Ann Ig 2021 Nov-Dec; 33(6): 555-563. doi: 10.7416/ai.2021.2436. Epub 2021 Feb 11.

The underestimated burden of aspiration event and pneumonia within hospitals: what happens after dysphagia

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Key words: Dysphagia, elderly, hospital care, risk management, adverse event
Parole chiave: Disfagia, anziani, cure ospedaliere, gestione del rischio, evento avverso

Abstract

Background. *Despite dysphagia large prevalence and the growing ageing phenomenon occurring in European countries, aspiration events among inpatients are often underestimated, given their frequent spontaneous resolution or silent contribution to aspiration syndromes. Our main objective was to evaluate the incidence of aspiration events among medical inpatients and to identify risk factors influencing the outcome of the event.*

Study design. *Prospective observational study.*

Methods. *Data about aspiration events - day, hour, type and outcome of the event occurred – along with underlying patient clinical conditions at the admission were collected. Between May 2015 and September 2016, data about aspiration event occurred among medical inpatients were collected in three large Italian hospitals.*

Results. *Patients affected by aspiration events were 135 on 102,619 cumulative days of hospitalization; they were mostly females (53%) with an average age of 82. The total incidence of aspiration events was of 1.4 every 1,000 days of hospitalization (C.I. 95%: 1.2-1.7) and the most frequent manifestation was cough (61.6%). The addition of drugs or an infection diagnosis during the 24 hours preceding the event acted as risk factors for those events that needed additional interventions during the hospitalization (OR 3.1 e OR 1.9 respectively), while the elimination of one or more prescribed drugs seemed to lead to aspiration events without impact on the hospitalization.*

Conclusions. *Results showed a large incidence of aspiration events within medical wards, many of them influencing patient outcomes. Healthcare professionals' attention concerning aspiration events should be fostered during the first hours and days of hospitalization.*

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Annali di Igiene : Medicina Preventiva e di Comunità (Ann Ig)
ISSN 1120-9135 https://www.annali-igiene.it

Introduction

The ageing phenomenon and the increasing prevalence of comorbidities such as obesity, gastroesophageal reflux and cerebrovascular and degenerative neurological diseases are leading to a growing number of people complaining dysphagia and swallowing problems (1, 2), to the extent that dysphagia has been recently recognized as a "geriatric syndrome" (3). Dysphagia risk burden among the general population was estimated up to 30% (4), but this rate increases when considering patients within specific settings, such as hospitals and nursing homes (53%) (5), or patients with specific comorbidities, such as Parkinson's Disease (PD), whose incidence reaches 82% (6). Despite the large prevalence of dysphagia, aspiration events are often underestimated as they can solve spontaneously or silently contribute to aspiration syndromes (7). Nevertheless, the relation between aspiration events and aspiration pneumonia, an adverse outcome which is itself associated with hospital admission and readmission, and increased mortality (2, 8, 9), has been confirmed (10, 11). Specific comorbidities already identified as risk factors for dysphagia and aspiration events, among others are: stroke (11), neurodegenerative diseases such as dementia (5, 9) and PD (6), and amyotrophic lateral sclerosis (ALS) (12). Other identified risk factors include: feeding time over 20 minutes, solid meal type, underweight (5), medications (1, 9, 13), dependent functional status and high nutritional risk (4, 5), difficulty swallowing food also post-extubation (13, 14). Aspiration events also have an important economic impact, in term of both direct and indirect costs: increased morbidity, mortality, hospital length of stay (LOS) and average admission costs (15) on one hand, but also caregivers working days loss on the other hand, can have negative reflections on the public health system as a whole. The early identification and the multidisciplinary management of dysphagia can reduce aspiration events and pneumonia (16), optimizing safety, efficiency and effectiveness of swallowing along with maintaining adequate patient nutrition and hydration (2) and finally improving patient health outcomes and quality of life (17).

The main objective of our study was to evaluate the incidence of aspiration events among patients admitted within hospital medical wards. The secondary objective was to identify risk factors or conditions that could influence outcomes and costs (e.g. hospitalization, patient outcomes, length of stay) in case of aspiration events.

Methods

Data collection

A prospective observational study was conducted from May 2015 to September 2016 in selected departments of three large Italian hospitals in Northern Italy: Azienda Sanitaria Universitaria Integrata di Udine (Hospital 1), Azienda Ospedaliera Ordine Mauriziano di Torino (Hospital 2) and Azienda Ospedaliera Universitaria Integrata di Verona (Hospital 3). In particular the observation period of general medicine patients lasted six months for Hospitals 1 and 2, respectively from 1st May 2015 to 31st October 2015 and from 1st April 2016 to 30th September 2016; Hospital 3 performed the study for a total of ten months, between 1st July, 2015 and 30th April, 2016 surveying three different wards: general medicine, geriatric medicine and gastroenterology.

The study focused on adult inpatients only (age >=18 years), and it was composed by two phases: the recognition of the aspiration events (*Phase one*) and the in-depth analysis of identified cases (*Phase two*). Before the beginning of the observation period, the study was presented to the ward personnel during a dedicated meeting, during which

the discussion included aims of the study and methods adopted to collect data. During *Phase one*, adequately trained ward personnel identified all the aspiration events occurred during the observation period and reported them in terms of patient ID and birth date, day, hour and type of event occurred (cough or dyspnoea or rasping breath during/after swallowing, vomiting or regurgitation or facial congestion after swallowing, aspiration pneumonia). Once or twice a week, all the identified cases were collected from the wards directly (Hospital 1 and 2) or via fax (Hospital 3), and then further data were collected by a research team member. *Phase two* in-depth data included: general information about patient clinical conditions at the admission (e.g. autonomy in nutrition), and detailed information about the aspiration event (see Supplementary material). The study was approved by the Friuli-Venezia Giulia Regional Unique Ethical Committee (CEUR).

Data analysis

When not reported in the form, patient body mass index (BMI) was calculated if height and weight data were available. Frequent pneumonia was considered when occurred at least once per year. Patients' autonomy in daily activities (e.g. ability to evacuate, get dressed, move, eat and wash themselves) was evaluated using the Adjusted Daily Living (ADL) score or the Barthel Index (BI). Barthel and ADL scores were translated in a unique scale to describe patient's level of autonomy: totally dependent (minimum Barthel or ADL score), totally autonomous (maximum Barthel or AD score), and partially autonomous (intermediate scores of both scales).

Incidence rate per 1,000 inpatient days for every type of aspiration event was calculated with confidence intervals, as well as descriptive frequencies of aspects characterizing the aspiration event itself. Furthermore, a logistic regression was conducted to assess the association between factors characterizing patient/hospitalization and the occurrence of an aspiration event that does not resolve spontaneously and/or needs a dysphagia evaluation during the hospitalization. The analysis was a full model logistic regression, including all the covariates shown in Figure 4, gender and age in years as a continuous variable. Individual time to event was not available for all patients. Inpatient days were only available as cumulative for the hospital wards included in the study. Statistical significance for all tests was set accepting a type I error $\alpha < 0.05$. A logistic regression with Backwards elimination with p-value to stay in the model = 0.20 was also conducted. All statistical analyses were performed using SASv9.2 (SAS Institute Inc, Cary, NC, USA).

Results

Population results

Patients affected by aspiration events were 135 on 102,619 cumulative days of hospitalization: 64 males (48%) and 71 (53%) females. Patients average age was 82 (min. 42, max. 100), while their median hospitalization length of stay was 18 days (min. 2; 1st quartile 12; 3rd quartile 28; max. 122). During the hospitalization, 35 enrolled patients died (26%). The clear majority of patients (133 cases; 98%) were hospitalized for medical reasons, while just two of them (2%) were admitted to hospital for surgical procedures (limb amputation, cranial trauma). Due to missing data, BMI was available only for 87 cases (64%): 12 patients were underweighted (13.8%), 48 had a condition of normal weight (55.2%); 20 were overweighted (23.0%) and seven obese (8.0%). A dysphagic problem was already present at the admission for 64 patients (47.4%), while it was not reported for 45 of them (33.3%); for 26 patients (19.3%) a specific assessment on dysphagia

was not reported on clinical record. Results of dysphagia evaluation at admission and its presenting characteristic are reported in Table 1.

Table 1 - Dysphagia assessment at the admission.

Type of dysphagia at hospital admission	Frequency %
Dysphagia to liquids	17 (12.6)
Dysphagia to solids	6 (4.5)
Dysphagia to both liquids and solids	41 (30.4)
Dysphagia (any kind)	64 (47.4)
No dysphagia	45 (33.3)
Not evaluated/not reported in clinical record	26 (19.3)
Total	135 (100.0)

At their hospital admission, 14 patients (10.4%) showed no anatomical or functional deficits related to swallowing; 14 (10.4%) were fully edentulous; 55 (40.7%) had dentures and seven (5.2%) had documented difficulties in swallowing; 45 (33.3%) had no evaluation of these aspects at the admission. Frequent pneumonia during the last year was documented for 31 patients (23.0%). More than half patients (79; 58.5%) were reported to have one to five comorbidities, and 55 patients (40.8%) more than five, while just one patient had none of them (0.7%). At the admission 56 patients (41,5%) were totally depending on someone else, 75 (55.6%) were partially autonomous and four (2.9%) totally autonomous. During the hospitalization, 91 patients (67.4%) maintained their level of independence in the ability of nourish themselves and 36 (26.7%) got worse requiring a major level of assistance; for eight patients (5.9%) this comparison was not possible due to missing data. Patients' level of autonomy in nutrition at home and during hospitalization are reported in Table 2. Concerning diet before the aspiration event, 40 patients (29.6%) had a variable consistency free diet, 20 (14.8%) a soft consistency diet, 52 (38.9%) a semi liquid consistency diet, while two patients (1.5%) had a liquid diet; nine patients (6.7%) were not having any oral nutrition and for eight patients (5.9%) data were missing.

Incidence of aspiration events

During the study period, 146 aspiration events were detected: 68 (46.57%) in Hospital 1; 62 (42.47%) in Hospital 3 and 16 (10.96%) in Hospital 2. The total incidence of aspiration events was of 1.4 every 1,000 days of hospitalization (C.I. 95%: 1.2-1.7), with differences among the three study centers ranging from 2.1 (1.6-2.6) of Hospital 1, 2.0 (1.2-3.3) of Hospital 2 and 1.0 (0.8-1.3) of Hospital 3. A unique aspiration event occurred for 125 patients (92.6%), while nine patients (6.7%) had two aspiration events and a single patient (0.7%) had three of them during the same hospitalization. Cough after swallowing was the most represented manifestation of aspiration (61.6%), while

Table 2 - Patients' nutrition autonomy level at home and during hospitalization.

Level of autonomy in nutrition	At home (n, %)	During hospitalization (n, %)
Autonomous	39 (28.9)	24 (17.8)
Partially autonomous	41 (30.4)	29 (21.5)
Completely not autonomous	45 (33.3)	78 (57.8)
Not evaluated/not reported in clinical record	10 (7.4)	4 (2.9)
Total	135 (100)	135 (100)

aspiration pneumonia was signaled for five patients (3.4%), four of them being confirmed also by radiography. Detailed clinical presentations of aspiration events are reported in Table 3.

Table 3 - Clinical presentation of aspiration events.

Presentation symptoms	Frequency (%)
Cough	90 (61.6)
Dyspnoea	15 (10.3)
Cough and dyspnoea	11 (7.5)
Vomiting or regurgitation	10 (6.9)
Cough and facial congestion	5 (3.4)
Aspiration pneumonia	5 (3.4)
Cough, facial congestion and dyspnoea	4 (2.7)
Cough and vomiting	2 (1.4)
Cough, dyspnoea, vomiting, facial congestion	2 (1.4)
Dyspnoea, facial congestion	1 (0.7)
Cough, vomiting and facial congestion	1 (0.7)
Total	146 (100)

Aspiration event risk factors

Aspiration events mostly occurred at the second day after admission (12.3%), with 13 events (8.9%) occurring during the very first hospitalization day; median time span between hospital admission and the first aspiration event was 8 days (min 0; max 73) (Figure 1).

In 13 cases (8.9%), the event occurred within the first 24 hours from ward admission: nine cases of patients transferred from other wards of the same hospital, and four new admissions.

Multiple events during the same hospitalization occurred for ten patients, with a minimum of ten hours and a maximum of 31 days between subsequent events. The aspiration event was reported in patient's clinical record in 110 cases (75.3%). For 126 events (86.3%), the occurrence time was recorded by ward personnel: 75 events (51.4%) occurred during the morning shift (8:00 a.m. - 2 p.m.), 33 (22.6%) during the afternoon shift (2 – 8 p.m.) and 18 (14.3%) during the night shift (8 p.m.- 8 a.m.).

The causes of the aspiration event were clearly identified for 120 events: oral

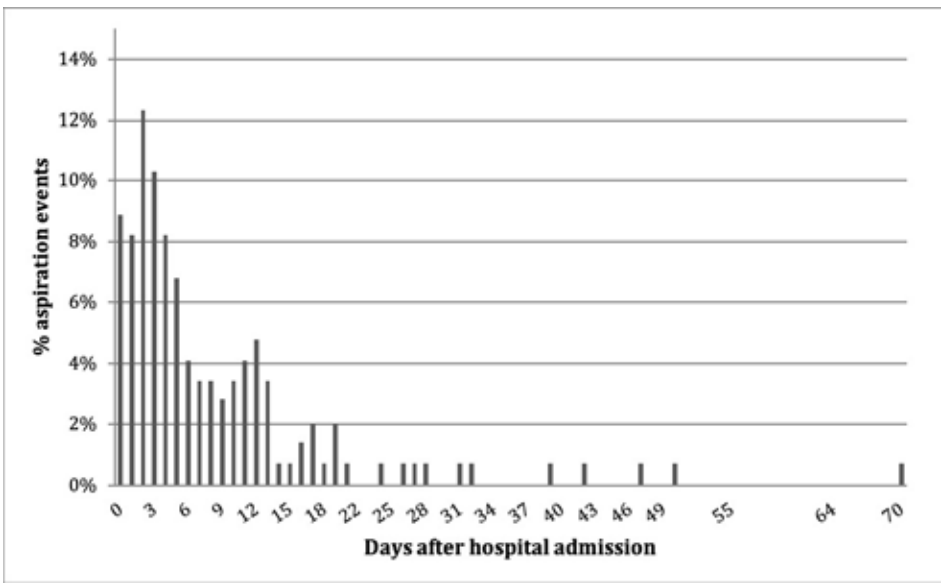

Figure 1 - Time interval between hospital admission and aspiration event.

alimentation or hydration was the main cause (81 events; 67.5%), followed by oral drug therapy administration (30 events, 25.0%).

For 62 events (42.5%) drug therapy had been modified in the preceding 24 hours: in particular one or more drugs were eliminated or added respectively in 25 (6.8%) and 37 cases (25.3%).

Moreover, during the 24 hours preceding the event: 15 patients (10.3%) underwent an invasive procedure (i.e. thoracentesis; placement of central venous catheter); 39 (26.7%) had an infection diagnosis (19 respiratory infection, eight urinary infection, six bloodstream infection, five gastroenteric infection and one sepsis) and 12 patients (8.2%) had fever (body temperature >38°C). Nasogastric tube was present for six patients (4.1%), trach tube for only one patient (0.7%) and parenteral nutrition for 19 patients (13.0%). Finally, 109 patients (74.7%) were bedridden from at least 24 hours.

Resolution came spontaneously for 56 events (38.4%), while the other 90 influenced in different way the hospitalization in terms of: necessity of invasive procedures or diet modification, dysphagia or aspiration pneumonia diagnosis, Intensive Care Unit transfer and death. After the event, in particular, a diet consistency modification was adopted for 40 patients (27.2%); for 34 (23.3%) a specialist consultation for dysphagia was requested (which confirmed the diagnosis for 26 patients) and for other 34 patients (23.3%) an aspiration of the respiratory tract was necessary. Only in case of suspected pneumonia, patients underwent X-rays. In 19 cases (13.0%) patients were prescribed parenteral nutrition, in six cases (4.1%) the oral administration of drug therapy was suspended, in four cases (2.7%) patients' families and caregivers were educated about the right way to feed and water a dysphagic patient; two patients (1.4%) were transferred to the Intensive Care Unit and two patients (1.4%) died.

The addition of drugs or the infection diagnosis during the 24 hours preceding the event acted as risk factors for events that did not resolve spontaneously or that

Table 4 - Association between factors and conditions and the occurrence of an aspiration event that needs additional interventions (i.e. drug therapy modification, aspiration, hospitalization in intensive care unit).

Factor/Condition	Odds Ratio* (OR)	Confidence Interval* 95%		Odds Ratio** (OR)	Confidence Interval** 95%	
Age (years, continuous)	1.008	0.969	1.049	-	-	-
Sex (Female Vs Male)	1.725	0.663	4.448	-	-	-
Factor/Condition in the preceding 24 hours						
Hospital admission	0.824	0.113	5.989	-	-	-
Transfer from another ward	1.171	0.200	6.855	-	-	-
Elimination of one or more oral drugs	0.179	0.048	0.674	0.361	0.120	1.087
Addition of one or more oral drugs	3.076	0.930	10.176	2.714	0.912	8.075
Surgery or other invasive procedures	0.503	0.108	2.346	-	-	-
Infection diagnosis	1.965	0.694	5.563	2.687	1.010	7.149
Oral anatomic or functional deficit	0.443	0.179	1.100	0.437	0.189	1.014
Dysphagia diagnosis	0.984	0.4080	2.375	-	-	-
Parenteral nutrition	3.061	0.576	16.261	3.310	0.677	16.178
Being bedridden	2.075	0.647	6.656	-	-	-

* Full model

** Backwards elimination

needed additional intervention during the hospitalization (dysphagia evaluations, hospitalization in Intensive Care Unit, etc.), although with a low significance level. On the contrary, the elimination of one or more drugs prescribed seemed to lead to aspiration events with no impact on the hospitalization (see Table 4). No association was found as far as age and sex are concerned (data not shown).

Discussion and conclusions

The study showed an incidence of aspiration events in medical wards of 1.4 /1,000 hospitalization days, that is like the incidence of falls, another adverse event that typically occurs among hospitalized patients, that is about 1.3/1,000 hospitalization days (18). Incidence variation among study groups (from 1.0/1,000 hospitalization days in Hospital 3 to 2.1/1,000 hospitalization days in Hospital 1) may be due to the different data collection procedures applied, as Hospital 3 received weekly ward aspiration events report via fax while Hospital 1 collected them directly from wards. Since the study was based on personnel voluntary reporting, weekly presence of the study group in the wards could have further increased personnel sensibility on events reporting. As a matter of fact, some events of Hospitals 1 and 2 had been reported after informal conversation between ward personnel and the study group data collector.

Cough was the most frequently reported aspiration symptom and for more than half cases, it represented the only clinical manifestation. Aspiration pneumonia diagnosis was reported for few events, and maybe the scarce physicians' involvement in signaling led to the underestimation of its actual incidence. The most frequent causes of aspiration events were water or food intake and oral drug therapy, suggesting that a more detailed evaluation of patient's level of autonomy in nourishing and swallowing would help in defining more properly the assistance level and the appropriate diet consistency needed. Nevertheless, also patients who were already prescribed a diet with the correct consistency, experienced aspiration events and therefore probably more attention has to be given to nutrition modalities, including appropriate training of caregivers, which appears to be essential in preventing aspiration events. Suggestions reported in literature include putting the patient in the right position during alimentation (instead of letting him lie in bed), trying to eliminate every kind of distraction in the room and taking the time to feed up the patient with an adequate speed (19).

At the admission, almost one third of the patients that had an aspiration event during the hospitalization was evaluated as patient with dysphagia. The increased incidence of aspiration events within the first hospitalization days is worth to be noted, as patients should be better monitored during these days to prevent adverse event occurrence. The logistic regression between condition present during the preceding 24 hours and the outcome of the aspiration event, although not statistically significant, underlined how the addition of drugs to the oral therapy is a risk factor for aspiration event with a bad outcome. Consideration of patient pharmacological therapy in both qualitative and quantitative terms is thus reconfirmed as an important topic in the management of the patient safety (1, 13). Moreover, recent ward admission was correlated to a bad aspiration event outcome, when the transfer was from other hospital wards, highlighting a possible communication deficiency risk.

More than half of the events occurred during the morning shift, that is characterized by a high level of activity: thus, during these hours, aspiration preventive and monitoring actions should be reinforced. Finally, data showed a low awareness level of ward

personnel on this specific issue, as initial evaluations were frequently lacking data on BMI, dysphagia or autonomy in daily activities, but also in terms of communication among healthcare professionals, as one quarter of the events were not reported on clinical records. Although an in-depth analysis on the variation of patients clinical conditions during the hospitalization will be necessary, these data showed how difficult to prevent is the risk of aspiration events, remarking the importance of health professionals awareness and preparedness on this issue (2, 16, 20).

Limits of the study. An underestimation of total aspiration events incidence could have followed the difficulty in identifying aspiration events due to silent aspiration (7), the possible not reported events by patients themselves (when not witnessed) and the suboptimal ward personnel participation in the study. Moreover, the lack of a control population and the limitation of data collection within medical wards may have had reflections on risk factors identification. Nevertheless, this is one of the most recent study aiming at evaluating aspiration events incidence and correlated risk factors among hospitalized patients, whose relevance is enhanced by the fact that more than half of the identified cases needed some intervention on the patients, ranging from drug therapy or diet changes to bronco aspiration up to their transfer to Intensive Care Unit. Furthermore, it is important to bear in mind the social and psychological impact of dysphagia on both patients and caregivers (17) that is worth to be tackled.

In conclusion, the study showed a large aspiration events incidence within medical wards, with a high percentage of relevant outcome on hospitalization. Results discussed could be a starting point for further investigations and in-depth analysis to better prevent aspiration events and identify risk factors correlated with adverse aspiration event outcomes that deserve higher attention among healthcare professionals, during the first hours and days of hospitalization. Increased awareness and effective training of caregivers on patient assistance during water, food and oral drug therapy administration would have potential additional benefits on patient safety.

Riassunto

Il problema sottostimato delle polmoniti ab ingestis conseguenti ad eventi di aspirazione in ospedale: cosa segue alla disfagia

Premessa. Nonostante l'alta prevalenza della disfagia e il crescente invecchiamento della popolazione europea, l'incidenza degli eventi di aspirazione tra i pazienti ospedalizzati risulta sottostimata anche a causa della loro frequente risoluzione spontanea o del loro silente contributo a sindromi da aspirazione. L'obiettivo principale del nostro studio è quello di valutare l'incidenza di eventi di aspirazione tra i pazienti ricoverati nei reparti di medicina e identificare i fattori di rischio che influenzano l'outcome dell'evento.

Disegno dello studio. Studio osservazionale prospettico.

Metodi. Tra maggio 2015 e settembre 2016 in tre grandi ospedali italiani sono stati raccolti i dati relativi agli eventi di aspirazione (giorno, ora, tipo, outcome dell'evento) e alle condizioni cliniche dei pazienti al momento dell'ammissione.

Risultati. Su un totale 102.619 giorni di degenza, 135 pazienti sono andati incontro a eventi di aspirazione; età media 82 anni, prevalentemente donne (53%) L'incidenza complessiva di eventi di aspirazione risulta quindi essere 1,4 per 1000 giorni di degenza (C.I.95%: 1,2-1,7) manifestandosi principalmente con tosse (61.6%). L'aggiunta di farmaci alla terapia in corso o la diagnosi di infezione nelle 24 ore precedenti l'evento costituiscono fattori di rischio per la necessità di intervento aggiuntivo durante la degenza (OR 3,1 e OR 1,9 rispettivamente); l'eliminazione di uno o più farmaci dalla terapia in corso, invece, sembra portare all'occorrenza di eventi di aspirazione senza impatto sulla degenza.

Conclusioni. I risultati ottenuti mostrano una incidenza considerevole di eventi di aspirazione tra i pazienti ricoverati in reparti medici, molti dei quali in grado di influenzare l'outcome di salute dei pazienti. L'attenzione dei professionisti sanitari nei confronti degli eventi di aspirazione dovrebbe essere in particolare promossa per quanto riguarda le prime ore e i primi giorni di degenza.

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