

广州市 2019—2023 年中小学生脊柱弯曲异常与近视共患流行状况及相关因素分析

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摘要:目的 分析广州市 2019—2023 年中小学生脊柱弯曲异常与近视共患流行状况及其相关因素, 为学生常见病“共病-共因-共防”机制建立提供参考。方法 2019—2023 年每年 9 月, 采取分层整群随机抽样方法, 对广州市 4 248、4 230、4 266、25 476、25 587 名中小学生开展脊柱弯曲异常和近视筛查以及问卷调查。采用 χ^2 检验比较组间差异和进行单因素分析, 采用多因素 logistic 回归模型探究脊柱弯曲异常与近视共患影响因素。结果 2019—2023 年广州市中小学生脊柱弯曲异常与近视共患率为 2.96%~6.00%。各学段学生、总体中小学生 5 年间两病共患率差异均有统计学意义(P 值均 <0.05)。多因素 logistic 回归分析结果显示, 已来月经或遗精($OR=1.77$, 95% CI : 1.04~3.02)、每天视屏时间 $2\sim<3h$ 和 $\geq 3h$ ($OR=3.06$, 2.28, 95% CI : 1.41~6.68, 1.02~5.19)、每天白天户外活动 $<2h$ ($OR=2.28$, 95% CI : 1.22~4.26)的四至六年级小学生, 消瘦($OR=1.72$, 95% CI : 1.11~2.67)、老师“从不或偶尔”提醒读写姿势($OR=1.50$, 95% CI : 1.06~2.12)、对坐姿/站姿自我要求不严格($OR=2.51$, 1.99, 95% CI : 1.29~4.86, 1.06~3.74)的初中生, 消瘦($OR=1.89$, 95% CI : 1.47~2.41)、课间休息时在教学楼内活动($OR=1.33$, 95% CI : 1.02~1.75)、读写时胸离桌沿“从不或偶尔”超过一拳($OR=1.27$, 95% CI : 1.05~1.53)的高中生两病共患风险相对较高(P 值均 <0.05)。结论 广州市中小学生脊柱弯曲异常与近视共患与日间运动锻炼、不良姿势久坐行为相关。应加强青春期学生, 尤其是城区、女性、消瘦学生脊柱弯曲异常和近视早筛早治。

关键词:脊柱弯曲异常; 近视; 学生; 共病; 回归分析

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Epidemic status and relevant factors on the co-morbidity of spinal curvature abnormality and myopia among primary and middle school students, Guangzhou, 2019-2023

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Abstract: Objective To analyze the co-morbidity of spinal curvature abnormality and myopia and the relevant factors in primary and middle school students in Guangzhou from 2019 to 2023, so as to provide references for the establishment of the mechanism of Co-morbidity, Shared Etiology, and Shared Prevention of common diseases in students. **Methods** From September 2019 to 2023, used stratified random cluster sampling, 4 248, 4 230, 4 266, 25 476, 25 587 primary and middle school students were selected as subjects for spinal curvature abnormality and myopia screening and questionnaire survey. The χ^2 test was used for comparing the group differences and univariate analysis. The multivariable logistic regression model was used to explore the influencing factors of their co-morbidity. **Results** the co-morbidity rates of spinal curvature abnormality and myopia were 2.96%~6.00% from 2019 to 2023 in primary and middle school students in Guangzhou. The differences in the co-morbidity rates among students of each phases of studying and the difference of the co-morbidity rate in primary and middle school students over the past 5 years were statistically significant ($P<0.05$). Multivariate logistic regression analysis showed that low BMI junior and senior high school students ($OR=1.72$, 1.89, 95% CI : 1.11~2.67, 1.47~2.41) were more likely to suffer these two diseases. Primary school students in grades 4 to 6 who had menarche or spermatorrhea ($OR=$

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1.77, 95% CI: 1.04 - 3.02), screening time 2 - <3h or \geq 3h per day ($OR = 3.06, 2.28, 95\% CI: 1.41 - 6.68, 1.02 - 5.19$), outdoor activities time <2h per day ($OR = 2.28, 95\% CI: 1.22 - 4.26$), junior high school students with low BMI ($OR = 1.72, 95\% CI: 1.11 - 2.67$), whose teacher "never or occasionally" reminded reading and writing posture ($OR = 1.50, 95\% CI: 1.06 - 2.12$), who were not strict with requiring standing and sitting posture themselves ($OR = 2.51, 1.99, 95\% CI: 1.29 - 4.86, 1.06 - 3.74$), senior high school students with low BMI ($OR = 1.89, 95\% CI: 1.47 - 2.41$) who had activities in the teaching building during recess ($OR = 1.33, 95\% CI: 1.02 - 1.75$), distance from chest to the edge of table "never or occasionally" more than 1 fist away during reading and writing ($OR = 1.27, 95\% CI: 1.05 - 1.53$) had a higher risk of spinal curvature abnormality and myopia - morbidity ($P < 0.05$). **Conclusion** The co - morbidity of spinal curvature abnormality and myopia was associated with daytime outdoor exercise and sedentary behavior with bad posture. Early screening and early treatment of spinal curvature abnormality and myopia should be strengthened among adolescent students, especially in urban, female and emaciated students.

Keywords: Spinal curvature abnormality; Myopia; Students; Co - morbidity; Regression analysis

脊柱弯曲异常和近视已成为影响我国儿童青少年健康和全面发展的突出问题。以往研究显示^[1-2], 脊柱弯曲异常和近视可能存在共同行为和环境影响因素,二者患病人群存在重叠^[3],探索“共因”、采取“共防”措施,在改善共病问题上能达到事半功倍的效果。目前我国有关二者共患相关报道较少,因此,本研究基于 2019—2023 年广州市近视等学生常见病和健康影响因素监测数据,分析脊柱弯曲异常与近视共患流行状况,探讨共病影响因素,为学生常见病“共病—共因—共防”机制建立提供参考。

1 对象与方法

1.1 对象 根据《全国学生常见病和健康影响因素监测与干预技术工作手册》^[4](简称工作手册)要求,采取分层整群随机抽样方法,按城郊分层,2019—2021 年选择广州市 1 个城区和 1 个郊区,2022—2023 年全市所有辖区均开展监测调查。按学段分层,城区随机抽取小学、初中、普通高中各 2 所,职业高中 1 所,郊区随机抽取小学、初中各 2 所,普通高中 1 所。按年级分层,以整班为单位,每年级至少抽取 80 名学生。最终共有 4 248、4 230、4 266、25 476、25 587 名中小學生纳入分析。本项目经广州市疾病预防控制中心伦理审查委员会批准(批号:GZCDC - ECHR - 2019P0056),调查前已取得家长和学生知情同意。

1.2 方法

1.2.1 脊柱弯曲异常筛查 按照《儿童青少年脊柱弯曲异常防控技术指南》^[5]开展筛查,包括一般检查、前屈试验、脊柱运动试验、俯卧试验和脊柱侧弯测量仪检查。一般检查异常或前屈试验阳性或 $ATR \geq 5^\circ$ 者,脊柱运动试验后脊柱侧弯测量仪检查 $ATR \geq 5^\circ$ 为脊柱侧弯筛查阳性^[5]。脊柱侧面检查有脊柱前凸或后凸体征,且俯卧试验阳性者为脊柱前后弯曲异常^[5]。

1.2.2 眼科检查 按照《儿童青少年近视筛查规

范》^[6]要求进行。远视力使用 5 米标准对数视力表检查,屈光在非睫状肌麻痹下使用台式自动电脑验光仪检测。裸眼远视力 <5.0 且非睫状肌麻痹下电脑验光等效球镜度数 < -0.50 D 为筛查性近视,单眼近视者、戴角膜塑形镜者纳入近视人数^[7]。

1.2.3 问卷调查 采用工作手册中小学版和中学版“学生健康状况及影响因素调查表”、“学生近视、脊柱弯曲异常及影响因素专项调查表”对四至六年级小学生和中学生开展问卷调查。该调查表已经过多轮专家论证和现场调查论证。小学三至六年级和初中每周 3 课时,高中阶段每周 2 课时为体育课课时数达标^[8]

1.3 统计学方法 使用 EpiData 3.1 软件建立数据库,并进行数据双录入和一致性检验,采用 Excel 2016 和 SPSS 26.0 软件整理和统计分析数据。分类资料使用频数和率描述。采用 χ^2 检验进行率的比较,采用二分类 logistic 回归模型分析脊柱弯曲异常与近视共患的相关因素。检验水准 $\alpha = 0.05$ 。

2 结果

2.1 脊柱弯曲异常与近视共患流行情况 2019—2023 年广州市中小學生脊柱弯曲异常与近视共患率为 3.70%、3.85%、6.00%、2.96%、3.19%。各学段学生、总体中小學生 5 年间两病共患率差异均有统计学意义(P 值均 <0.05)。见表 1。

2.2 不同学段学生脊柱弯曲异常与近视共患的单因素分析 三个学段学生两病共患率在监测点、性别、消瘦情况、来月经或遗精情况、课间休息时活动场所、每天视屏时间、每天白天户外活动时间、做到每天 ≥ 60 min 中高强度运动天数、做到每天 ≥ 60 min 中高强度运动频率(周末或节假日)、读写时超过一拳一尺一寸频率、老师提醒读写姿势频率、坐姿/站姿自我要求上差异有统计学意义(P 值均 <0.05)。见表 2。

表 1 2019 — 2023 年广州市中小學生脊柱弯曲异常与近视共患率比较

Table 1 Comparison of the co - morbidity rate of spinal curvature abnormality and myopia in primary and middle school students in Guangzhou from 2019 to 2023

年份	脊柱弯曲异常与近视共患率% (检出人数/受检人数)				
	小学	初中	普通高中	职业高中	中小学
2019	0.57(12/2 100)	4.91(54/1 099)	9.37(74/790)	6.56(17/259)	3.70(157/4 248)
2020	0.71(15/2 109)	5.38(58/1 079)	7.43(59/794)	12.50(31/248)	3.85(163/4 230)
2021	1.00(21/2 096)	7.42(83/1 118)	13.77(111/806)	16.67(41/246)	6.00(256/4 266)
2022	0.43(49/11 470)	3.86(233/6 041)	6.27(357/5 690)	5.01(114/2 275)	2.96(753/25 476)
2023	0.61(70/11 500)	3.73(224/6 000)	6.37(354/5 559)	6.61(167/2 528)	3.19(815/25 587)
χ^2 值	12.06	38.44	71.80	63.20	111.50
P 值	0.017	<0.001	<0.001	<0.001	<0.001

表 2 2023 年广州市不同学段学生脊柱弯曲异常与近视共患的单因素分析(n = 19 788)

Table 2 Univariate analysis of spinal curvature abnormality and myopia co - morbidity of different phases of studying students from Guangzhou in 2023 (n = 19 788)

因素	选项	小学(n = 5 816)			初中(n = 5 958)			高中(n = 8 014)		
		两病共患 [n(%)]	χ^2 值	P 值	两病共患 [n(%)]	χ^2 值	P 值	两病共患 [n(%)]	χ^2 值	P 值
监测点	城区	61(1.27)	7.31	0.007	209(4.30)	22.66	<0.001	508(6.81)	21.65	<0.001
	郊区	3(0.30)			14(1.28)			10(1.79)		
性别	男	10(0.32)	37.01	<0.001	56(1.78)	71.46	<0.001	166(4.15)	70.81	<0.001
	女	54(1.99)			167(5.94)			352(8.77)		
消瘦	否	60(1.16)	1.67	0.196	187(3.47)	11.43	0.001	433(6.02)	22.89	<0.001
	是	4(0.61)			36(6.29)			85(10.35)		
来月经或遗精	否	42(0.88)	12.61	<0.001	49(2.06)	30.82	<0.001	66(5.09)	4.81	0.028
	是	22(2.15)			174(4.85)			452(6.73)		
一周做到每天 ≥ 60 min 中高强度运动天数	0 天	10(1.86)	3.30	0.192	22(4.49)	2.41	0.300	116(8.41)	11.61	0.003
	1~6 天	44(1.06)			173(3.82)			360(6.18)		
	7 天	10(0.90)			28(2.97)			42(5.17)		
周末或节假日做到每天 ≥ 60 min 中高强度运动	都能 + 多数能做到	23(0.89)	2.27	0.322	49(2.77)	12.24	0.002	82(4.95)	11.60	0.003
	一半日子能做到	14(1.11)			54(3.28)			95(5.84)		
	几乎 + 少数能做到	27(1.36)			120(4.71)			341(7.21)		
一周上体育课节数	不达标	15(0.83)	1.69	0.193	16(3.96)	0.06	0.811	35(7.16)	0.42	0.520
	达标	49(1.22)			207(3.73)			483(6.42)		
根据身高调整课桌椅高度	少于一学年一次	25(1.15)	0.09	0.771	112(3.64)	0.18	0.673	328(6.16)	2.51	0.113
	不少于一学年一次	39(1.07)			111(3.85)			190(7.08)		
课间休息时活动场所	教学楼内	57(1.27)	5.10	0.024	194(4.09)	7.91	0.005	454(6.89)	11.29	0.001
	户外	7(0.53)			29(2.38)			64(4.48)		
每天放学后读写时间	<1 h	11(0.96)			22(4.65)	6.70	0.153	53(5.24)	3.49	0.480
	1~<2 h	29(1.19)	0.45	0.978	63(3.10)			130(6.99)		
	2~<3 h	15(1.10)			74(3.57)			117(6.39)		
	≥ 3 h	7(1.10)			55(4.66)			201(6.60)		
	不知道	2(0.95)			9(4.52)			17(6.34)		
读写时胸离桌沿超过一拳	从不或偶尔	30(1.08)	0.02	0.882	123(3.95)	0.76	0.384	336(7.22)	10.42	0.001
	经常或总是	34(1.12)			100(3.52)			182(5.42)		
读写时眼离书本超过一尺	从不或偶尔	32(1.24)	0.88	0.348	122(4.20)	3.25	0.072	312(6.96)	4.09	0.043
	经常或总是	32(0.99)			101(3.31)			206(5.84)		
读写时手指离笔尖一寸	从不或偶尔	31(1.35)	2.24	0.135	117(4.31)	4.42	0.035	271(6.55)	0.10	0.748
	经常或总是	33(0.94)			106(3.27)			247(6.37)		
老师提醒读写姿势	从不或偶尔	40(1.18)	0.48	0.487	181(4.27)	11.36	0.001	435(6.59)	0.93	0.335
	经常或总是	24(0.99)			42(2.44)			83(5.89)		

(续表)

因素	选项	小学(<i>n</i> = 5 816)			初中(<i>n</i> = 5 958)			高中(<i>n</i> = 8 014)		
		两病共患 [<i>n</i> (%)]	χ^2 值	<i>P</i> 值	两病共患 [<i>n</i> (%)]	χ^2 值	<i>P</i> 值	两病共患 [<i>n</i> (%)]	χ^2 值	<i>P</i> 值
每天视屏时间	<1 h	43(0.99)	11.45	0.010	140(3.77)	2.74	0.434	257(6.35)	7.79	0.050
	1 ~ <2 h	6(0.72)			43(4.10)			95(8.00)		
	2 ~ <3 h	8(2.76)			12(2.45)			61(6.92)		
	≥3 h	7(1.98)			28(3.94)			105(5.53)		
躺着或趴着看书或电子屏幕	从不或偶尔	55(1.05)	1.55	0.214	190(3.74)	0.00	0.985	399(6.48)	0.01	0.939
	经常或总是	9(1.62)			33(3.75)			119(6.43)		
每天白天户外活动时间	不知道	4(1.19)	7.13	0.028	6(2.53)	6.71	0.035	9(3.98)	9.96	0.007
	<2 h	47(1.39)			143(4.30)			388(7.03)		
每天睡眠时间	<8h	10(1.29)	0.29	0.592	109(3.97)	0.74	0.389	416(6.71)	2.68	0.102
	≥8 h	54(1.07)			114(3.55)			102(5.63)		
背书包习惯	双肩包背胸前	2(1.48)	2.35	0.672	1(0.74)	7.12	0.130	17(7.14)	0.20	0.995
	双肩包背背后	60(1.13)			199(3.75)			434(6.46)		
	双肩包背一侧	2(1.09)			12(3.83)			42(6.34)		
	背单肩包	0(0.00)			7(7.53)			20(6.41)		
	用带轮书包	0(0.00)			4(3.77)			5(6.33)		
自我感觉书包重量	很轻	0(0.00)	6.24	0.284	10(3.91)	3.13	0.681	37(4.89)	6.82	0.235
	较轻	3(0.63)			33(4.50)			134(6.54)		
	中等	23(0.98)			109(3.74)			249(6.56)		
	较重	26(1.45)			47(3.44)			71(7.76)		
	很重	11(1.32)			21(3.99)			13(4.98)		
	没感觉	1(0.51)			3(1.89)			14(5.88)		
对坐姿/站姿自我要求	无所谓, 舒服就行	12(1.49)	3.66	0.300	54(4.48)	10.84	0.013	139(5.44)	12.82	0.005
	有时会监督自己	23(1.02)			116(4.02)			290(7.44)		
	时常会提醒自己	20(1.34)			42(3.51)			65(6.06)		
	时刻保持良好姿势	9(0.72)			11(1.64)			24(4.93)		

2.3 不同学段学生脊柱弯曲异常与近视共患的多因素 logistic 回归分析 以两病共患与否为因变量(是 = 1, 否 = 0), 将单因素分析中有统计学意义的因素作为自变量纳入多因素 logistic 回归分析(向前 LR 法)。结果显示, 已来月经或遗精(*OR* = 1.77)、每天视屏时间 2 ~ <3 h 和 ≥3 h(*OR* = 3.06, 2.28)、每天白天户外活动时间 <2h(*OR* = 2.28) 的四至六年级小学生, 两病共患发生风险相对较高(*P* 值均 < 0.05)。消瘦

(*OR* = 1.72)、老师“从不或偶尔”提醒读写姿势(*OR* = 1.50)、对坐姿/站姿自我要求“无所谓, 舒服就行”和“有时会监督自己”(*OR* = 2.51, 1.99)的初中生两病共患发生风险相对较高(*P* 值均 < 0.05)。消瘦(*OR* = 1.89)、课间休息时在教学楼内活动(*OR* = 1.33)、读写时胸离桌沿“从不或偶尔”超过一拳(*OR* = 1.27)的高中生, 两病共患发生风险相对较高(*P* 值均 < 0.05)。见表 3。

表 3 2023 年广州市不同学段学生脊柱弯曲异常与近视共患的多因素 logistic 回归分析(*n* = 19 788)

Table 3 Multiple logistic regression analysis of spinal curvature abnormality and myopia co - morbidities of different phases of studying among primary and secondary school students from Guangzhou in 2023 (*n* = 19 788)

自变量	选项	β 值	标准误	Wald χ^2 值	<i>P</i> 值	<i>OR</i> 值(95% <i>CI</i>)
小学	监测点					1.00
	郊区					4.15(1.30 ~ 13.29)
性别	城区	1.42	0.59	5.73	0.017	
	男					1.00
来月经或遗精	女	1.70	0.35	23.54	<0.001	5.46(2.75 ~ 10.85)
	否					1.00
每天视屏时间	是	0.57	0.27	4.40	0.036	1.77(1.04 ~ 3.02)
	<1h					1.00
	1 ~ <2 h	-0.32	0.44	0.54	0.462	0.72(0.31 ~ 1.71)

(续表)

自变量	选项	β 值	标准误	Wald χ^2 值	P 值	OR 值(95% CI)
每天白天户外活动时间	2 ~ <3 h	1.12	0.40	7.93	0.005	3.06(1.41 ~ 6.68)
	≥ 3 h	0.82	0.42	3.86	0.049	2.28(1.02 ~ 5.19)
	≥ 2 h					1.00
	不知道	0.54	0.58	0.86	0.355	1.71(0.55 ~ 5.33)
	<2 h	0.82	0.32	6.70	0.010	2.28(1.22 ~ 4.26)
初中						
监测点	郊区					1.00
	城区	1.22	0.28	18.96	<0.001	3.37(1.95 ~ 5.83)
性别	男					1.00
	女	1.26	0.16	62.45	<0.001	3.53(2.58 ~ 4.82)
消瘦	否					1.00
	是	0.55	0.22	5.96	0.015	1.72(1.11 ~ 2.67)
老师提醒读写姿势	经常或总是					1.00
	从不或偶尔	0.41	0.18	5.26	0.022	1.50(1.06 ~ 2.12)
对坐姿/站姿自我要求	时刻保持良好姿势					1.00
	无所谓,舒服就行	0.92	0.34	7.38	0.007	2.51(1.29 ~ 4.86)
	有时会监督自己	0.69	0.32	4.54	0.033	1.99(1.06 ~ 3.74)
	时常会提醒自己	0.60	0.35	2.98	0.084	1.81(0.92 ~ 3.57)
高中						
监测点	郊区					1.00
	城区	1.36	0.32	17.76	<0.001	3.90(2.07 ~ 7.35)
性别	男					1.00
	女	0.78	0.10	63.21	<0.001	2.18(1.80 ~ 2.65)
消瘦	否					1.00
	是	0.63	0.13	25.17	<0.001	1.89(1.47 ~ 2.41)
课间休息时活动场所	户外					1.00
	教学楼内	0.29	0.14	4.32	0.038	1.33(1.02 ~ 1.75)
读写时胸离桌沿超过一拳	经常或总是					1.00
	从不或偶尔	0.24	0.10	6.24	0.013	1.27(1.05 ~ 1.53)

3 讨论

本项调查结果显示,2019—2023 年广州市中小学生学习脊柱弯曲异常与近视共患率为 3.70%、3.85%、6.00%、2.96% 和 3.19%,高于内蒙古地区^[1],各年两病共患率均为高中最高、小学最低,可能与随年龄增加,持续近距离用眼时间增多、不良姿势久坐、户外锻炼减少等危险因素日积月累以及青春期生长突增和激素分泌有关^[9-11],提示脊柱弯曲异常和近视防控关口须前移。

已来月经或遗精是小学生脊柱弯曲异常与近视共患的危险因素,与魏汝硕等^[12]、伍晓艳等^[13]研究结果一致,确切机制尚未明确。每天视屏 ≥ 2 h、每天日间户外活动<2 h 的小学生两病共患风险较高,以往一些学者的研究支持这一观点^[3, 13-14],其发生机制可能与脊柱周围肌肉和韧带力量不足和不均衡,眼脉络膜血流速度减慢、睫状肌调节疲劳、多巴胺分泌减少等有关^[9, 11, 15]。

本项研究发现,消瘦的中学生更容易共患脊柱弯曲异常与近视。李凯洋等^[2]、李梦等^[16]的研究结果支持此结论。原因可能与骨骼肌肌力和肌含量对稳

定躯体平衡、维持脊柱正常力线和支持力具有重要作用^[9, 11],而前者与体重呈正相关^[17],营养缺乏容易引起眼部疾病有关。

老师不常提醒读写姿势、对坐姿/站姿自我要求较低的初中生,课间休息在教学楼内活动、读写姿势“从不或偶尔”达到“一拳”的高中生两病共患风险较高。研究表明,青春期间长期不良姿态并缺乏运动锻炼引起的脊柱两侧受力不均可导致脊柱发育畸形^[17-18],读写姿势不良可能通过双眼睫状肌调节功能不一致、远视性离焦、巩膜缺氧等机制与引发和加重近视^[19-20]。

综上,提出以下两病共防建议,一是加强四年级及以上师生家长脊柱健康教育,提升防治意识;二是重视四年级及以上女生(尤其是月经初潮将至期)、消瘦学生的脊柱弯曲异常筛查;三是从小学起养成每天日间户外活动 2 小时的习惯,利用好课间、体育课和校内托管班,指导学生开展增强肌肉骨骼力量的护脊运动;四是注重正确身体姿势管理,不躺卧看书和视屏;五是小学阶段严格控制如视屏等近距离持续用眼时间。总之,需以日间户外锻炼为主要抓手,实现脊柱弯曲异常与近视同防同控。

本研究的局限性在于筛查阳性与确诊存在差距,横断面研究无法验证因果关系,自填式问卷存在回忆偏倚,后续可针对共患确诊人群开展研究。

利益冲突声明 本研究不存在任何利益冲突

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(上接第 3724 页)

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