

# Blenderized Tube Feeding and Enterostomy Tube Occlusions Among Adults with Amyotrophic Lateral Sclerosis and Primary Lateral Sclerosis

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## ABSTRACT

Adults with amyotrophic lateral sclerosis (ALS) and primary lateral sclerosis (PLS) may develop swallowing difficulties and elect to receive an enterostomy feeding tube for nutrition support. Blenderized tube feeding (BTF) appeals to those interested in a homemade enteral nutrition option, but there are concerns of feeding tube occlusion and limited research on this potential risk. Therefore, our purpose was to determine the frequency of, and risk factors for, feeding tube occlusions among adults with ALS or PLS who use BTF. For this retrospective study, the electronic medical records of tube-fed adults with ALS or PLS who received outpatient care at a provincial ALS clinic during a two-year period were reviewed ( $n = 651$ ). There were 97 tube-fed patients identified, of which 20 (21%) used BTF. Average duration of BTF use was  $11.25 \pm 7.5$  months. Seven subjects (35%) used BTF exclusively, while 13 (65%) used a combination of BTF and commercial enteral formula. All received BTF by gastrostomy tube, sized 14 to 24 French. BTF administration methods and compliance with water flush recommendations varied. Despite the perceived risk of feeding tube occlusions with blenderized tube feeding, no occlusions were found to have occurred in this study.

**Key words:** Enteral nutrition, amyotrophic lateral sclerosis, primary lateral sclerosis, gastrostomy, dysphagia.

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## RÉSUMÉ

Les adultes atteints de sclérose latérale amyotrophique (SLA) et de sclérose latérale primaire (SLP) peuvent développer des difficultés de déglutition et choisir de recevoir un soutien nutritionnel sous forme de sonde d'entérostomie. L'alimentation par sonde avec nourriture en purée (ASNP) suscite l'intérêt des personnes qui aimeraient avoir une alimentation entérale faite maison, mais l'on craint d'éventuelles occlusions de la sonde, et peu de recherches ont été menées sur ce risque. Ainsi, notre objectif était de déterminer la fréquence et les facteurs de risque d'occlusions de la sonde d'alimentation chez les adultes atteints de SLA ou de SLP ayant recours à l'ASNP. Dans le cadre de cette étude rétrospective, les dossiers médicaux électroniques d'adultes alimentés par sonde et atteints de SLA ou de SLP qui ont reçu des soins en clinique externe dans une clinique provinciale de SLA durant une période de deux ans ont été examinés ( $n = 651$ ). On a identifié 97 patients alimentés par sonde, dont 20 (21 %) ont eu recours à l'ASNP. La durée moyenne d'utilisation de l'ASNP était de  $11,25 \pm 7,5$  mois. Sept sujets (35 %) avaient exclusivement recours à l'ASNP, tandis que 13 (65 %) utilisaient une combinaison d'ASNP et de préparations entérales commerciales. Tous recevaient l'ASNP par sonde de gastrostomie de format 14 à 24 Ch. Les méthodes d'administration de l'ASNP et le respect des recommandations en matière de rinçage à l'eau variaient. Malgré le risque perçu d'occlusion de la sonde par la nourriture en purée, aucune occlusion ne s'est produite dans le cadre de cette étude.

**Mots-clés :** alimentation entérale, sclérose latérale amyotrophique, sclérose latérale primaire, gastrostomie, dysphagie.

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## INTRODUCTION

Blenderized tube feeding (BTF) is an enteral nutrition option where food and fluids are blended together to create homemade liquid meals for tube feeding. This can be used exclusively or in combination with the more common option of commercial tube feeding formula (CF), a sterile liquid nutrition product with a known and consistent nutrient content. Research suggests that BTF is generally well tolerated, supports a more diverse intestinal microbiome, and appeals to tube-fed individuals and their caregivers based on views that it is more natural and contains preferable ingredients compared with CF [1–8]. There are also challenges with this enteral nutrition option as individual practices can vary widely

and there is limited professional oversight of BTF design and preparation in the home setting. Poorly prepared BTF may pose a risk of microbial contamination and insufficient nutritional content [9–13]. Another concern with BTF is the potential for feeding tube occlusion, where the lumen of the tube is obstructed by particles of food, resulting in delayed administration of nutrition, hydration, and medication [14, 15].

Although there does not appear to be evidence to support the perception that BTF causes tube occlusions, without more information about the frequency of feeding tube occlusions among BTF users, clinicians may be hesitant to support the option of BTF or find it difficult to weigh the risks and benefits for their patients. Patients and caregivers may also find it

challenging to make informed decisions about their tube feeding preferences without a better understanding of the likelihood of tube occlusion with BTF compared with CF.

The objective of this study was to determine the frequency of enterostomy tube occlusion with BTF use and to identify variables associated with tube occlusions and the perceived reasons for, and consequences of, these occurrences. It should be noted that this study utilized a convenience sample of adults diagnosed with amyotrophic lateral sclerosis (ALS) or primary lateral sclerosis (PLS) who received care at an interdisciplinary outpatient ALS clinic that provides specialized services to patients across British Columbia and the Yukon. ALS and PLS are neurodegenerative diseases resulting in a progressive loss of voluntary muscle function. Both conditions can compromise swallowing ability and, for this reason, there is a relatively high prevalence of enterostomy tube feeding in this patient population [16].

## METHODS

### Design

We conducted a retrospective review of the electronic medical records of all patients diagnosed with ALS or PLS who received outpatient services at a provincial ALS clinic over a two-year period. The clinic's interdisciplinary health care team oversees the nutritional care of the clinic patients, including enteral nutrition support and management of enterostomy feeding tubes. In some cases, patients are visited at home or provided care and guidance remotely by phone or email. All interactions are documented in the medical record.

Ethics approval for this study was granted by the University of British Columbia Research Ethics Board.

### Participants

The electronic medical records of patients who received care at the ALS clinic between 1 January 2018 and 31 December 2019 were screened for inclusion in the study. Patients met inclusion criteria if they were adults ( $\geq 18$  years of age), had a diagnosis of ALS or PLS, received partial or complete nutrition through an enterostomy feeding tube, and had documented use of BTF during the study period. BTF was defined as home-made blended food or fluids used for tube feeding in any amount—exclusively or in combination with CF.

### Data collection

The electronic medical records (Plexia 8; version 1602.63; Plexia EMR; Burnaby, BC; 2010) of subjects were comprehensively reviewed by a single research team member, with use of a standardized data collection tool.

Demographic data were collected, as well as clinical data including diagnosis and disease onset. Data were also collected on enterostomy feeding tube characteristics such as type/position, size, and design. Other data collected included the number of months of BTF use during the study period, partial or complete nutritional intake by enterostomy tube, use of CF,

BTF administration method, person responsible for BTF administration, and medication route. We also noted whether or not there was documented education from a registered dietitian on BTF preparation and administration and documented compliance with recommended peri-prandial feeding tube water flushes.

Lastly, we collected data regarding enterostomy feeding tube occlusions including whether or not an occlusion occurred (defined in this study as a documented loss of tube patency), the reason for the occlusion, and the outcome (tube replacement or successful clearance of the occlusion).

### Data analysis

A descriptive analysis was conducted by use of means, mode, and frequencies using data analysis software (Excel; version 15.0.5293.1000; Microsoft; Redmond, US; 2013).

## RESULTS

Of the 651 medical records screened, 97 patients (15%) were found to have received partial or complete nutrition via enterostomy feeding tube during the study period. Of these patients, 20 (21%) used BTF and met all inclusion criteria. The demographic and clinical characteristics of the study subjects are displayed in [Table 1](#).

### BTF use

Of the 20 subjects who used BTF, 15 (75%) relied on tube feeding for the entirety of their nutrition, whereas five subjects (25%) received partial tube feeding and had some degree of oral intake. The average duration of BTF use during the two-year study period was 11.25 months  $\pm$  7.5 months. Seven subjects (35%) used BTF exclusively for their nutrition, whereas 13 (65%) used a combination of BTF and CF.

### Feeding tube occlusions

There were no feeding tube occlusions identified among any of the subjects.

### Enterostomy tube findings

All subjects received BTF by transcutaneous gastrostomy feeding tube. There were seven documented tube replacements during the study period, making a total of 27 gastrostomy feeding tubes used for BTF by the cohort during the two-year study period. None of the tube replacements were related to tube occlusion. Reasons for tube replacement included routine change (3), tube damage (2), broken balloon (1), and request for low-profile tube design (1).

There were a variety of tube design types, including: long shaft with internal disc retention, long shaft with balloon-style retention, and low profile with balloon-style retention, representing a proportion of 70%, 15%, and 15%, respectively. Subjects' gastrostomy feeding tubes ranged in size from 14 to 24 French. The mode tube size was 20 French.

**Table 1.** Demographic and clinical characteristics of patients who used blenderized tube feeding.

Characteristics	Patients (n = 20)
Age, y (mean ± SD)	64 ± 11
Gender, n (%)	
Male	12 (60)
Female	8 (40)
Care setting (home : care facility)	20 : 0
Primary diagnosis, n (%)	
ALS	18 (90)
PLS	2 (10)
ALS disease onset, (n (%))	
Bulbar	12 (67)
Limb	5 (28)
Unknown	1 (6)

Note: ALS, amyotrophic lateral sclerosis; PLS, primary lateral sclerosis.

### Administration methods and education

Syringe feeding was the most common BTF administration method, used by 18 subjects (90%). Three subjects received BTF by gravity infusion and one used an enteral nutrition infusion pump. Note that the counts exceed 20, as three of the subjects used more than one administration method. Those responsible for administration of BTF included self, relatives or friends, and home health care professionals. Ninety-five percent of subjects (n = 19) used their gastrostomy tube for medication administration in addition to nutrition and hydration.

Seventeen subjects (85%) received education from an ALS clinic registered dietitian on how to prepare and administer BTF. We noted variable compliance with peri-prandial gastrostomy tube water flushes as recommended by the ALS clinic dietitian. Based on documentation in the medical records, 14 subjects (70%) reported compliance with the recommended gastrostomy tube water flushes, two subjects (10%) were noncompliant, and four subjects (20%) did not have any documented information in regards to their peri-prandial water flush practices.

## DISCUSSION

### Use of BTF

Findings from this study indicate that BTF is used by tube-fed ALS and PLS patients and that many chose to use a combination of BTF and CF. We speculate that the convenience of ready-to-use products, as well as its known nutritional content, make CF an attractive option that provides flexibility and security when combined with the more labour-intensive and nutrient-variable option of BTF.

### Feeding tube occlusions

Our aim was to determine the frequency of feeding tube occlusions among a cohort of BTF users and to identify risk

factors associated with tube occlusions. However, analysis could not be conducted to identify variables associated with occlusions as none of the subjects were found to have experienced a feeding tube occlusion, regardless of tube size, tube design, administration method or water flush practices.

It is possible that subjects could have experienced a partial or temporary feeding tube occlusion but were able to regain patency independently in the home setting. Situations such as these may not have been reported by subjects and therefore would not be documented in the medical record or captured as a tube occlusion occurrence in this study. Although such transient occlusions may have occurred, it should be noted that the subjects' choice to use BTF did not result in increased cost to the health care system, as no tube replacements were required and there were no clinic visits, dietitian phone calls, or hospitalizations related to tube occlusions.

### Proposed rationale for the absence of occlusions

There are a small number of laboratory studies that have found BTF to be higher in viscosity than CF and it needing increased force for syringe bolus administration [13, 17, 18]. However, it appears that the higher viscosity of BTF does not necessarily impose a greater risk of feeding tube occlusion. In fact, no studies have demonstrated a correlation between BTF use and feeding tube occlusions among tube-fed patients. Several BTF studies align with our results in that authors have noted an absence of feeding tube occlusions among research subjects who used BTF [5, 7, 11]. Feeding tube size may be a factor in the results of this study as most subjects had size 20 French tubes, and the smallest tube used by any subject was size 14 French.

Another potential reason for the absence of tube occlusions may be that narrow points in the feeding system make it unlikely for large food particles to pass through the feeding system and create an occlusion in the feeding tube lumen. For example, with gravity and pump infusion of BTF, the reservoir bag portion of the feeding set provides the first layer of protection against occlusions, as only food particles small enough to exit the bag can enter into the tubing portion of the administration set and continue to flow towards the feeding tube. With syringe feeding, overly viscous blends and those with large food particles would not be easily drawn into the syringe, given the small opening at the syringe tip. Likewise, large food solids would not be able to pass easily out of the syringe tip and into the feeding tube, whether by gravity or push method.

A final consideration as to the rationale for the absence of feeding tube occlusions in this study is that most subjects received BTF education from a registered dietitian, which would typically include recommendations in regards to BTF preparation methods. Information was not collected on individual blending practices, type of blender, or whether or not blended food was strained, as this detailed information would not have been consistently available in the medical

record. It is reasonable to assume that there would have been a wide variety of blenders used by the subjects, and that straining may have been performed by some, but not necessarily all, subjects.

### Limitations

Because of the retrospective design, this study is limited by the accuracy of documentation in the medical record and may be confounded by the potential occurrence of transient feeding tube occlusions in the home setting that were not reported by subjects. Since this study reports on a small sample size of subjects from a single centre, further research is needed to determine if these results are reproducible.

### RELEVANCE TO PRACTICE

In this study, no enterostomy feeding tube occlusions were found to have occurred among tube-fed adults who used BTF at home over a long period of time. These findings align with previous BTF studies that have noted an absence of feeding tube occlusions among subjects. Further research on this topic is needed to unequivocally rule out feeding tube occlusion as a risk of BTF; however, considering the benefits of BTF and the growing interest among patients and caregivers, it is important that clinicians do not restrict this enteral nutrition option based on perceived increased risk of feeding tube occlusion, as there is no evidence to suggest such risk.

**Financial support:** No funding was received for this study.

**Conflict of interest:** Claire Kariya has a blenderized tube feeding resource website and has received speaking/writing honoraria from Nestle Health Science and Medline Industries. Lisa Vardi has no conflicts of interest to declare.

### REFERENCES

- Hurt RT, Edakkanambeth Varayil J, Epp LM, Pattinson AK, Lammert LM, Lintz JE, et al. Blenderized tube feeding use in adult home enteral nutrition patients: a cross-sectional study. *Nutr Clin Pract.* 2015;30(6):824–829. PMID: 26150105. doi: 10.1177/0884533615591602.
- Johnson TW, Spurlock AL, Epp L, Hurt RT, Mundi MS. Reemergence of blended tube feeding and parent's reported experiences in their tube fed children. *J Altern Complement Med.* 2018;24(4):369–373. PMID: 29185782. doi: 10.1089/acm.2017.0134.
- Phillips G. Patient and carer experience of blended diet via gastrostomy: a qualitative study. *J Hum Nutr Diet.* 2019;32:391–399. PMID: 30506947. doi: 10.1111/jhn.12614.
- Boston M, Wile H. Caregivers' perceptions of real-food containing tube feeding: a Canadian survey. *Can J Diet Pract Res.* 2020;81(4):193–197. PMID: 32495643. doi: 10.3148/cjdp-2020-012.
- Batsis ID, Davis L, Pritchett L, Linxuan W, Shores D, Yeung KA, et al. Efficacy and tolerance of blended diets in children receiving gastrostomy feeds. *Nutr Clin Pract.* 2020;35(2):282–288. PMID: 31549432. doi: 10.1002/ncp.10406.
- Gallagher K, Flint A, Mouzaki M, Carpenter A, Haliburton B, Bannister L, et al. Blenderized enteral nutrition diet study: feasibility, clinical, and microbiome outcomes of providing blenderized feeds through a gastric tube in a medically complex pediatric population. *J Parenter Enteral Nutr.* 2018;42(6):1046–1060. doi: 10.1002/jpen.1049.
- Pentiuk S, O'Flaherty T, Santoro K, Willging P, Kaul A. Pureed by gastrostomy tube diet improves gagging and retching in children with fundoplication. *J Parenter Enteral Nutr.* 2011;35(3):375–379. doi: 10.1177/0148607110377797.
- Kernizan D, Mintz D, Colin M, Lee M, Yoakam L, Chen YP, et al. Outcomes and safety of blenderized tube feedings in pediatric patients: a single center's experience. *J Pediatr Gastroenterol Nutr.* 2020;71(4):e124–e128. PMID: 32810040. doi: 10.1097/MPG.0000000000002853.
- Borghi R, Duta Araujo T, Airoldi Vieira RI, Theodoro de Souza T, Waitzberg DL. ILSI task force on enteral nutrition; estimated composition and costs of blenderized diets. *Nutr Hosp.* 2013;28(6):2033–38. PMID: 24506385.
- O'Hara C. Scurvy related to the use of a homemade tube feeding formula. *Infant Child Adolesc Nutr.* 2015;7(6):381–384. doi: 10.1177/1941406415616373.
- Papakostas P, Tsaousi G, Stavrou G, Rachovistsas D, Tsiropoulos G, Rova C, et al. Percutaneous endoscopic gastrostomy feeding of locally advanced oro-pharyngo-laryngeal cancer patients: blenderized or commercial food?. *Oral Oncol.* 2017;74:135–141. PMID: 29103742. doi: 10.1016/j.oraloncology.2017.10.001.
- Viera MMC, Santos VFN, Bottoni A, Morais TB. Nutritional and microbiological quality of commercial and homemade blenderized whole food enteral diets for home-based enteral nutritional therapy in adults. *Clin Nutr.* 2018;37(1):177–81.
- Sullivan MM, Sorreda-Esqueria P, Platon MB, Castro CG, Chou NR, Shott S, et al. Nutritional analysis of blenderized enteral diets in the Philippines. *Asia Pac J Clin Nutr.* 2004;13(4):385–90. PMID: 15563445.
- Armstrong J, Buchanan E, Duncan H, Ross K, Gerasimidis K. Dietitians' perceptions and experience of blenderised feeds for paediatric tube-feeding. *Arch Dis Child.* 2017;102(2):152–156. PMID: 27677635. doi: 10.1136/archdischild-2016-310971.
- Kariya C, Bell K, Bellamy C, Lau J, Yee K. Blenderized tube feeding: a survey of dietitians' perspectives, education and perceived competence. *Can J Diet Pract Res.* 2019;80(4):190–194. PMID: 30907125. doi: 10.3148/cjdp-2019-007.
- Katzberg HD, Benatar M. Enteral tube feeding for amyotrophic lateral sclerosis/motor neuron disease. *Cochrane Database Syst Rev.* 2011; CD004030.
- Madden AM, Baines S, Bothwell S, Chen E, Goh S, Jerome L, et al. A laboratory-based evaluation of tube blocking and microbial risks associated with one blended enteral feed recipe. *J Hum Nutr Diet.* 2019;32(5):667–675. PMID: 31270891. doi: 10.1111/jhn.12685.
- Mundi MS, Epp L, Hurt RT. Increased force required with proposed standardized enteral feed connector in blenderized tube feeding. *Nutr Clin Pract.* 2016;31(6):795–798. PMID: 27091746. doi: 10.1177/0884533616639126.