

# Mortality Trend and Predictors of Mortality in Dysphagic Stroke Patients Postpercutaneous Endoscopic Gastrostomy

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## Abstract

**Background:** Percutaneous endoscopic gastrostomy (PEG) feeding is widely used in stroke patients suffering from persistent dysphagia; however, predicting the risks and benefits of PEG insertion in the individual patient is difficult. The aim of our study was to investigate if candidate risk factors could predict short-term mortality risk in poststroke patients who had PEG tube insertion for persistent dysphagia.

**Methods:** This was a retrospective study of 3504 consecutive stroke patients admitted to two metropolitan hospitals during the period January 2005 to December 2013 and who also underwent PEG insertion for feeding due to persistent dysphagia.

**Results:** A total of 102 patients were included in the study. There were 22 deaths in 6 months after insertion of PEG tubes and 20 deaths of those occurred within 3 months post PEG. Those who survived beyond 6 months showed significantly lower mean age ( $75.9 \pm 9.0$  years vs.  $83.0 \pm 4.9$  years,  $P < 0.001$ ), a lower mean American Society of Anesthesia (ASA) score ( $3.04 \pm 0.63$  vs.  $3.64 \pm 0.58$ ,  $P < 0.001$ ) compared to nonsurvivors. In multiple Logistic, age ( $P = 0.004$ , odds ratio [OR] = 1.144; 95% confidence interval [CI]: 1.044–1.255); ASA ( $P = 0.002$ , OR = 5.065; 95% CI: 1.815–14.133) and albumin level pre-PEG insertion ( $P = 0.033$ , OR = 0.869; 95% CI: 0.764–0.988) were the independent determinants of mortality respectively.

**Conclusions:** We propose that age, ASA score and albumin level pre-PEG insertion to be included as factors to assist in the selection of patients who are likely to survive more than 3 months post PEG insertion.

**Key words:** Age; Albumin; American Society of Anesthesia; Mortality; Percutaneous Endoscopic Gastrostomy; Stroke

## INTRODUCTION

Dysphagia is a common complication after stroke. It is estimated that 29–50% of stroke patients suffer dysphagia.<sup>[1-3]</sup> Although many gradually recover their swallowing function by 6 months,<sup>[4]</sup> there is increasing evidence to suggest that dysphagia persists longer in stroke patients with advanced age and multiple co-morbidities, with high mortality of 26% in the over 75-year age group.<sup>[5]</sup>

Percutaneous endoscopic gastrostomy (PEG) feeding has been used as an alternative to enteral feeding in dysphagic stroke patients. Clinical predictors of patients requiring PEG feeding include aspiration, ischemic heart disease (IHD), low Glasgow Coma Scale (GCS) score and high National Institutes of Health Stroke Scale score.<sup>[1,2,6,7]</sup>

The question of whether these dysphagic stroke patients with severe disabilities should have PEG insertion, and whether

there is a benefit in terms of mortality and quality of life remains a difficult clinical and ethical dilemma for physicians and families.<sup>[8]</sup> There is some evidence suggesting that many patients will not benefit from PEG insertion even in the short-term due to early mortality and that deaths are often due to co-morbidities such as respiratory and cardiac diseases.<sup>[9,10]</sup> James *et al.*<sup>[9]</sup> reported a 28% in-hospital mortality rate in a study of 126 stroke patients following PEG insertion and 57% mortality after a 31-month median follow-up. Ha and Hauge<sup>[5]</sup> reported an overall 19% early mortality rate out of 83 stroke patients with dysphagia and PEG feeding. The high early mortality rate is often related to poor patient selection and multiple co-morbidities.<sup>[11-13]</sup> Therefore, more accurate prediction of longer term survival may lead to better patient selection for this invasive procedure.

There have been some studies that examine predictors of early mortality in PEG patients of all causes (but not exclusive to

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dysphagic stroke patients). The reported predictors include advanced age, hypoalbuminemia, low body mass index, cardiac risk factors, a higher Charlson co-morbidity score and malignancy.<sup>[14-19]</sup> However, very few studies exclusively look at predictors of survival of dysphagic stroke patients with PEG insertion and of those studies that did examine the question, small sample size and single site of studied subjects mean there is limitation to generalization of findings.

In this retrospective study, we aimed to examine various factors associated with increased early mortality in postacute dysphagic stroke patients following PEG insertions, using two hospital sources of patients and a larger total number to improve on the validity of generalization. We are particularly interested in the American Society of Anesthesia (ASA) score and albumin as predictors of early mortality. As PEG is an invasive procedure with sedative, and if the patient dies shortly after, it can be considered as ineffectual and medical resources may be wasted.

## METHODS

### Participants

This study involved a retrospective review of medical records of consecutive patients admitted to Bankstown-Lidcombe Hospital and Blacktown Hospital with acute stroke who underwent PEG insertion procedure from January 2005 to December 2013. The medical records were reviewed by a gastroenterologist and two neurologists. We excluded patients transferred from other hospitals or facilities for stroke rehabilitation who already had PEG insertions. All patients received PEG by the Ponsky–Gauderer (pull-string) method. The sedative was propofol injection with or without fentanyl.

Patient data obtained from medical records included the following: Age, sex, length of stay, stroke types (e.g., total anterior circulation infarct [TACI], partial anterior circulation infarct [PACI], posterior circulation infarct [POCI], lacunar infarct [LACI], and intracerebral hemorrhage [ICH]); main cardiovascular co-morbidities (e.g., IHD), hypertension, and atrial fibrillation; diabetes; hyperlipidemia; cerebrovascular disease history; malignancy; GCS on admission day; albumin levels on admission and prior to PEG procedure; ASA score; naso-gastric tube and PEG insertion dates; complications after PEG feeding; and mortality in 6-month after PEG procedure. The mortality data was ascertained from the patients' medical notes or telephone follow-up with family/patient, general practitioners, and residential care facilities.

### Ethics

The study was approved by the Human Research Ethics Committee of the South Western Sydney and Western Sydney Area Health Services.

### Statistical analysis

Categorical variables are expressed as number (%). Continuous variables normally distributed are reported as mean ± standard deviation (SD). Independent sample *t*-test was used to compare the means of continuous variables

between the stroke survivors and nonsurvivors groups. Chi-square test was used for comparing the frequency of categorical data.  $P < 0.05$  was considered as statistically significant; multiple stepwise Logistic regression analysis with backward elimination method was performed to examine the independent effect of the variables with  $P < 0.05$  on univariate analysis. Logistic regression models were used to estimate odds ratios (ORs) and 95% confidence interval (CI) regarding risk of mortality. Statistical analysis was carried out with SPSS (version 15.0, SPSS Inc., Chicago, IL, USA).

## RESULTS

A total of 3504 patients were admitted with strokes during this period with 107 (3.05%) patients undergoing PEG procedures, 5 patients were excluded as 2 were transferred from other hospitals for rehabilitation (PEG was already inserted before arrival), and 3 did not have acute strokes, leaving 102 patients for analysis.

Of the 102 eligible patients, 43 (42.2%) were male and 59 (57.8%) female. The mean age was 79 years (range from 48 to 92 years). Eighty-nine (87.3%) patients had ischemic strokes, classified as total anterior circulation infarct (TACI) (31, 30.4%), partial anterior circulation infarct (PACI) (34, 33.3%), lacunar infarct (LACI) (4, 3.9%), and posterior circulation infarct (POCI) (14, 13.7%). Sixteen (15.7%) patients had primary ICH strokes. The

**Table 1: Demographic and clinical characteristics of study patients**

Characteristics	Values
Gender, <i>n</i> (%)	
Male	43 (42.2)
Female	59 (57.8)
Age, years, median (range)	79 (48–92)
Length of hospital stay, days, mean ± SD	50.7 ± 27.9
Past medical history, <i>n</i> (%)	
IHD	33 (32.4)
AF	44 (43.1)
Hypertension	77 (75.5)
Diabetic mellitus	29 (28.4)
Hyperlipidemia	29 (28.4)
Stroke	34 (33.3)
TIA	16 (15.7)
Malignancy	10 (9.8)
Dementia	10 (9.8)
Ischemic stroke, <i>n</i> (%)	89 (87.3)
TACI	31 (30.4)
PACI	34 (33.3)
LACI	4 (3.9)
POCI	14 (13.7)
ICH, <i>n</i> (%)	16 (15.7)

IHD: Ischemic heart disease; AF: Atrial fibrillation; TIA: Transient ischemic attack; TACI: Total anterior circulation infarct; PACI: Partial anterior circulation infarct; POCI: Posterior circulation infarct; LACI: Lacunar infarct; ICH: Intracerebral hemorrhage; SD: Standard deviation.

mean length of hospital stay (LOS) for these patients was  $50.7 \pm 27.9$  days. The patients' demographics and co-morbidities are shown in Table 1.

Follow-up data of mortality (or survival status) were completed on 102 patients. There were 22 (21.6%) deaths in 6 months after insertions of PEG tubes and 20 (19.6%) deaths occurred within 3 months post-PEG: 14 (13.7%) cases in the 1<sup>st</sup> month, 3 (2.9%) case in the 2<sup>nd</sup> month, 3 (2.9%) cases in the 3<sup>rd</sup> month, 2 (2.0%) cases in the 4<sup>th</sup> month. The survival curve is shown in Figure 1. The causes of death include aspiration pneumonia, 16 cases (15.7%), upper gastrointestinal bleeding, 4 cases (3.9%), cardiovascular disease, 2 cases (2.0%). There were some complications related to PEG. Two patients (1.96%) had mild pneumoperitoneum that was absorbed by themselves. Five patients (4.9%) with incision bleeding are recovered by bumper pressure. Twelve (11.8%) patients had PEG mild site infection recovered using antibiotics. One patient pulled out the PEG tube then a doctor placed a new tube by endoscopy. No serious complications such as necrotizing fasciitis or PEG tube leaking were found.

Compared to nonsurvivors, survivors beyond 6 months had significantly lower mean age ( $75.9 \pm 9.0$  years vs.  $83.0 \pm 4.9$  years,  $P < 0.001$ ) and lower mean ASA score ( $3.04 \pm 0.63$  vs.  $3.64 \pm 0.58$ ,  $P < 0.001$ ). There was also a trend for albumin level to be higher in the survivors compared to the nonsurvivors pre-PEG insertion ( $33.7 \pm 4.4$  g/L vs.  $31.8 \pm 4.5$  g/L respectively,  $P = 0.073$ ). General Characteristics comparisons of the survivors and non-survivors stroke groups after PEG are shown in Table 2. However, there were no statistically significant differences between the survivors and nonsurvivors in terms of LOS, GCS on admission, stroke type, IHD and albumin level on admission.

In multiple Logistic regression analysis, the age ( $P = 0.004$ ,  $OR = 1.144$ ; 95%  $CI$ : 1.044–1.255); ASA ( $P = 0.002$ ,  $OR = 5.065$ ; 95%  $CI$ : 1.815–14.133) and albumin level pre-PEG insertion ( $P = 0.033$ ,  $OR = 0.869$ ; 95%  $CI$ : 0.764–0.988) were associated with mortality of

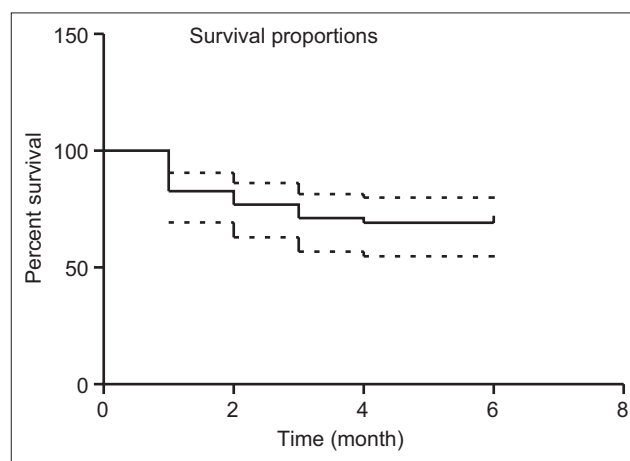
stroke patients after PEG. These were statistically significant. Age, ASA and albumin level pre-PEG insertion were the independent determinants of mortality. Advanced age and higher ASA face a higher risk of death for such patients. It seems like higher albumin level pre-PEG insertion was a protection factor. Logistic regression analysis results about risk factors of death within 6-month after insertion of PEG is shown in Table 3.

## DISCUSSION

We examined all stroke patients admitted to two hospitals with PEG for enteral nutrition. Our study showed that the 6-month general mortality for patients receiving PEG was 21.6%, with no deaths being directly related to PEG insertions or anesthesia. Overall 6-month mortality of 21.6% was similar to previously described mortality rates in stroke patients receiving PEG of 12–57%.<sup>[5,9]</sup> The mean age of patients undergoing PEG in our study was 79 (48–92) years. Advanced age and persistent dysphagia are independent risk factors for poor survival after stroke.<sup>[4]</sup> Our findings that patients with advanced age had a high mortality after PEG procedures are consistent with previous findings.

Our findings that high ASA scores may predict short-term mortality is novel and worth further exploration as an independent predictor. The score of ASA marks patient's operation risk and condition, for those patients with higher ASA, PEG operations with sedative may have a negative effect.

Serum albumin is an important factor that describes the nutrition status of patients. So we investigated it to predict the risk of mortality. Albumin levels and high C-reactive protein (CRP) levels were both linked to malnutrition; the research of John Blomberg showed the albumin and CRP levels solely or in combination had shown predictive value for overall mortality after PEG. The poor nutritional states could essentially mean higher short-term mortality within 30 days.<sup>[20]</sup> Also, the research results of Lee *et al.* revealed serum albumin levels lower than 31.5 g/L predicted an



**Figure 1:** Six-month survival curve among 102 stroke patients with dysphagia after percutaneous endoscopic gastrostomy.

**Table 2: General characteristics of the survivors and nonsurvivors stroke groups after PEG**

Characteristics	Survivors (n = 80)	Nonsurvivors (n = 22)	P
Age, years, mean $\pm$ SD	75.9 $\pm$ 9.0	83.0 $\pm$ 4.9	<0.001
ASA, mean $\pm$ SD	3.04 $\pm$ 0.63	3.64 $\pm$ 0.58	<0.001
LOS, days, mean $\pm$ SD	52.8 $\pm$ 30.5	42.9 $\pm$ 12.9	0.142
GCS, mean $\pm$ SD	11.9 $\pm$ 2.58	11.36 $\pm$ 2.3	0.425
ALb (A), g/L, mean $\pm$ SD	39.6 $\pm$ 4.75	39.09 $\pm$ 3.02	0.545
ALb (P), g/L, mean $\pm$ SD	33.7 $\pm$ 4.4	31.8 $\pm$ 4.5	0.073
ICH, n (%)	12 (15)	4 (18)	0.744
IHD, n (%)	23 (28.8)	9 (40.9)	0.306

ASA: American Society of Anesthesia; LOS: Length of hospital stay; GCS: Glasgow Coma Scale; ALb (A): Albumin levels on admission; ALb (P): Albumin levels on prior to PEG; ICH: Intracerebral hemorrhage; IHD: Ischemic heart disease; PEG: Percutaneous endoscopic gastrostomy; SD: Standard deviation.

**Table 3: Risk factors of death within 6 months after insertion of PEG among 102 patients**

Variables	B	SE	Wald	df	P	Exp (B)	95.0% CI for Exp (B)	
							Lower	Upper
Age	0.135	0.047	8.238	1	0.004	1.144	1.044	1.255
ASA	1.622	0.524	9.603	1	0.002	5.065	1.815	14.133
ALb (P)	-0.141	0.066	4.571	1	0.033	0.869	0.764	0.988
Constant	-13.019	4.943	6.937	1	0.008	0		

ASA: American Society of Anesthesia; ALb (P): Albumin levels on prior to PEG; SE: Standard error; PEG: Percutaneous endoscopic gastrostomy; CI: Confidence interval; df: Degree of freedom.

increased risk of 30 days mortality after PEG. In addition, the combination of serum albumin levels lower than 31.5 g/L and CRP levels higher than 21.5 mg/L was associated with an increased risk of long-term mortality after PEG.<sup>[21]</sup> But human albumin infusion can increase serum albumin level also, but this change will be consumed by insufficient nutrition. Finally, the albumin will be converted into energy. So in advanced countries such as Australia, doctors prefer enteral nutrition if possible. Dennis reported that mortality would decline 5–8% of stroke patients with dysphagia if tube feeding was provided at an early stage.<sup>[22]</sup> Enteral nutrition is superior to parenteral nutrition because nutrients that are absorbed from the gastrointestinal tract meet physiological needs. Enteral nutrition maintains the barrier function of the gastrointestinal tract to avoid intestinal infection. The rational conclusion suggests there is a relationship with individual status and the short-term mortality after PEG rather than PEG itself.<sup>[23,24]</sup> We studied only stroke patients, specifically the albumin level on admission and pre-PEG insertion. Only the albumin level pre-PEG insertion had prognostic significant with short-term mortality (in 3 months). How to improve these patient's nutrition status before PEG to add more score for better outcomes is a critical question.

Our study did not show a significant relationship between 6-month mortality and patient factors such as gender, IHD, stroke type, LOS, GCS on admission, and albumin level on admission. These findings differed from those described in the previous literature<sup>[7,25]</sup> where patients' other characteristics may have played a role in causing the difference.

From the largest retrospective study by Johnston *et al.* in 719 patients,<sup>[10]</sup> the risk of acquiring an upper gastrointestinal bleeding complication following PEG insertion in general (for all diseases that require PEG) was about 3.5% (25/719 patients). In our study of dysphagic stroke patients, the upper gastrointestinal bleeding complication rate of PEG was 3.9% (4/102) which is comparable. The mean age in our population was 79 which was comparable to Johnston's study, also similar to Johnston's population was that our patients had multiple co-morbidities.<sup>[10]</sup> However, our post-PEG mortality was about 19.6% within 3 months. This was much lower than the high mortality rate of 43% in Johnston's study. The main cause of the difference might have been due to different selection criteria of patients for PEG or patient characteristics; all our patients had stroke that was non-progressive while Johnston's population were made up of many different causes including progressive

neurological diseases. Our low complication rate among stroke patients was again echoed in a smaller case-control study by Teasell *et al.*<sup>[26]</sup>

FOOD trial, a study that compared patients with PEG and naso-gastric tube feeding in 321 stroke patients, had found that early PEG feeding (within 30 days) was associated with increased risk of death or poor outcome of 7.8% (CI: 0–15.5) compared to naso-gastric tube feeding after 6 months.<sup>[22]</sup> Consequently, the authors did not support early initiation of PEG feeding in major poststroke dysphagic patients. Our study that also found new discriminators (ASA, albumin level pre-PEG insertion) would add more information in selecting the right patients for this invasive procedure. For high risk patients of early mortality, taking into account of the result of FOOD trial also, we suggest that the decision of PEG feeding can be postponed and patients be fed on naso-gastric tube instead according to patients status, as such delays in itself does not change the mortality rate in this group of patients and early intervention may be ineffectual.

In contrast with Australia, most patients in China prefer to keep using naso-gastric tubes when they have yet to restore swallow function possibly because of people's apprehension of operations and the lack of knowledge of PEG.<sup>[27]</sup> Australia and other western countries have adopted a positive attitude to PEG for those stroke patients in need of long-term enteral nutrition support. Nevertheless, the result of our research reminds doctors not all patients will acquire benefit from PEG. PEG for advanced age and patients in poor condition cannot change the prognosis and even worse it may accelerate the death of the patients because it's an invasive operation with sedative. The risk of death related to PEG was 1–2%.<sup>[10]</sup> From a socio-economic view, we have some evidence for doctors that inappropriate patient selections for PEG will cause wastes in medical resources.

In conclusion, PEG insertion may be necessary for stroke patients with persistent dysphagia, and careful selection can yield lower mortality. Patients with advanced age, higher ASA score and lower albumin level pre-PEG insertion must be considered carefully for PEG because of high early mortality postprocedure.

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