International Journal of Cerebrovascular Disease and Stroke
Ding R. Int J Cerebrovasc Dis Stroke 4: 140.
www.doi.org/10.29011/2688-8734.000041
www.gavinpublishers.com

Research Article

Dysphagia Incidence and Comorbidity in Hospitalized Acute Stroke Patients

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Citation: Ding R (2021) Dysphagia Incidence and Comorbidity in Hospitalized Acute Stroke Patients. Int J Cerebrovasc Dis Stroke 4: 140. DOI: 10.29011/2688-8734.000041

Received Date: 16 November, 2021; **Accepted Date:** 02 December, 2021; **Published Date:** 06 December, 2021

Abstract

Introduction: There has been limited literature examined in a general population sample of the incidence of dysphagia in acute stroke patients, stroke patients with pneumonia and gastrostomy comorbidity, and the increased costs associated with the complications.

Methods: The current study used Illinois Hospital Discharge data for in-patients admitted during September 2012 to June 2016 to investigate the incidence of dysphagia among patients who had a primary diagnosis of stroke. Sub-analysis of dysphagia incidence among stroke patients with co-morbidity pneumonia and gastrostomy was also performed.

Results: The study found a 14.9% incidence of dysphagia in a population of hospitalized acute stroke patients. The rate of dysphagia was greater in the elderly and in blacks and Hispanics than whites. In stroke patients diagnosed with dysphagia, the incidence of pneumonia is 23.1% and the incidence of percutaneous endoscopic gastrostomy (PEG) is 62.1%. Stroke patients with dysphagia had doubled length of hospital stay than those without dysphagia. With the co-morbid conditions of dysphagia and pneumonia or PEG tube placement, the length of hospital stay tripled. Increased length of hospital stay is associated with significantly higher healthcare cost.

Conclusions: These findings suggested the importance of early detection and treatment of dysphagia in stroke population.

Keywords: Stroke; Dysphagia; Pneumonia; Gastrostomy; Length of Hospital Stay

Introduction

Stroke is one of the leading causes of neurological disorders and every year more than 795,000 people in the United States have a stroke [1]. Dysphagia is one of the common complications post stroke with reported incidence ranged from 10% to 40% [2]. Pneumonia, another common complication post stroke, can occur in 10.0% to 40.0% of patients with stroke [3-10]. In stroke patients with a diagnosis of dysphagia, the presence of pneumonia is considered a comorbid condition. Lim and colleagues [7], found the incidence of pneumonia in dysphagia patients post stroke to be 10.0% during inpatient stay while Mann et al. (1999) reported a 20.0% incidence of chest infection [8]. Nevertheless, the presence of dysphagia and/or pneumonia contribute to increased mortality rate in stroke. Enteral feeding via Percutaneous Endoscopic Gastrostomy (PEG) tube placement is an alternative way of providing nutrition and hydration when patient is unable to eat safely. Studies have shown patients who have pneumonia were more likely to have PEG tubes than patients who did not develop pneumonia [11]. In stroke patients, the presence of complications such as dysphagia, pneumonia and or PEG tube placement may result in substantial increase in length of hospital stay and medical expenses. One study found in patients diagnosed with stroke and dysphagia, the likelihood of hospitalization longer than 7 days

was 73.9% compared to only 14.0% of patients without dysphagia [12]. Similar results were confirmed by another study that found that stroke patients with dysphagia stayed longer at monitored stroke unit beds (7.2 days vs. 5.1 days) [3].

To date, there has been limited literature examined in a general population sample of the incidence of dysphagia in acute stroke patients, stroke patients with pneumonia and gastrostomy comorbidity, and the increased costs associated with the complications. This study used Illinois discharge data to investigate these issues, and its findings should add to the knowledge of dysphagia in acute stroke patients.

Materials and Methods

Patient data

This study used Illinois Hospital Discharge data for in-patients to conduct a cross-sectional review of dysphagia occurrence among patients who had a primary diagnosis of stroke. Dysphagia among stroke co-morbidities pneumonia and gastrostomy patients were also investigated.

The Division of Patient Safety and Quality at Illinois Department of Public Health collects patient level discharge data from all Illinois acute care hospitals, specialty hospitals and ambulatory surgical treatment centers. The patient level data include demographic information, primary diagnosis and up to 23 secondary diagnoses, up to 24 procedures a patient received during hospitalization, length of stay, total charges, and other variables. For data collected prior to 10/1/2015, ICD-9 codes were used; ICD-10 codes were used thereafter. As no unique patient ID key was available in discharge data prior to September 2012, this study includes only data thereafter to be able to evaluate the dysphagia incidence among hospitalized stroke patients at individual level, not based on admissions. Since the data provided by the Division of Patient Safety and Quality at Illinois Department of Public Health did not contain any identifiable patient information, individual patient consent was waived and the study was granted an exemption from the Elmhurst University Institutional Review Board.

In the current analysis, we included all in-patients in Illinois who had a primary diagnosis of stroke during September 2012 to June 2016 (most recent when the study initiated). Cases of stroke were identified using ICD-9 code 43491 or ICD-10 code I639 in the primary discharge diagnosis. In any of up to 23 secondary diagnoses, if there was any ICD-9 code 78720, 78721, 78722, 78723 or ICD-10 code R1310, R1311, R1312, R1313, R1314, R1319, then a dysphagia diagnosis was ascertained; If there was any ICD-9 code 5070, 5078 or ICD-10 code J690, a pneumonia diagnosis was ascertained; and if any ICD-9 code V441 or ICD-10 code Z931, a gastrostomy tube diagnosis was ascertained.

The ICD-9-CM code definitions for stroke and Transient Ischemic Attack (TIA) were based on the American Heart Association/American Stroke Association (AHA/ASA) updated definition of stroke, but excluded retinal and spinal infarction and included V12.54 for TIA.22. Additionally, ICD-9-CM code 436 was defined as strokes that were not otherwise specified. In case of multiple hospital admissions for stroke during the study period, all analyses were restricted to using the data from the first hospital admission. Records were excluded if there was a missing ICD-9-CM or ICD-10-CM code.

Statistical analysis

Incidence of dysphagia among stroke hospitalizations were calculated overall as well as stratified by gender, age, race/ethnicity, and co-morbidity of pneumonia or gastrostomy tube. Chi-square test was used to determine statistical significance of dysphagia rates among comparison groups. T-test was used to compare mean length of stay between the two groups, and general linear model was used to compare mean length of stay among multiple groups. To control for potential confounding factors, multivariate logistic regression analysis was performed to examine the risk factors associated with dysphagia in acute stroke patients including age, race and ethnicity, and stroke type. SAS for Windows 9.3 was used to perform the data analysis. Significance level was set at 0.05, two-sided.

Results

The demographic and clinical characteristics of hospitalized stroke patients is reported in table 1. A total of 67,722 stroke in-patients were included in the analysis, including 33,196 males (49.0%) and 34,526 females (51.0%). Overall, the incidence of dysphagia was 14.9% of the hospitalized stroke patients, with 14.5% in males and 15.2% in females. Dysphagia incidence increased significantly with age, was 12.2% in patients younger than age 65 years, 14.5% in patients aged 65 to 84 years, and 20.5% in patients 85 years or older. The incidence of dysphagia in blacks and Hispanics were significantly higher than in whites (16.9%, 16.3%, and 13.8%, respectively). There was significant difference in dysphagia incidence by stroke type ($p<0.001$), with an incidence of dysphagia 16.8% in hemorrhagic stroke and 14.6% in ischemic stroke. The overall pneumonia co-morbidity in stroke patients were 2.8%, whereas for stroke patients with dysphagia, 23.1% had a co-morbidity of pneumonia, 62.1% had the presence of percutaneous gastrostomy tube.

		Dysphagia				
		No	**Yes**	**% Yes**	**p-value**	**Total**
Sex	Male	28,397	4,799	14.46	0.003	33,196
	Female	29,252	5,274	15.28		34,526
Age (years)	<64	19805	2771	12.27	<0.001	22,378
	65-84	27,797	4,719	14.51		32,516
	85+	10,047	2,583	20.45		12,630
Race/ethnicity	White	38,294	6,141	13.82	<0.001	44,435
	Black	10,833	2,208	16.93		13,041
	Hispanic	4,534	885	16.33		5,419
	Other	3,988	839	17.38		4,827
Stroke type	Hemorrhagic	7,805	1,576	16.80	<0.001	9,381
	Ischemic	49,844	8,497	14.56		58,341
Co-morbidity	Pneumonia					
	No	56,175	9,630	14.63	<0.001	65,805
	Yes	1,474	443	23.11		1,917
	Gastrostomy					
	No	57,542	9,898	14.68	<0.001	67,440
	Yes	107	175	62.06		282
Total		57,649	10,073	14.87		67,722

Table 1: Demographic and clinical characteristics among hospitalization of stroke patients by secondary dysphagia diagnosis.

The length of stay and total hospital charge data of the stroke patients are reported in table 2. For stroke patients, the presence of dysphagia significantly increased the length of hospital stay from 4.3 days to 9.1 days, which resulted in increased hospital charge from $52,440 to $87,438. In stroke patients without dysphagia, the presence of pneumonia increased the length of hospital stay from 4.2 to 8.9 days. Similarly, in stroke patients without dysphagia the presence of PEG tube increased the length of hospital stay from 4.3 to 6.2 days. When a stroke patient with the co-morbidity of both dysphagia and pneumonia, the length of stay increased from 4.3 days to 12.8 days, which resulted in increased hospital charge from $52,440 to $138,691. In stroke patients with a co-morbidity of dysphagia and PEG tube, the length of stay increased from 4.3 days to 14.7 days, which increased the hospital charge from $52,440 to $75,082.

	Non-dysphagia 1			**Dysphagia 2**			**1 -2 difference**	**p**
	n	**mean**	**SD**	**n**	**mean**	**SD**		
Length of stay		day			day			
All stroke	57,649	4.3	5.0	10,073	9.1	8.5	-4.8	<0.001
Hemorrhagic	7,805	7.6	9.3	1,576	15.3	14.3	-7.8	<0.001
Ischemic	49,844	3.8	3.6	8,497	7.9	6.3	-4.1	<0.001
W/O pneumonia	56,175	4.2	4.7	9,630	8.9	8.4	-4.7	<0.001
With pneumonia	1,474	8.9	8.9	443	12.8	9.5	-3.9	<0.001

W/O gastrostomy	57,542	4.3	4.9	9,898	9.0	8.4	-4.7	<0.001
With gastrostomy	107	6.2	6.7	175	14.7	13.1	-8.5	<0.001
Total charge		US$			US$			
All stroke	57,649	52,440	72,108	10,073	87,438	99,831	-34,998	<0.001
Hemorrhagic	7,805	111,764	151,887	1,576	176,292	175,731	-64,527	<0.001
Ischemic	49,844	43,150	42,004	8,497	70,958	65,985	-27,807	<0.001
W/O pneumonia	56,175	50,892	68,386	9,630	85,080	97,187	-34,188	<0.001
With pneumonia	1,474	111,418	146,883	443	138,691	136,327	-27,274	<0.001
W/O gastrostomy	57,542	52,402	71,790	9,898	87,657	100,133	-35,255	<0.001
With gastrostomy	107	72,990	172,276	175	75,082	80,231	-2,092	<0.001

Table 2. Length of stay and total charge among hospitalization of stroke patients by secondary dysphagia diagnosis.

The impact of dysphagia diagnosis among stroke inpatients on co-morbidities was determined using a multivariate analysis. A multivariate analysis was used to control confounding factors. Multivariate logistic regression results are shown in table 3. Dysphagia among stroke was greater among older patients (age 65-85 vs age 64 or younger, OR=1.32, 95% CI: 1.26-1.39; age 85+ vs age 64 or younger, OR=2.09, 95% CI: 1.97-2.23), in blacks (vs white, OR=1.46, 95% CI: 1.38-1.54) and Hispanics (vs white, OR=1.31, 95% CI: 1.21-1.42), in hemorrhaging stroke (vs ischemic, OR=1.19, 95% CI: 1.12-1.27), in patients with pneumonia (vs no pneumonia, OR=1.58, 95% CI: 1.42-1.77), and in patients had gastrostomy (vs no gastrostomy, OR=9.53, 95% CI: 7.46-12.16).

	Odds Ratio	**95% CI**	
Male vs Female	1.03	0.99	1.08
Age 65-84 vs 0-64	1.32	1.26	1.39
Age 85 or older vs 0-64	2.09	1.97	2.23
Hispanic vs non-Hispanic white	1.31	1.21	1.42
Non-Hispanic black vs non-Hispanic white	1.46	1.38	1.54
Other races vs non-Hispanic white	1.38	1.27	1.49
Hemorrhaging vs ischemic	1.19	1.12	1.27
Pneumonia vs no pneumonia	1.58	1.42	1.77
Gastrostomy vs no gastrostomy	9.53	7.46	12.16

Table 3: Results (odds ratio) of multivariate logistic regression on factors associated with dysphagia incidence among acute stroke patients.

Discussion & Conclusion

Our study investigated population-level dysphagia incidence among hospitalized acute stroke patients. Our study found the incidence of dysphagia in stroke patients was 14.9%, which is consistent with findings in a study conducted by Arnold et al., who found the incidence of dysphagia in stroke patients was between 10.5% and 20.7% [3]. Since dysphagia often resolves spontaneously during recovery process, the reported incidence of dysphagia therefore depends to a great extent on the time post stroke. The incidence of dysphagia is also affected by the diagnosis methods. One study found that the incidence of dysphagia in stroke patients varied by diagnostic methods, ranging from 37.0% to 45.0% using cursory screening techniques to 51.0% to 55.0% using clinical testing and to 64.0% to 78.0% using instrumental testing [13]. Since there is no data in our database that indicated how dysphagia is diagnosed, the incidence of dysphagia needs to be interpreted cautiously.

We also found that the rate of dysphagia was greater in the elderly and in blacks and Hispanics compared to whites. The racial disparities of dysphagia in stroke patients were confirmed by a study that investigated racial disparities in the development of dysphagia after stroke, it reported that the rate of dysphagia was higher for Asians (8.6%), African Americans (6.4%), and Hispanics (6.9%) compared with Caucasians (5.4%) [14]. Our finding as well as findings from other studies makes it important to identify dysphagia in vulnerable population such as elderly or minority early on in the diagnosis of stroke.

Other than dysphagia, pneumonia is another common complication of stroke. It has been reported that pneumonia causes the highest attributable mortality of all medical complications following stroke, accounting for 31.2% of all deaths [10]. Our study found that 2.8% of stroke patients had a diagnosis of pneumonia. This was consistent with what Arnold et all found in their study that the overall rate of pneumonia is 6.0% [3], however, the rate of pneumonia can be significantly higher in intensive care units [5,6].

Our study found that for stroke patients with the diagnosis of dysphagia, the incidence of pneumonia increased significantly to 23.1%. Previous studies have shown that in stroke patients the comorbidity of dysphagia and pneumonia ranged from 10% to 20% [7,8]. Our study finding is at the high end of the incidence. These variations could be attributed to differences in definition and assessment of dysphagia, timing of swallowing examination and patient selection. Since our database only showed diagnostic ICD code of dysphagia without information on when it was diagnosed and with what method, it was difficult to make comparisons with other studies. Nevertheless, it is still an important finding that in stroke patients the presence of dysphagia changes the incidence of pneumonia 10 folds compared to stroke patients without dysphagia. Early detection and effective treatment of dysphagia in stroke patients will prevent these patients from developing pneumonia therefore significantly reduced mortality rate in stroke.

For patients who cannot recover swallow function sufficiently, PEG tube is recommended. The decision for PEG insertion was individualized to each patient through the interdisciplinary evaluation that indicated enteral tube feeding was necessary to avoid further loss of body weight, to correct significant nutritional deficiencies, to rehydrate the patient, and to stop the related deterioration in the quality of life of the patient due to inadequate or unsafe oral nutritional intake. Our study found that for stroke patients with dysphagia 62.06% had the presence of percutaneous gastrostomy tube. Kumar and his colleagues found that the presence of the bihemisphere infarcts in a stroke patient with severe dysphagia increased the odds of PEG placement by a factor of 4.6 [15]. It appears a high percentage of stroke patients with the presence of dysphagia receive PEG tube placement. Even though PEG tube is a safe and effective method to provide long term enteral nutrition for stroke patients [16], it still has long term side effects such as infection and aspiration.

Dysphagia has been associated with increased length of stay, malnutrition, dehydration, and death. Our study found that the presence of dysphagia doubled the length of hospital stay from 4.3 days to 9.1 days and substantially increased the hospital charge. The result from the current study was consistent with several previous studies that showed the presence of dysphagia significantly increased patient's length of hospital stay [17,19].

Our study found that without dysphagia, the presence of pneumonia or PEG tube placement increased the length of hospital stay but the significant increase in length of hospital stay occurs when stroke patients were also diagnosed with dysphagia. When a stroke patient has a co-morbidity of dysphagia and pneumonia the length of stay almost tripled from 4.3 days to 12.8 days. Affected patient more often underwent chest radiographs and antibiotic treatment, stayed longer at a stroke unit and more frequently was transferred to rehabilitation clinics.

When a stroke patient has co-morbid conditions of dysphagia and PEG tube placement, the length of hospital stay also more than tripled from 4.3 days to 14.7 days. Similar finding was reported by a recent study [20]. Patient needed more nursing care with PEG tube and more antibiotics treatment in these situations.

The major strength of our study included large sample size, the ability to take into account the effects of age and sex and other important determinants of poor outcomes for length of stay such as stroke subtypes, presence of dysphagia and PEG tube. The increase length of stay in our study may be due to the primary diagnosis of stroke, the secondary diagnosis of dysphagia, development of pneumonia, and/or the need for a gastrostomy to

supplement their nutrition or a combination of all characteristics. Further research would need to be conducted to determine to what extent the individual diagnoses or other characteristics caused the increased length of stay.

While dysphagia occurs in only a small portion of hospitalized patients, the impact on hospital resources is substantial. The presence of aspiration often leads to the need for antibiotic use and endotracheal intubation, with their potential risks. Furthermore, hospital discharge planning is delayed secondary to enteral feeding plans that might include placement of nasogastric or percutaneous gastrostomy tubes. The increased association of dysphagia with mortality is also linked to costs associated with end-of-life care. Hence the significantly prolonged length of hospital stay in the comorbid conditions of dysphagia and pneumonia or dysphagia and PEG tube placement suggests that that early detection and treatment of dysphagia in patients with acute stroke not only will reduce these complications of but also reduced length of hospital stay and overall healthcare expenditures. A team approach that involves speech language pathologists in the early stages will be the best practice in stroke management.

Acknowledgement

The author wishes to show gratitude to the Division of Patient Safety and Quality at Illinois Department of Public Health for providing the hospital discharge data used in this study.

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