Archives of Gerontology and Geriatrics 97 (2021) 104498

Contents lists available at ScienceDirect

Archives of Gerontology and Geriatrics

journal homepage: www.elsevier.com/locate/archger

Hospital readmissions after stroke in patients with and without dementia and undergone gastrostomy tube placement

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ARTICLE INFO

Keywords:
Dementia
Stroke
Dysphagia
Percutaneous endoscopic gastrostomy

ABSTRACT

Introduction: Percutaneous endoscopic gastrostomy (PEG) in stroke patients is associated with high hospital readmission rates. The impact of dementia on hospital readmission rates in stroke patients who underwent PEG is unknown. We aimed to assess if stroke patients with dementia who undergo PEG are at risk for readmission.
Methods: We conducted a retrospective, observational study using the National Readmission Database from Healthcare Cost and Utilization Project (HCUP) from 2013 to 2014. Patients 65 years or older admitted with stroke and who had gastrostomy in the same hospital admission were included. We compared readmission rates at 30 and 60 days between patients with and without dementia and assessed the five most common readmission diagnosis. The association of dementia and hospital readmission was analyzed.
Results: Out of 492,727 patients over 65 who had stroke/PEG, 45,477 (9 %) had dementia. Patients with dementia underwent PEG placement more frequently than those without dementia (4.3% vs. 3.3%, respectively). There was no significant difference in the 30 and 60 days readmission rates between those with dementia and those without. Septicemia, aspiration pneumonitis and complications from the procedure were among top five readmission diagnosis. Dementia was not significantly associated with 30-day (odds ratio (OR) 0.99, 95% CI 0.87-1.13) or 60-day (OR 1, 95% CI 0.89-1.12) readmissions.
Conclusions: Risks and benefits of gastrostomy in older adults with stroke and dementia should be honestly discussed with patients and their families since it exposes them to a higher risk of hospital readmission due to aspiration pneumonitis and complications from PEG.

1. Introduction

Stroke is one of the leading causes of morbidity and mortality in the world and a significant burden during hospital stay and after discharge (Erin, 2018). Previous published studies using administrative databases or hospital based registries have shown that the rate of 30-day readmissions in patients who had a stroke is up to 14.4 % (Lichtman et al., 2013). Previously identified positive predictive factors for unplanned 30-day readmission are living in assisted living facility at the time of index stroke, prior diagnosis of hypertension, diagnosis of dementia and percutaneous endoscopic gastrostomy (Omorogieva & Brooke, 2016, Smith et al., 2006). Studies have shown that stroke patients with a PEG tube placement during their index hospital stay are more likely to be readmitted within 30 days compared to stroke patients without PEG placements (Wilmskoetter et al., 2016).

In patients with advanced dementia, PEG tube placement is associated with several serious complications, including increased in-hospital mortality, recurrent aspiration pneumonia, worsening pressure ulcers, and overall poor survival (Oluwasaya & Oluwasalape, 2019). There is now a consensus against using feeding tubes in patients with advanced dementia. Oral feeding is recommended and supported by the American Geriatrics Society and the American Board of Internal Medicine Foundation's Choosing Wisely Campaign (American Geriatrics Society Ethics Committee and Clinical Practice and Models of Care Committee, 2014, Choosing, 2021).

In the absence of standardized guidelines to address dysphagia in patients with stroke and dementia, weighing the benefits and risks of enteral nutrition support is crucial. More importantly, little is known

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https://doi.org/10.1016/j.archger.2021.104498
Received 6 April 2021; Received in revised form 23 July 2021; Accepted 26 July 2021
Available online 29 July 2021

about the impact of dementia upon hospital readmission rates in stroke patients who had PEG placement. Thus, the aims of our study were: 1) to identify the 30- and 60-day readmission rates in older patients with stroke who underwent PEG tube placement, 2) to determine if dementia is an independent predictor for hospital readmissions in stroke patients who had PEG tube placement, and 3) to evaluate the primary diagnoses associated with readmission events. Using a nationally representative dataset, this study aims to enable a better understanding of hospital readmission causes in patients with stroke and dementia who undergo PEG tube placement and can guide further interventions on preventing hospital readmissions.

2. Methods

2.1. Cohort selection

A retrospective observational analysis was performed using the National Readmission Database (NRD) from Healthcare Costs and Readmission Database from Healthcare Costs and Utilization Project (HCUP) from 2013 to 2014. The National Readmission Database is designed to support various research regarding national readmission rates for all patients, regardless of the payer, it includes discharges for patients with and without repeat hospital visits in a year and those who have died in the hospital (The Nationwide Readmission Database 2021). Unweighted, the NRD contains data from approximatively 18 million discharges each year, using weights, it estimates up to 36 million discharges in the U.S.

The index visit to determine the eligibility was the first hospital discharge of the year with a primary diagnosis of stroke and a procedure code for PEG. Patients who were 65 years or older at the time of the index visit were included. International Classification of Diseases, Ninth Revision, (ICD – 9) codes were used to identify the patients' clinical conditions, including stroke, PEG procedure, and dementia from the discharge diagnoses from the dataset (ICD 9 codes for PEG tube: 43.11, 43.19, ICD 9 codes for stroke: 430.xx, 431.xx, 432.xx, 433.xx, 434.xx, 435.xx, 436.xx, 437.xx, ICD 9 codes for dementia: 290.xx, 294.1, 294.10, 294.11, 294.2, 294.20, 294.21). Patients' baseline demographic (gender, age, insurance type) and clinical data (presence of comorbidities) were obtained from the dataset. For comorbidities, we identified Elixhauser comorbidities index using command –elixhauser- based algorithms by Quan et al (Quan et al., 2005, Quan et al., 2002, Elixhauser et al., 1998) using ICD-9 codes. Readmission diagnoses were identified using the Clinical Classification Software (CCS) codes from HCUP (Agency for Healthcare Research and Quality 2021). CCS is a classification system based on the ICD coding system that collapsed them into 260 codes to make the analysis more efficient.

2.2. Statistical analysis

First, we conducted a Chi-square test to compare the main demographic and clinical characteristics between the patients who had dementia and who had not among the older adults who were admitted with stroke and underwent gastrostomy. Secondly, we compared the readmission rates for 30-days and 60-days between the two groups using a Chi-square test. Then, we identified the five most frequent diagnoses associated with readmission events and we compared their frequencies in patients with dementia versus patients without dementia. We also analyzed the differences between dementia and non-dementia group for each readmission diagnoses in part and in a cumulative manner. Lastly, we conducted a multivariable logistic regression to estimate the odds ratio for experiencing 30-day or 60-day readmission among patients admitted with stroke and who also received PEG. Significance was evaluated at the p-$<$0.05 level. In order to balance for potential selection bias, we performed a sensitivity analysis using propensity score matching with single nearest neighbor method. The same covariates that were previously used in the regression model (age, sex, insurance type, discharge location, Elixhauser comorbidities, length of stay and urban location) were selected to further compare the rate of 30-day and 60-day readmission between the dementia group and non-dementia group. Even after matching, there was no significant difference between the 30- and 60 days readmission rate (22.29 % vs 22.093% for dementia vs non-dementia group for 30 days readmission, p-value 0.881, and 29.41% vs 28.44% for dementia vs non-dementia for 60 days readmission, p-value 0.492). Statistical analysis was performed using Stata/IC 14.2 (College Station, TX). This study obtained an exemption from the IRB at UTHealth (HSC-MS-19-0302) due to the data's publicly available nature.

3. Results

3.1. Baseline characteristics and PEG placement

Out of 492,727 (weighted N=1,087,367) patients with stroke initially included in the study, 45,477 (9.0%, weighted N=98,012) patients had underlying dementia (Fig. 1). Patients with stroke and dementia when compared with patients with stroke and without dementia were predominantly females and had significantly more associated comorbidities such as cardiovascular diseases, diabetes mellitus with and without complications, renal failure, chronic pulmonary disease and malignancy. These patients had a higher Elixhauser comorbidity score (4 vs 3.6) and higher length of stay in the hospital (6.4 vs 5.5 days) (Table 1) (Agency for Healthcare Research and Quality 2021). Also, 4.3% of patients with dementia underwent gastrostomy tube placement while only 3.3% of patients without dementia had PEG placement ($p<0.01$).

3.2. 30- and 60-day readmission

Among stroke patients who underwent new PEG placement, there was no significant difference in readmissions within 30- or 60-days for patients with or without dementia (30-days: 22.45% in dementia group vs. 21.41% in patients without dementia, p=0.3343; 60 days: 29.3% in dementia group vs. 28.44% in patients without dementia p=0.426).

3.3. Association of dementia with readmission

Multivariable logistic regression analyses performed for 30-day or 60-day readmission among patients with stroke and PEG showed that dementia was not significantly associated with readmission at 30 days (odds ratio (OR) 0.99, 95% CI 0.87-1.13) or readmission at 60 days (OR 1, 95% CI 0.89-1.12). When looking at other variables, female sex was found to be an independent factor for hospital readmission both at 30 and 60 days as well as presence of comorbidities such as diabetes with and without complications and history of cardiac failure. The presence of pre-stroke neurological deficits was not associated with higher odds of 30 or 60 days hospital readmission. The duration of hospital stay was not found to be an independent factor for readmission; however, in regards to patients' disposition, patients who were discharged to skilled nursing facility had a higher readmission risk at both 30 and 60 days than patients discharged home with home health or to inpatient rehab (Table 2).

3.4. Readmission diagnoses

The primary readmission diagnoses for either 30-day and 60-day readmissions were not significantly different between the two study groups (patients with dementia vs. patients without dementia) (Fig. 2). Septicemia was the most common diagnosis upon readmission for both groups (28.9% in the dementia group vs. 24.9% in the non-dementia group for 30-day readmission, and 28.3% vs 24.0% for 60-day readmission). Aspiration pneumonitis was the second most common readmission diagnosis. Patients in the dementia group had a higher rate of readmission with aspiration pneumonitis (9.8% vs 8.9% for 30-day

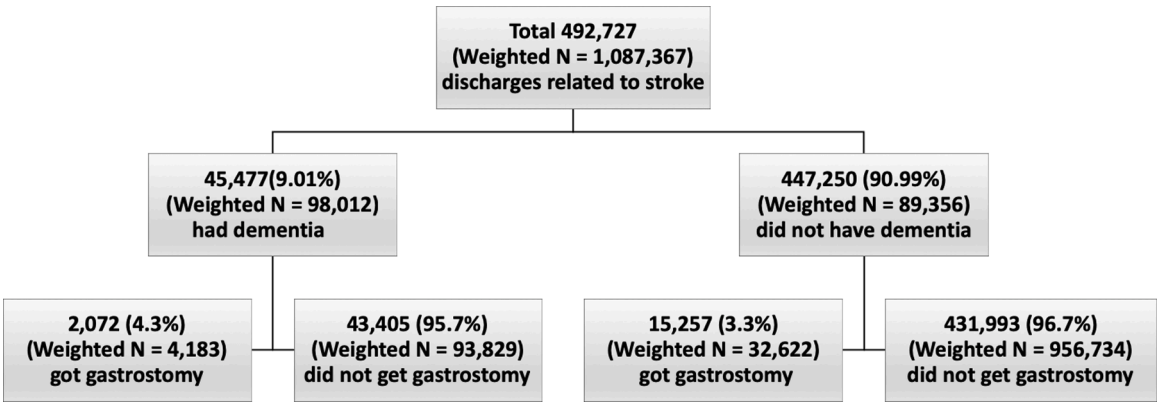

Fig. 1. Percentage of patients with stroke and dementia who underwent gastrostomy.

readmission, respectively, and 9.9% vs 8.0% for 60-day readmission). Acute cerebrovascular disease was the third most common diagnosis (7.0% vs 8.5% for 30-day readmission, respectively, 6.4% vs 8.3% for 60-day readmission). Complication from a previous procedure, such as complications related to the device or medical care was the fourth most common readmission diagnosis, with the percentage in the dementia group being higher but not statistically significant (6.5% and 6.3% for 30-day readmission, respectively and 6.3% and 5.8% for 60-day readmission, respectively). The fifth most common diagnosis was pneumonia in both groups (4.6% vs 4.5% for 30-day, respectively 4.9% vs 4.5% for 60 day). When we analyzed the differences between dementia and non-dementia for each readmission diagnoses in part and in a cumulative manner, no significant difference was identified, suggesting that there is not a particular higher risk for a type of readmission diagnosis in the presence of dementia.

4. Discussion

To our knowledge, this is the first study to assess whether dementia is significantly associated with readmission in stroke patients who undergo PEG tube placement using a nationally representative dataset. Previous studies showed that factors predicting readmission post-stroke are older age, race in the age group of 65-74, lower-income, prior stroke and stroke type, the presence of comorbidities such as cardiac disease, length of hospital stay, and discharge destination (Smith et al., 2006).

Our study results show that dementia was not predictive of readmission at both 30 and 60 days in stroke patients who had PEG tube placement. Instead, stroke patients with dementia in our cohort who had heart failure or diabetes were more vulnerable to subsequent readmissions. This finding is similar with previous published data on unplanned readmission within 1 year in stroke survivors which shows that cerebrovascular and cardiovascular diseases were the main causes of readmission (Mittal et al., 2017). Diabetes, hypertension, atrial fibrillation and congestive heart failure are well recognized risk factors for stroke and dementia, thus, in order to prevent further readmissions/deaths patients need to be educated on the importance of controlling these risk factors.

The analysis of post-stroke readmission rates according to discharge destination revealed that patients who had stroke and PEG tube placement had a higher readmission risk at both 30 and 60 days when compared to patients discharged home with home health or inpatient rehab. More than half (57.1%) of the patients with stroke and dementia were discharged to a skilled nursing facility, therefore it is to be expected that the largest proportion of readmitted patients come from this group. This finding, however, does not mean that patients in SNFs receive inferior care when compared but rather then patients who were more ill and require more assistance were discharged to SNFs instead of other locations. Therefore, future studies are required to further evaluate readmissions that are linked to SNFs.

Our study did find that patients with dementia were more likely to receive PEG compared to those without dementia. Dysphagia secondary to cerebrovascular accidents or degenerative brain diseases affecting swallowing is frequently encountered in hospitalized older patients (González-Fernández et al., 2013). In patients with stroke and dementia, factors such as age, previous functional status, amount of brain tissue injured by the stroke, and previously expressed wishes must be considered when making the decision to start tube feeding. Tube feeding in patients with advanced dementia can be associated with delirium, agitation, greater use of physical and chemical restraints, and greater utilization of healthcare due to tube-related complications (Austin et al., 2015).

To that end, our study also found that PEG tube-related complications were one the top five most most prevalent readmission diagnoses, as well as aspiration pneumonitis and pneumonia. Septicemia, aspiration pneumonitis and pneumonia might mask PEG-tube related complications, therefore the true contribution of PEG tube induced complications to hospital readmission warrants further investigations in prospective studies. Moreover, because we have identified readmission based on discharge diagnosis codes, a PEG tube complication diagnosis may not be captured if the clinician fails to include it as a discharge diagnosis.

However, our results suggest that specific and early interventions (to reduce the risk of oropharyngeal aspiration such as compensatory strategy/positioning changes, dietary interventions, pharmacologic therapies, and oral hygiene) are needed. Tube feeding is not essential in all patients with dysphagia who aspirate and although short-term tube feeding may be indicated in patients with dysphagia in whom improvement of the swallowing is expected, in patients with dementia, tube feeding has not been associated with lower risk of aspiration pneumonia and penumonitis, therefore conversations with patients and family about risks and benefits of PEG placement are crucial (Finucane et al., 1999). Due to limitations of the NRD dataset, our study does not account for specific protocols for clinicians to discuss with patients and their families about PEG tube placement. Definitive conclusions about that can only be drawn from appropriately designed prospective clinical trials and meta-analyses and our findings should be viewed in that context.

Although it draws its conclusions from a large nationally representative dataset which maximizes the generalizability of results, there are some inherent limitations of the present study. We analyzed a secondary dataset and, thus, there is the potential for ascertainment bias with possible mismatches between coding and clinical assessments. Thus, we acknowledge that our data may not reflect the full spectrum of complications from PEG tube placement in stroke patients. In future, the design of clinical trials in patients with stroke and should give more consideration to PEG related outcomes that are of specific relevance and

Table 1
Baseline demographic and clinical characteristics of the patients who were admitted with stroke and with or without dementia.

	Patients with Dementia (N=45477) (N, %)	Patients without Dementia (N=447250) (N, %)	*P*-value
Sex			
Female	28164 (61.9%)	239065 (53.5%)	< 0.01
Comorbidities			
Congestive heart failure	8524 (18.7%)	67534 (15.1%)	< 0.01
Cardiac arrhythmias	19349 (42.6%)	163867 (36.6%)	< 0.01
Valvular disease	5144 (11.3%)	48247 (10.9%)	< 0.01
Pulmonary circulation disorders	1888(4.2%)	16374 (3.7%)	<0.01
Peripheral vascular disorders	5075 (11.2%)	60380 (13.6%)	<0.01
Hypertension, uncomplicated	29573 (65.3%)	304722 (68.1%)	< 0.01
Hypertension, complicated	9413 (20.7%)	76066 (17.0%)	<0.01
Diabetes, uncomplicated	12315 (27.1%)	126765 (28.3%)	< 0.01
Diabetes, complicated	2805 (6.2%)	26512 (5.9%)	< 0.01
Hypothyroidism	8991 (19.8%)	74126 (16.6%)	<0.01
Renal failure	9378 (20.6 %)	75271 (16.8%)	< 0.01
Chronic pulmonary disease	8155 (17.96%)	86011 (19.2%)	< 0.01
Paralysis	10260 (22.6%)	92105 (20.6%)	< 0.01
Other neurological disorders	16927 (37.2%)	112989 (25.3%)	<0.01
Liver disease	471 (1.0%)	5940 (1.3%)	<0.01
Peptic ulcer disease excluding bleeding	340 (0.8%)	2912 (0.7%)	0.015
Lymphoma	228 (0.5%)	2981 (0.7%)	<0.01
Solid tumors without metastases	922 (2.0%)	12794 (2.9%)	< 0.01
Metastatic cancer	346 (0.8%)	6284 (1.4%)	< 0.01
Rheumatoid arthritis/ collagen vascular disorders	1246 (2.7%)	13613 (3.0%)	<0.01
Coagulopathy	1865 (4.1%)	17431 (3.9%)	0.033
Obesity	1984 (4.4%)	36481 (8.2%)	<0.01
Weight loss	3239 (7.1%)	17074 (3.8%)	<0.01
Blood loss anemia	149 (0.3%)	1440 (0.3%)	0.839
Deficiency anemia	1426 (3.1%)	10201 (2.3%)	<0.01
Alcohol abuse	914 (2.0%)	11848 (2.7%)	<0.01
Drug abuse	281 (0.6%)	3568 (0.8%)	<0.01
Psychoses	1479 (3.3%)	6437 (1.4%)	<0.01
Depression	7817 (17.2%)	47148 (10.5%)	< 0.01
Insurance type			
Medicare	42203 (94.3%)	403664 (91.5%)	<
Medicaid	605 (1.4%)	6465 (1.5%)	0.01
Private insurance	1842 (4.1%)	29154 (6.6%)	
Other	116 (0.3%)	1850 (0.4%)	
Disposition			
Home	8242 (19.5%)	205418 (49.1%)	<
Transfer to other inpatient care	525 (1.2%)	5678 (1.4%)	0.01
Skilled nursing facility	24113 (57.1%)	126126 (30.1%)	
Home with home health	9265 (21.9%)	79205 (18.9%)	
Other	101 (0.2%)	2141(0.5%)	
	Patients with Dementia (Mean ± SD)	**Patients with No Dementia (Mean± SD)**	***P*-value**
Age	82.7(±6.84)	77.7 (±7.7)	< 0.01
Length of stay	6.4 (±7.8)	5.5 (±7.6)	< 0.01
Elixhauser comorbidity score	4.0 (± 2.0)	3.6 (±2.0)	< 0.01

Table 2
Odds ratio for 30-day or 60-day readmission among patients with stroke and PEG.

Variable	30 days readmission (OR, 95% CI)	60 days readmission (OR, 95% CI)
Dementia	0.99 (0.870 - 1.127)	1.00 (0.89 - 1.13)
Age	1.01 (1.000 -1.012)	1.00 (0.996 - 1.01)
Sex (female)	0.85 (0.778 - 0.926)	0.89 (0.82 - 0.97)
Comorbidities		
Congestive heart disease	1.15 (1.04 - 1.27)	1.16 (1.06 - 1.28)
Cardiac arrhythmias	1.06 (0.97 - 1.16)	1.01 (0.93 - 1.09)
Valvular disease	0.92 (0.80 - 1.05)	0.88 (0.77 - 1.00)
Pulmonary circulation disorders	0.92 (0.77 - 1.12)	0.93 (0.78 - 1.11)
Peripheral vascular disorders	1.08 (0.95 - 1.24)	1.06 (0.94 - 1.20)
Hypertension, uncomplicated	0.96 (0.86 - 1.08)	0.95 (0.85 - 1.05)
Hypertension, complicated	1.21 (0.99 - 1.48)	1.21 (1.00 - 1.45)
Diabetes, uncomplicated	1.16 (1.06 - 1.26)	1.14 (1.05 - 1.24)
Diabetes, complicated	1.51(1.26 - 1.80)	1.41 (1.19 - 1.67)
Hypothyroidism	0.93 (0.83 - 1.05)	0.90 (0.81 – 1.01)
Renal failure	1.06 (0.87 - 1.29)	1.02 (0.84 - 1.23)
Chronic pulmonary disease	1.16 (1.04 - 1.30)	1.10 (0.99 - 1.22)
Neurological deficits (paralysis)	0.99 (0.91 - 1.07)	1.03 (0.95 - 1.11)
Other neurological disorders	0.91 (0.84 - 0.99)	0.93 (0.86 - 1.00)
Liver disease	0.76 (0.54 - 1.07)	0.81 (0.59 - 1.10)
Peptic ulcer disease excluding bleeding	1.04 (0.85 - 1.27)	1.01 (0.84 - 1.22)
Lymphoma	1.20 (0.63 - 2.28)	1.03 (0.57 - 1.84)
Solid tumors without metastases	0.77 (0.57 - 1.06)	0.84 (0.64 - 1.10)
Metastatic cancer	0.76 (0.47 - 1.24)	0.63 (0.40 - 0.98)
Rheumatoid arthritis/collagen vascular disorders	1.17 (0.87 - 1.58)	1.16 (0.88 - 1.52)
Coagulopathy	0.90 (0.76 - 1.06)	0.94 (0.81 - 1.10)
Obesity	1.06 (0.90 - 1.25)	1.12 (0.97 - 1.30)
Weight loss	0.98 (0.88 - 1.08)	1.03 (0.94 - 1.13)
Blood loss anemia	1.34 (0.80 - 2.25)	1.21 (0.76 - 1.94)
Deficiency anemia	0.98 (0.76 - 1.27)	1.03 (0.81 - 1.31)
Alcohol abuse	1.08 (0.85 - 1.35)	1.04 (0.85 - 1.28)
Drug abuse	1.04 (0.65 - 1.65)	1.01 (0.66 - 1.57)
Psychoses	1.01 (0.72 - 1.40)	1.14 (0.84 - 1.54)
Depression	0.94 (0.81 - 1.08)	0.88 (0.78 - 1.01)
Insurance type		
Medicare	Reference	
Medicaid	0.99 (0.76 - 1.27)	0.99 (0.78 - 1.27)
Private insurance	0.97 (0.81 - 1.17)	0.91 (0.76 - 1.08)
Others	0.95 (0.53 - 1.70)	0.97 (0.57 - 1.65)
Length of stay	0.99 (0.99 – 0.996)	0.996 (0.993 - 0.999)
Disposition		
Home	Reference	
Transfer to other inpatient care	0.99 (0.71 - 1.39)	1.24 (0.93 - 1.66)
Skilled nursing facility	1.51 (1.18 - 1.93)	1.46 (1.18 - 1.81)
Home with home health	1.07 (0.80 - 1.42)	1.03 (0.80 - 1.32)
Others	1.83 (0.09 - 37.35)	1.07 (0.05 - 22.15)
Urban location	1.31 (1.15 – 1.49)	1.28 (1.13 – 1.44)

importance to this patient population. This study also did not address possible benefits associated with PEG tube placement, such as providing an alternative route for medication administration, improvement of nutritional status, and hydration. Moreover, we could not stratify patients on type of stroke, stroke severity, presence of pre-stroke dysphagia which are important indicators for the clinical burden. However, the results of our study show the relative impact of dementia compared with that of other common medical comorbidities present simultaneously with stroke.

5. Conclusions

More than 20% of older adults who were initially admitted with stroke and had a PEG placed were readmitted to the hospital within 30 days. Although, dementia was not a significant risk factor associated with either 30 or 60 days of readmission, a higher percentage of

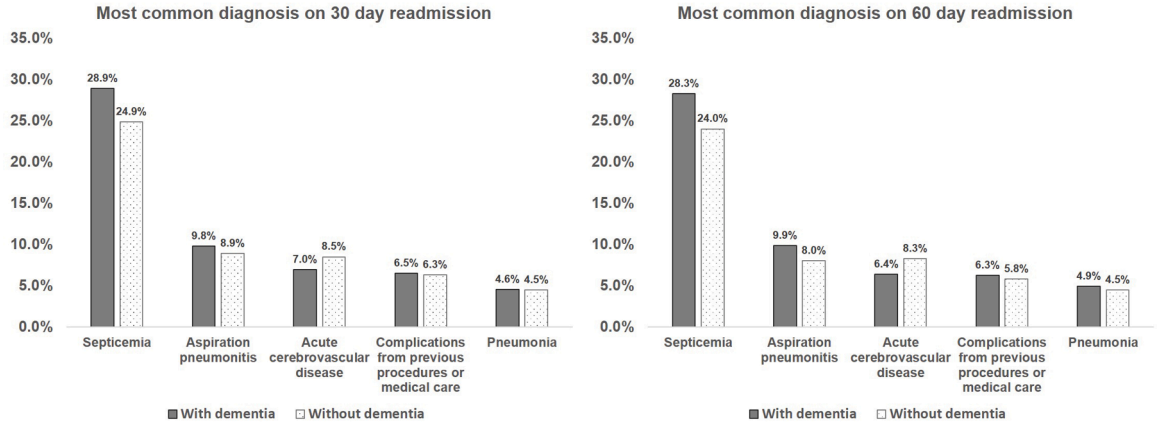

Fig. 2. Most common diagnosis upon readmission after stroke in patients with and without dementia.

dementia patients underwent PEG placement. This is concerning given that aspiration pneumonia and complications from the device or medical care were included among the top five most common diagnoses for readmission in this group. Implementing individualized decisions on placing a PEG tube can potentially reduce hospital readmissions. Although there are some limitations to this observational study, further studies to identify the real impact of dementia, especially adjusting to the severity of dementia when focusing on stroke patients with dysphagia, are warranted to reduce readmission rates in this high-risk group of patients.

CRediT authorship contribution statement

Dana Giza: Formal analysis, Writing – original draft, Writing – review & editing. **Jessica Lee:** Writing – review & editing. **Jongoh Kim:** Methodology, Data curation, Formal analysis, Writing – review & editing. **Renee Flores:** Writing – review & editing. **Seung Won Chung:** Conceptualization, Writing – review & editing. **Danyi Zheng:** Conceptualization, Writing – review & editing. **Min Ji Kwak:** Conceptualization, Methodology, Data curation, Formal analysis, Writing – original draft, Writing – review & editing, Supervision.

Declaration of Competing Interest

None.

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