

Pica: An Important and Unrecognized Problem in Pediatric Dialysis Patients

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Objective: Pica is the compulsive consumption of non-nutritive substances, and this disorder may occur more frequently in dialysis patients. The purpose of our study was to determine the prevalence of pica and the associated demographic and metabolic characteristics.

Design: Retrospective, cross-sectional analysis.

Setting: Hospital-based, outpatient, pediatric hemodialysis unit.

Subjects: Eighty-seven pediatric patients on chronic dialysis therapy were interviewed. Sixty-seven patients were receiving hemodialysis, whereas the remaining 20 were maintained on peritoneal dialysis. The predominantly nonwhite (93%) patient population had a mean age of 17.2 ± 7.2 years. Dialysis efficiency, estimated by urea clearance per patient volume (Kt/V), averaged 1.5 ± 0.5 .

Intervention: Standard patient interview and documentation of laboratory and dialytic parameters.

Main outcome measure: Prevalence of pica and associated comorbid conditions.

Results: The survey indicated that 46% of patients experienced pica, further divided into simple “ice” pica (34.5%) versus “hard” pica (12.6%). Hard pica included the consumption of chalk, starch, sugar, soap, sand, clay, Ajax cleanser, sponge, wood, and potting soil. Patients on hemodialysis were 8.3 times more likely to have hard pica compared with those on peritoneal dialysis. Greater than 5 years on dialysis was associated with a 3.2 odds ratio of having pica ($P = .02$). Anemia was the most

significant morbid association, occurring at an odds ratio of 4.4 ($P = .001$) for all pica and 10.6 ($P = .004$) for hard pica.

Conclusion: Pica, therefore, is prevalent and potentially harmful, requiring further attention in the nutritional management of pediatric dialysis patients.

Introduction

The compulsive consumption of non-nutritive substances, pica, is a phenomenon that has been explored in children, pregnant women, and the mentally handicapped, with more recent study of the dialysis-dependent population.¹ There are well-described associations of geophagy, most notably with religious or medicinal attributions, often occurring in ethnic African American communities in the Southeast United States.²

In healthy children, the prevalence of pica has been reported over a wide range, depending on the definition used and age-group studied, with higher rates observed in younger children.^{3,4} However, more precise estimates place the prevalence at 25% to 33% of children aged <6 years.³ Invariably, the rate is higher among African American children, as compared with Caucasians.^{3,5} Among adult dialysis patients, pica has been observed particularly in the Southeastern United States.^{6,7} In Atlanta, GA, incident dialysis patients were noted to have a rate of 16%,⁸ whereas established patients exhibited a higher rate of 22%.⁹

A number of comorbid conditions have been associated with pica, the most common of which is anemia, specifically iron-deficiency anemia. Whether pica has been spurred by iron deficiency, or whether the consumption of non-nutritive substances prevents gastrointestinal iron absorption,¹⁰ has been greatly debated. Proposed mechanisms for adverse effects mediated by pica behavior include excess calories, displacement or reduced absorption of essential nutrients, toxicity, and relative excess essential nutrients in compromised individuals.¹¹ Consequently, case reports of various pica behaviors in adult dialysis patients have identified several other metabolic derangements, including hyper-/hypokalemia,¹²⁻¹⁴ hyper-/hypophosphatemia,^{6,8,14} hypercalcemia,¹⁴ alkalosis,⁶ hypoalbuminemia,^{2,8} ascorbic acid deficiency,² and zinc deficiency.^{6,13} However, data are particularly lacking with respect to the pediatric dialysis population, whose combination of young age and high prevalence of anemia may yield prime candidates for the behavior of pica. The purpose of this study was to explore the prevalence of pica and associated comorbidities in an established group of children undergoing chronic dialysis therapy.

Patients and Methods

The study was a retrospective, cross-sectional analysis of dietary history assessments required under standard of care. All subjects were assured anonymity in compliance with the Health Insurance Portability and Accountability Act. The study included 87 patients on chronic dialysis therapy who were followed at the pediatric dialysis center of the University of Miami/Holtz Children's Hospital from January 2006 through January 2010. These patients were surveyed for the compulsive ingestion of non-nutritive substances, reported for at least 1 month. These dietary histories were obtained monthly as a standard component of nutritional health assessment in our multidisciplinary outpatient center. Ice pica is defined as the nonnutritive and compulsive ingestion

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of ice alone, whereas hard pica reflects the similar consumption of any other substance. The patients were also assessed for demographic, nutritional, and metabolic characteristics. The patients received either hemodialysis (HD) or continuous cycling peritoneal dialysis (PD). Those undergoing HD received three to four weekly sessions, using hollow fiber dialyzers. Those undergoing PD received nightly cycling. Dialysis efficiency was estimated by calculating urea clearance per patient volume, Kt/V. Variables were compared using Fisher exact test, calculating odds ratios (OR) with 95% confidence intervals (CI) for effect size. Multiple regression analysis was performed using pica as the dependent variable compared with age, gender, race, dialysis modality, dialysis vintage, dialysis efficiency, and hematocrit. Results are reported as mean \pm standard deviation. Statistical significance was set at $P < .05$. Software package GraphPad InStat 3.0 was used for these analyses.

Results

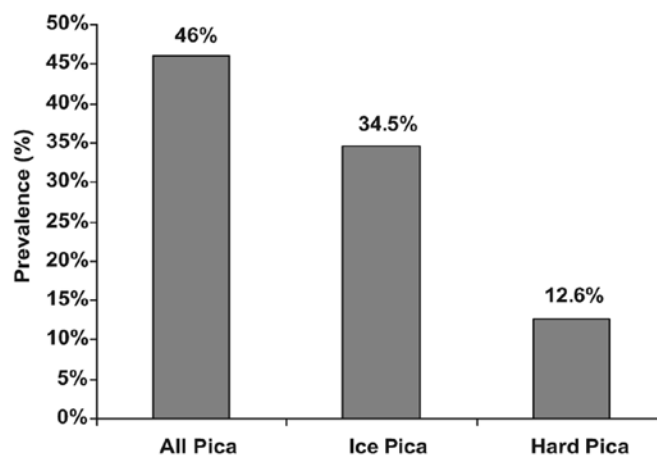
Of the 87 patients surveyed, 38 (44%) were male and 49 (56%) were female. The mean age of the patients was 17.2 ± 7.2 years. The racial composition of the group was predominantly African American (56%) and Hispanic (37%), with only 7% Caucasian participants. All patients were established on chronic dialysis therapy for 3 months. Sixty-seven patients (77%) received HD, whereas the remaining 20 (23%) received PD. Patient demographic information is summarized

Table 1. Demographics of the Subjects

Total Patients	n = 87
Age (years)	17.2 \pm 7.2
Gender	n (%)
Male	38 (44)
Female	49 (56)
Race	n (%)
Caucasian	6 (7)
African American	49 (56)
Hispanics	32 (37)
Dialysis modality	n (%)
HD	67 (77)
PD	20 (23)
Kt/V	Mean: 1.5 \pm 0.5
Kt/V <1.2	n = 55
Kt/V >1.2	n = 26
TOD (years)	Mean: 4.0 \pm 3.6
TOD >5 years	n = 59
TOD <5 years	n = 28
Hematocrit (%)	Mean: 33.0 \pm 4.0
Hematocrit >34%	n = 47
Hematocrit <34%	n = 40

HD, hemodialysis; PD, peritoneal dialysis; TOD, time on dialysis.

Figure 1. Prevalence of pica



in Table 1. The survey identified some form of pica to be present in 40 patients, indicating a prevalence of 46%. Of these 40 patients, 30 exhibited ice pica and 11 exhibited hard pica, including 1 patient who reported both types of behavior. These data reflect overall prevalence rates of 34.5% and 12.6% for ice pica and hard pica, respectively, as depicted in Figure 1. Beyond ice, the objects consumed included starch, clay, sand, chalk, potting soil, sponge, sugar, soap, Ajax cleanser, and wood. Type of dialysis therapy and dialysis-specific variables were studied for their association with pica. Table 2 shows that, with respect to dialysis modality, in this population, patients exhibiting hard pica were more likely to be receiving HD than PD (OR: 8.3; 95% CI: 0.5 to 148.2; $P = .06$). There was no statistically significant difference identified when ice pica alone was examined. There was also no difference when comparing hard pica and ice pica. Dialysis adequacy, as estimated by Kt/V urea, averaged 1.5 ± 0.5 , which was above the recommended minimum of 1.2. There was no difference in Kt/V values between those patients with and without pica, or between the pica subgroups.

Duration of time receiving dialysis therapy was a significant variable. This time reflects the most recent initiation of chronic dialysis therapy, but it does not include interruptions, due to transplantation, for example. The mean time on dialysis was 4.0 ± 3.6 years, among all of the patients surveyed. Greater than 5 years on dialysis was associated with an OR of 3.2 (95% CI: 1.3 to 8.3; $P = .02$) for any form of pica, more specifically, hard pica (OR: 9.8; 95% CI: 2.2 to 44.2; $P = .002$). Multiple regression analysis further elucidated the significant ($P = .005$) relationship of time on dialysis to hard pica. When comparing the two types of pica, for patients on dialysis for greater than 5 years, the odds of hard pica versus ice pica was 5.3:1.

Anemia, a long-studied comorbidity of renal failure, was evident in this patient population, with a mean hematocrit of $33 \pm 4\%$. Patients with any form of pica displayed an OR of 4.3 (95% CI: 1.8 to 10.8; $P = .001$) for hematocrit < 34%. Multiple regression analysis revealed significant relationships between this variable

and all forms of pica, as well as hard pica ($P = .0061$ and $.02$, respectively). Further breakdown of the data revealed that for patients with a hematocrit of $< 34\%$, when comparing pica subgroups with non-pica patients, there were ORs of 3.0 (95% CI: 1.2 to 8.0; $P = .03$) and 10.6 (95% CI: 2.0 to 55.5; $P = .004$) for ice pica and hard pica, respectively. The concurrent use of either iron or erythropoietin derivative was not taken into account in these analyses.

Additional complications were observed in some children who exhibited hard pica. Hypophosphatemia was seen in association with chalk pica, whereas poor weight gain, abdominal pain, and fever resulted in multiple hospitalizations for one patient with sponge pica.

Discussion

In this South Floridian, multiethnic, pediatric dialysis population, we identified a high prevalence of pica. This predominantly African American and Hispanic group exhibited a prevalence of 46% of patients endorsing any form of compulsive consumption. Of the 87 patients surveyed, 34.5% acknowledged ice pica and 12.6% acknowledged hard pica. This overall prevalence is greater than the range reported in the adult literature, even greater than that noted by Stillman and Gonzalez,⁷ whose adult study population was otherwise analogous to the one described here. More interesting, however, is that the prevalence in this adolescent aged group is higher than that previously noted in healthy children aged 6 years, who are known to have a higher rate owing to their developmental immaturity. Dialysis patients with pica are likely to have learned it from other family members.⁸ In fact, the end-stage renal disease state, per se, may constitute a potent stress and stimulus for pica in those patients with an underlying cultural predisposition.⁹ Therefore, the high prevalence may be anticipated to some degree by the high proportion of African American patients in the study population, as the increased prevalence of pica in otherwise healthy African Americans is already known.

Prolonged time on dialysis was significantly associated with pica. Those patients with the behavior were 3.2 times more likely to have received dialysis for greater than 5 years. Moreover, a dialysis vintage of greater than 5 years conferred an increased risk of exhibiting hard pica, specifically. Further, there was an increased proportion of pica-endorsing patients on HD, although without statistical significance. This could not be explained by inefficient dialysis, as Kt/V values were not only adequate but also equal between patients with and without pica. However, it may be explained by the fact that in this cross-sectional group, on average, there was a greater dialysis vintage among HD patients as compared with PD patients.

Unlike the adult-based study, also from Miami, FL,⁷ our pediatric patients with pica exhibited a significant risk for anemia. While patients with ice pica alone were more likely to be anemic, which is consistent with previous findings,⁸ those with hard pica were 10 times at risk for anemia. Multiple regression analysis confirmed the association between anemia and pica. However, the debate remains regarding the causal

relationship between anemia and pica, and whether either spurs the other. Coltman¹⁵ and Crosby¹⁶ have argued that iron deficiency is the primary insult, through iron repletion studies and anecdotal reports, respectively. In contrast, Gutelius, as cited by Reid,¹⁷ found that iron therapy had no effect on pica behavior, as compared with placebo. Although this work supports the association of anemia and pica in pediatric HD patients, further research of iron deficiency in this context is warranted.

In this study, an increased prevalence of pica was unveiled, despite study limitations, including small sample size and retrospective analysis. As a potentially harmful problem, pica deserves further nutritional and psychological management in dialysis-dependent children.

Practical Application

This study extends the discussion of pica, as the first published report of prevalence and associated factors in pediatric dialysis patients. Forty-six percent of study patients endorsed either ice pica or hard pica, with potential causal associations to prolonged time on dialysis and anemia. It is appropriate to inquire about these behaviors to prevent further morbidity in an already vulnerable population.

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