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## A survey of oral and dental health in children on home parenteral nutrition

### ABSTRACT

**Aim** To determine oral and dental problems in children who are receiving long term intravenous nutrition at home.

**Materials and methods** Design: Children who had been at home on parenteral nutrition (PN) for a period of at least 3 months were recruited from the intestinal failure clinic database of a large tertiary nutrition centre. The parents were contacted by email, face to face or telephone and asked to fill in a questionnaire. Information about the PN, enteral nutrition, type of feeding in infancy, weaning, dental and oral problems was collected.

**Results** A total of 35 patients were identified, of which 28 participated in the study. The age of the children ranged from 1-18 years with a median age of 5.5 years. The average duration of PN administration was 4.3 years. Just over half were also orally fed and three quarters had a history of breast and/or bottle feeding in infancy. Around 60% of children reported oral problems including teeth staining (29%), gum infections (11%), teeth decay and delayed dentition (16%). 68% regularly visited the dentist at 2-12 monthly intervals.

**Conclusion** In comparison to the general UK paediatric population, oral and dental problems occurred less commonly in our study group of children on HPN, unlike adult patients on intravenous nutrition where poor oral health was much more prominent compared to the general public. However the overall prevalence was similar in the adult and paediatric age group receiving long-term HPN highlighting the need for specific health advice in this patient group.

**Keywords** Parenteral nutrition; Oral health.

## Introduction

Children with intestinal failure (IF) are dependent on intravenous nutrition to meet their nutritional and fluid requirements and allow for adequate hydration and growth [Goulet et al., 2004]. Central venous catheters are the primary route for administration of PN and strict aseptic precautions are applied to prevent catheter-related blood stream infection (CRBSI). There is concern about poor dental hygiene being associated with increased incidence of CRBSI and many physicians caring for patients with IF give prophylactic antibiotics to cover dental treatment [Lee et al., 2012]. Also tooth brushing can cause bacteraemia if oral hygiene is poor and particularly if there is bleeding of the gums [Lockart et al., 2009]. Bacterial colonisation of the teeth is associated with infective endocarditis in patients with underlying heart disease and oral bacteria can lead to vascular access infections in patients on haemodialysis [D'Amato-Palumbo et al., 2013]. Children are particularly vulnerable as damage to primary teeth will have an impact on secondary dentition [Willershausen et al., 2011]. In patients with gastrointestinal conditions oral health is affected by a number of factors like gastro-oesophageal reflux, polypharmacy and its side effects, tooth brush aversion and access to dentist. Data obtained from adult practice has shown that HPN administration is associated with poor oral health with more than half of patients experiencing dental problems [Lee et al., 2013]; 28% of 5 year-old children had tooth decay according to oral health survey 2012 in England and nearly one fourth of children had untreated decay [North West Public Health England, 2012]; 43-57% of children were identified to have tooth decay in 5-12 year age groups in 2003 survey on dental health in England [Office of National Statistics, 2003]. Little is known about the incidence of dental problems in children who are on long term HPN.

The aim of our study was to determine the oral and dental problems in this group of patients to inform a discussion about how to best address these concerns and the need for future service provision.

## Materials and methods

Children who had been at home on PN for a period of at least 3 months were recruited from the intestinal failure clinic database of a large tertiary nutrition centre. Thirty five patients on long-term HPN were managed by the nutritional care team at the time and the parents of 28 children agreed to enter their child into the study. A questionnaire was developed in English to assess the various aspects of oral health and validated by comparing the responses on 5 self-completed questionnaires with an interview. Ethical approval was not obtained as it was a service assessment and improvement project.

A cross-sectional survey was carried out between

July 2012 and September 2012 on a sample of 28 HPN patients. The parents of the children were contacted initially by telephone and 28 of them answered the call within the first three attempts. Based on their preference, the questionnaires were filled in by e-mail, face to face or over the phone. Twenty seven parents answered directly in English and one with the help of an interpreter.

Information about the duration of HPN, mode of enteral feeding, breast and bottle feeding in infancy, age at weaning, use of any high calorie drink and presence of gastro-oesophageal reflux were collected. Frequency of dental visits, oral health problems and their type (teeth staining, delayed dentition, dental fillings, teeth loss and gum inflammation) frequency of brushing, use of toothpaste and use of dental accessories (e.g. dental floss, dental braces) was also noted.

## Results

Dental health on 28 children who were on HPN was analysed. Nine responded by email, five had a face to face interview, six completed a questionnaire in the outpatient clinic and eight had a telephone interview. The age group of the study population was 1-18 years with a median age of 5.5 years at the time of survey. The male:female ratio was 4:3. The length of HPN administration was ranging from nine months to 7 years 10 months, with an average duration of 4.3 years.

Just over half (53.5%) took food by mouth and 75% of patients were breast and/or bottle fed in infancy. The average age at weaning onto solids was 11 months in those children who were weaned. Only three children were on high calorie feeds. Regular visits to the dentist were undertaken by 68% in 2-12 monthly intervals. One child had never visited a dental practitioner again after the first consultation as she was unwilling to cooperate.

Regular brushing was carried out by 86% of children and 64% used toothpaste. One patient complained of abdominal pain triggered by brushing. Gastro-oesophageal reflux was reported by 64% of parents. As for oral conditions, 57% of children had dental problems, 29% had teeth staining, 11% suffered from gum infection, 14% had delayed dentition and one child reported teeth loss. One child with Costello syndrome had intermittent gum inflammation known to be associated with her underlying medical condition. None in the study cohort used any dental accessories.

## Discussion

The use of parenteral nutrition in children has come of age since its first use around forty years ago. HPN is now an established practice in young patients with prolonged intestinal failure. Children are discharged from hospital on HPN as soon as their clinical condition allows. In this

Any other type of feeding			
› PEG › Naso-gastric › Naso-jejunal › Oral › Other			
› If Yes, duration of such feeding			
Associated gastro-oesophageal reflux			
Breast feeding	Yes	No	Duration of same
Bottle feeding	Yes	No	Duration of same
When was weaning started?			
Use of any high calorie feed or high sugar feeds			
Dental history			
Teeth problems if any)			
› staining › caries › delayed teeth eruption › gum inflammation › teeth loss › other (explain)			
How often do you visit the dentist?			
How often does your child brush his/her teeth?			
Does your child use tooth paste?			

TABLE 1 Questionnaire used in the survey.

way the young patient can be re-integrated into a normal family life and engage in age appropriate activities such as regular schooling and socialising with peers. Initially long-term PN was only offered to patients with a chance to achieve intestinal autonomy [Pittiruti et al., 2009]. Since small bowel transplantation has become a realistic option, more and more children with irreversible intestinal failure or more complex health needs not just related to the gut are entered into HPN programs [Pellerin, 2012].

According to 2010 survey by Beath et al., the point prevalence of HPN in children in the United Kingdom was 139, which is nearly a fourfold increase since 1993 [Beath et al., 2011]. Although HPN allows children to grow and develop in an age appropriate way it is by far no panacea and leaves the physician caring for such children with the challenging task to keep them well and complication free for many years. PN is generally administered through a central venous catheter and strict aseptic precautions in handling, preparation and administration is important to prevent catheter-related infections [Staun et al., 2009].

Minimally invasive methods are being employed by intervention radiologists in their insertion to preserve veins and reduce the risk of infection. There is overwhelming evidence that the number of CRBSI is significantly reduced in the HPN setting [Hojsak et al., 2012]. However, recurrent CVC changes with subsequent loss of central venous access and recurrent line sepsis with its impact on intestinal failure associated liver disease [Wales et al., 2014] and the potential to be life threatening remain a major concern in these children. Every effort should be made to minimise catheter-related blood stream infections (CRBSI). Dental infections and treatment is a potential causative factor [Lee et al., 2013]. Adult data has shown that the oral health is poor in HPN patients compared to the UK standard population, with 60% of them experiencing

poor oral health and 56% psychological discomfort as a consequence [Lee et al., 2013]. Oral health is affected by a number of complications of IF such as gastro-oesophageal reflux which can lead to erosion and loss of tooth structure [Lazarchik and Frazier, 2009]. Interestingly Wright et al. [1991] reported premature tooth loss in patients on parenteral nutrition due to alveolar bone loss related to underlying electrolyte imbalances [Pankhurst, 2013]. Higher frequency of dental caries is reported in patients with inflammatory bowel disease (IBD) in case control studies (BNF for children, 2013/2014). Oropharyngeal candidiasis is associated with long-term proton pump inhibitor therapy, recurrent use of antibiotics to treat line sepsis and small bowel bacterial overgrowth and immunosuppressive medication prescribed for underlying inflammatory enteropathies [Lazarchik and Frazier, 2009]. Drug side effects and the underlying disease process (e.g. Crohn's disease with oral ulceration) may also play a role leading to reluctance of brushing. Nystatin can cause oral irritation and Aminoglycosides are associated with stomatitis in rare cases (BNF for children, 2013/2014).

A number of children who are receiving liquid diets, high calorie feeds and exclusion diets could have a further impact on oral health. Others are nil by mouth due to feed intolerance or severe oral aversion leading to reduced saliva production and dry mouth. Gagging induced by insertion of a tooth brush in the oral cavity is common in children with long standing feeding difficulties. Very young children often require general anaesthesia for dental treatments and many community dentists could be unfamiliar with the complex health needs of the paediatric IF patient. Hence access to a dentist confident in the treatment of children with complex health needs can prove to be difficult and families of children on HPN often struggle to travel long distances as connection and disconnection to the home intravenous nutrition bag is time consuming [Pironi et al., 2012]. Dental health in children is internationally compared at 12 years of age as it is the age when children start to fully establish permanent dentition and nearly 90% of children in our study group were less than 12 years of age making it a difficult comparison with published data. Oral health survey 2012 by National dental epidemiology programme revealed that nearly 28% of 5 year old had tooth decay (North West Public Health England, 2012). Data from the office of national statistics 2003 for England showed that 43-57% of 5-12 years children had tooth decay (Office of National Statistics, 2003). When compared to these available data, our study population had better oral health with 56% of children reporting dental problems of which 28% had teeth staining, 8% gum infection and only 16% teeth decay and delayed dentition.

We understand the limitations of this study such as the different modalities used to collect information from the parents that could have contributed to bias. However the questionnaire has been validated. We have only obtained data from 80% of the study population, but none of

the families refused to participate and the selection was based on parents who were contactable by telephone after a maximum number of three attempts. In addition the results are based on their parent's assessment of their child's dental status which could be subjective. Prospective studies including the objective dental examination of HPN patients carried out by a dentist who is blinded to the information of length of PN and dental routine would be useful to establish the association between dental health and HPN.

## Conclusion

In our cohort of children on home PN oral and dental problems occurred less commonly in comparison to the general UK paediatric population, unlike adult patients on intravenous nutrition where poor oral health was much more prominent compared to the general public. However the overall prevalence was similar in the adult and paediatric age group receiving long-term HPN highlighting the need for specific health advice in this patient group. Dental examination should be included in patient care pathways of HPN patients.

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