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Pain as a Comorbidity of Pediatric Obesity

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Abstract

The purpose of this study was to document the prevalence and characteristics of physical pain in a sample of severely obese children and adolescents. In this retrospective chart review, primary measures included current and past pain, pain intensity, and pain characteristics during a 5-minute walk test. Pain assessments for 74 patients (mean age 11.7 years; 53% female; 41% African American) were conducted by a physical therapist. Past pain was reported by 73% of the sample, with 47% reporting pain on the day of program enrollment. Although average pain intensity was moderate ($M = 5.5/10$), alarmingly, 42% of those with current pain reported severe pain (6/10 to 10/10). Overall, pain occurred primarily in the lower extremities and with physical activity. Patients reporting current pain had a significantly higher body mass index than those reporting no pain. These findings suggest that pain is common in severely obese youth, and furthermore, that pain should be recognized as a comorbidity of pediatric obesity. Routinely screening severely obese children and adolescents for pain presence and intensity is recommended.

Keywords

obesity; pain; pediatric population; body mass index

Obesity has reached epidemic proportions around the globe. In the United States, currently more than one third of adults and 17% of children are obese.^{1,2} Associated systems affected by obesity in childhood include the cardiovascular, metabolic, gastrointestinal, pulmonary, and skeletal as well as psychosocial functioning.³ Although physical pain is common in obese adults, and is recognized as a comorbidity of obesity in adults,⁴ it is typically not recognized as such within pediatric obesity. This is unfortunate because among other negative implications, pain can act as an independent barrier to physical activity,^{5,6} a key intervention goal.^{7,8} In our efforts to develop appropriate treatment interventions for

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pediatric obesity, it is critical that we understand the pain experiences of obese children and adolescents.

A number of investigations have shed light on pain experiences and the role of pain in obesity treatment for adults. For example, in a study of obese adults seeking weight-loss treatment, 48% reported moderate to severe pain,⁹ and in a large community sample, 36% reported experiencing pain at least monthly.⁴ Obese adults are also more likely to experience pain in the knee, hip, back, and hand,^{10–13} as well as headache¹⁴ and migraine¹⁵ pain, than adults with a normal weight. Importantly, increased weight has been positively correlated with pain intensity and with the number of locations affected by pain.⁴ Pain-related treatment outcomes have also been investigated. For example, pain intensity has been shown to decrease after surgically induced weight loss,^{16,17} and investigators have shown that coupling pain coping skills training with a behavioral weight management intervention resulted in decreased pain (among other positive outcomes) as compared with outcomes in control conditions.⁸

“Although physical pain is common in obese adults, and is recognized as a comorbidity of obesity in adults, it is typically not recognized as such within pediatric obesity.”

In contrast, little attention has been paid to the pain experiences in samples of obese children and adolescents. Of the available data, the majority of studies have focused on pain-related orthopedic complications. For example, although there is still need for further study,¹⁸ we have known for some time that Blount’s disease^{19,20} and slipped capital femoral epiphysis²¹ are associated with obesity in youth. Pain has been explained in part by the excess force on the lower extremities. This explanation is supported by studies that have shown a greater likelihood of fractures, musculoskeletal discomfort,²² and chronic ankle morbidity²³ in overweight youth. Additionally, body weight has been shown to be positively correlated with pain in the knee and hip joints.²⁴ However, as found in adults, pain in obese youth has been linked to other locations. One study found the risk of headaches for adolescents and females to be 4 times greater for overweight youth than for youth with a healthy weight.²⁵ Finally, a study was recently undertaken with the aim of identifying comorbidities of pediatric obesity in community samples.²⁶ Overweight and obese school children were significantly more likely to report musculoskeletal and headache pain than a matched control group with normal weight. Furthermore, it appears that likelihood increases with weight: Whereas the overweight youth were 1.5 times more likely to report musculoskeletal pain than the controls, obese youth were 4.1 times more likely to do so.

Only one previous study has explicitly examined pain and bodyweight in obese youth²⁴; however, the pain assessment focused on the back and lower extremities. No previous studies have examined pain intensity or pain while engaged in a physical activity; information critical to pain management and to the development of appropriate exercise prescriptions, among other implications. The objective of this study was to extend previous research by documenting the prevalence of past and current pain among severely obese youth and to describe the nature of pain reports, including pain intensity, both in general and during a 5-minute walk test.

Methods and Procedures

Design and Sample

This retrospective chart review included the records of patients consecutively evaluated across a 6-month time frame (February–July) for enrollment in a pediatric weight management program. The NEW Kids Program (Nutrition, Exercise, and Weight management) at Children’s Hospital of Wisconsin provides comprehensive,

multidisciplinary care for children 2 to 18 years old with medical comorbidities related to obesity (dyslipidemia, insulin resistance, fatty liver, orthopedic complications, including slipped capital femoral epiphyses and Blount's disease, pseudotumor cerebri, sleep apnea, or hypertension). Referral to the NEW Kids Program is open to pediatric providers in Wisconsin and northern Illinois. To be referred, patients must have a body mass index (BMI) 95th percentile, and have at least one medical comorbidity, as described by Skelton et al.²⁷ To maintain consistency in measures and evaluation, charts were included in the review under the following conditions: (a) initial appointments included an assessment by a physical therapist who used a structured evaluation of pain and mobility and (b) the patient was 5 years or older. The charts of 77 patients were identified; the final sample of convenience included data for 74 patients who met inclusion criteria. This study was approved by the Hospital Human Research and Review Board.

Measures

Demographics—Demographic variables included gender, age, ethnicity, self-report (or parent report) of child age when his or her weight concerns began.

Body mass index—BMI (defined as kg/m²): Height and weight were measured by trained staff using a Harpenden stadiometer (Holtain, Dyfed, UK) and Health o meter Pro Plus electronic wheelchair scale (Pelstar, Alsip, IL), with shoes removed and in light clothing.

Pain assessment—The evaluation was conducted by a licensed physical therapist. The evaluation included a structured medical history focused on questions concerning pain:

1. History of Pain and Current Pain (both assessed as present/absent). History of pain: Patients were asked whether they had experienced bodily pain prior to the current appointment. For children younger than 8 years, parents either responded for, or supplemented the child's report.
2. Current Pain: Patients were asked whether they were experiencing any bodily pain at that moment.
 - a. Current Pain location (qualitative response).
 - b. Current Pain intensity for each location with current pain. Pain intensity was measured by selfreport with an age-appropriate scale: Verbal Numeric Rating Scale (0 = *no pain* to 10 = *worst pain*; ages 13–18 years) or the Faces Pain Scale–Revised (scored 0–10; ages 5–12 years).²⁸
 - c. Conditions under which current pain is experienced (qualitative data from the open-ended question).
 - d. Amount of sedentary time per day (hours).

Five-minute walk test—As an active assessment of functional capacity, the evaluation included a 5-minute walk test (modified from the typical 6-minute walk test).²⁹ Children are asked to walk the length of a corridor for a 5-minute span of time. Variables assessed during the walk test included whether pain occurred during the test (present/absent), and if so, the time point at which pain occurred (reported in minutes), and pain location. Pain intensity was assessed using the scales identified above.

Statistical Analyses

Patient demographics and pain intensity are reported using means $\pm$ standard deviations ($M \pm SD$), ranges, and percentages. Patients were dichotomized as reporting/not reporting pain

either on the day of program enrollment or in the past (history of pain). Differences between groups (patients reporting current pain vs those not reporting pain) were analyzed with *t* tests. Relationships between continuous variables were examined with Pearson correlations (normally distributed data) or Spearman's correlations. Analyses were conducted using SPSS statistical software version 11.5 (SPSS, Chicago, IL).

Results

Study Population

Table 1 presents a detailed summary of patient demographics. The sample consisted of slightly more female (53%) than male patients, with age ranging from 5 to 18 years ($M \pm SD = 11.7 \pm 3.3$ years). The sample was diverse, with 41% African American youth, followed by 41% Caucasian and 8% Hispanic. The average age at which the child's weight concerns began was 6.6 ± 3.9 years. The mean BMI (kg/m^2) for the sample was $37.0 \pm 8.3 \text{ kg}/\text{m}^2$, with a range of 26.1 to $61.3 \text{ kg}/\text{m}^2$. The BMI of 41 (55%) patients was greater than the 99th percentile for sex and age.³⁰

History of Pain

When patients were asked whether they had experienced bodily pain in the past (*history of pain*), 73% ($n = 54$) indicated that they had experienced pain (Table 2). The majority of these patients reported pain in 1 anatomic location, with many (39%) reporting pain in 2 locations. Although most past pain locations involved the weight-bearing joints, patients also reported experiencing pain in other locations, including the head and stomach (Table 3).

Current Pain

When asked about pain at the time of program enrollment (*current pain*), approximately half (47%, $n = 35$) of the sample reported that they were currently experiencing pain. Patients reporting current pain were older than patients reporting no pain, $t(73) = -2.20$, $P < .05$. Pain intensity ranged from mild to severe (1–10), with an average intensity of 5.5 ± 2.8 out of 10, indicating moderate pain. Whereas patient age was significantly correlated with BMI ($r = .49$, $P = .003$), age was not related to pain intensity ($r = .03$, $P > .05$). Despite the fact that all patients had elevated BMIs, BMI was significantly higher, $t(71) = 2.09$, $p < .05$, for those reporting pain ($M \pm SD = 39.1 \pm 9.0 \text{ kg}/\text{m}^2$) than for those reporting no pain ($35.1 \pm 7.1 \text{ kg}/\text{m}^2$). Total number of sedentary hours was unrelated to current pain intensity ($r = .16$, $P > .05$).

Current Pain Locations

Current pain locations primarily involved the back/lower back and pain in the lower extremities (Table 3). Of the 35 patients reporting current pain, 18 (51.4%) reported pain in 1 location, 11 (31.4%) reported pain in 2 locations, and 6 (17.1%) reported pain in 3 or more locations. BMI was positively correlated with the number of current pain locations: $r_s = .31$, $P < .01$. Based on each patient's highest reported pain score (for those reporting multiple pain locations), pain intensity was positively correlated ($r_s = .90$, $P < .05$) with the number of current pain locations. Pain intensity for those reporting 1 location was moderate ($M \pm SD = 5.1 \pm 2.6$), whereas for those reporting 3 locations, pain was severe (8.7 ± 2.0).

When Pain Occurs

Regardless of whether the patient did/did not report current pain, all patients were asked an open-ended question about whether they experienced pain, and if so, when pain occurred. Not all participants gave a response to this question: 91% (32/35) of those reporting current pain, and 33% (13/39) of those reporting no current pain responded. Of the responders who

reported current pain, 21 (65.6%) indicated that the pain occurred primarily during/after physical activity, which included “exercise,” “running,” “climbing,” and “walking”; 6 (18.8%) reported that the pain occurred primarily while standing, 3 (9.4%) reported that pain occurred 3 times per week, 1 (3.1%) reported 1 time/week, and 1 patient reported that pain has been occurring for the past 6 years. Of the responders who did not report current pain ($n = 12$), 11 (91.7%) reported that pain occurred during/after “exercise,” and 1 (8.3%) reported that pain occurred 4 times/week.

Five-Minute Walk Test

All youth completed the 5-minute walk test. Ten patients (13.5% of the entire sample) reported pain while walking (see Table 4). Of these patients, 2 had not reported current pain. The mean pain intensity score reported during the walk was 4.2 ± 2.5 out of 10, with a range of 2 to 10. During the walk test, 6 of the 10 patients reported pain in 1 location, whereas the remaining 4 patients reported pain in 2 locations. Three of the multiple responses included neck and calf pain, and 1 included neck and heel pain. The mean point at which pain occurred during the walk was 2.03 ± 1.3 minutes, with a range of 0 (immediately reported) to 4.0 minutes.

Discussion

The findings of this study suggest that pain, including past and current pain, is common in severely obese children and adolescents seeking treatment for weight management. An important contribution of this study is the documentation of pain intensity: Almost half of youth reporting pain at the time of the initial evaluation reported severe pain. It is important to note that despite the significantly elevated BMIs in this sample, patients who reported current pain were significantly heavier than those not reporting pain. No previous studies have assessed the intensity of pain complaints in obese youth, and no studies have described the nature of pain without restriction to a specific type of pain or anatomic location.

Our findings showed that all current complaints involved musculoskeletal pain of the lower extremities, with the greatest percentage involving pain in the knee joint. However, patients also reported past pain involving locations other than the weight-bearing joints, such as the head and neck. While the findings from the qualitative responses and the walk test must be interpreted with caution, these initial results suggest that although they are young, severely obese children and adolescents may be experiencing moderate levels of pain in multiple locations while engaged in “everyday” activities.

The findings reported here are critical for the development of appropriate treatment approaches, particularly given the centrality of physical activity in treatment protocols and the barriers that pain often creates against increasing physical activity. In the adult literature, pain management has been identified as a potentially important first step in increasing mobility and in turn, physical activity,⁵ thereby increasing opportunities for treatment success.

Limitations and Future Directions

Several limitations of this study exist, including a relatively small sample size. While consistent evaluation by a single physical therapist increases the strength of these findings, the generalizability may have been influenced by self-reports and homogeneity of the sample. These findings should be replicated with larger samples, and extended to other clinical and community samples. When asking about past pain history, although the physical therapist implied pain related to the patient’s weight, we cannot be certain that patients were able to make this causal determination. For younger patients, we are unable to determine if

reports of past pain were given by patients, their parents, or a combination. Pain experienced during the walk test may not reflect the pain youth may experience during more vigorous activity; to better understand whether pain acts as a barrier to physical activity, it will be important to examine the nature and extent of pain during daily functioning, including activities that range from simple movement to vigorous activity. Although studies exist,^{31,32} this report purposely did not address obesity in pediatric chronic pain samples; the co-occurrence of *chronic* pain and obesity in children and adolescents may have characteristics that are unique because of the chronicity of the pain condition. Future studies should examine similarities and differences between samples of obese children with chronic versus acute pain.

In summary, pain experiences of moderate to severe intensity are common in youth seeking treatment for obesity. It is critical that pain is recognized and managed in all children; this fact is no different for obese youth. Given that physical activity is a central component of long-term pediatric weight management programs, it is imperative that pain presence and intensity are routinely assessed and incorporated into treatment regimens.

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Table 1

Patient Demographics for the Whole Sample and for the Sample Dichotomized by Pain Presence at Program Enrollment (*Current Pain*)

	Whole Sample	Sample Dichotomized by Pain Presence	
		Reporting Pain	Reporting No Pain
N (%)	74 (100.0)	35 (47.3)	39 (52.7)
Gender; n (%)			
Female	39 (52.7)	17 (47.2)	22 (56.4)
Male	35 (47.3)	18 (52.8)	17 (43.6)
Age in years; mean $\pm$ SD	11.70 $\pm$ 3.34	12.63 $\pm$ 3.10 ^a	10.87 $\pm$ 3.37
Body mass index in kg/m ² ; mean $\pm$ SD	36.95 $\pm$ 8.25	39.06 $\pm$ 9.03 ^a	35.11 $\pm$ 7.12
Ethnicity; n (%)			
African American	30 (40.5)	17 (48.6)	13 (33.3)
Asian	1 (1.4)	1 (2.9)	0 (0.0)
Caucasian	30 (40.5)	13 (37.1)	17 (43.9)
Hispanic	6 (8.1)	3 (8.3)	3 (7.7)
Native American	1 (1.4)	1 (2.9)	0 (0.0)
Other	6 (8.1)	0 (0.0)	6 (15.4)

^a Analyses include those reporting pain versus those reporting no pain; significant at $P < .05$.

Table 2**Pain: Prevalence and Characteristics**

Characteristic	n(%)
History of pain	54 (73.0)
Number of past pain locations	
1 Location	28 (51.9)
2 Locations	21 (38.9)
3 Locations	5 (9.3)
Current pain	35 (47.3)
Intensity Mean $\pm$ SD	5.5 $\pm$ 2.8
Range	1–10
Number of current pain locations	
1 Location	18 (51.4)
2 Locations	11 (31.4)
3 Locations	6 (17.1)
Pain during 5-minute walk test	10 (13.5)
Intensity Mean $\pm$ SD	4.2 $\pm$ 2.50
Range	2–10
Number of pain locations	
1 Location	6 (60.0)
2 Locations	4 (40.0)
Point of pain report	
Mean $\pm$ SD (minutes)	2.03 $\pm$ 1.30
Range (minutes)	0–4

Table 3Pain Location: Past and Current Pain^a

	Past Pain; n (%)	Current Pain; n (%)
N	54	35
Head	1 (1.9)	1 (2.9)
Shoulder	1 (1.9)	
Wrist	1 (1.9)	
Chest	2 (3.7)	1 (2.9)
Stomach	1 (1.9)	
Unspecified joint pain	1 (1.9)	
Back/lower back	15 (27.8)	10 (28.6)
Hip	1 (1.9)	1 (2.9)
Sciatic nerve	1 (1.9)	1 (2.9)
Leg(s)	6 (11.1)	4 (11.4)
Knee(s)	24 (44.4)	14 (40.0)
Calf	4 (7.4)	3 (8.6)
Ankle(s)	13 (24.1)	15 (42.9)
Foot/feet	14 (25.9)	8 (22.9)

^a n (%) within columns reflect multiple pain locations reported by some patients, resulting in percentages exceeding 100%.

Table 4Location of Pain Experienced During the 5-Minute Walk Test^a

Pain Location	n (%)
Neck	4 (40.0)
Stomach	1 (10.0)
Knee(s)	5 (50.0)
Calf	3 (30.0)
Heel	1 (10.0)

^a n (%) reflect multiple pain locations reported by some patients, resulting in percentages exceeding 100%.