Does Artificial Enteral Nutrition Prolong the Survival of Institutionalized Elders With Chewing and Swallowing Problems?

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Background. There is a lack of prognostic data regarding tube feeding of institutionalized elderly people. The objective of this study was to determine the impact of feeding tubes on the survival of nursing home residents with chewing and swallowing problems, and to follow the course of the tube-fed residents over one year.

Methods. We conducted a cohort study with 12-month follow-up using Minimum Data Set resident assessments from 1991. Participants included 5,266 nursing home residents over the age of 65 with chewing and swallowing problems living in 272 Washington state nursing homes. Residents who had a feeding tube were identified. Baseline clinical characteristics and 12-month survival were compared for residents with and without feeding tubes. The proportion of tube-fed residents who became tube-free during the follow-up period was determined, and clinical features that predicted this outcome were examined.

Results. Among the residents with chewing and swallowing problems, 10.5% had a feeding tube. After adjusting for potential confounding covariates, tube-fed residents had a significantly higher one-year mortality rate than those without feeding tubes (risk ratio, 1.44; 95% CI, 1.17–1.76). Of the 430 residents with feeding tubes who survived the follow-up period, 25.1% became free of a feeding tube. Age less than 87 years was associated with a significantly greater likelihood of becoming tube-free (odds ratio, 1.66; 95% CI, 1.03–2.6).

Conclusions. Residents selected for feeding tube placement have poorer survival after one year than residents who are not tube-fed. However, the feeding tubes are removed in a significant proportion of residents who survive one year. Residents with a potentially reversible condition, for whom the feeding tubes are a temporary intervention, need to be identified.

CHEWING and swallowing problems are common among nursing home residents. While the placement of a feeding tube is often considered, the provision of artificial enteral nutrition to a frail, elderly person is a complex decision in long-term care. The dilemma involves weighing the putative benefits of feeding tube placement against the risks of the procedure, as well as the consideration of patient and family preferences, attitudes of the health care team, and institutional policies.

Unfortunately, there is currently a lack of prognostic data regarding the purported benefits of tube feeding in institutionalized elders (1) to help guide this decision. While recurrent lung aspiration is a commonly cited reason for the placement of a feeding tube, there is little evidence to indicate that this intervention reduces aspiration (2–10). Although it is also widely believed that artificial enteral nutrition may prolong life (11), there are no data known to us that support this view. Previous studies that describe mortality rates have been limited by small sample sizes, retrospective designs, and lack of a control group matched for other comorbidities (6,12). There is an increasingly recognized need for investigations to include control groups in order to better understand the outcomes of artificial enteral nutrition in institutionalized elders (13).

Earlier work by our group suggests that feeding tube placement does not prolong the survival of nursing home residents with advanced cognitive impairment who can no longer eat independently (14). Thus, we hypothesized that a less cognitively disabled cohort who undergo feeding tube placement because of chewing and swallowing difficulties would more likely have a survival benefit.

In order to study a large sample of elderly subjects with recognized chewing and swallowing problems, we utilized a well-validated data set containing demographic, clinical, and functional information on more than 36,000 nursing home residents. We examined whether or not enteral nutritional support had an impact on survival over one year. In addition, we described the proportion of residents who eventually became free of a feeding tube at the end of one year. This prognostic information is important for health care providers, patients, and families faced with the difficult decision of feeding tube placement for chewing and swallowing problems in the long-term care setting.

METHODS

Study Population
The study population was derived from residents over
the age of 65 who had been living in a nursing home in the state of Washington (272 homes) from the start of 1991 \((N = 36,498)\). Data were obtained from the Minimum Data Set (MDS), a federally mandated, functionally based assessment instrument (15). Data are collected by nurses who are trained by designated staff in each facility. The assessments are submitted for computerization to a central state agency, where they are reviewed for completeness. Data for this study were available from five quarterly resident assessments over the course of 12 months (baseline, 3, 6, 9, and 12 months). The exact date of death was available for residents who did not survive the follow-up period. Data were missing in less than 4% of cases for all variables analyzed. MDS items analyzed in this study have met a high standard of reliability (intraclass correlation of 0.6 or higher) (16).

In order to identify a subset of nursing home residents at risk for feeding tube placement, we used an MDS item that identifies residents with a "chewing or swallowing problem" at their baseline assessment. This study population consisted of 5,266 residents with a median age of 87 years (range, 65–107 yr), of whom 3,813 (72.4%) were female. This cohort was then categorized into those who did and those who did not have a feeding tube. Residents were excluded from the analysis if they did not have a feeding tube at baseline but received one during the follow-up period.

**Definition of Variables**

Based on our clinical knowledge, independent variables were chosen from the complete data set that might, a priori, be associated with whether or not a nursing home resident would undergo feeding tube placement, as well as clinical characteristics that might influence survival in this population. Independent variables fell into several broad categories: demographic, general health status, baseline functional and cognitive status, medical diagnoses, and advance directives. These variables were derived from the residents' baseline assessments.

Demographic variables included age and gender. The age variable was dichotomized into groups of residents greater than or less than and equal to 87 years (median age). General health status included: weight loss (>5% in the previous 30 days or >10% in the previous 180 days), body mass index (BMI; kg/m²), pressure ulcers, recurrent lung aspirations, and an unstable medical condition (a condition that causes the resident's cognitive, functional, or behavioral status to be precarious).

Cognitive function was defined using the Cognitive Performance Scale (CPS), a validated measure of cognitive impairment in nursing home residents (17,18). The CPS uses five MDS variables to group residents into seven hierarchical cognitive performance categories. These categories include: 0 = intact, 1 = borderline intact, 2 = mild impairment, 3 = moderate impairment, 4 = moderately severe impairment, 5 = severe, and 6 = very severe. Baseline cognitive impairment was categorized into four levels based on the resident's CPS score at baseline assessment: none or minimal = 0 or 1, mild–moderate = 2 or 3, moderately severe–severe = 4 or 5, and very severe = 6.

Baseline functional status was calculated from the sum of the Activities of Daily Living (ADL) scores, which rate seven domains of function including: bed mobility, transferring, locomotion, dressing, eating, toileting, and grooming. Each domain is graded on a 5-point scale (0 = independent, 1 = supervision, 2 = limited assistance, 3 = extensive assistance, 4 = unable to do). A maximum score of 28 indicates total dependence. The cumulative ADL score was divided into three levels of functional dependence: mild = 0–10, moderate = 11–20, severe = 21–28.

The medical diagnoses considered included: pneumonia, stroke, diabetes, Parkinson's disease, congestive heart failure, atherosclerotic heart disease, chronic obstructive lung disease, cancer, depression, and dementia (all causes). We also considered whether or not the subjects or their proxies had indicated a preference not to be resuscitated in the event of a cardiac or pulmonary arrest. Finally, we examined who was the designated health care decision maker for the resident (e.g., legal guardian, the patient, or a family member).

For those patients who died, survival time was determined from the time of their baseline assessment until the date of death. For residents who remained alive, survival time was calculated from the time of their baseline assessment until the date of their last assessment in the one-year follow-up period.

**Statistical Analyses**

Data were analyzed with SAS software, version 6.09 (19). Kaplan Meier estimator (log rank test) was used to determine if residents with chewing and swallowing problems who received a feeding tube survived longer than those without a feeding tube. In order to identify potential confounding covariates, bivariate analyses of the association of individual clinical factors with feeding tube status and survival were performed. Chi-square tests and logistic regression were used to derive proportions, odds ratios, and 95% confidence intervals (CI) for the unadjusted analyses of the associations between clinical characteristics and feeding tube status. Baseline ADL scores, CPS scores, and guardian status were grouped into ordinal categories, and the lowest category was used as the referent group (dummy variable). Unadjusted analyses were also performed to determine which individual clinical factors were associated with survival using Cox proportional hazards regression (20). Risk ratios and 95% CI were derived from these analyses.

Variables that were associated \((p \leq .10)\) with both survival and feeding tube status in the bivariate analyses were considered as potential confounders. These covariates were then entered into a Cox proportional hazards model. Stepwise selection was used to determine the best set of independent predictors of survival among residents with chewing and swallowing problems. Feeding tube status was then added to the final model in order to explore the effects of the covariates on its relationship to survival.

Proportional hazards assumptions were checked and were considered violated if the time interaction term for the covariate had a \(p\) value < .05.
RESULTS

Survival

Unadjusted analysis.—Among the 5,266 residents with chewing and swallowing problems at baseline, 551 residents (10.5%) had feeding tubes. Using the Kaplan Meier estimator of survival, tube-fed residents had a higher mortality rate over one year than those without feeding tubes (logrank, \( p < .0001 \); see Figure 1). This relationship was similar to that found in the unadjusted Cox proportional hazards model examining the effect of feeding tube status on survival (risk ratio, 1.78; 95% CI, 1.46–2.16). Seven hundred forty-five (14.1%) of the residents in the cohort died during the 12-month follow-up period. The median follow-up time for the entire cohort was 352 days, and 179 days for residents who did not survive.

Confounders.—The bivariate analyses of individual clinical characteristics associated with feeding tube status and survival are shown in Tables 1 and 2, respectively. Clinical features that were associated \(( p < .10 )\) with both feeding tube status and survival in the bivariate analyses included: baseline CPS score, gender, recurrent lung aspiration, pressure ulcers, a diagnosis of dementia, recent weight loss, body mass index < 21 \( \text{m/kg}^2 \), pneumonia, atherosclerotic heart disease, and an “unstable medical condition.”

Adjusted analysis.—Potential confounding covariates were entered into a Cox proportional hazards regression using stepwise selection. In the final model, feeding tube status remained independently associated with poorer survival (risk ratio, 1.44; 95% CI, 1.17–1.76) (Table 3). The covariates, which remained significantly associated with increased mortality, included: weight loss, female sex, an unstable condition, pneumonia, no diagnosis of dementia, atherosclerotic heart disease, and pressure ulcer. Pneumonia was a confounder for recurrent lung aspiration (e.g., beta coefficient decreased by >10%); therefore, the aspiration variable does not appear in the final model. CPS category was collinear with a diagnosis of dementia, and therefore it also does not appear in the final model. Other model-building techniques were explored, including forward and backward selection, but the final model did not change. All variables in the final model met the criteria for proportional hazards assumptions.

Subgroup analyses.—We explored whether there was a survival benefit among specific resident subgroups that may be expected, a priori, to have better outcomes with a feed-

Figure 1. One-year survival comparison of residents with chewing and swallowing problems with (dotted line) and without (solid line) feeding tubes. By the end of the follow-up period, 77% of subjects were still alive; accordingly, the y axis is scaled to originate at 0.5.
ing tube. Strata within the following clinical variables were examined: age, baseline cognitive and functional status, and aspiration. Feeding tube status remained significantly associated with poorer survival in all subgroups analyzed, and the magnitude of the association remained essentially unchanged.

**Natural History of Residents With Feeding Tubes**

Among the 551 residents who had a feeding tube at baseline, 121 (22.0%) died over the 12-month follow-up period. Of the 430 residents who survived, 108 (25.1%) eventually became and remained free of the feeding tube during the 12 months studied. The only clinical factor significantly associated with feeding tube removal was age < 87 years (odds ratio, 1.66; 95% CI, 1.03–2.69). Factors that tended to be associated with removal of the tube but did not reach statistical significance included: no aspiration, no diagnosis of dementia, and no diabetes.

**DISCUSSION**

While long-term enteral nutrition remains a treatment option for nursing home residents with serious chewing and swallowing problems, it is not known whether this intervention impacts survival in this population. In this study of 5,266 nursing home residents with chewing and swallowing problems, a notable proportion had feeding tubes (n = 551, 10.5%). Even after adjusting for potential confounding variables, residents with feeding tubes had a significantly higher mortality rate over 12 months compared to those without feeding tubes. However, among the residents who...
ARTIFICIAL ENTERAL NUTRITION IN NURSING HOMES

Table 2. Unadjusted Analysis: Clinical Characteristics Associated With Decreased Survival Among Residents With Chewing and Swallowing Problems (N = 5266)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Risk Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feeding tube</td>
<td>1.78 (1.46-2.16)</td>
</tr>
<tr>
<td>Baseline CPS score (level of impairment)*</td>
<td></td>
</tr>
<tr>
<td>0, 1 (none-minimal)</td>
<td>referent</td>
</tr>
<tr>
<td>2, 3 (mild–moderate)</td>
<td>0.99 (0.82-1.20)</td>
</tr>
<tr>
<td>4, 5 (moderate–severe)</td>
<td>0.69 (0.56-0.86)</td>
</tr>
<tr>
<td>6 (very severe)</td>
<td>0.74 (0.60-0.93)</td>
</tr>
<tr>
<td>Health care decision maker</td>
<td></td>
</tr>
<tr>
<td>None designated</td>
<td>referent</td>
</tr>
<tr>
<td>Legal guardian</td>
<td>1.26 (0.77-2.05)</td>
</tr>
<tr>
<td>Family member</td>
<td>1.35 (0.85-2.14)</td>
</tr>
<tr>
<td>Patient</td>
<td>1.94 (1.20-3.11)</td>
</tr>
<tr>
<td>Baseline ADL score (level of dependence)†</td>
<td></td>
</tr>
<tr>
<td>0–10 (mild)</td>
<td>referent</td>
</tr>
<tr>
<td>11–20 (moderate)</td>
<td>1.13 (0.91-1.39)</td>
</tr>
<tr>
<td>21–28 (severe)</td>
<td>1.06 (0.87-1.29)</td>
</tr>
<tr>
<td>Aspiration</td>
<td>2.36 (1.68-3.32)</td>
</tr>
<tr>
<td>Age &gt;87 years</td>
<td>1.02 (0.88-1.18)</td>
</tr>
<tr>
<td>Female sex</td>
<td>1.93 (1.67-2.33)</td>
</tr>
<tr>
<td>No diagnosis of dementia</td>
<td>1.49 (1.28-1.72)</td>
</tr>
<tr>
<td>Unstable condition</td>
<td>1.84 (1.60-2.13)</td>
</tr>
<tr>
<td>&quot;Do not resuscitate&quot; order</td>
<td>1.02 (0.86-1.20)</td>
</tr>
<tr>
<td>Pressure ulcer</td>
<td>1.53 (1.23–1.90)</td>
</tr>
<tr>
<td>Weight loss</td>
<td>2.06 (1.75-2.42)</td>
</tr>
<tr>
<td>Body mass index (&lt;21 kg/m²)</td>
<td>1.28 (1.11–1.49)</td>
</tr>
<tr>
<td>Atherosclerotic heart disease</td>
<td>1.31 (1.08–1.58)</td>
</tr>
<tr>
<td>Chronic obstructive lung disease</td>
<td>2.02 (1.69–2.42)</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>1.56 (1.33–1.83)</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>1.57 (1.31–1.88)</td>
</tr>
<tr>
<td>Stroke</td>
<td>1.09 (0.94–1.27)</td>
</tr>
<tr>
<td>Parkinson’s disease</td>
<td>1.09 (0.86–1.39)</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>2.00 (1.59–2.51)</td>
</tr>
<tr>
<td>Depression</td>
<td>0.87 (0.70–1.08)</td>
</tr>
<tr>
<td>Cancer</td>
<td>1.88 (1.48–2.39)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.43 (1.18–1.73)</td>
</tr>
</tbody>
</table>

*CPS = Cognitive Performance Scale.
†Total ADL score is sum of scores in each 7 domains including: bed mobility, dressing, toileting, transferring, eating, grooming, locomotion. Each domain was scored on a 5-point scale (0 = independent, 1 = supervision, 2 = limited assistance, 3 = extensive assistance, 4 = total dependence).

survived, one quarter became free of a feeding tube over the one-year follow-up period. These residents were younger and tended to have less dementia, diabetes, and aspiration than those residents who were still tube-fed at the end of one year. Thus, there may be an identifiable population in the long-term care setting for whom tube feeding is a temporary intervention that can eventually be discontinued.

Our results support and extend the observations of previous investigations that describe the mortality rates of tube-fed nursing home patients (6,12). Although these studies also suggest that survival among these patients is generally poor, their conclusions regarding the impact of tube feeding on survival are limited by the lack of comparison groups (13). In this study we were able to include a control group with chewing and swallowing problems but without feeding tubes and to use multivariate techniques to adjust for co-morbid conditions.

There are several possible explanations for our observation that residents with feeding tubes have significantly poorer survival after one year than those without tubes. Despite our best efforts to control for confounding, it is possible that the group who received feeding tubes was actually sicker than the control group (e.g., confounding by indication). If such confounding were responsible for our observation, it would be reasonable to question whether many of the residents selected for feeding tube placement were too debilitated to derive any significant survival benefit from the intervention.

Another possible explanation for our finding is that feeding tube placement introduced additional morbidity that led to worse outcomes. While recurrent lung aspiration is commonly cited as a reason for placing a feeding tube, this intervention has never been shown to prevent aspiration and may actually worsen it (2,5,21). Feeding tubes also have the potential to cause agitated behavior in cognitively impaired residents, which may lead to the use of restraints, psychotropic medication, immobility, and functional decline. Nursing home residents with feeding tubes have been found to be restrained and to have pressure ulcers more often than matched controls without feeding tubes (5). Enteral nutrition in the frail elderly also runs the risk of diarrhea with consequent fluid and electrolyte imbalances. Finally, local complications related to the feeding tube may lead to adverse outcomes including: peritonitis, infection of the abdominal wall, bowel obstruction, tube dislodgement, ostomy leakage, and gastritis (6).

We found that 25% of the tube-fed residents who survived were free of a feeding tube at the end of one year. The tubes may have been removed due to complications or a change in the care goals of these patients. Alternatively, these residents may have been retrained to eat orally. This possibility is supported by the observation that younger residents were more likely to have their feeding tube removed than older residents. Furthermore, previous work has found that a significant proportion of tube-fed nursing home residents can be successfully weaned from their feeding tubes (22). Inadequate statistical power may have prevented us
from finding other resident characteristics predictive of feeding tube removal in these subgroup analyses. It is important to note that there may be financial and staffing disincentives on the part of the nursing home to initiate weaning trials. In most states, there is a higher reimbursement rate for tube-fed patients, and hand feeding a disabled resident takes considerably more staff time than operating a feeding tube pump (22).

Potential limitations of this study need to be addressed. First, as discussed above, we may not have been able to adjust for all the clinical differences between residents with and without feeding tubes. Ideally, a randomized, controlled, clinical trial would be needed to adequately match the two groups prospectively. However, such a trial would be difficult, if not impossible to perform, due to the ethical and emotional issues involved in the decision to tube feed an elderly patient with chewing and swallowing problems.

Second, we could not determine from this data set the type of feeding device used. However, the majority of feeding tubes used in long-term care facilities are jejunostomy or gastrostomy tubes, rather than nasogastric tubes, which are usually only used as temporary devices. Although there may be some theoretical advantage of jejunostomy tubes over gastrostomy tubes in reducing aspiration, neither device has been shown to effectively prevent this complication (4,7–10,21). Therefore, it is unlikely that specific information regarding the type of feeding tube used would have significantly altered our results.

Finally, although there may be some inaccuracies in the resident assessments, the data are collected uniformly and are carefully monitored. Given that the variables are explicitly defined in a coding manual and that the nurses have been specifically trained in its use, the degree of misclassification is likely to be small and nondifferential.

A major strength of this investigation is that this data set affords a unique opportunity to study a large cohort of nursing home residents at risk for feeding tube placement and to follow them prospectively. It would be extremely problematic to acquire the sample size necessary to conduct this type of analysis through primary data collection. In addition, the comprehensive functional and clinical data available in the MDS allowed us to control for a large number of potential confounding covariates. The conclusions of previous studies in this area have been limited by the lack of suitable control groups (13).

One of the reasons that many patients and families opt for tube feeding in the nursing home setting is the belief that the intervention will prolong life (11). Thus, our finding that nursing home residents with chewing and swallowing problems who were selected for feeding tube placement died at a faster rate than those without feeding tubes is critical. While this observation may be due to the advanced disability of the patients selected, it may also be secondary to the potential adverse consequences of feeding tubes. However, our data suggest there is a subgroup with chewing and swallowing problems for whom the feeding tube is a temporary intervention. Therefore, in the interest of avoiding unnecessary patient burden and potentially risky procedures, targeting those with a reversible condition, as well as those who can be successfully weaned from tube feeding, is crucial and deserves further study. This information would be beneficial to clinicians and families considering treatment options and for institutions designing rational health care policy, as well as for patients who wish to make informed decisions regarding their own advance directives.

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