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Spinal and limb abnormalities in adolescents with intellectual disabilities

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ABSTRACT

There are not many studies pertaining to the spinal or limb abnormalities in people with intellectual disabilities, without a clear profile of these deformities of them, efforts to understand its characters and improve their quality of life will be impossible. Therefore, this paper aims to describe the prevalence and related factors of spinal and limb abnormalities in adolescents with intellectual disabilities. The participants who participated in health examinations as they enrolled into special schools at the first year, a total of 822 aged 15–18 years adolescents with ID were recruited to this study. The results showed that there were 14.5% and 8.5% cases had spinal and limb abnormalities based on the physician's observation and X-ray test. Factors of BMI level and limb abnormalities were significantly predicted the spinal abnormality occurrence in those adolescents with ID. Gender, disability level and have a spinal abnormality were variables that can statistically correlate to limb abnormality condition. The study highlights that in order to ensure people with intellectual disabilities receive an appropriate quality of care, it is important to have a precise understanding of the ways in which the needs of them who have spinal or limb deformities differ from the sole intellectual disability and the general population as a whole.

1. Introduction

There has not been much published literature pertaining to the spinal or limb abnormalities in people with intellectual disability (ID) in the previous decades. One earlier study by G.B. Solitare described "The spinal cord of the Mongol" in 1969. He reported four autopsies on Mongols (now Down syndrome) to examine their spinal cord lesion (Solitare, 1969). Smith, Schindeler, Elbualy, and Shear (1970) indicated that limb abnormalities are occasionally found in populations of ID individuals. A recent study by Tangerud, Hestnes, Sand, and Sunndalfoll (1990) indicated that there was a significant increase in degenerative changes in the upper part of the cervical spine in persons with Down's syndrome. Maclachlan et al. (1993) also concerned that adults with Down syndrome were high risk of high prevalence of degenerative disease of the cervical spine and consideration should be given to this diagnosis in the appropriate clinical setting.

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The consequences of spinal or limb abnormalities in people with ID are complicated. Mori et al. (2005) examined the correlation between spinal characteristics and respiratory function in patients with severe physical disabilities and ID. These observations suggest that the spinal abnormalities affect respiratory patterns in a restrictive manner and increase the respiratory change rate during tidal breathing. Lutkenhoff and Oppenheimer (1997) described the adolescents with spina bifida "Young people with spina bifida with have many questions about themselves and their futures which they may not want to ask of their parents or doctors. Even if they do ask, there is likelihood that the person asked won't know the answer". However, without a clear profile of spinal or limb deformities in people with ID, efforts to understand its characters and improve their quality of life will be impossible. Therefore, the purposes of this paper were to describe the prevalence and related factors of spinal and limb abnormalities in adolescents with ID.

2. Methods

This sample group was part of a retrospective, cross-sectional study examining the health examination results for children and adolescents with ID (Lin, Lin, Chen, et al., 2010; Lin, Lin, Lin, et al., 2009, 2010). Participants were recruited from three special educational schools, the adolescents with ID who participated in health examinations as they enrolled into schools at the first year. The examination included body physical exam, biochemical (blood, urine and stool specimen) and X-ray check-up. The study was designed to analyze all the health examination charts which included all eligible adolescents aged 15–18 years with ID from all three special schools. Research ethical approval and written informed consent were obtained from all the study special schools.

The present study aimed to analyze the conditions of spinal and limb abnormalities and to examine the determinants of these two characteristics. There were 822 participants whose data were analyzed. Those data included demographic characteristics (age and gender), disability condition (type and level), body mass index (BMI; kg/m^2), hands, feet and spinal abnormalities. Hands and feet abnormalities (called limb abnormalities) were based on the medical physicians' observations, and an X-ray was used to determine spinal abnormalities. Finally, those abnormalities which showed in medical charts were based on the diagnosis results of medical physicians in the study. Data were analyzed by SPSS 14.0. Analyses included frequency distributions and percentage for the demographic characteristics and the prevalence of spinal and limb abnormalities among adolescents with ID. Chi-square tests were obtained for the relationship between demographic characteristics, BMI value and spinal and limb abnormalities. Logistic regression procedures were used to examine the risks of having spinal and limb abnormalities.

3. Results

The mean age of study participants was 15.69 ± 0.75 years old, 60.7% of the participants were boys and 39.3% were girls. In our samples, most of the people with ID had a moderate level of disability (52.7%) and severe and profound disability accounting for 29.6%. There was nearly 70% of the study participants evinced ID solely, while 30.5% were affected by multiple disabilities (ID accompanied with other disabilities). With regard to the physical figure of the participants, the results of BMI analysis indicated their average score was 22.2 and 34.1% subjects were normal, 13.7% were overweight, 24.9% were obese and 27.3% were underweight. The physical observation and X-ray test results showed that there were 14.5% and 8.6% cases had spinal and limb abnormalities in the study (Table 1).

Tables 2 and 3 analyzed chi-square relation between personal characteristics and spinal or limb abnormalities in the bivariant analysis. BMI was significantly correlated to spinal abnormalities ($p < 0.001$). Underweight adolescents with ID (prevalence = 22.9%) were more likely to have spinal abnormalities than the other BMI level groups. Those factors of gender, disability type and level were not correlated to spinal abnormalities in adolescents with ID. However, the factors of disability type and disability level were statistically correlated to limb abnormalities in adolescents with ID. Those adolescents with multiple disabilities (abnormal prevalence = 19.3%) were more than five times more likely to have limb abnormalities than the ID solely cases (abnormal prevalence = 3.7%). In addition, the more serious of the disability level, the more prevalent of the limb abnormalities in adolescents with ID in the study ($p < 0.001$). Table 4 also found that spinal abnormality was significantly correlated to limb abnormality in the study subjects ($p < 0.001$).

Table 5 tested the logistic regression model of spinal abnormality occurrence of adolescents with ID. The BMI level ($p = 0.035$) and limb abnormalities ($p < 0.001$) were significantly predicted the spinal abnormality occurrence in those adolescents with ID ($p < 0.05$). The spinal abnormality cases tends to be more prevalent in the underweight group than in the normal weight group (OR = 1.82, 95% CI = 1.04–3.18), and the limb abnormality cases were more likely to have spinal abnormalities than those adolescents do not have limb abnormalities (OR = 6.12, 95% CI = 3.15–11.9). With respect to the risk factors of limb abnormality occurrence in adolescents with ID, we found that the factors of gender, disability level and spinal abnormality were variables that could significantly predict a limb abnormality condition after controlling factors of disability type, age and BMI (Table 6). Those boys adolescents were less chance to have a limb abnormality than girl cases (OR = 0.47, 95% CI = 0.25–0.90). However, those subjects with multiple disabilities (OR = 3.63, 95% CI = 1.72–7.58) and a spinal abnormality (OR = 5.90, 95% CI = 3.01–11.56) were more likely to have a limb abnormality.

Table 1
Subject's demographic characteristics and their body deformities.

Characteristics	*N*	%	Mean ± S.D. (range)
Gender (*N* = 822)			
Boys	499	60.7	
Girls	323	39.3	
Age (years) (*N* = 822)			15.69 ± 0.75 (15–18)
Disability type (*N* = 822)			
ID	571	69.5	
Multiple[a]	251	30.5	
Disability level (*N* = 822)			
Mild	80	9.7	
Moderate	433	52.7	
Serve	243	29.6	
Profound	66	8.0	
BMI (kg/m^2) (*N* = 812)			22.19 ± 5.55 (8.7–50.4)
Underweight	222	27.3	
Normal	277	34.1	
Overweight	111	13.7	
Obesity	202	24.9	
Spine (*N* = 812)			
Normal	694	85.5	
Abnormal	118	14.5	
Limb (*N* = 701)			
Normal	641	91.4	
Abnormal	60	8.6	

[a] ID accompanied with other disabilities.

Table 2
Relation of subject's characteristics and spine abnormalities.

Variable	Spine		χ^2	*p*-Value
	Normal (%)	Abnormal (%)		
Gender (*N* = 812)			0.11	0.737
Boys	418 (60.2)	73 (14.9)		
Girls	276 (86.0)	45 (14.0)		
Disability type (*N* = 812)			0.38	0.537
ID	490 (86.0)	80 (14.0)		
Multiple	204 (84.3)	38 (15.7)		
Disability level (*N* = 812)			2.46	0.482
Mild	71 (88.8)	9 (11.3)		
Moderate	370 (85.5)	63 (14.5)		
Severe	202 (86.0)	33 (14.0)		
Profound	51 (79.7)	13 (20.3)		
BMI (*N* = 806)			21.45	<0.001
Underweight	168 (77.1)	50 (22.9)		
Normal	244 (88.7)	31 (11.3)		
Overweight	92 (82.9)	19 (17.1)		
Obese	185 (91.6)	17 (8.4)		

4. Discussion

Traditionally, the medical care needs and problems of persons with ID living in the general community have received limited attention in healthcare systems (Lin, 2009; Lin et al., 2007; Lin, Yen, Wu, & Kang, 2009; Minihan & Dean, 1990; van Schrojenstein Lantman-de Valk, Metsemakers, Soomers-Turlings, Haveman, & Crebolder, 1997). Many studies have demonstrated that individuals with ID experience poorer health (Lin, Lin, Chen, et al., 2010; Lin, Lin, Lin, et al., 2009, 2010; Lin, Wu, & Lee, 2003; Lin, Yen, Li, & Wu, 2005; Yen & Lin, 2010; Yen, Loh, & Lin, 2009) and use more medical care services than the general population (Hsu et al., 2009; Lin, Lin, Yen, Loh, & Chwo, 2009; Lin, Loh, Yen, Li, & Wu, 2006; Yen, Lin, Loh, Shi, & Shu, 2009). Most of them experience barriers in accessing health services and supports for their health needs (Lin, Hsu, et al., 2009; Lin, Yen, Chwo, Tung, & Lee, 2005). To ensure that people with ID can enjoy the same health right as the general population, the health care system should take further steps to develop an appropriate monitoring system and health services for them (Lin, Yen, Chwo, et al., 2005). This paper aimed to examine the prevalence and related factors of spinal and

Table 3
Relation of subject's characteristics and limb abnormalities.

Variable	Limb		χ^2	*p*-Value
	Normal (%)	Abnormal (%)		
Gender ($N = 701$)			2.45	0.118
Boys	387 (92.8)	30 (7.2)		
Girls	254 (89.4)	30 (10.6)		
Disability type ($N = 701$)			46.34	<0.001
ID	465 (96.3)	18 (3.7)		
Multiple	176 (80.7)	42 (19.3)		
Disability level ($N = 701$)			43.16	<0.001
Mild	67 (98.5)	1 (1.5)		
Moderate	355 (95.9)	15 (4.1)		
Severe	178 (85.6)	30 (14.4)		
Profound	41 (74.5)	14 (25.5)		
BMI ($N = 691$)			7.19	0.066
Underweight	173 (89.2)	21 (10.8)		
Normal	216 (93.9)	14 (6.1)		
Overweight	87 (90.6)	9 (9.4)		
Obese	164 (95.9)	7 (4.1)		

limb abnormalities in adolescents with ID. We found that there were 14.5% and 8.5% cases had spinal and limb abnormalities in the study based on physician's observation and X-ray test. Factors of BMI level and limb abnormalities significantly predicted the spinal abnormality occurrence in those adolescents with ID. Gender, disability level and having a spinal abnormality were variables that were statistically correlated to limb abnormality condition.

Table 4
Relation of spinal and limb abnormalities ($N = 691$).

Variable	Spine		χ^2	*p*-Value
	Normal (%)	Abnormal (%)		
Limb			32.89	<0.001
Normal	555 (87.4)	80 (12.6)		
Abnormal	33 (58.9)	23 (41.1)		

Table 5
Logistic regression model of spinal abnormalities ($N = 685$).

Variable	β	S.E.	OR	95% CI	*p*-Value
Constant	−2.38	2.33	0.09		0.307
Gender					
Girls			1.00		
Boys	0.16	0.23	1.17	0.74–1.85	0.500
Age	−0.01	0.15	1.00	0.74–1.33	0.972
Disability type					
ID			1.00		
Multiple	−0.48	0.31	0.62	0.34–1.14	0.122
Disability level					
Mild			1.00		
Moderate	0.38	0.44	1.47	0.63–3.44	0.377
Severe	0.18	0.48	1.20	0.47–3.10	0.706
Profound	0.88	0.59	2.40	0.75–7.64	0.139
BMI					
Normal			1.00		
Underweight	0.60	0.28	1.82	1.04–3.18	0.035
Overweight	0.44	0.35	1.55	0.79–3.05	0.206
Obese	−0.26	0.34	0.77	0.40–1.51	0.451
Limb					
Normal			1.00		
Abnormal	1.81	0.34	6.12	3.15–11.90	<0.001

Table 6
Logistic regression model of limb abnormalities ($N = 685$).

Variable	β	S.E.	OR	95% CI	p-Value
Constant	−7.43	3.25	0.001		0.022
Gender					
Female			1.00		
Male	−0.75	0.33	0.47	0.25–0.90	0.022
Age	0.20	0.20	1.23	0.83–1.81	0.306
Disability type					
ID			1.00		
Multiple	1.29	0.38	3.63	1.72–7.58	0.001
Disability level					
Mild			1.00		
Moderate	0.62	1.06	1.86	0.23–14.90	0.557
Severe	1.42	1.08	4.13	0.50–33.99	0.188
Profound	1.50	1.14	4.48	0.48–41.72	0.188
BMI					
Normal			1.00		
Underweight	0.28	0.41	1.32	0.60–2.93	0.493
Overweight	0.28	0.49	1.32	0.50–3.45	0.575
Obese	−0.41	0.50	0.67	0.25–1.77	0.415
Spine					
Normal			1.00		
Abnormal	1.78	0.34	5.90	3.01–11.56	<0.001

Smith et al. (1970) stated that sometimes the limb abnormalities may be so characteristic of a syndrome that the diagnosis can be made directly. In most instances, the limb abnormality is not specific and it is only diagnostic when the total clinical complex is examined. They highlighted the limb abnormalities in people with ID may frequently suggest a specific diagnosis or syndrome. The present study highlights the high abnormal rate in spinal and limb among adolescents with ID need to be addressed in the healthcare system. Many studies have provided the opportunities to treat spinal or limb abnormalities. Burch, Clegg, and Bailey (1987) demonstrated that electronic switches can be used effectively as therapeutic tools to correct improper posture of the individuals during functional daily activities. Behavior therapy or physical therapies are also good tools to promote independent ambulation in people with ID (Horton & Taylor, 1989). Generally, physical rehabilitation following spinal cord injury-related paralysis or abnormalities has traditionally focused on teaching compensatory techniques, thus enabling the individual to achieve daily function despite significant neurological deficits (Sadowsky & McDonald, 2009). They supported the idea of utilizing physical activity and exercise are not a luxury, but instead are needed therapeutic intervention to manage the condition such as spinal cord injury, and eventually other disorders of the CNS like stroke and CP.

Two limitations in the present study need to be pointed out. First, we only recruited cases who were in special schools; they may not represent the full the general population of adolescents with ID. Second, the health exam results lack double check of another health setting will possible affect the results. However, this study provides a general profile of physical deformities among adolescents with ID. To ensure that people with ID receive an appropriate quality of care, it is important to have a precise understanding of the ways in which the needs of them who have spinal or limb deformities differ from the sole ID and the general population as a whole.

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