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0～3 岁婴幼儿超声骨密度现状调查及影响因素分析 *

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摘要 目的：了解 0～3 岁婴幼儿的骨密度现状，并分析其相关影响因素，为婴幼儿骨密度不足的预防工作提供依据。**方法：**选取 2016 年 1 月 -2018 年 10 月期间于我院进行健康体检的 0～3 岁婴幼儿 860 例为研究对象。采用超声骨密度测量仪对入选婴幼儿左腿胫骨中段骨密度进行检测，并对婴幼儿的骨密度现状进行分析。采用问卷调查方式收集所有婴幼儿的性别、年龄、喂养方式、是否补充维生素 D、户外活动时间等资料，并采用单因素和多因素 Logistic 回归分析 0～3 岁婴幼儿骨密度的影响因素。**结果：**860 例婴幼儿中，骨密度正常婴幼儿 336 例，轻度骨密度不足婴幼儿 196 例，中度骨密度不足婴幼儿 179 例，重度骨密度不足婴幼儿 149 例，骨密度不足发生率为 60.93%。单因素分析结果显示，不同年龄、性别、是否补充维生素 D 及不同户外活动时间婴幼儿之间的骨密度不足发生率比较差异有统计学意义（P<0.05），而不同喂养方式婴幼儿之间的骨密度不足发生率比较差异无统计学意义（P>0.05）。多因素 Logistic 回归分析结果显示，年龄（0~6 个月，7~12 个月）、性别（女）、补充维生素 D（否）、户外活动时间（<1 h）为 0～3 岁婴幼儿骨密度的危险因素（P＜0.05）。**结论：**0~3 岁婴幼儿的骨密度不足发生率较高，年龄、女性、未补充维生素 D、户外活动时间过少均是 0～3 岁婴幼儿骨密度的危险因素，可通过适量补充维生素 D、增加户外活动时间以提高婴幼儿骨密度值。

关键词：婴幼儿；超声；骨密度；调查；影响因素

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Current Status and Influencing Factors of Ultrasound Bone Density in Infants Aged 0-3 Years*

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ABSTRACT Objective: To understand the status of bone density in infants aged 0-3 years, and to analyze the related influencing factors, so as to provide basis for the prevention of bone density deficiency of infants. **Methods:** 860 infants aged 0-3 years who underwent routine health examinations in our hospital from January 2016 to October 2018 were selected as subjects. All infants received the ultrasonic bone density detection in the middle of left leg tibia by the Bone Densitometer. The present situation of bone density in infants was also analyzed. The data of gender, age, feeding methods, vitamin D supplementation and outdoor activity time of all infants were collected by questionnaire. Univariate and multivariate logistic regression were used to analyze the influencing factors of bone density in infants aged 0-3 years. **Results:** Among 860 infants, there were 336 infants with normal bone density, and 196 infants with mild bone density deficiency, 179 infants with moderate bone density and 149 infants with severe bone density, the incidence of bone density deficiency was 60.93%. Univariate analysis showed that there were significant differences in the incidence of bone density deficiency among infants of different age, gender, vitamin D supplementation and outdoor activities (P<0.05). There was no significant difference in the incidence of bone density deficiency among infants fed with different methods (P>0.05). Multivariate logistic regression analysis showed that age (0-6 months, 7-12 months), gender (female), vitamin D supplementation (no), and outdoor activity time (<1 h) were the risk factors affecting bone density in infants aged 0-3 years (P<0.05). **Conclusion:** The incidence of bone density deficiency in infants aged 0-3 years is higher. The age, female, no vitamin D supplementation, and too little outdoor activity time were all the risk factors of bone density in infants aged 0-3 years in this area. Adequate vitamin D supplementation and increased outdoor activities can improve the bone density of infants.

Key words: Infant; Ultrasound; Bone density; Investigation; Influential factors

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前言

婴幼儿时期的骨密度是成年骨峰值的关键影响因素[1],婴幼儿骨密度不足易引发骨折、增加婴幼儿佝偻病、成年骨质疏松的发生率[2-4],因此,人们对婴幼儿时期的骨密度关注度也越来越高。人体骨矿物质含量可在维持骨骼强度和内环境稳定中发挥作用,而骨密度是人体单位器官组织内的骨矿物质含量,骨密度值可以反映骨吸收情况和骨骼强度,是评价婴幼儿生长发育、营养状况、骨矿化等的重要指标[5,6]。超声骨密度检测技术具有精密度高、准确度高、无放射性、无创伤性损害、简便、快捷等优点[7],其能够客观地检测出婴幼儿骨骼发育情况,且极大程度上方便了婴幼儿的骨密度检测[8]。本研究通过对0~3岁婴幼儿的骨密度进行检测,并分析婴幼儿骨密度的影响因素,以期为防治婴幼儿骨密度不足提供依据。

1 对象与方法

1.1 研究对象

2016年1月-2018年10月,选取来我院进行健康体检的婴幼儿860例,纳入标准:① 足月儿;② 年龄0~3岁;③ 出生体重为2.50~4.00 kg;④ 婴幼儿的监护人知情本研究并签署同意书。排除标准:① 双胎、巨大儿等高危出生儿;② 合并遗传性疾病者;③ 合并代谢性疾病者;④ 有骨折史、创伤史者。本研究获得我院伦理委员会批准。

1.2 研究方法

(1)采用问卷调查的方式收集研究对象的以下信息:① 基本资料:性别、年龄;② 喂养方式;③ 是否补充维生素D;④ 每日户外活动时间。调查数据由专人记录用于统计。(2)采用HITACHI AVIUS超声仪对受试婴幼儿的左腿胫骨中段进行骨密度检测。每次开机后,利用标准体模进行仪器校正,由固定的2名专业医师进行检测操作,收集软件计算出的骨密度Z值。

1.3 骨密度不足判断标准[9]

正常:Z值>-1.0;轻度骨密度不足:-1.5<Z值≤-1.0;中度骨密度不足:-2.0≤Z值≤-1.5;重度骨密度不足:-Z值<-2.0。

1.4 统计分析

采用SPSS20.0软件进行数据处理,计数资料以例或百分比(%)表示,组间比较采用卡方检验(x^2检验),采用单因素和多因素Logistic回归分析0~3岁婴幼儿骨密度的影响因素,设定检验标准α=0.05。

2 结果

2.1 婴幼儿骨密度的现状分析

860例婴幼儿中,男496例,女364例;年龄0~3岁(0-36个月),平均(15.26± 4.26)个月。超声仪检测结果显示,336例婴幼儿骨密度正常,524例婴幼儿骨密度不足,骨密度不足发生率为60.93%,其中轻度骨密度不足196例,占22.79%;中度骨密度不足179例,占20.81%;重度骨密度不足149例,占17.33%。

2.2 婴幼儿骨密度影响因素的单因素分析

单因素分析结果显示,不同年龄、性别、是否补充维生素D及不同户外活动时间婴幼儿的骨密度不足发生率比较差异有统计学意义(P<0.05),而不同喂养方式婴幼儿的骨密度不足发生率比较差异无统计学意义(P>0.05),见表1。

表1 0~3岁婴幼儿骨密度影响因素的单因素分析[n (%)]

Table 1 Univariate analysis of influencing factors of bone density in infants aged 0-3 years[n (%)]

Related factors		n	Normal bone density(n=336)	Bone density deficiency(n=524)	x^2	P
Age (month)	0~6	372	42(11.29)	330(88.71)	351.135	0.000
	7~12	248	87(35.08)	161(64.92)		
	13~24	139	112(80.58)	27(19.42)		
	25~36	101	95(94.06)	6(5.94)		
Gender	Male	496	214(43.15)	282(56.85)	8.176	0.004
	Female	364	122(33.52)	242(66.48)		
Vitamin D supplementation	Yes	503	325(64.61)	178(35.39)	7.336	0.007
	No	357	198(55.46)	159(44.54)		
Outdoor activity time (h)	<1	279	92(32.97)	187(67.03)	7.448	0.024
	1-2	286	126(44.06)	160(55.94)		
	>2	295	118(40.00)	177(60.00)		
Feeding methods	Breast-feeding	330	132(40.00)	198(60.00)	1.754	0.416
	Artificial feeding	252	104(41.27)	148(58.73)		
	Mixed feeding	278	100(35.97)	178(64.03)		

2.3 婴幼儿骨密度影响因素的多因素Logistic回归分析

以单因素分析中的年龄、性别、是否补充维生素D及户外活动时间作为自变量,以骨密度是否不足为因变量,建立非条件多因素Logistic回归模型,回归过程采用后退法以选择和剔

除变量(α退=0.05),结果显示,年龄(0~6个月,7~12个月)、性别(女)、补充维生素D(否)、户外活动时间(<1 h)为0～3岁婴幼儿骨密度的危险因素(P<0.05),见表2。

表2 0～3岁婴幼儿骨密度影响因素的多因素Logistic回归分析

Table 2 Multivariate Logistic regression analysis of influencing factors of bone density in infants aged 0-3 years

Factors	β	S.E	Wald x^2	P	OR	95% confidence interval
Age (0-6 months,7-12 months)	0.318	0.054	10.526	0.019	1.537	1.136-1.532
Gender (female)	0.627	0.151	13.247	0.034	1.934	1.543-1.632
Vitamin D supplementation (no)	0.483	0.339	6.249	0.017	2.149	1.219-4.316
Outdoor activity time (<1 h)	0.729	0.148	14.295	0.046	2.036	0.157-0.264

3 讨论

婴幼儿时期和青春期是人体骨骼的生长高峰期,婴幼儿时期发生骨密度不足会导致机体抵抗力降低，从而引发肺炎、腹泻等疾病,甚至会引起维生素D缺乏性佝偻病[10-12]。佝偻病是婴幼儿常见疾病,是婴幼儿体内缺乏维生素D、钙磷代谢紊乱等导致的骨骼病变[13,14],严重影响婴幼儿生长发育,且对患儿日后正常生活也将造成严重困扰[15]。佝偻病的早期症状如夜惊、哭闹等变现缺乏特异性,易造成误诊或漏诊[16],因此监测婴幼儿骨骼状态,通过检测婴幼儿骨密度,评估可能的影响因素,在出现典型症状前,给予针对性的预防和干预措施,对预防佝偻病具有十分积极的意义[17]。近年来,随着医疗技术的迅速发展,临床上骨密度检测技术日益更新,如双能X线、定量CT、SPA单光子等，但因以上方法对婴幼儿可造成潜在的放射性损伤,限制了其在婴幼儿群体中的应用[18,19]。而超声骨密度检测方法具有操作方便、无痛、无创、无放射性等优点,易于被婴幼儿接受,目前已在临床广泛应用[20]。

本研究发现,0~3岁婴幼儿的骨健康状况并不乐观，骨密度不足发生率较高,且女婴幼儿骨密度不足发生率为66.48%,高于男婴幼儿的56.85%，与Zuccotti G和Liao等的研究结果相近[21,22]。分析原因可能与生长激素、性激素的调控相关,而且男性婴幼儿活动强度大于女性婴幼儿,因此男性婴幼儿骨骼发育相对较好。本研究结果显示,0~3岁的婴幼儿随着年龄的增长,其骨密度不足的发生概率呈下降趋势,与文献报道基本一致[23],分析原因为随着婴幼儿年龄的增长,其骨骼发育逐渐成熟,骨骼内的矿物质沉积逐渐增加,因此发生骨密度不足的几率就越小;此外,随着年龄增加,婴幼儿的活动量明显增多,有利于骨骼内的矿物质沉积[24,25]。而既往研究也显示,增强机械刺激会促进成骨细胞增殖,从而可以使骨质形成增多[26]。与此同时,本研究结果显示,0~6个月、7~12个月的婴幼儿发生骨密度不足的几率较高。分析其原因可能是由于此年龄段婴幼儿的生长速度最快,但活动量,尤其是户外活动量较少导致。既往研究表明,接受日光照射的时间增加,有利于骨骼内的矿物质沉积[27],与本研究的另一结论相似,即户外活动时间是婴幼儿骨密度的重要影响因素,户外活动时间越长,即接受日光照射的时间越长,婴幼儿发生骨密度不足的概率越低。同时,婴幼儿户外活动时间过少,光照时间过少,也是导致佝偻病发生的因素之一[28]。本研究结果还显示，是否补充维生素D是发生骨密度不足的重要因素，补充维生素D婴幼儿发生骨密度不足的比例为35.39%,远远低于未补充维生素D婴幼儿的44.54%。大量研究证实,维生素D可增加肠道的钙吸收,提高血钙浓度,维生素D能够增加破骨细胞数量,进而增加骨吸收[29,30],提示增加维生素D摄入量,促进钙的吸收,可以增加骨量沉积,降低骨密度不足的发生。

综上所述,0~3岁婴幼儿的骨密度不足发生率较高，年龄(0~6个月,7~12个月)、性别(女)、补充维生素D(否)、户外活动时间(<1 h)均是骨密度的危险因素,适量补充补充维生素D、增加户外活动时间,有利于骨骼健康生长,若出现骨密度不足,应足够重视,及早就诊。

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