



## Impact of Post-Stroke Dysphagia on Length of Hospital Stay

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### Citation

Carmignani I, Santopadre S, Chisari C, Mancuso M, Bastiani L, Fattori B (2024) Impact of Post-Stroke Dysphagia on Length of Hospital Stay. Eur J Gastroenterol Digestive Dis 1: 1-9

### Publication Dates

**Received date:** January 10, 2024

**Accepted date:** February 10, 2024

**Published date:** February 13, 2024

### Abstract

**Background:** Given the frequency of post-stroke dysphagia and the increasing economic burden on the health system, it is extremely useful to understand the influence of the dysphagia complication on the health costs of this pathology.

**Methods:** To verify the impact of dysphagia on the health system, we have enrolled 411 patients admitted to the Neurology and Neurorehabilitation departments of the Pisa University Hospital (AOUP) with stroke diagnosis from 2017 to 2018. All patients recruited were analyzed by calculating LOS (Length of stay) and examining generic data (age, gender), type of ictal event (ischemic or hemorrhagic), and any complications that arose (dysphagia, aphasia, dysarthria, neglect, cognitive deficit, hemiplegia). Population studied was then divided into two groups: 1. Patients who had swallowing problems (dysphagia group); 2. Patients who had no swallowing problems (no dysphagiagroup).

**Results:** Mean hospital stay was 9.38 days for the "no dysphagia" group and 17.22 days for the "dysphagia" group showing a statistically significant correlation ( $p=0.000$ ). This significance also emerged by analyzing only the sample from the neurology ( $p=0.000$ ) while it did not emerge in the neurorehabilitation ( $p=0.380$ ).

**Conclusions:** Dysphagia is a very common post-stroke consequence; it was present in 24.3% of the total sample (21.6% in Neurology and 43.1% in Neurorehabilitation). Swallowing problems following a stroke event are statistically correlated with the increase in hospital stay, with a very strong relationship in the acute phase in the Neurology department and weaker in the hospital rehabilitation phase.

**Keywords:** Dysphagia, Post-Stroke, LOS, Cost



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## Introduction

Stroke is a major cause of death and disability worldwide with a significant physical and socio-economic impact [1]. The economic impact of stroke has direct, indirect, and intangible components, with direct cost representing 70% of the total costs. The direct cost is largely determined by the length of the average hospital stay (LOS Length of stay), which therefore represents the main determinant of direct costs for stroke assistance [2]. Mainly, the use of health resources is attributable to hospitalization and rehabilitation: the acute phase is responsible for 30-40% and rehabilitation services for 15-35% of the total costs [3]. 25% of hospital admissions for stroke are discharged into institutions, thus determining institutional care as a considerable part of the direct costs of stroke [4,5].

Rehabilitation therapy, which is an important component in stroke treatment, represents 16% of the total costs in the first six months. Furthermore, with the decrease in the age-standardized mortality rate in stroke patients and with the increase in the average age in developed countries, a greater number of stroke patients will seek rehabilitation services in the future, therefore this percentage value will be significantly increased. [6] Dysphagia, a swallowing problem that occurs with a percentage between 37% and 78%, is one of the most serious complications of a stroke.

Dysphagia, therefore, affects a substantial part of stroke patients and can have a great impact on the patient's clinical outcome, mortality and institutionalization. It is associated with worse short and long-term outcomes. [7]

Even today, one in four patients with dysphagia develop pneumonia *ab ingestis* despite constant monitoring and control. This observation requires an improvement in the management of patients with swallowing problems, by carrying out a careful screening and a correct instrumental evaluation by the staff to be able to efficiently manage the swallowing framework and setting, if necessary, a rehabilitation treatment even in the acute phase.

Given the frequency of post-stroke dysphagia and the increasing economic burden on the health system, it is extremely useful to understand the influence of the dysphagia complication on the health costs of this pathology.

In fact, at an international level, health systems are subject to an ever-growing demand for services that must be provided effectively, efficiently, and economically [8].

To date, national and international literature does not boast of many studies on the subject; what is present must deal with the difficulty in analyzing the data necessary to frame this aspect on an economic level.

In this regard, the present study seeks to investigate how post-stroke dysphagia affects the health system in terms of length of hospital stay [9], as it is the major determinant of the direct cost of care and in terms of generic healthcare costs related to swallowing complication in post-stroke patients.

## Materials and Methods

### Population studied

To verify the impact of dysphagia on the health system, we have enrolled 411 patients admitted to the Neurology and Neurorehabilitation departments of the Pisa University Hospital (AOUP) with stroke diagnosis from 2017 to 2018.

All patients recruited were analyzed by calculating LOS and examining generic data (age, gender), type of ictal event (ischemic or hemorrhagic), and any complications that arose (dysphagia, aphasia, dysarthria, neglect, cognitive impairment, hemiplegia). This information was obtained from the medical records and discharge letters of individual patients.

The population studied was then divided into two groups: 1. Patients who had swallowing problems (dysphagia group); 2. Patients who had no swallowing problems (no dysphagia group). In addition to the clinical aspects, the parameter "discharge disposition" of patients to other facilities was analyzed for the population of the Neurology department. This character has not been analyzed in the Neurorehabilitation department since almost all the patients, after their rehabilitation stay, were discharged to their homes [10].

### Statistical analysis

The statistical analysis of the collected data was performed using the SPSS 23 software (IBM Corp. SPSS Statistics) and with GraphPad Software considering a level of statistical significance with  $p < 0.05$ . The collected variables are described using descriptive statistics indices: mean and standard deviation for continuous variables and percentages for categorical variables. The continuous variables were tested with the t-test respectively, while the chi-square test was used for categorical variables. Finally, to study the factors associated with dysphagia, a multivariate

statistical analysis (Binary Logistic Regression) was performed. The statistical model has also been adjusted for gender and age.

## Results

### Neurology Unit

360 patients are recruited in the Neurology unit. Their features are summarized in Table 1. 83.6% had an ischemic stroke

while 16.4% had a hemorrhagic stroke. The most-reported complication was hemiplegia (81.9%) followed by aphasia (35%), dysarthria (29.7%), dysphagia (21.6%), neglect (19.4%), and cognitive impairment (13.3%).

Features		Total patients (n= 360)	No dysphagia (n=282)	Dysphagia (n=78)	p value
<b>Gender</b>	male	214 (59.4%)	172 (47.8%)	42 (11.6%)	0.2974
	female	146 (40.6%)	110 (30.6%)	36 (10%)	
<b>Age</b>	< 50 years	19 (5.3%)	16 (4.4%)	3 (0.9%)	0.9270
	50-69 years	107 (29.7%)	84 (23.3%)	23 (6.4%)	
	70- 90 years	234 (65%)	182 (50.6%)	52 (14.4%)	
<b>LOS Lenght of stay</b>	days	9.61±7.88	8.17±6.38	17.79±10.30	<b>0.000</b>
<b>Ictal injury</b>	Ischemic	301 (83.6%)	240 (66.7%)	61 (16.9%)	0.1666
	Hemorrhagic	59 (16.4%)	42 (11.7%)	17 (4.7%)	
<b>Functional impairment</b>	Aphasia	126 (35%)	82 (22.8%)	44 (12.2%)	<b>0.0001</b>
	No aphasia	234 (65%)	200 (55.6%)	34 (9.4%)	
	Dysarthria	107 (29.7%)	78 (21.7%)	29 (8%)	0.1234
	No dysarthria	253 (70.3%)	204 (56.7%)	49 (13.6%)	
	Neglect	70 (19.4%)	38 (10.5%)	32 (8.9%)	
	No neglect	290 (80.5%)	244 (67.8%)	46 (12.7%)	
	Hemiplegia	295 (81.9%)	219 (60.8%)	76 (21.1%)	<b>0.0001</b>
	No hemiplegia	65 (18%)	63 (17.5)	2 (0.5%)	
	Cognitive impairment	48 (13.3%)	16 (4.4%)	32 (8.9%)	<b>0.0001</b>
	No cognitive impairment	312 (86.7%)	266 (73.9%)	46 (12.8%)	
<b>Discharge disposition</b>	Yes	124 (34.4%)	59 (16.4%)	65 (18%)	<b>0.0001</b>
	No	236 (65.6%)	223 (62%)	13 (3.6%)	

**Table 1:** Description of the population studied in Neurology

The average hospital stay was 9.61 days for all patients: 8.17 days for the "no dysphagia" group and 17.79 days for the "dysphagia" group. In addition, 65% of the aforementioned population has been transferred to their home, while the remaining 34.4%, of which a greater percentage appeared to be part of the "dysphagia" group that has been transferred to another facility.

### Neurorehabilitation Unit

51 patients are recruited in the Neurorehabilitation unit. Their

features are summarized in Table 2. 74.5% had an ischemic stroke while 25.5% had a hemorrhagic stroke. The most-reported complication was hemiplegia (92.1%) followed by dysphagia (43.1%), dysarthria (35.5%), aphasia (25.5%), neglect (17.6%), and cognitive impairment (7.9%). The average hospital stay was 24.04 days for all patients: 22.86 days for the "no dysphagia" group and 25.59 days for the "dysphagia" group.

Features		Total patients(n=51)	No dysphagia (n=29)	Dysphagia(n=22)	p value
Gender	Male	38 (74.5%)	19 (37.25%)	19 (37.25%)	
	Female	13 (25.5%)	10 (19.6%)	3 (5.9%)	0.1145
Age	< 50 years	2 (3.9%)	1 (1.96%)	1 (1.96%)	
	50-69 years	21 (41.2%)	10 (19.6%)	11 (21.6%)	
	70- 90 years	28 (54.9%)	18 (35.3%)	10 (19.6%)	0.4920
LOS Length of stay	Days	24.04 ±10.88	22.86 ± 10.56	25.59± 11.34	0.3800
Ictal injury	Ischemic	38 (74.5%)	21 (41.2%)	17 (33.3%)	
	Hemorrhagic	13 (25.5%)	8 (15.7%)	5 (9.8%)	0.7555
Functional impairment	Aphasia	13 (25.5%)	6 (11.8%)	7 (13.7%)	
	No aphasia	38 (74.5%)	23 (45%)	15 (29.5%)	0.5182
	Dysarthria	18 (35.3%)	9 (17.64%)	9 (17.64%)	
	No dysarthria	33 (64.7%)	20 (39.2%)	13 (25.5%)	0.5590
	Neglect	9 (17.6%)	3 (5.9%)	6 (11.8%)	
	No neglect	42 (82.4%)	26 (51%)	16 (31.4%)	0.1499
	Hemiplegia	47 (92.1%)	29 (56.8%)	18 (35.3%)	
No hemiplegia	4 (7.9%)	0	4 (7.8%)	<b>0.0293</b>	
Cognitive impairment	Cognitive impairment	4 (7.9%)	1 (1.96%)	3 (5.9%)	
	No cognitive impairment	47 (92.1%)	28 (54.9%)	19 (37.2%)	0.3030

**Table 2:** Description of population studied in Neurorehabilitation

As regards the average hospital stay, this parameter was analyzed considering the overall sample of patients (Neurology+Neurorehabilitation). The mean hospital stay was 9.38 days for the "no dysphagia" group and 17.22 days for the "dysphagia" group showing a statistically significant correlation ( $p=0.000$ ). This significance also emerged by analyzing only the sample from the neurology ( $p=0.000$ ) while it did not emerge in the neurorehabilitation ( $p=0.038$ ).

In addition, to evaluate that the increase of LOS was primarily attributable to the dysphagia symptom, a multivariate analysis was performed considering all the post-stroke side effects. The parameter "dysphagia", "neglect" and "hemiplegia" in the neurology unit emerged significantly for a hospital stay. In the neurorehabilitation unit, no parameter was statistically significant for the length of stay (Table 3).

LOS Length of stay(days)	Total patients	Neurology	Neurorehabilitation
No dysphagia(n=305)	9,38	7,96	22,86
Dysphagia(n=106)	17,12	15,02	25,59
P value	<b>0,000</b>	<b>0,000</b>	0,380
No aphasia(n=272)	10,96	8,82	24,11
Aphasia(n=139)	12,27	11,07	23,85
P value	0,189	<b>0,010</b>	0,942
No dysarthria(n=288)	11,18	9,56	23,67
Dysarthria(n=123)	11,92	9,72	24,72
P value	0,472	0,859	0,744
No neglect(n=332)	10,65	8,91	22,67
Neglect (n=79)	14,56	12,51	30,44
P value	<b>0,001</b>	<b>0,001</b>	0,051
No hemiplegia(n=69)	8,29	6,78	32,75
Hemiplegia(n=342)	12,03	10,23	23,30
P value	<b>0,003</b>	<b>0,001</b>	0,096
No cognitiveimpairment (n=359)	11,08	9,11	24,19
Cognitive impairment (n=51)	13,69	12,96	22,25
P value	0,069	<b>0,002</b>	0,736

**Table 3:** Population studied divided by complications

### Dysphagia patients have a chance:

- 4 times greater to present aphasia or neglect compared to patients without dysphagia
- 3 times greater to present dysarthria
- 2 times greater to present hemiplegia and cognitive impairment

Gender, age, and type of ictal (ischemic or hemorrhagic) event were not significant variables (Table 4).

Finally, to evaluate the economic impact with the support of the AOUP Management Control unit, the cost per patient with stroke recovered in neurology and neurorehabilitation were considered. The daily cost of hospitalization in Neurology was around double the daily cost in Neurorehabilitation.

Parameters	p value	OR (95%)
Neurology/ Neurorehabilitation	0,740	0,863
Cognitive impairment	<b>0,034</b>	2,155
Hemiplegia	0,058	2,713
Neglect	<b>0,000</b>	4,289
Dysarthria	<b>0,000</b>	3,093
Aphasia	<b>0,000</b>	4,398
Ictal Injury	0,810	0,948
Lenght of stay	<b>0,000</b>	1,083
Gender	0,782	0,924
Age	0,702	0,996

**Table 4:** Correlation between dysphagia and other complication

## Discussion

The processing of the data obtained confirmed our basic hypothesis: LOS in post-stroke patients with dysphagia is greater than the same type of patients without dysphagia.

This result would suggest that the correlation between length of hospital stay and dysphagia is stronger in the acute phase in which the patient is in the neurology ward, while it is not statistically significant in the hospital rehabilitation phase.

This partly differs from what emerged in the study conducted by D.G. Smithers *et al* [11] according to which the presence of dysphagia during the acute phase is associated with poor outcomes during the subsequent year, particularly at 3 months.

To be able to mainly attribute the increase in hospital stay to the difficulties of swallowing, a multivariate analysis was performed. Considering all the post-stroke complications, greater significance emerged precisely with the symptom "dysphagia" ( $p=0.000$ ) "hemiplegia" and "neglect" ( $p=0.001$ ) [12].

Both of these complications were strongly correlated in the total sample and the neurology department sample; this is fully in line with the literature up to now present in international realities [13-17]. What has been added with the present study is the distinction between the acute phase and the hospital rehabilitation phase. These complications were not statistically significant for the population of the neurorehabilitation department.

This could be explained by the fact that in the acute and sub-acute phase diagnosis and evaluation of the swallowing disorder must be carried out with possible modification of the diet and/or use of alternative systems of nutrition and speech therapy rehabilitation for the restoration of swallowing as functional as possible.

In a phase of hospital rehabilitation, the onset of complications of dysphagia should be reduced, as the swallowing problem is already framed and the patient has already undergone all the procedures aimed at feeding safely. A careful screening and a correct and timely evaluation of the swallowing problem is fundamental both to improve the health of patients and to decrease the days of hospitalization and consequently the costs for the health system.

Subsequently, to highlight the economic impact of dysphagia on the health system, we analyzed the cost for the daily stay in the Neurology and Neurorehabilitation departments. Therefore, considering the average hospital stay for the "dysphagia" and "no dysphagia" groups, an increase in costs for the national health system emerged of 88% in the Neurology department and 12% in the Neurorehabilitation department.

Finally, focusing only on dysphagia patients, which were 24.3% of the total sample (21.6% in Neurology and 43.1% in Neurorehabilitation), a percentage slightly below international estimates [18], it emerged that these patients have a 4 times greater probability compared to patients without dysphagia to present aphasia and neglect, 3 times greater to present dysarthria and 2 times greater to present hemiplegia or cognitive deficits.

As for age, gender, and type of stroke event, it can be deduced from the analysis of the data on our study sample that dysphagia has not proved to be a factor associated with age, gender, or the nature of the stroke (ischemic or hemorrhagic). Therefore swallowing problems affected the patients considered regardless of the gender and age factor. In addition, the dysphagia symptom occurred indiscriminately in patients with ischemic stroke and hemorrhagic stroke.

This would differ, as regards age, from what emerged from the study conducted by M. Toscano *et al.*[14], according to which the patients who presented dysphagia were significantly older than those who did not present dysphagia. The data emerging from our study, therefore, suggests that post-stroke dysphagia affects stroke patients regardless of age factor, and this may be justified by the fact that neurogenic dysphagia is not the direct consequence of the reduction of the cough reflex and the alteration of the coordination of swallowing / breathing (elements debilitated in the elderly) but there are other factors at the base such as a marked slowing of the trigger of the swallowing reflex, frequent aspiration of liquids with a high risk of pneumonia *ab ingestis* and significant residue in the pharynx.

Analyzing, however, the nature of the ictal event (ischemic or hemorrhagic) from our sample, no differences emerged considering the dysphagia symptom. This data can be very useful in investigating post-stroke dysphagia since in the literature there are few data available that report a different risk factor for dysphagia, depending on the type of stroke. Paciaroni *et al.* found in a study conducted on 406 stroke patients a greater frequency of dysphagia in patients with hemorrhagic stroke than in ischemic ones, assuming however that this figure could be related to the severity of the stroke[13].

Regarding the detailed analysis conducted, the limit with which every possible study has to deal with must be highlighted: LOS is influenced by more than just patient status; this study does not include all possible variables that could influence costs. Despite this limitation, this study provides a very helpful assessment of dysphagia-related costs post-stroke in a context where the studies conducted are very limited.

## Conclusion

Based on the results obtained in our study, dysphagia is a very common post-stroke consequence present in 24.3% of the total sample (21.6% in Neurology and 43.1% in Neurorehabilitation).

Here are the main points that emerged from the analysis of our data:

- Swallowing problems following a stroke event are statistically correlated with the increase in hospital stay (LOS), with a very strong relationship in the acute phase in the Neurology department and weaker in the hospital rehabilitation phase. Another complication, strongly correlated with the prolongation of days of hospitalization, even if less than dysphagia, was hemiplegia.
- This increase in hospital stay in patients with dysphagia has increased the costs for the health system with 88% in the Neurology department and 12% in the Neurorehabilitation department in our study.
- Swallowing problems are also strongly correlated with the institutionalization rate: 85% of patients with dysphagia in the Neurology department have been transferred to another facility, unlike patients without dysphagia who have instead been transferred in 20% of cases.
- Swallowing ability is not correlated with age, gender, or stroke nature (ischemic or hemorrhagic), but patients with dysphagia are 4 times more likely than patients without dysphagia to present aphasia and neglect, 3 times greater to present dysarthria, and 2 times greater to present hemiplegia or cognitive deficits.

In conclusion, the present study confirmed that dysphagia is a consequence of both acute and post-acute ictal events, which significantly affects the clinical, social, and economic outcomes. Other studies are needed to gain a full understanding of the impact of post-stroke dysphagia on healthcare cost. In the future, we believe that further studies should investigate this impact in the various steps of taking care of the patient with stroke: from the acute phase up to any outpatient rehabilitation.

## Funding

None to declare

## Conflict of Interest Statement

None to declare

## Availability of data and material

Possible

## Code availability

Not applicable

## Authors' contribution

Each author has participated actively in designing and writing this article: Bruno Fattori is the maincreator of the work and critically discussed the final manuscript. Ilaria Carmignani assisted in conception of the study and in data collection, manuscript preparation, discussion and statistical analysis; Luca Bastiani assisted statistical analysis and Stefania Santopadre, Carmelo Chisari and Michelangelo Mancuso assisted in data collection.

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