

嘉兴市中小學生脊柱側彎調查

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摘要: **目的** 了解浙江省嘉兴市中小學生脊柱側彎發生情況, 為兒童青少年脊柱側彎防治提供依據。**方法** 於2019年採用分層整群抽樣方法, 抽取嘉兴市小学四~六年級和初中一~三年級學生為調查對象, 通過問卷調查收集人口學信息、飲食行為與營養狀況、體力活動、學習環境和讀寫習慣等資料; 採用一般檢查、前屈試驗和脊柱側彎測量儀篩查脊柱側彎, 採用直立位全脊柱X線攝片診斷脊柱側彎; 描述性分析中小學生脊柱側彎流行情況。**結果** 調查中小學生8 026人, 有效調查7 304人, 調查有效率為91.00%。其中小学3 667人, 占50.21%; 初中3 637人, 占49.79%。男生3 776人, 占51.70%; 女生3 528人, 占48.30%。初篩脊柱側彎陽性659例, 初篩陽性率為9.02%。胸段、胸腰段和腰段初篩陽性率分別為2.93%、4.56%和4.56%。平湖市(10.45%)、初中(11.74%)、女生(11.96%)、有貧血病史(22.44%)、過去1周中等強度體力活動<3 d(9.46%)、過去1周步行時間超過10 min的天數<3 d(10.18%)、過去1周靜坐時間≥5 h/d(10.74%)、班級座位每學期或每月調換1次(10.28%)、放學後讀寫時間≥3 h/d(10.93%)和讀寫時胸口距桌子邊緣未超過10 cm(1拳)(9.67%)的學生脊柱側彎初篩陽性率較高(均 $P<0.05$)。218例初篩陽性學生行直立位全脊柱X線攝片, 確診132例, 確診率為60.55%。估算嘉兴市中小學生脊柱側彎患病率為5.46%。**結論** 嘉兴市中小學生脊柱側彎初篩陽性率為9.02%。性別、學段、營養狀況、運動頻率和讀寫習慣可能是脊柱側彎發生的影響因素。

关键词: 脊柱側彎; 篩查; 影響因素; 青少年

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A cross-sectional study on prevalence of scoliosis among primary and middle school students in Jiaxing City

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Abstract: Objective To investigate the prevalence of scoliosis among primary and middle school students in Jiaxing City, Zhejiang Province, so as to provide insights into scoliosis control among children and adolescents. **Methods** Grade 4 to 6 primary school students and grade 1 to 3 junior high school students were recruited using a stratified cluster sampling method in Jiaxing City in 2019. Participants' demographic characteristics, dietary habits and nutritional status, physical activity, learning environments, reading and writing habits were collected using questionnaires. Scoliosis was screened through general examinations, forward bend test and scoliometer, and scoliosis was diagnosed with whole-spine X-ray scans in an erect position. The prevalence of scoliosis was descriptively analyzed among primary and middle school students. **Results** A total of 8 026 primary and middle school students were included, 7 304 valid questionnaires were recovered, with an effective recovery rate of 91.00%. The respondents included 3 667 primary school students (50.21%) and 3 637 junior high school students (49.79%), and included 3 776 boys (51.70%) and 3 528 girls

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(48.30%)。There were 659 participants with initial screening positive for scoliosis (9.02%), and the percentages of positive initial screening of thoracic, thoracolumbar and lumbar scoliosis were 2.93%, 4.56% and 4.56%, respectively. A higher percentage of positive initial screening of scoliosis was diagnosed among participants living in Pinghu City (10.45%), junior high school students (11.74%), girls (11.96%), students with a medical history of anemia (22.44%), students with less than 3 days of moderate-intensity physical activity in the past week (9.46%), students with less than 3 days of walking duration of over 10 minutes in the past week (10.18%), students with daily sitting duration of 5 hours and more in the past week (10.74%), students with their class seats exchanged every semester or month (10.28%), students with daily reading and writing duration of 3 hours and more after school (10.93%) and students with less than 10 cm distance from the chest at reading or writing to the edge of the table (9.67%) (all $P < 0.05$). A total of 218 students received whole-spine X-ray scans in an erect position, 132 participants were definitively diagnosed as scoliosis (60.55%), and the estimated prevalence of scoliosis was 5.46%. **Conclusion** The percentage of positive initial screening of scoliosis was 9.02% among primary and middle school students in Jiaxing City. Gender, stage of learning, nutritional status, exercise frequency and habits of reading and writing may be factors affecting the development of scoliosis.

Keywords: scoliosis; screening; influencing factor; teenager

脊柱侧弯是青少年最常见的肌肉骨骼问题之一,可伴随肢体不对称,严重者引起肺功能下降和呼吸短促^[1]。儿童青少年正处于生长发育的关键时期,脊柱侧弯早期筛查和干预具有重要临床意义。研究显示,中小学生对脊柱侧弯检出率为0.96%~12.18%,筛查方法主要包括“目测+前屈试验+脊柱运动试验+俯卧试验”“一般检查+前屈试验+X线检查”以及脊柱侧弯测量仪或体表三维扫描技术检查^[2-4]。直立位全脊柱X线摄片Cobb角 $>10^\circ$ 是诊断脊柱侧弯的金标准,但直接用于儿童青少年筛查可能带来不必要的辐射,可采用脊柱侧弯测量仪辅以前屈试验筛查。于2019年采用“一般检查+前屈试验+脊柱侧弯测量仪检查+X线检查”,对浙江省嘉兴市中小学生对脊柱侧弯筛查,为儿童青少年脊柱侧弯防治提供依据。

1 对象与方法

1.1 对象 选择嘉兴市小学四~六年级和初中一~三年级学生为调查对象。调查对象及其监护人均知情同意。本调查通过浙江省疾病预防控制中心伦理委员会审查,审批号:T-043-R20180515。

1.2 方法

1.2.1 抽样方法 根据现况调查总体率估算样本量公式^[5],置信水平为95%,脊柱侧弯率 p 取0.05,容许误差取 $0.1p$,估算最小样本量为7299人。采用分层整群抽样方法,从嘉兴市的区、县和县级市各随机抽取1个调查点,每个调查点按城市和农村分别抽取1所小学和1所初中,选取小学四~六年级和初中一~三年级学生为调查对象。

1.2.2 脊柱侧弯筛查 按照GB/T 16133—2014《儿童青少年脊柱弯曲异常的筛查》^[6]开展脊柱侧弯筛查,包括一般检查和前屈试验。前屈试验时辅助使用

脊柱侧弯测量仪测量脊柱各段的弯曲程度,记录侧弯的部位、方向和度数,以胸段、胸腰段和腰段任一处侧弯为脊柱侧弯初筛阳性。初筛阳性者转诊至医院行直立位全脊柱X线检查,由浙江省儿童医院骨科专家对X线片进行复核,Cobb角 $>10^\circ$ 诊断为脊柱侧弯。

1.2.3 问卷调查 采用自行编制的调查问卷进行调查,内容包括:(1)性别、年龄和居住地等人口学信息;(2)饮食行为与营养状况,含糖饮料、新鲜水果、新鲜蔬菜和早餐的摄入频率,贫血史和消瘦;(3)体力活动,体育课频率、重体力活动频率、中等强度体力活动频率和静坐时间;(4)学习环境、读写姿势和读写时间。

1.2.4 定义 根据WS/T 456—2014《学龄儿童青少年营养不良筛查》^[7]判定消瘦。重体力活动指需要花费大力气完成,呼吸较平常明显增强的活动,如搬(举)重物、跑步、游泳和踢足球等;中等强度体力活动指需要花费中等力气完成,呼吸较平常稍微增强的活动,如搬(举)轻物、骑自行车、打太极拳和羽毛球等。静坐时间指学习和从事休闲活动等静坐行为的累计时间,如坐着看电视、看书和乘车等。脊柱侧弯患病率(%) = [(初筛阳性人数×复查确诊率) / 调查总人数] × 100%。

1.3 统计分析 采用EpiData 3.1软件录入数据,采用SPSS 26.0软件统计分析。定性资料采用相对数描述,组间比较采用 χ^2 检验,以 $P < 0.05$ 为差异有统计学意义。

2 结果

2.1 基本情况 调查8026人,有效调查7304人,调查有效率为91.00%。其中小学3667人,占50.21%;初中3637人,占49.79%。男生3776人,

占 51.70%; 女生 3 528 人, 占 48.30%。

2.2 脊柱侧弯筛查结果 脊柱侧弯初筛阳性 659 例, 初筛阳性率为 9.02%。其中男生 237 例, 初筛阳性率为 6.28%; 女生 422 例, 初筛阳性率为 11.96%。胸段侧弯 214 例, 初筛阳性率为 2.93%; 胸腰段侧弯 333 例, 初筛阳性率为 4.56%; 腰段侧弯 333 例, 初筛阳性率为 4.56%。平湖市、初中、女生、有贫血史、过去 1 周中等强度体力活动 < 3 d、

过去 1 周步行时间超过 10 min 的天数 < 3 d、过去 1 周静坐时间 ≥ 5 h/d、班级座位每学期或每月调换 1 次、放学后读写时间 ≥ 3 h/d 和读写时胸口距桌子边缘未超过 10 cm (1 拳) 的学生脊柱侧弯初筛阳性率较高 ($P < 0.05$)。见表 1。

218 例初筛阳性学生行直立位全脊柱 X 线检查, 确诊脊柱侧弯 132 例, 确诊率为 60.55%。估算嘉兴市中小學生脊柱侧弯患病率为 5.46%。

表 1 中小學生脊柱侧弯初筛阳性率比较

Table 1 Comparison of percentages of positive initial screening of scoliosis among primary and middle school students

项目 Item	调查人数 Respon- dents	初筛 阳性 Initial screen- ing positive	阳性 率 Percent- age/ %	χ^2 值	P 值	项目 Item	调查人数 Respon- dents	初筛 阳性 Initial screen- ing positive	阳性 率 Percent- age/ %	χ^2 值	P 值
区县 Region				11.527	0.003	<3	2 544	259	10.18		
秀洲区 Xiuzhou	2 560	239	9.34			≥3	4 760	400	8.40		
嘉善县 Jiashan	2 705	207	7.65			过去 1 周静坐时间 Daily sitting duration in the past week/ (h/d)				23.439	<0.001
平湖市 Pinghu	2 039	213	10.45			<5	3 859	289	7.49		
居住地 Residence				0.142	0.707	≥5	3 445	370	10.74		
城市 Urban area	3 053	280	9.17			班级座位调换频率 Frequency of class seat exchange				7.905	0.019
农村 Rural area	4 251	379	8.92			从不 Never	1 035	98	9.47		
学段 Studying phase				65.197	<0.001	每学期或每月 1 次 Every semester or month	2 246	231	10.28		
小学 Primary school	3 667	232	6.33			1~2 周 1 次 Every 1-2 weeks	4 023	330	8.20		
初中 Junior high school	3 637	427	11.74			调整课桌椅高度频率 Fre- quency of adjusting the height of desks and chairs				5.579	0.061
性别 Gender				71.812	<0.001	从不 Never	3 759	368	9.79		
男 Male	3 776	237	6.28			每学年或每学期 1 次 Every academic year or semester	2 593	214	8.25		
女 Female	3 528	422	11.96			2~3 个月 1 次 Every 2-3 months	952	77	8.09		
过去 1 周含糖饮料摄入频率 Frequency of sugary drinks intake in the past week (次 Time/d)				0.311	0.856	放学后读写时间 Reading and writing dura- tion after school/ (h/d)				23.829	<0.001
0	829	75	9.05			<1	848	47	5.54		
<1	5 927	531	8.96								
1	548	53	9.67								
过去 1 周新鲜水果摄入频率 Frequency of fruit intake in the past week (次 Time/d)				2.652	0.266						
<1	1 858	171	9.20								
1	3 582	337	9.41								
≥2	1 864	151	8.10								
过去 1 周蔬菜摄入频率 Frequency of vegetable in- take in the past week/ (次 Time/d)				2.545	0.280						

表 1 (续) Table 1 (continued)

项目 Item	调查人数 Respon- dents	初筛阳性 Initial screen- ing positive	阳性率 Percent- age/ %	χ^2 值	P 值	项目 Item	调查人数 Respon- dents	初筛阳性 Initial screen- ing positive	阳性率 Percent- age/ %	χ^2 值	P 值
<1	1 240	124	10.00			1	2 494	204	8.18		
1	2 653	244	9.20			2	2 332	230	9.86		
≥ 2	3 411	291	8.53			≥ 3	1 363	149	10.93		
过去1周吃早餐频率 Frequency of breakfast in- take in the past week				0.463	0.793	不知道 Unknown	267	29	10.86		
每天 Every day	6 166	556	9.02			参加文化类补习班时间 Duration of taking inten- sive classes for studying/ (h/d)				1.358	0.851
偶尔 Occasionally	1 077	96	8.91			<1	2 440	223	9.14		
从不 Never	61	7	11.48			1	1 116	92	8.24		
消瘦 Emaciation				3.468	0.063	2	903	80	8.86		
是 Yes	474	54	11.39			≥ 3	1 333	120	9.00		
否 No	6 830	605	8.86			不知道 Unknown	1 512	144	9.52		
贫血史 History of anemia				34.940	<0.001	读写时胸口距桌子边缘超 过 10 cm More than 10 cm distance from the chest at reading and writing to the edge of the table				4.380	0.036
是 Yes	156	35	22.44			是 Yes	3 342	276	8.26		
否 No	7 148	624	8.73			否 No	3 962	383	9.67		
过去1周体育课频率 Frequency of physical education classes in the past week/节 Class				3.964	0.138	读写时眼睛距书本超过 33 cm More than 33 cm distance from the eyes at reading and writing to the book				2.446	0.118
≤ 1	383	45	11.75			是 Yes	3 192	269	8.43		
2~3	6 526	582	8.92			否 No	4 112	390	9.48		
≥ 4	395	32	8.10			读写时手指距笔尖 3 cm 3 cm distance from the fin- gers at reading and writ- ing to the tip of the pen				3.390	0.066
过去1周重体力活动频率 Frequency of heavy physi- cal activity in the past week/d				2.232	0.135	是 Yes	3 597	302	8.40		
<3	3 372	286	8.48			否 No	3 707	357	9.63		
≥ 3	3 932	373	9.49			过去1周步行时间超过10 min 的天数 Days of walking duration of over 10 min- utes in the past week/d				6.381	0.012
过去1周中等强度体力活动 频率 Frequency of mode- rate intensity physical activity in the past week/d				4.055	0.044	<3	5 114	484	9.46		
<3	5 114	484	9.46			≥ 3	2 190	175	7.99		
≥ 3	2 190	175	7.99								

3 讨论

中小學生健康体检脊柱侧弯筛查大多采用一般检

查,而脊柱运动试验、俯卧试验和脊柱侧弯测量仪检查等方法尚未广泛应用。嘉兴市 2020 年学生常见病监测结果显示,中小學生脊柱侧弯初筛阳性率仅为

0.21%。本研究采用一般检查结合前屈试验、脊柱侧弯测量仪检查和 X 线检查开展中小學生脊柱侧弯筛查,初筛阳性率为 9.02%,估算嘉兴市中小學生脊柱侧弯患病率为 5.46%。提示仅采用一般检查可能会严重低估脊柱侧弯的实际患病情况,而采用“一般检查+前屈试验+脊柱侧弯测量仪检查+X 线检查”能有效筛查脊柱侧弯高危人群。

女生脊柱侧弯初筛阳性率高于男生。多项研究表明性别与脊柱侧弯的发生密切相关,男女生脊柱侧弯发生率约为 1:1.706~1:2.45^[3-4, 8]。这种性别差异可能与雌激素作用及其受体基因多态性有关^[9]。ZHENG 等^[10]研究发现,雌激素能明显增加青春期双足大鼠脊柱侧弯的发生率和严重程度。此外,男女生肌肉、韧带发育的生理差异,久坐及缺乏体育锻炼均与脊柱侧弯的发生有关^[11]。初中學生脊柱侧弯初筛阳性率高于小学生,与长期坐姿不端正、长时间坐位学习、长时间使用电子产品、缺乏锻炼、近视和睡眠不足等因素相关^[3-4]。不同区县學生脊柱侧弯初筛阳性率存在差异,尽管采用相同的调查方法,并对调查员进行统一培训,但实际体检和问卷调查过程仍可能存在一致性差异,导致系统误差,提示调查工作中应注意加强质量控制和人员培训。

有贫血史的中小學生脊柱侧弯初筛阳性率较高。儿童青少年贫血与脊柱侧弯的病理机制有待进一步探究。现有研究发现, β -珠蛋白生成障碍性贫血常导致脊柱受累,在重型贫血中,遗传和后天风险因素可导致骨质疏松、脊柱病理性骨折、背痛、脊柱不对称和明显的脊柱侧弯^[12];范科尼贫血患者也会出现脊柱侧弯、肋骨异常等骨骼病变^[13]。

低体质指数(BMI)可能与脊柱侧弯发生有潜在关联。JEON 等^[14]研究发现,在控制年龄、性别的影响后,低体重和极低体重发生脊柱侧弯的风险显著高于正常体重。龙凤等^[8]调查发现,低体重人群脊柱侧弯患病率较高。一项前瞻性研究表明,10 岁时的 BMI 或体重与 15 岁时的脊柱侧弯发生情况呈负相关^[15]。患青少年特发性脊柱侧弯的女生存在瘦素生物利用度的改变,导致体重、BMI、骨骼肌质量、体脂和体脂百分比均较低^[16]。海波等^[17]研究发现,营养不良是腰段脊柱侧弯的影响因素。本研究中消瘦學生与非消瘦學生脊柱侧弯初筛阳性率差异无统计学意义,可能与嘉兴市中小學生消瘦率较低有关。

中等强度体力活动、步行时间和静坐时间均与中小學生脊柱侧弯有关。国内外关于体力活动对脊

柱侧弯的影响存在争议。TAM 等^[16]研究认为青少年特发性脊柱侧弯患者与对照组的体力活动无明显差异。DE ASSIS 等^[18]研究发现缺乏体力活动是青少年脊柱侧弯的危险因素。一项前瞻性队列研究证明,11 岁时保持中重度体力活动的儿童在 15 岁前患脊柱侧弯的风险降低 30%,且存在剂量-反应关系,中重度体力活动越充足,发生脊柱侧弯的风险越低。该研究还发现,久坐不动的儿童在 15 岁前患脊柱侧弯的可能性升高 18%,但调整年龄、性别和体重等因素后,久坐与脊柱侧弯无显著关联^[19]。

DE ASSIS 等^[18]和邹艳等^[20]认为姿势习惯与脊柱侧弯的发生无显著关联,不正确的坐位或站姿更容易引发腰痛症状^[21]。但本次调查结果显示,读写姿势、班级座位调换频率、放学后读写时间与中小學生脊柱侧弯存在统计学关联,考虑脊柱侧弯不是由单一因素导致的,在讨论姿势习惯的影响时,不能忽略时间效应的影响。

针对中小學生脊柱侧弯现状,推荐将脊柱侧弯测量仪和直立位全脊柱 X 线检查联合应用于脊柱侧弯筛查,可有效检出脊柱侧弯高危人群,有利于早期采取针对性干预措施,获得最佳干预效果。本次筛查仅 33.08% 的初筛阳性者行 X 线检查,说明學生家长对脊柱侧弯的重视程度较低,复检依从性较差,提示卫生和教育部门应加强中小學生脊柱侧弯防治宣传,提高学生、家长和教师对脊柱侧弯的知晓水平。

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