The sample is determined by purposive sampling method with inclusion criteria ie students whose parents signed informed consent and present at the time of the research. This study took place at Muhammadiyah 8 and 10 primary school Banjarmasin conducted in August 2017. The Angle of Trunk Rotation measurements used the scoliometer tool on the students in Adam’s Forward Bending position. The examination of physic used Du Q *et al*’s study method¹² with modification to determine the scoliosis potential. While the examination with c7 plumb line test is done by standing upright.

FINDINGS AND DISCUSSION

Table 1. Distribution of Potential Scoliosis on a fifth and sixth-grade student in Banjarmasin Generally August 2017 Period.

Exami-nation	Scoliosis Potential	Total	%
Scoliometer	Positive	33	25.98
	Negative	94	74.02
	Total	127	100
Physical examination	Positive	12	9.44
	Negative	115	90.56
	Total	127	100
C7 Plumb Line Test	Positive	0	0
	Negative	127	100
	Total	127	100

Based on table 1 above, it can be seen that in a scoliometer examination 33 students have potential scoliosis (25.98%) consist of 27 students have intermediate potential scoliosis (21.26%), and 6 students with high potential scoliosis (4.72%). The results showed a 4.72% high potential scoliosis student in line with studies conducted by Kamtsiuris et al in Germany in children and adolescents, that the overall prevalence of idiopathic scoliosis ranged from 0.47-52.2%.¹³ These results were also similar to those in the study conducted by Parera et al in 2016 at Mapanget Manado in sixth-grade student of the primary school that found 4% high scoliosis students.¹⁴ Detection of potential scoliosis was not designed as a diagnostic method but to find children with a high probability of scoliosis.¹⁰

Based on the visual inspection physical examination results, 12 students (9,44%) were suspected having scoliosis potential due to the deformity appearance of hump, shoulder and hip asymmetry, and lateral curvature of the spine. The study results are not much different than the previous literature reports. The results of Du Q *et al* study (2016) showed 6,47% scoliosis potential based on visual inspection physical examination and the results of Guo Y *et al* study (2017) showed 9,76% scoliosis potential.^{12,15}

On the other result with C7 plumb line test, there was not found a potential scoliosis student (see table 1). Most of the children detected have shown a deviation in the spine. However, the deviation is still < 3 cm, so it can not be said to have the potential of scoliosis. This corresponds to the prevalence of scoliosis in the world, which is 1% of the total human population.⁴ Based on a recent study in 2013 that collected various data about scoliosis in the world, scoliosis prevalence of 0.47 to 0.52%.¹⁶

There is a difference of minimum standard deviation in the examination with c7 plumb line test, also affect the results of this research. Another citation says that if the deviation is > 2 cm have potentially scoliosis.¹⁷ However, in this study using standards established by Scoliosis Research Society (SRS). SRS is one of the world organizations that provide a recommendation on the early detection of scoliosis, which is potentially scoliosis if deviation ≥ 3 cm.^{18,19}

Table 2. Distribution of Spinal Deviation on Students of Grade V and VI SD Muhammadiyah 8 and 10 Banjarmasin in 2017

Deviation (cm)	Students	%
0	43	33,8
0,1 - 0,5	26	20,5
0,6 – 1	35	27,6
1,1 – 1,5	14	11
1,6 – 2	7	5,5
2,1 – 2,5	2	1,6
Total	127	100

Based on table 2, it can be seen the children that were found a deviation in the spine is 84 students. The ranges of deviation found from 0.2 cm to 2.5 cm. Two students with a 2.5 cm deviation are female. Two points five-centimeter deviation is close enough to the minimum standard of scoliosis potential (≥ 3 cm), so they need more monitoring.

Scoliosis develops faster at puberty.²⁰ Accelerated development of spinal deformities in scoliosis occurs during an adolescent growth spurt. During the period of a growth spurt, muscle and bone stiffness occurs. High growth rates have side effects on bone strength, making it more prone to abnormalities. The growth spurt in young women occurs at age 10-12 years, whereas in men 13-14 years.²¹ Early detection is recommended for children at puberty. Imbalances of the endocrine system during puberty lead to impaired metabolism of water and minerals that ultimately lead to bone relaxation of the skeleton. It also affects the metabolism of the connective tissue on the intervertebral discs that will decrease the disc power when there is torsion (rotation) of the spine. It will eventually lead to the development of scoliosis.²²

Spine curvature in patients with scoliosis can occur in the cervical, thoracic or lumbar vertebrae. With radiological examination, the curvature of the spine will be C or S. In each scoliosis patients have different types of curvature and degree of severity. It causes that not all scoliosis patients will have a spinal shift.^{22,23}

Tabel 3. Distribution of Potential Scoliosis Using Scoliometer and Physical Examination on a fifth and sixth-grade student in Banjarmasin by age August 2017 Period

Age	Exami-nation	Potentially Scoliosis		No Scoliosis Potential	
		n	%	n	%
≤ 10 years	Scoliometer	22	25.3	65	74.7
	Physical examination	10	11.5	77	88.5
> 10 years	Scoliometer	11	27.5	29	72.5
	Physical examination	2	5	38	95

There are 6 out of 127 samples are students with high potential scoliosis of 4 in ≤ 10 years old. The percentage of students with high potential scoliosis at age > 10 years was 5%, while at age ≤ 10 years was 4.6%. Based on these data, the potential scoliosis was found to be greater in students aged > 10 years (27.5%) than students aged ≤ 10 years (25.29%). These results are in line with Yong et al research in Singapore and Parera et al in Mapanget Manado in elementary students, that the percentage of students with potential scoliosis at age 11 is higher than at age 10.^{14,24} Scoliosis tends to develop with age.²⁰ The development of spinal deformities with scoliosis occurs during a growth spurt or accelerated growth during puberty.²¹

Scoliosis potential prevalence using visual inspection physical examination at juvenile age (4-10 years) has not been studied. Wong's study showed the scoliosis prevalence based on a positive result of scoliometer at age 9-10 years (juvenile) as many as 17,4% lower than in age 10-11 years as many as 42%. The scoliosis potential prevalence on age ≤ 10 years more in this study may be influenced by noncompliance factor in the placement of book packages and bags to the locker that provided by its school.²⁵

Table 4. Scoliosis potential prevalence of 5th and 6th-grade primary schools students according to gender in August 2017

Age	Exami-nation	Potentially Scoliosis		No Scoliosis Potential	
		n	%	n	%
Male	Scoliometer	15	19.23	63	80.77
	Physical examination	4	5.13	74	94.87
Female	Scoliometer	18	36.73	31	63.27
	Physical examination	8	16.33	41	83.67

Based on table 4 above, in the scoliometer examination result, students with potential scoliosis were more common in female (36.73%) than in male (19.23%). These results are in line with Parera et al research at Mapanget Manado in sixth-grade students, that scoliosis potential is more likely to be in female than in the male.¹⁴ The results also correspond to the study of Zhang et al in elementary school students in China that by gender, the prevalence of scoliosis in the female is higher than in male.²⁶

Idiopathic scoliosis in adolescents is more common in females than in males, with a ratio of 3:1 at 10-11 years of age and increased to 11:1 at 12-13 years.¹³ This increase in the ratio is due to the onset of bone growth during a growth spurt in the female is faster than in male.²⁷

Table 4 shows that in the physical examination result, the prevalence of female students with potential scoliosis were 8 out of 49 students (5.13%) higher than the male students as many as 4 out of 78 students (16.33%). These results support most previous literature that the prevalence of scoliosis is higher in female than in the male.^{12,15} the female/male ratio of this study is 1:2. In the previous study, Du Q *et al*¹² reported a female/male ratio was 1:1.2 and Guo Y¹⁵ reported 1:3.13. Most studies reported a male/female ratio of scoliosis between 1:2.1 and 1:11.6 (1:2.1 for Greece, 1:2.4 for Korea, 1:2.6 for Turkey, 1:4.6 for Singapore, and 1:11.6 for Japan).^{15,28} Fred Mo states during the period of puberty growth primarily female, the ratio of scoliosis prevalence among female and male increased by 1.6:1 at the age 9-10 years and 6.4:1 at age 11-12 years.²⁹

CONCLUSION

Students who have potential scoliosis were 33 students (25.98%) with scoliometer, 12 students (9.44%) with direct visual inspection physical examination, and nothing with C7 plumb line test. Students aged > 10 years have a greater percentage of potential scoliosis (27.5%) than students aged ≤ 10 years (25.3%) in scoliometer measurement, but vice versa in visual inspection. Female

students have a greater percentage of potential scoliosis (36.73% with scoliometer and 16.33% with visual inspection) than in male students (19.23% and 5.13%).

Ethical Clearance: Before conducting the data retrieval, the researchers conducted a decent test of ethics conducted at the Faculty of Medicine, Lambung Mangkurat University, Indonesia to determine that this study has met the feasibility. Information on an ethical test that the study is eligible to continue. The feasibility of the research was conducted to protect the human rights and security of research subjects.

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