Survival After Percutaneous Endoscopic Gastrostomy Placement in Older Persons

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Background. The prolongation of life is an important consideration in the decision to initiate long-term tube feeding. This report critically synthesizes the evidence regarding the impact of percutaneous endoscopic gastrostomy (PEG) tube placement on survival in older persons.

Methods. A systematic search was conducted using MEDLINE from January 1980 until January 1999. Articles reporting survival data in older persons (mean or median age >65 years) after PEG tube placement were identified. The number and age of subjects, length of follow-up, setting, and survival data were extracted from all eligible studies. Mortality data at 1, 2, 6, and 12 months after PEG placement were quantitatively synthesized. Clinical characteristics associated with decreased survival among subjects with PEG tubes were identified.

Results. Five cohort studies compared survival in patients with and without feeding tubes in nursing homes, but none demonstrated a survival benefit. Another cohort study reported increased survival for tube-fed patients with amyotrophic lateral sclerosis. The pooled proportion of all subjects surviving after PEG placement was as follows: 1 month = 0.81 (95% confidence interval [CI], 0.74–0.88), 2 months = 0.70 (95% CI, 0.65–0.74), 6 months = 0.56 (95% CI, 0.20–0.92), and 12 months = 0.38 (95% CI, 0.26–0.49). Advanced age and malignancy were the factors most often reported to be associated with poorer survival among subjects with PEG tubes.

Conclusions. The impact of PEG placement on survival is not known because the level of evidence is limited. PEG tubes may prolong life in selected populations. However, the majority of older patients selected for PEG placement will not survive 1 year after the procedure. Certain factors may identify those patients more likely to derive a survival benefit from long-term tube feeding. This information may offer some guidance to decision makers for whom prolongation of life is an important factor in the tube-feeding decision.

Approximately 10% of the institutionalized elderly population in the United States are tube fed (1,2). The decision to initiate long-term tube feeding in this population is complex. The transfer of evidence-based tube-feeding knowledge by the health care team to the decision maker is critical for this process. Unfortunately, the data regarding risks and benefits of tube feeding are not easily interpreted. This is partly because there are no randomized trials of long-term tube feeding. The emotional and ethical issues that surround this intervention render a randomized clinical trial difficult to conduct. Despite this limitation, data from nonrandomized studies and case series can provide useful information for the decision makers. For example, the prevention of aspiration is a commonly cited reason to initiate tube feeding. However, a recent critical review of the literature has clearly shown that many subjects continue to aspirate after placement of a feeding tube (3). A similar approach has offered useful insights into the association between tube feeding and its impact on nutrition (4).

The prolongation of life is also a frequently cited goal of tube feeding. In a survey of cognitively intact nursing home residents, 50% would choose to have a feeding tube if they suffered permanent brain damage. The most common reason for this choice was the hope of improving survival (5). In a survey of substitute decision makers for institutionalized, tube-fed older persons, the wish to prolong life was the most common reason for choosing the intervention (6). Despite this widely held belief that artificial enteral nutrition will improve survival, there are limited data to support this view. Percutaneous endoscopic gastrostomy (PEG) tubes are the most common devices currently used for long-term tube feeding (6). Therefore, the objective of this report is to critically summarize the scientific literature regarding survival after PEG placement, focusing on older populations. This type of information is important to help guide decision makers when faced with the difficult dilemma of whether to initiate long-term tube feeding.

Methods

Study Selection

PEG tube placement was first described in 1980 (7) and was adopted into standard practice after 1990. Therefore, a systematic search of the English-language literature from January 1980 through January 1999 was conducted using MEDLINE to identify all relevant studies examining survival after PEG placement. The following medical subject headings were used to identify the articles: enteral nutrition, gastrostomy, and gastrointestinal intubation. The following key words were also used: enteral feeding, artificial nutrition, tube feeding, and gastrostomy tube. References of identified articles were also reviewed for relevant citations.

Articles identified through the MEDLINE search were screened to meet the following eligibility criteria: (i) type of
feeding tube placed was a PEG, (ii) mean or median age of the study population was 65 years or older, and (iii) survival was measured as an outcome. Studies were excluded if the setting was an intensive care unit. Studies were classified as either cohort studies (included a control group without tubes) or as case series (only tube-fed subjects were followed).

There is a recognized need for investigations to include control groups to better understand the outcomes of tube feeding (2,3,8). Therefore, cohort studies were included if they compared survival data in subjects with and without feeding tubes but had minor exceptions to the aforementioned criteria. These exceptions are described where relevant.

**Data Abstraction**

The number and age of subjects, length of follow-up, setting (acute care hospital vs institution), and survival data were determined for all eligible studies. Subject ages and the duration of follow-up were not consistently reported. Therefore, means, proportions, and ranges are described for these variables when available. Factors associated with poorer survival among subjects with PEG tubes were extracted when reported.

**Statistical Analysis**

Articles reporting mortality rates at 1, 2, 6, and 12 months following PEG placement were identified. An overall mortality rate was derived using a weighted average of the individual mortality rates. Weights were based on the inverse of the precision of the rates (i.e., reciprocal of the squared standard deviation) as described by Hedges and coworkers (9). Chi-square tests for homogeneity were conducted. A random effects model was used when the chi-square test was significant. Based on this method, random effects models were deemed necessary to combine the data for all time periods, except for 2-month survival when a fixed effects model was appropriate. The pooled proportion of subjects surviving each time period with its associated 95% confidence interval (CI) was derived from these analyses.

**Results**

**Cohort Studies Comparing Subjects With and Without Feeding Tubes**

Seven cohort studies compared survival among subjects with and without a feeding tube (Table 1) (1,2,10–14). Only one investigation collected data prospectively (13).

Five of the cohort studies examined tube feeding in the nursing home population (1,2,10–12). Two of these investigations compared survival among videofluoroscopically proven aspirators with and without feeding tubes (10,11). Neither study demonstrated a statistically significant difference in mortality between the two groups; however, only a small number of subjects were analyzed. It is important to note that the study by Croghan and coworkers included nine tube-fed subjects with nasogastric tubes, as well as eight with PEG tubes (10). The subjects with nasogastric tubes had poorer survival compared with the subjects with PEG tubes.

Bourdell-Marchasson and colleagues conducted a retrospective analysis of 108 nursing home residents for whom nutritional support was raised as a clinical concern (12). Survival was compared between subjects who did and did not opt for PEG placement, but did not statistically differ between the two groups. Adequate comparison of potential confounding variables between the two study groups was not conducted, nor were appropriate statistical techniques of survival analysis utilized.

Mitchell and colleagues conducted two retrospective cohort studies of nursing home residents using data from the Minimum Dataset (1,2). The first study found no difference in 24-month survival between residents with severe cognitive impairment who did and did not have feeding tubes (1). The second study found that among residents with chewing

**Table 1. Survival Data From Cohort Studies Comparing Subjects With and Without Feeding Tubes**

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>No. of Subjects</th>
<th>Population</th>
<th>Follow-up (months)</th>
<th>Attempt to Adjust for Confounders</th>
<th>Mortality (tube fed vs not tube fed)</th>
</tr>
</thead>
</table>
| Croghan 1994 (10) | Retrospective | 17† | Nursing home, aspirators | 12 | No | 53% vs 43%
| Ahmed 1998 (11) | Retrospective | 17 | Acutely hospitalized nursing home residents, aspirators | 6 | No | 65% vs 70%
| Bourdel-Marchasson 1997 (12) | Retrospective | 58 | Nursing home | 40 | No | Risk ratio = 0.90 (95% CI 0.67–1.21)
| Mitchell 1997 (1) | Retrospective | 135† | Nursing home, advanced dementia | 24 | Yes | Risk ratio = 1.44 (95% CI 1.17–1.76)
| Mitchell 1998 (2) | Retrospective | 551† | Nursing home, chewing and swallowing problems | 12 | Yes | |
| Mazzini 1995 (13) | Prospective | 31 | Amyotrophic lateral sclerosis, mild–severe dysphagia and weight loss | 24 | Comparable baseline features | 61% vs 97%, p < .001 |
| Cowen 1997 (14) | Retrospective | 80 | Acutely hospitalized, abnormal videofluoroscopy, nonoral feeders | 36 | Partial | Risk ratio = 0.48 (95% CI 0.32–0.74)

†9 subjects had nasogastric tubes, 8 had percutaneous endoscopic gastrostomy tubes.

Type of feeding tube is unknown.
or swallowing problems, those with feeding tubes had a higher 1-year mortality rate compared with those without tubes (2). Although the type of feeding tube could not be identified from the data set, the majority of feeding tubes used in nursing homes are PEG tubes (6).

Two cohort studies have reported a survival benefit from PEG tubes in selected populations (13,14). Mazzini and coworkers prospectively followed patients with amyotrophic lateral sclerosis (ALS) with dysphagia and weight loss who were offered PEG placement (mean age, 60 years) (13). The 24-month mortality in the group who opted for tube placement was 61% compared with 97% among those without tubes (p < .001). Cowen and colleagues retrospectively examined acutely hospitalized older patients with abnormal videofluoroscopic studies and minimal oral intake (14). Thirty-six-month mortality was significantly lower among subjects who underwent PEG placement compared with those who chose “comfort care.” Cowen and colleagues did adjust for four risk factors associated with decreased survival; however, the investigators admit that “it is likely that the survival advantage was due to other prognostic factors which were influencing the decision to place the PEG tube.”

**Survival Among Subjects With PEGs**

Figure 1 presents the summarized results of all eligible studies reporting survival following PEG placement. The pooled proportion of subjects surviving for each time period is as follows (n = number of studies used to derive the data): 1 month (n = 28) 0.81 (95% CI, 0.74–0.88) (12,14–40); 2 months (n = 4) 0.70 (95% CI, 0.65–0.74) (12,16,37,39); 6 months (n = 3) 0.56 (95% CI, 0.20–0.92) (19,23,37); and 12 months (n = 9) 0.38 (95% CI, 0.26–0.49) (12,15–17,19,23,27,30,40).

One study by Grant and coworkers used a large database to derive the 1-month and 12-month survival of 81,105 persons over 65 years, 59,969 of whom had a PEG, and 21,136 had a surgically placed gastrostomy tube (40). We felt it was important to include this large, well-conducted study in the analyses despite the fact that a proportion of subjects had surgically placed tubes. However, we also calculated 1- and 12-month survival excluding the data from Grant and coworkers to determine the impact of this individual study (and the subjects with surgically placed tubes). Reassuringly, the point estimates for survival at 1 month (n = 27) 0.81 (95% CI, 0.72–0.90) (12,14–39) and 12 months (n = 8) 0.38 (95% CI, 0.22–0.54) (12,15–17,19,23,27,30) are unchanged when the study by Grant and coworkers is excluded; however, the CIs are slightly wider.

**Factors Associated With Survival After Feeding Tube Placement Reported in Case Series**

Subject characteristics associated with poorer survival among patients with PEG tubes are presented in Table 2. These eight case series differed with respect to the covariates selected as potential predictors of survival, length of follow-up time, and patient population. Only four of these studies used multivariate techniques to determine independent predictors for survival (17,18,28,41).

Older age was found to be a risk factor for increased mortality in five of the seven studies that considered age as a predictor (15,25,28,40,41). Fisman and coworkers did not find this association (17). However, all subjects in this cohort were over 65 years, which may have decreased the ability to detect an age-related impact. Friedenberg and colleagues also did not find an age-related association, but only followed a small number of subjects for 30 days (18). Two larger studies of 30-day mortality post-PEG placement found older age to be associated with decreased survival (28,40).

Among the six case series that included primary diagnostic indications for tube feeding as potential predictors, five found “malignancy” to be associated with poorer survival (15,17,39–41). Friedenberg and colleagues did not detect this association, but once again, this analysis was limited by small sample size and only 30-day follow-up (18). No other diagnostic indications, including specific neurological conditions (e.g., stroke vs dementia), were consistently reported to impact survival.

Two investigations found that tube-fed men had poorer survival compared with women (40,41). Surprisingly, only two studies considered aspiration as a possible risk factor for death among patients with PEG tubes (28,41). One reported that aspiration was not associated with survival (41), although the other found an increased risk of death with aspiration (28).

Only two studies considered functional or cognitive status as potential predictors of mortality (18,41). Taylor and colleagues found that the ability to toilet or transfer was not associated with increased mortality (41). This investigation also examined a broad classification of cognitive status (normal, impaired consciousness, and unconscious), but did not find an association with survival. Friedenberg and coworkers found Mini-Mental Status Examination (MMSE) scores unrelated to 30-day mortality among patients with PEG tubes (18). However, nearly all subjects had MMSE scores between 0–5 (range 0–30, with scores below 10 representing very advanced cognitive impairment). Therefore, this cohort was far too impaired to consider cognition as a meaningful prognostic indicator. Finally, low serum albumin was associated with decreased survival in two studies (18,25).
Table 2. Characteristics Associated With Decreased Survival Among Subjects Receiving Percutaneous Endoscopic Gastrostomy (PEG) Tubes

<table>
<thead>
<tr>
<th>Study</th>
<th>No. Subjects</th>
<th>Age (years)</th>
<th>Follow-Up (months)</th>
<th>Older age</th>
<th>Gender</th>
<th>Indication for tube feeding</th>
<th>Aspiration</th>
<th>Function</th>
<th>Cognition</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clarkston</td>
<td>42</td>
<td>Mean 71.4</td>
<td>Range &lt;1–4</td>
<td>—</td>
<td>—</td>
<td>Malignancy</td>
<td>—</td>
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<td>1990 (39)</td>
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<tr>
<td>Light 1995</td>
<td>416</td>
<td>Mean 74.7</td>
<td>1 (all)</td>
<td>Yes</td>
<td>NS</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<tr>
<td>(28)</td>
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<tr>
<td>Friedenberg 1996</td>
<td>7369</td>
<td>Mean 76.5</td>
<td>Range &lt;1–45</td>
<td>Yes</td>
<td>—</td>
<td>Malignancy or transferring</td>
<td>NS</td>
<td>—</td>
<td>—</td>
<td>Diabetes</td>
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<td>1997 (18)</td>
<td></td>
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<tr>
<td>Grant 1998</td>
<td>81,105</td>
<td>All &gt;65</td>
<td>36</td>
<td>Yes</td>
<td>Male</td>
<td>Malignancy</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>——Pneumonia, influenza</td>
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<tr>
<td>(40)</td>
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<td></td>
<td>—</td>
</tr>
<tr>
<td>Fisman 1999</td>
<td>175</td>
<td>All &gt;65</td>
<td>Mean 77</td>
<td>NS</td>
<td>NS</td>
<td>Malignancy</td>
<td>—</td>
<td>—</td>
<td>—</td>
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</tr>
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</table>

Notes: NS = not significant; DNR = do not resuscitate.

1Study analyzed patients referred for PEG, 9 out of 97 did not get a tube.
2Study included 21,136/81,105 persons who had tube placed surgically (not PEG).

DISCUSSION

This report summarizes the best available data regarding the association between survival and PEG placement for older patients. The few cohort studies comparing nursing home residents with and without feeding tubes have not demonstrated a survival benefit in this population (1,2,10–12). Advanced age and malignancy are risk factors that have been most consistently identified with decreased survival among subjects with PEG tubes. This prognostic information may be useful for decision makers faced with this difficult dilemma of whether to initiate tube feeding in older persons.

Although it may seem intuitive that providing nutrition with a PEG tube would improve survival, we have found very little evidence that suggests an association, let alone a causal relationship. First, tube feeding has not been definitively shown to improve nutritional status (4). Second, PEG tubes may introduce additional morbidity leading to adverse events. Higher prevalences of aspiration (3,24,42), restraint use (42), and hospitalization (43) have been reported among tube-fed patients compared with those without tubes. Enteral nutrition also runs the risk of diarrhea and electrolyte disturbances (12,31,34). Local complications associated with PEG placement may result in worse outcomes including bowel obstruction or perforation, tube dislodgement, and infection (12,22,31,33,34). Finally, certain populations selected for tube feeding may be too debilitated to derive a survival benefit from the intervention. For example, patients with malignancies are consistently shown to have a shorter survival compared with other patients selected for tube feeding (15,17,39–41). Although advanced age appears to portend a worse prognosis in many studies (15,25,28,40,41), age may have been confounded by other factors that were not satisfactorily considered in the analyses. Specifically, baseline functional and cognitive status have not been adequately examined as independent predictors of survival among tube-fed patients.

The information in this review is limited by the data from which it is derived. Cohort studies are not able to fully adjust for important prognostic factors that may differ between patients selected for tube feeding and those who are not (e.g., “confounding by indication”). Most cohort studies to date have been retrospective, which makes it even more difficult to collect relevant data. Without an adequate control group, it is impossible to know how long patients would live without a PEG tube. Furthermore, factors such as advanced age, malignancy, and low albumin are likely highly associated with mortality regardless of tube status. Despite the clinical equipoise regarding the outcomes of long-term tube feeding, a randomized trial would be difficult to conduct because of the associated emotional and ethical issues. Therefore, in the future, a rigorously designed, large, prospective cohort study examining the outcomes of tube feeding in specific populations (e.g., dementia and stroke patients studied separately) may provide a higher level of evidence than is currently available.

There are some limitations with this report that deserve comment. The results may not be generalizable to all populations who are tube fed. The articles were limited to those carried out in non-intensive care settings that focused on predominantly older populations with PEG tubes (except where indicated). Survival data may differ in more acute clinical settings, among younger patients, and with other devices. Furthermore, despite our inclusion criteria, studies differed considerably with respect to subject population, indications for tube feeding, duration of follow-up, and setting. Finally, prolongation of life may not be the most important outcome for patients considered for tube feeding.
For many, it is the functional status and quality associated with that life that is most relevant.

It is reasonable to assume that there are certain patients who will survive longer with a PEG tube than without one. However, with an average mortality rate of 62% 1 year after PEG placement, it behooves investigators and clinicians to identify subgroups of patients most likely to benefit from this costly and invasive procedure. Moreover, it is the responsibility of practitioners to provide decision makers with the best possible data, so that they may weigh this information against their values and preferences. For those of whom prolongation of life is an important factor in the tube feeding decision, the information presented in this review may offer some guidance.

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REFERENCES