Research Article

Karyotype, Phenotype Characteristics, and Quality of Life in Adolescents with Turner Syndrome; Are They Related?

Novina Novina[1],Hartono Gunardi[2],Aman B. Pulungan[2]

Received on:
26-June-2019

Accepted for Publication:
30-Sept-2019

Correspondence to:
Novina Novina, Indonesia
novina@unpad.ac.id

Author's Affiliation:
1-Department of Child Health, Faculty of Medicine, Universitas Padjadjaran, Bandung, Indonesia
2-Department of Pediatrics, Faculty of Medicine, University of Indonesia, Jakarta, Indonesia

Abstract:

Background: Turner syndrome is characterized by the absence of a part or of the entire X chromosome in a woman and categorized as classical and mosaic based on karyotype. Comorbidities such as difficulty in learning and abnormalities of ear or cardiovascular system may affect the patient's quality of life (QoL). Up to date, very few researches have been done regarding the relationship between karyotype, phenotype, and QoL in adolescents with Turner syndrome.

Aims: To evaluate the relationship between karyotype, phenotype, and QoL in adolescents with Turner syndrome.

Methods: Analytic correlative cross-sectional study was done in Cipto Mangunkusumo National Hospital's pediatric endocrinology outpatient clinic from July to December 2018. PedsQLTM was used to evaluate the QoL in adolescents with Turner syndrome. Analyses were performed using SPSS (ver. 23.0).

Results: Out of 21 subjects (12-21-year-old), eight were having classical karyotype and 13 were having mosaic karyotype. There was a significant correlation between karyotype and the fourth domain of PedsQLTM from parents' report ($P = 0.016$). Significant relationship was found between karyotype, webbed neck ($P = 0.032$), and cubitus valgus ($P = 0.046$).

Limitation: The limitation of this study is there was no specific PedsQLTM for Turner syndrome, thus, it appears as if the quality of life of the patient was not disturbed while in reality, it might be disturbed.

Conclusions: Karyotype was related with webbed neck and cubitus valgus in Turner syndrome. It was also significantly correlated to the QoL on the school domain (parents' report).

Keywords: Turner syndrome, karyotype, quality of life, phenotype, PedsQLTM

Introduction

Turner syndrome is a group of symptoms in a woman that is caused by the X chromosome abnormality. Turner syndrome is categorized as classical and mosaic based on the karyotype.[1, 2] Some of its phenotypes are short stature, sexual infantile and cubitus valgus, while some of its comorbidities are learning difficulty and ear abnormalities.[3] It is implied that karyotype might play a role in the phenotype and comorbidity of Turner syndrome.[4]

Health-Related Quality of Life (HRQoL) is a subjective perception in health status (physical, psychological, social function and welfare status).[5] Mostly, Turner syndrome patients are having psychosexual problems which can impact their quality of life (QoL).[6, 7] Several studies on the QoL of adult Turner syndrome patients have been done, but there are still very few studies regarding the QoL of the children and the adolescents with Turner syndrome.[8, 9]

Methods

Subjects were obtained from the Pediatric Endocrinology Out-Patient Clinic, who were also the member of the Turner Syndrome Society at Jakarta, Bogor, Depok, Tangerang, Bekasi, West Java, and Bandar Lampung from July to December 2018. Twenty-one subjects with complete data, who met the inclusion criteria (adolescents who were diagnosed with Turner syndrome, whose age range were within 12–21 years old, and who underwent estrogen hormone therapy for at least one month) and did not meet the exclusion criteria (those who had any history of malignancy in adrenal glands, uterine, and ovarium, and those who had chronic/terminal diseases such as cyanotic congenital heart disease and tuberculosis in reproductive organs, or if the parents refused to participate) were included in this study. All of the subjects were female. This study was approved by the Institutional Review Boards of the Faculty of Medicine, University of Indonesia, and had been conformed to the ethical guidelines of the Declaration of Helsinki. Patients were anonymized and de-identified before analysis. Informed consent was given to each patient and their parents before they agree to participate.

This was a cross-sectional study, using correlative analysis method to determine the relationship between the karyotype and the quality of life of adolescents with Turner syndrome, and also the relationship between the karyotype and the phenotype. History taking was done to determine the subjects' characteristics and comorbidities. Afterwards, physical examination was done to determine the physical characteristics of the patients.

Quality of life was measured using PedsQL^{TM}. PedsQL^{TM} is an instrument which is used to determine the QoL in healthy and sick children. PedsQL^{TM} has modules for general and specific diseases. However, there is still no specific PedsQL^{TM} module made for Turner syndrome patients.[10] The questionnaires on PedsQL^{TM} ask about what the subject feels in the last 30 days. This measurement tool consists of questionnaires for children's report and parent's report, and divided into groups based on the age (8-12 years old group and 13-18 years old group). In this study, samples older than 18 years old were included in the 13-18-year-old age group. This instrument consists of four domains, including physical, social, emotional, and school functions. There are five responding scales (0 = never; 1 = almost never; 2 = sometimes; 3 = often; 4 = almost always). Then, those scores are transformed to the scale of 0 - 100 as follow: 0 = 100, 1 = 75, 2 = 50, 3 = 25, 4 = 0. The higher the end score is, the better the quality of life the subject has. Scores higher or equal to 70 indicates an unaffected life, while scores < 70 indicates affected life.[10, 11]

Delayed puberty is one of the most common findings in Turner syndrome.[1] Estrogen hormone therapy is usually given to induce puberty and secondary sex characteristics appearance in Turner syndrome patients.[3] Menstruation is closely related to premenstrual syndrome (PMS). In this study, the severity of PMS was measured using Shortened Premenstrual Assessment Form (SPAF) for each subject who had already had menstruation.[12] In this instrument, there are three subscales of the symptoms, which are specified in ten questions. The range of the score is 10 to 60. Each symptom can be scored from one to six. Score <30 indicates no to mild symptoms and score ≥ 30 means that the symptoms are severe.[12]

Statistical Analysis

Exact Fisher Test was used to determine the relationship between karyotype and phenotype. Correlation between karyotype and QoL was determined using Spearman's correlation test. SPSS ver. 23.0 was used for the statistical analysis.

Results

The age range of the subjects was 12-21 years old. The youngest age of diagnosis was at birth on one subject. Most patients were diagnosed at adolescence. All of the subjects received proper formal education.

There were various types of mosaic karyotype found in the samples, dominated by 45XO/46XX karyotype variant. Mosaic karyotype consisted of 13 samples while classical karyotype consisted of 8 samples.

There was a significant relationship between karyotype and two phenotypes (webbed neck and cubitus valgus). Six (75%) of the classical karyotype showed webbed neck compared to 3 (23%) of the mosaic karyotype (P = 0,032). Eight (100%) of the classical karyotype group showed *cubitus valgus* compared to seven (54%) of the mosaic karyotype group (P = 0,046).

Scores ≥70 in PedsQL™ from parents' report on school domain were found on 11 subjects (52%) in the mosaic karyotype, meanwhile, there were only 3 subjects (14%) who had ≥70 score in the classical karyotype. Analysis using Spearman's correlation showed that there was a significant correlation between karyotype and quality of life in the school domain based on the parents' report at PedsQL™ (P = 0.016).

Learning disability and concentration problem were found in most subjects in this study, comprised of five subjects with classical karyotype and one subject with mosaic karyotype. In general, except for the learning disability and concentration problem, other comorbidities

regarding abnormalities in the organs and body metabolism were found more in the subjects with mosaic karyotype compared to the subjects with classical karyotype in this study.

Discussion

Twenty-one subjects were included in this study. The samples were categorized as adolescents at the time of data collection. Eight were having classical karyotype and thirteen were having mosaic karyotype. Turner syndrome was diagnosed at various ages, with adolescents age group as the majority (>12-18 years old). Only one out of 21 subjects (4.8%) was diagnosed at birth. Nuchal translucency, cystic hygroma and left heart obstruction anomaly such as coarctation of the aorta are some of the findings on the ultrasonography (USG) which were suggestive of prenatal Turner syndrome diagnosis.[3] A study that was done in Belgium had a different result on the age of diagnosis of Turner syndrome, whereas the diagnosis established during infancy was 30%, 48% during childhood, and 22% during adolescence.[13] If the diagnosis is made when the patients are older, the therapy will most likely be delayed and thus, the outcome will be affected.

There was a significant correlation between classical karyotype and several specific findings, which were: *webbed neck* (P = 0,032) and *cubitus valgus* (P = 0,046). *Webbed neck* was found on 75% of the subjects with classical karyotype compared to 23% subjects with mosaic karyotype. *Cubitus valgus* was found on all (100%) subjects with classical karyotype, while only 54% of the findings were positive on the subjects with mosaic karyotype. Narrowed maxilla and malocclusion were commonly found on the classical karyotype (88%) compared to the mosaic karyotype (38%). Other specific physical findings were positive on both classical and mosaic karyotypes, but there was no significant correlation (P > 0,005). This might be caused by a more extensive X chromosome haploinsufficiency in the classical karyotype group compared to the mosaic karyotype group, thus, more clinical manifestations were found in classical karyotype group.[26] SHOX gene haploinsufficiency can cause short stature, abnormal bone growth such as *cubitus valgus* and imperfect bone differentiation.[14-16] Pseudoautosomal gene haploinsufficiency

at X chromosome causes lymphatic system abnormality and might cause generalized lymphedema, webbed neck, low posterior hairline, nail dysplasia, and lymphedema.[16]

Premenstrual syndrome is a group of symptoms happening in women during the menstrual cycle.[17] In Turner syndrome patients, estrogen hormone therapy needs to be done due to gonadal failure.[18] Hormonal factor was found to play a great role in the severity of PMS, thus, in turn, hormonal disturbance can affect the QoL too.[17, 19, 20]

There was a significant correlation between the quality of life based on PedsQL™ parents' report on the school domain and karyotype (P = 0,016). A better score was found on the mosaic karyotype group (52%) compared to the classical karyotype group (14%). Overall, based on the PedsQL™ parents' report on the school domain, 66% of all subjects' score was ≥70 while only 34% of all subjects' score was <70. This study also showed that there was no significant correlation between karyotype and other quality of life based on PedsQL™ parameter.

Generally, Turner syndrome patients might attain a normal Intelligence Quotient (IQ) score and a good verbal skills, although there might also be some deficits in visuospatial ability, executive function, social cognitive function, and decreased mathematics ability.[21, 22] Those findings might happen due to the brain structure differences between normal people and Turner syndrome patients. A study found that the gray matter on the brain of the Turner syndrome patients was increased in parts of the brain which played a role in verbal function.[21] Intervention in the form of practices that were done to increase patients' visuospatial function after Turner syndrome was diagnosed was found to be effective in increasing the nonverbal function, thus, a good result can be attained on the patients' intelligence performance.[23] The aforementioned factors could play a role in Turner Syndrome patients' normal IQ findings and good verbal skills. A research done in the United States even showed that lots of Turner Syndrome patients could achieve bachelor education and could get a decent job in society.[24] Thus, it was reasonable that a good school performance domain based on the parents' report on PedsQL™ in this study showed a good score.

In some other parts of the brain, Turner syndrome patients' gray matter was also found to be lesser than normal people. The areas with the less gray matter were different between people with classical karyotype and mosaic karyotype. In the classical karyotype, decreased gray matter was found in several areas such as bilateral cuneus, calcarine sulcus, postcentral gyrus, right precuneus, superior parietal lobule, lingual gyrus, left precentral gyrus and cingulate gyrus. On mosaic karyotype, decreased amount of gray matter was found in different areas in the brain such as left precuneus, cingulate gyrus, postcentral gyrus, supramarginal gyrus, angular gyrus, and cuneus. Those brain areas were related to visual-spatial function, calculation, logic, and concentration[21]. Intellectual function difference was also found between classical karyotype and mosaic karyotype. People with classical karyotypes were commonly found to have a lower intelligence function compared to mosaic karyotype.[23] The difference in the area with decreased gray matter in classical and mosaic karyotype might result in the difference between both karyotype's quality of life in parents' report school domain based on PedsQL^{TM}, as the result of this study showed.

It can be seen from this study that comorbidities, especially regarding body metabolic system and abnormalities in the organs were found more in patients with the mosaic karyotype compared to the classical karyotype. This finding was contradictory to the previous studies, which stated that comorbidities were found more in the classical karyotype.[4] One possible explanation is it might be due to the different kinds of mosaicism in each subject. A study found that different types of karyotype mosaicism were more prone to some comorbidities, while the others were not. For example, in the isochromosome mosaic karyotype, HbA1c was found to be slightly elevated compared to the classical karyotype, indicating a slightly increased risk for diabetes mellitus. Isochromosome had been reported to increase the incidence of hearing loss, autoimmunity and congenital heart disease. However, in most cases, comorbidities and phenotypes in isochromosome mosaic karyotype were found to be similar to classical karyotype.[4]

Physical abnormalities that happened in Turner syndrome were found to be closely related to the haploinsufficiency. Hearing problems were commonly found, and it was thought to be caused by an error during embryologic development of the ears which would cause anatomical abnormality in ears later due to the insufficiency of SHOX gene expression. Hearing loss might happen, be it conductive, sensorineural, or mixed hearing loss. Thus, a routine hearing examination is important for Turner syndrome patients.[25] Thyroid abnormality in Turner syndrome was thought to result from autoimmunity. However, it was also found that autoantibody was not always found in Turner syndrome patients with thyroid abnormality, although routine treatment was still recommended for these patients.[26]

Lipid abnormality was commonly found in Turner syndrome patients and was thought to be caused by ovarian failure, which would affect estrogen hormone production. Estrogen deficient state was found to increase total cholesterol level, and both HDL and LDL cholesterol. Another possible contributing factor to this condition was insulin resistance, although there was still no clear connection found between insulin resistance and lipid abnormality in Turner syndrome.[19]

Kidney abnormalities, mostly structural, were also commonly found in Turner syndrome. This might contribute to a higher risk of hypertension, urinary tract infection, and hydronephrosis, although initially, structural anomalies might be asymptomatic. This implied that renal screening was also important in Turner syndrome patients.[27]

Very few studies have been done regarding the correlation between Turner Syndrome patients' karyotype and their quality of life, and also between karyotype, phenotype, and comorbidity, so, this study was done with the intention to shed some light about that and to hopefully initiate future, more detailed studies in those areas.

The limitation of this study is there was no specific PedsQL™ questionnaire for Turner syndrome patients. In this study, the quality of life of the patients based on the PedsQL™ showed a normal result, except for the school domain by parents' report. It might happen

because the questions which are asked in general PedsQL™ questionnaire are not specific for Turner syndrome patients, thus, in this study, it appears as if the quality of life of the patient was not disturbed while in reality, it might be. In the future, the making of a specific PedsQL™ questionnaire for Turner syndrome patients can be considered to support other studies with similar purposes with this study.

Conclusions

1. Karyotype in Turner Syndrome is significantly correlated with the quality of life in the school domain, and mosaic karyotype has a better outcome compared to the classical karyotype. This might be affected by the difference in the gray matter composition in brain areas between classical and mosaic karyotype.
2. Karyotype is related to several phenotype characteristics in Turner syndrome.
3. Specific PedsQL™ for Turner syndrome is required to determine Turner syndrome patients' QoL more accurately.

Acknowledgments

The authors would like to thank the Turner Syndrome Society for the help received during sample collection.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest regarding this study.

References

1. Turner Syndrome. Genetics home reference. United States National Library of Medicine. [Cited 2018 May 1]. Available from: https://ghr.nlm.nih.gov/condition/turner-syndrome.
2. Stochholm K, Juul S, Juel K, Naeraa RW, Højbjerg Gravholt C. Prevalence, incidence, diagnostic delay, and mortality in Turner syndrome. J Clin Endocrinol Metab. 2006;91(10):3897-902.
3. Shankar RK, Backeljauw PF. Current best practice in the management of Turner syndrome. Ther Adv Endocrinol Metab. 2018;9(1):33-40.
4. Cameron-Pimblett A, La Rosa C, King TF, Davies MC, Conway GS. The Turner syndrome life course project: Karyotype-phenotype analyses across the lifespan. Clin Endocrinol (Oxf). 2017;87(5):532-8.
5. Leidy NK, Revicki DA, Genesté B. Recommendations for evaluating the validity of quality of life claims for labeling and promotion. Value Health. 1999;2(2):113-27.
6. Christopoulos P, Deligeoroglou E, Laggari V, Christogiorgos S, Creatsas G. Psychological and behavioral aspects of patients with Turner syndrome from childhood to adulthood: a review of the clinical literature. J Psychosom Obst Gynecol. 2008;29(1):45-51.
7. Boman UW, Bryman I, Möller A. Psychological well-being in women with Turner syndrome: somatic and social correlates. J Psychosom Obs Gynecol. 2004;25(3-4):211-9.
8. Cragg SJ, Lafreniere KD. Effects of Turner syndrome on women's self-esteem and body image. J Dev and Phys Disabil. 2010;22(5):433-45.
9. Suzigan LZ, Silva RBP, Marini SH, Baptista MTM, Guerra Jr G, Magna LA, et al. Turner syndrome: the patients' view. J Pediatr. (Rio J). 2004;80(4):309-14.
10. Brown L, Seid M. The healthy families program health status assessment (PedsQLTM) final report. September 2004 [Available from: http://www.mrmib.ca.gov/mrmib/HFP/PedsQL3.pdf.]

11. Varni JW, Burwinkle TM, Seid M. The PedsQL™ as a pediatric patient-reported outcome: Reliability and validity of the PedsQL™ measurement model in 25,000 children. Expert Rev Pharmacoecon Outcomes Res. 2005;5(6):705-19.
12. Allen S, McBride C, Pirie P. The shortened premenstrual assessment form. J Reprod Med. 1991;36(11):769-72.
13. Massa G, Verlinde F, De Schepper J, Thomas M, Bourguignon JP, Craen M, et al. Trends in age at diagnosis of Turner syndrome. Arc of Dis Child. 2005;90(3):267-8.
14. Stratakis CA, Sarafoglou K, Miller BS. Pediatric endocrinology and inborn errors of metabolism. In: Sarafoglou K, editor. United States: McGraw-Hill Companies; 2009. p. 477-86.
15. Hjerrild BE, Mortensen KH, Gravholt CH. Turner syndrome and clinical treatment. Br Med Bull. 2008;86(1):77-93.
16. Davenport ML. Approach to the patient with Turner syndrome. J Clin Endocrinol Metab. 2010;95(4):1487-95.
17. Kronenberg HM, Larsen PR, Melmed S, Polonsky KS. Williams Textbook of Endocrinology. 13th ed: Elsevier; 2016.
18. Gravholt CH, Andersen NH, Conway GS, Dekkers OM, Geffner ME, Klein KO, et al. Clinical practice guidelines for the care of girls and women with Turner syndrome: proceedings from the 2016 Cincinnati International Turner Syndrome Meeting. Eur J Endocrinol. 2017;177(3):G1-G70.
19. Ross JL, Feuillan P, Long LM, Kowal K, Kushner H, Cutler Jr GB. Lipid abnormalities in Turner syndrome. J Pediatr. 1995;126(2):242-5.
20. Choi D, Lee D-Y, Lehert P, Lee IS, Kim SH, Dennerstein L. The impact of premenstrual symptoms on activities of daily life in Korean women. J Psychosom Obstet Gynaecol. 2010;31(1):10-5.

21. Zhao Q, Zhang Z, Xie S, Pan H, Zhang J, Gong G, et al. Cognitive impairment and gray/white matter volume abnormalities in pediatric patients with Turner syndrome presenting with various karyotypes. J Pediatri Endocrinol Metab. 2013;26(11-12):1111-21.
22. Culen C, Ertl D-A, Schubert K, Bartha-Doering L, Haeusler G. Care of girls and women with Turner syndrome: beyond growth and hormones. Endocr Connect. 2017;6(4):R39-R51.
23. O'Connor J, Fitzgerald M, Hoey H. The relationship between karyotype and cognitive functioning in Turner syndrome. Ir J Psychol Med. 2000;17(3):82-5.
24. Gould HN, Bakalov VK, Tankersley C, Bondy CA. High levels of education and employment among women with Turner syndrome. J Women's Health. 2013;22(3):230-5.
25. Alves C, Oliveira CS. Hearing loss among patients with Turner's syndrome: literature review. Braz J Otorhinolaryngol. 2014;80(3):257-63.
26. Gawlik A, Gawlik T, Januszek-Trzciakowska A, Patel H, Malecka-Tendera E. Incidence and dynamics of thyroid dysfunction and thyroid autoimmunity in girls with Turner’s syndrome: a long-term follow-up study. Horm Res Paediatrics. 2011;76(5):314-20.
27. Carvalho AB, Guerra Júnior G, Baptista MTM, Faria APMd, Marini SHVdL, Guerra ATM. Cardiovascular and renal anomalies in Turner syndrome. Rev Assoc Med Bras. 2010;56(6):655-9.

Characteristics		Karyotype		N	Percentage
		Classical	Mosaics		
Current age	Infants (0-2 years old)	0	0	0	0%
	Children (>2-12 years old)	0	0	0	0%
	Adolescents (>12-21 years old)	8	13	21	100%
Age when diagnosed	Infants (0-2 years old)	1	0	1	4.76%
	Children (>2-12 years old)	1	5	6	28.57%
	Adolescents (>12-21 years old)	6	8	14	66.67%
Education	Elementary school	0	1	1	4.76%
	Junior high school	5	1	6	28.57%
	Senior high school	1	5	6	28.57%
	College	2	6	8	38%
Estrogen hormone therapy	Natural Synthetic	6 2	7 6	13	61.9% 38.1%
Premenstrual syndrome	No menarche No-mild symptoms Moderate-severe symptoms	5 1 2	2 9 2	7 10	33.33% 47.62% 19.05%

Table 1. Turner Syndrome Patients' Characteristics

Table 2. Karyotype Distribution

Karyotype	n	Percentage	Total (%)
Classical			
45XO	8	38	38
Mosaic			
45XO/46XX	6	28	62
45XO/46Xi(X)(q10)	4	19	
46Xi(X)(q10)/46XX	1	5	
45XO/46XY	1	5	
45XO/46XY/47XYY	1	5	

Table 3. Correlation Between Karyotype with Turner Syndrome Patients' Phenotype Characteristics

Characteristic physical examination	Karyotype		
	Classical (n=8)	Mosaics (n=13)	*P* value*)
Short stature	7 (88%)	11 (92%)	0.906
Lymphedema	0	1 (8%)	1.000
Webbed neck	6 (75%)	3 (23%)	0.032
Pigmented nevus	2 (25%)	7 (54%)	0.367
Abnormal and twisted ear shape	4 (50%)	2 (15%)	0.146
Narrow maxillae and maloccluded	7 (88%)	5 (38%)	0,067
Low posterior hairline	7 (88%)	9 (69%)	0.606
Wide chest, increased nipple distance	8 (100%)	10 (77%)	0.257
Ptosis	6 (75%)	5 (38%)	0.183
Cubitus valgus	8 (100%)	7 (54%)	0.046
Shortened metacarpal IV	5 (62%)	7 (54%)	1.00
Nail dysplasia	0	2 (15%)	0.505
High located palatum	7 (88%)	9 (69%)	0.606
***Coarctation* aorta**	1 (12%)	0	0.381
Scoliosis	2 (25%)	3 (23%)	1.00
Delayed puberty	8 (100%)	13 (100%)	-

Note : *) with Exact Fisher Test.

Tabel 4. Correlation between Karyotype and Quality of Life (PedsQL children and parents report)

PedsQL	Karyotype		*P* value*
	Classical (n=8)	Mosaics (n=13)	
QL domain 1 (physical)			
Skor <70	2 (10%)	4 (19%)	0.861
Skor ≥70	6 (29%)	9 (43%)	
QL domain 2 (emotional)			
Skor <70	4 (19%)	6 (29%)	0.359
Skor ≥70	4 (19%)	7 (33%)	
QL domain 3 (social)			
Skor <70	3 (14%)	6 (29%)	0.944
Skor ≥70	5 (24%)	7 (33%)	
QL domain 4 (school)			
Skor <70	5 (24%)	4 (19%)	0.269
Skor ≥70	3 (14%)	9 (43%)	
PEDS QL-1 parents report (physical)			
Skor <70	2 (10%)	0	0.413
Skor ≥70	6 (29%)	13 (62%)	
PEDS QL-2 parents report (emotional)			
Skor <70	3 (14%)	1 (5%)	0.371
Skor ≥70	5 (24%)	12 (57%)	
PEDS QL-3 parents report (social)			
Skor <70	3 (14%)	1 (5%)	0.236
Skor ≥70	5 (24%)	12 (57%)	
PEDS QL-4 parents report (school)			
Skor <70	5 (24%)	2 (10%)	0.016
Skor ≥70	3 (14%)	11 (52%)	

Note: *with Spearman's correlation test

Table 5. Comorbidity in Turner Syndrome

Comorbidity	Karyotype	
	Classical (n=8)	Mosaic (n=13)
Strabismus	0	1
Ear abnormality	1 (12.5%)	0
Graves' disease	0	1 (7.7%)
Dyslipidemia	0	2 (15.4%)
Renal hypoplasia	0	2 (15.4%)
Hypertension	0	1 (7.7%)
Adrenal tumour	0	1 (7.7%)
Atresia ani	0	1 (7.7%)
Rectovaginal fistule	0	1 (7.7%)
Diabetes mellitus type II	0	1 (7.7%)
Intellectual disability	1 (12.5%)	1 (7.7%)
Learning disability and concentration problem	5 (62.5%)	1 (7.7%)