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Original Research Article

Overweight and obesity in children with newly diagnosed inflammatory bowel disease

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ABSTRACT

Purpose: Determination of overweight and obesity prevalence in children with inflammatory bowel disease (IBD) at the time of diagnosis.
Material and methods: This was a multicenter retrospective study. The study group consisted of children with new cases of IBD diagnosed in 2005–2013 according to the Porto criteria. Hospital admission records were reviewed for demographic and clinical characteristics. BMI-for-age and gender percentile charts were used to define overweight as ≥85th BMI percentile and obesity as ≥95th BMI percentile.
Results: 675 patients were evaluated: 368 with Crohn's disease (CD) and 307 with ulcerative colitis (UC). Of these, 54.8% were boys and 45.2% were girls. There were no statistically significant differences in age, weight, height and disease activity between the CD and UC patients. The UC patients had higher BMI values than the CD patients. The prevalence of overweight and obesity was higher in the UC than the CD patients (4.89% CI95 2.76–7.93 vs. 2.45% CI95 1.12–4.59 and 8.47% CI95 5.61–12.16 vs. 1.9% CI95 0.77–3.88, respectively); the differences were statistically significant (−2.44% CI95 −5.45 to 0.49 and −6.57% CI95 −10 to −3.1, respectively). The risk of overweight/obesity was 3.5 times higher for patients with UC (OR = 0.272, CI95 0.14–0.49, $p = 0.0004$).
Conclusions: The prevalence of overweight and obesity in newly diagnosed children with IBD was 8.4% and was higher in patients with UC than in patients with CD. The results of this study have shown that not only malnourished children may suffer from IBD but also children who are overweight or obese at the time of diagnosis.

1. Introduction

Over the last few years, the problem of excessive body weight in children and adolescents has become one of the most serious public health problems throughout the world [1]. For many years, the highest percentages of overweight and obese children have been observed in the United States [2] and Western Europe [3,4]. Recently, the problem has become noticeable in Middle Europe, including Poland [5,6]. Obese children are at risk for being overweight or obese adults [7]. Because obesity is associated with numerous comorbidities such as type 2 diabetes, cardiovascular disease, nonalcoholic fatty liver disease, cancer, and other immune-related disorders such as asthma and infection, it is especially worrying when it accompanies some other chronic disease state [8].

Traditionally, malnutrition was of concern as one of the major symptoms of inflammatory bowel disease (IBD), especially Crohn's disease (CD). Malnutrition is included in the gold standard for pediatric CD activity index assessment [9]. However, according to

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recent findings, the nutritional status of patients with IBD is changing, and more overweight and obese patients are observed in this group [10]. This may delay the correct diagnosis of IBD. Moreover, overweight adults with IBD have higher morbidity and disease activity, require surgery earlier than their underweight counterparts or have more frequent perianal complications [11]. Adult obese patients with CD and overweight patients with ulcerative colitis (UC) are more likely to have an IBD flare than patients of normal body weight [12]. Recently, excessive body weight has been associated with an earlier time to loss of response to infliximab [11].

1.1. Objective

Because overweight and obesity rates have been increasing in the general pediatric population in Poland, we hypothesized that they may affect children with IBD. Therefore, the aim of this study was to determine overweight and obesity rates among children with IBD at the time of diagnosis.

2. Material and methods

This multi-center retrospective study was conducted in five university-affiliated hospitals for children in Poland (cities of Warsaw, Poznan, Wroclaw, Katowice and Cracow). The hospital admission records between January 2005 and August 2013 for newly diagnosed pediatric (up to 18 years old) IBD patients were reviewed. For each enrolled subject, clinical and demographic characteristics including age, sex, place of residence, symptom duration, type of IBD and disease activity assessment were collected at the time of initial diagnosis. CD and UC were diagnosed based on clinical signs and symptoms as well as on endoscopic, histological and radiological parameters according to the Porto criteria [13]. The severity of CD and UC was evaluated using the *Pediatric Crohn's Disease Activity Index* (PCDAI) and the *Pediatric Ulcerative Colitis Activity Index* (PUCAI), respectively, which incorporate symptoms, physical examination findings and laboratory test results. A PCDAI score $\leq$10 for CD and a PUCAI score $<$10 for UC were defined as remission. Children with indeterminate colitis were excluded from the analysis. The socioeconomic status of IBD patients was subjectively assessed by doctors. Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters (kg/m^2). BMI categories and corresponding percentiles were as follows: $\leq$5th percentile – underweight, 5th–84th percentile – normal weight, $\geq$85th percentile – overweight, $\geq$95th percentile – obesity. Percentiles were measured using the BMI-for-age and gender percentiles charts according to the World Health Organization [14].

2.1. Statistical analysis

The odds ratio and its 95% confidence interval were used as a measure of effect size. The confidence intervals for the differences of two independent binomial proportions were estimated with the Agresti–Caffo method. The confidence interval for difference between two dependent proportions was determined using the Wald procedure with the Agresti and Min modification. McNemar's test was used for two dependent proportions. The global test for the difference between two sets of k dependent proportions, i.e., $x_1 = (p_{11}, \ldots, p_{1k})^T$ and $x_2 = (p_{21}, \ldots, p_{2k})^T$, was $T = \|x_1 - x_2\|_2 / \mathrm{SE}_{\|x_1 - x_2\|_2}$, where the distribution of the T statistic was estimated with 9999 bootstrapped samples. The chi-square test for two proportions and the exact test, if necessary, were used for cross-classification tables. The median was used as a location parameter. The S_n statistic was computed as the measure of variability: $S_n = \mathrm{med}\,\{\mathrm{med}\,|x_i - x_j|\,;\ j = 1, \ldots, n\}$ [15]. Confidence intervals for the difference between two medians were estimated with the studentized bootstrap approach.

3. Results

In this study, 675 patients were evaluated, including 368 with CD and 307 with UC. The baseline characteristics of the study groups are shown in Table 1. There were no statistically significant differences in age, weight, height and disease activity between CD and UC patients. Both diseases were associated with lower BMI values, although UC patients had generally higher BMI values than CD patients, as shown in Fig. 1.

The prevalence of overweight and obesity was higher in UC than in CD patients (4.89% CI95 2.76–7.93 vs. 2.45% CI95 1.12–4.59 and 8.47% CI95 5.61–12.16 vs. 1.9% CI95 0.77–3.88, respectively); the differences were statistically significant ($-$2.44% CI95 $-$5.45 to 0.49 and $-$6.57% CI95 $-$10 to $-$3.1, respectively). Overall, the prevalence of overweight and obesity among CD patients was 4.3% and this rate was higher in UC patients (13.4%). The percentage of overweight and obesity in the IBD population was 8.4%. There were no correlations between BMI values and socioeconomic status or place of residence both in CD ($p = 0.9705$; $p = 2894$, respectively) and UC patients ($p = 0.2362$; $p = 0.5495$; respectively). Also there was no correlation between duration of symptoms and BMI values ($p = 0.2556$).

The risk of overweight or obesity was 3.5 times higher for UC patients (OR = 0.272, $p = 0.0004$). This risk decreased with an increase in disease activity index (OR = 0.5342, $p = 0.0012$) for both diseases. It was observed that CD patients with severe disease were at the lowest risk of being overweight/obese.

4. Discussion

The results of this study indicate that the prevalence of overweight and obesity in children with newly diagnosed IBD amounted 8.4% and was more than 3 times higher in UC patients.

To date, few studies have assessed overweight and obesity in IBD patients. Kugathasan et al. [10] in the only study performed in newly diagnosed IBD children, found that 10% of children with CD and 20–30% with UC were overweight or obese. In the largest multicenter study, which included 1598 children, the prevalence of overweight or obesity was 23.6% (20% for CD and 30.1% for UC) [16]. That study included both previously and newly diagnosed patients without sub-analyses of the groups. The prevalence of overweight or obesity in adult IBD patients was much higher than in children and ranged between 36% and 56% in different European studies [17–19]. Although the data are limited, it seems that the prevalence of overweight and obesity we observed is several times lower than that reported in previous studies [10,16]. This may be a result of geographical variation in the incidence of overweight and obesity in the general population. In the United States, 18.3% of adults [20] and 9.5% of children [10] with IBD were obese, compared to more than one-third of adults and almost 17% of youth in the general population in 2009–2010 [21]. In Scotland, Steed et al. found that 18% of the IBD population was obese (BMI $>$ 30 kg/m^2) in comparison to 23% of the general population [19]. Overall, 38% of IBD patients were overweight (BMI $>$ 25 kg/m^2), which was the same proportion as in the general population [19].

In the Polish national research project called "OLAF" (conducted from 2007 to 2010) 17,500 children aged 7–18 years were examined. The results of that project demonstrated that 18.6% of boys and 14.5% of girls were overweight or obese. Overall, the prevalence of children with excess body weight was 20% compared to 8.4% in our study [6]. Therefore, the incidence of overweight and obesity in IBD patients could be a mirror of the incidence of

Table 1
Characteristics of the population of children with inflammatory bowel disease (IBD), stratified by Crohn's disease (CD) or ulcerative colitis (UC), at the time of diagnosis.

Characteristic	Children with CD		Children with UC		Total IBD		CD – UC
Gender							
Male	214		156		370		7.34%
Female	154		151		305		CI95 (−0.21%; 14.8%)
% *M*	58.15		50.81		54.81		
Age (years)							
Me[a]	13.79		13.25		13.5		0.54
S_n [b]	2.92		3.29		3.08		CI95 (−0.15; 1.19)
Weight (kg)							
Me	1		43.2		42		−2.2
S_n	13		14.8		13.5		CI95 (−6.9; 1.2)
Height (m)							
Me	1.55		1.57		1.56		−0.02
S_n	0.164		0.17		0.17		CI95 (−0.066; 0.0065)
BMI (kg/m^2)							
Me	16.65		17.12		16.89		−0.47
S_n	2.27		2.25		2.38		CI95 (−0.91; −0.012)
Duration of IBD symptoms (months)							
Me	6		3		4		3
S_n	4		2		3		CI95 (1.76; 4.38)
Disease activity[c]	*n*	%	*n*	%	*n*	%	Δ[d] = 0.0346
Inactive	19	5.2	0	0	19	2.8	CI95 (−0.049; 0.115)
Mild	93	25.3	86	28	179	26.5	
Moderate	196	53.3	171	55.7	367	54.4	
Severe	60	16.3	50	16.3	110	16.3	
Overweight							
Yes	9		15		24		−2.44%
No	359		292		651		CI95 (−5.45%; 0.49%)
% *Yes*	2.45		4.89		3.56		
CI95%	1.12; 4.59		2.76; 7.93		2.29; 5.25		
Obesity							
Yes	7		26		33		−6.57%
No	361		281		642		CI95 (−10%; −3.1%)
% *Yes*	1.9		8.47		4.89		
CI95%	0.77; 3.88		5.61; 12.16		3.39; 6.79		
Overweight and obesity							
Yes	16		41		57		−9.01%
No	352		266		618		CI95 (−13.37%; −4.62%)
% *Yes*	4.35		13.36		8.44		
CI95%	2.5; 6.96		9.76; 17.68		6.46; 10.8		

[a] Me, median.
[b] S_n, average dispersion.
[c] Disease activity assessed by the physician for CD according to PCDAI and for UC according to PUCAI.
[d] Δ measure of two ordinal distributions; $\Delta = 0$ if and only if groups are identically distributed.

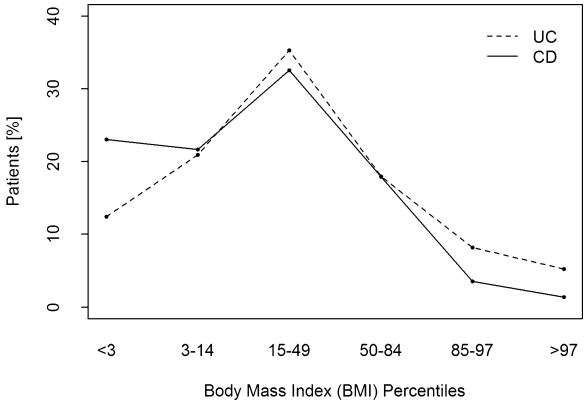

Fig. 1. Distribution of body mass index percentiles in CD and UC patients for age and gender. UC, children with ulcerative colitis; CD, children with Crohn's disease. In this figure, original units (percentiles and percentages of patients) were used, but the graphics were done after the transformation of the results into a double logarithmic scale (hence the disproportionate intervals on the axes).

overweight and obesity in the general population. As the incidence of obesity has increased worldwide, we expect further reports on how this epidemic will influence the IBD patient population.

In the present study, the prevalence of overweight or obesity depended on the disease type and was higher in UC children. This result is in accordance with the results of most previous studies conducted in children [10,13,22] and in adults [11,17]. However, Steed et al. [19] observed significantly more obese adult patients with CD than with UC ($p = 0.05$), but they were unable to interpret these results. CD has been always considered as a disease leading to malnutrition due to malabsorption, loss of protein and blood through the small intestine and lowered energy intake [23]. In UC, the ileum is not involved in the inflammatory process so normal absorption is expected; malnutrition or nutritional disturbances are less common. We found no differences in disease activity between newly diagnosed CD and UC children. We could not compare our results to the results of a study in newly diagnosed IBD children because the authors did have not enough data [10]. Our findings are in line with the results of a study assessing

overweight and obesity in a large cohort of American children with IBD [16]. There are a few studies in the adult IBD population that assessed the association between increased body weight and disease activity. Blain et al. [11] observed that obese patients with CD had a different disease course compared to CD patients of normal weight. Obese patients had a higher incidence of perianal disease (35% vs. 24%), more disease relapses (OR 1.50) and were hospitalized more frequently (OR 2.35). In another retrospective case–control study, it was found that the time to surgery in obese patients (24 months) was shorter than in non-obese patients (72 months), although the difference was not statistically significant [24].

In our study we found no association between duration of IBD symptoms and BMI ($p = 0.2556$). Blain et al., in the only study assessing that association, found no difference in delay between onset of symptoms and diagnosis between obese and non-obese patients. Although the data is limited we may suggest that BMI in normal or higher ranges, as the only factor, does not delay the IBD diagnosis.

Although there is no data on impact of socioeconomic status on BMI in IBD children at the moment of diagnosis, results of our study do not confirm that lower socioeconomic status is well-known factor for overweight and obesity worldwide.

This is the first multicenter study in Europe to assess the prevalence of overweight and obesity in IBD patients. The study group was homogenous. We have examined a large group of children with IBD from various centers in Poland. Moreover, none of the patients was excluded from the study, and all newly diagnosed patients were analyzed. The most significant shortcomings of the present study are the retrospective design and the lack of a control group.

5. Conclusion

The results of the present study demonstrated that the prevalence of overweight or obesity in new-onset pediatric IBD patients in Poland was 8.4%, which is lower than in the United States and Western Europe. The risk of overweight or obesity was more than 3 times higher for UC patients. The results of this study have shown that the problem of excessive body weight also exists in patient with IBD. It is essential for physicians, to realize that CD or UC may also occur among children who are overweight or obese so malnutrition should not be always expected as a main symptom of the disease.

Conflict of interests

None declared.

Financial disclosure

None declared.

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