GERIATRIC MEDICINE | RESEARCH ARTICLE

Rehospitalisation and mortality after hospitalisation for oropharyngeal dysphagia and community-acquired pneumonia: A 1-year follow-up study

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Abstract: Research has documented a high prevalence of oropharyngeal dysphagia (OD) in older patients with community-acquired pneumonia (CAP). This study investigated OD as a risk factor for long-term re-hospitalization and mortality in patients hospitalized with CAP. A total of 36 patients (72.2% male, mean age 80.9 years) who were alive 30 days after discharge were included in the follow-up study. Demographic data, CURB65, Charlson Comorbidity Index, Modified Rankin Scale and Barthel-20 score were recorded and OD was assessed with Volume Viscosity Swallow Test. 69.5% of the patients were moderately to severely disabled, and the mean Barthel-20 score was 13.2 and 27.8% lived in nursing homes. In the period from 31 to 180 days 50% of the patients were re-hospitalized and from 181 to 360 days 60.7% were re-hospitalized. Re-hospitalized patients had a significantly higher Barthel-20 score and longer length of stay (LOS) in the hospital. During 31–180 days after discharge 22.2% of the patients died. From 181 to 360 days after discharge 46.4% of the patients died, they had a significantly higher Charlson Comorbidity Index and a significantly weaker handgrip. The one-year mortality was 71.7%. Despite the small sample size, this study confirms a high re-hospitalisation frequency and high mortality. The 1-year mortality is 71.7% for patients hospitalised with CAP and OD.

Subjects: Medicine; Gerontology; Infectious Diseases; Clinical Nutrition; Nursing

Keywords: dysphagia; pneumonia; aged; risk factor; frailty

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PUBLIC INTEREST STATEMENT

Pneumonia is a leading cause of hospitalization and death especially among elderly patients. Elderly people get pneumonia four times as often as young people do and elderly people are more likely to be hospitalized than young people. It is well known that elderly people with swallowing disorders who are choking during meals are in high risk of aspiration and pneumonia caused by aspiration.

The present study documents that patients hospitalised with pneumonia and swallowing disorders are in high risk of rehospitalization. More than seven out of ten patients with pneumonia and swallowing disorders are dead within 12 months.
1. Introduction

Community-acquired pneumonia (CAP) is a common and severe cause of admission, readmission and death among elderly adults (Almirall et al., 2000; Klausen et al., 2012; Vila-Corcoles et al., 2009).

Old age is the main risk factor for CAP (Klausen et al., 2012; Loeb, McGeer, McArthur, Walter, & Simor, 1999) and as the senior population increases, the number of patients with CAP expands (Thomsen et al., 2006). Other factors predispose older adults to CAP such as poor functional and nutritional status, weight loss, comorbidity, and deterioration of swallowing function (Jackson, Nelson, & Jackson, 2009; Loeb et al., 2009; Manabe, Teramoto, Tamiya, Okochi, & Hizawa, 2015; Torres, Peetermans, Viegi, & Blasi, 2013). The 1-year mortality in patients with CAP ranges from 7.2 to 41% (Adamuz et al., 2014; Johnstone, Eurich, Majumdar, Jin, & Marrie, 2008; Juthani-Mehta et al., 2013; Restrepo, Faverio, & Anzueto, 2013). Reported risk factors for death are chronic obstructive pulmonary disease (COPD), and living in nursing homes (Holter et al., 2016). Readmission 31 days or more after pneumonia are not well-described (Prescott, Sjoding, & Iwashyna, 2014) but studies found an assessed cumulative readmission rate beyond 30 days of 22–35.6% (Bohannon & Maljanian, 2003; Hedlund, 1995) and 46% after 12 months (Johnstone et al., 2008).

The prevalence of swallowing disorders also increases with age, and a high prevalence has been reported and ranges from 34 to 86% in older patients hospitalised for pneumonia (Almirall et al., 2013; Cabre et al., 2010; Melgaard, Baandrup, Bogsted, Bendtsen, & Hansen, 2016; Teramoto et al., 2008). It is well known and accepted that oropharyngeal dysphagia (OD) is a risk factor for aspiration pneumonia in older adult patients, especially in those living in nursing homes (Marik, 2003; van der Maarel-Wierink, 2011). OD and frailty are closely related, and older frail people are at high risk for aspiration pneumonia (Carrión et al., 2015; Rofes et al., 2010; Wirth et al., 2016). Patients with OD have a 1-year mortality rate of 51.7–65.8% (Carrión et al., 2015; Rofes et al., 2010) and increased risk of re-hospitalisation (Cabre et al., 2014), but the risk factors for re-hospitalisation and death are often not addressed in the literature.

The aim of this study was to characterize patients with CAP and OD, who were rehospitalised or dead after hospitalisation. Further, this study intended to determine whether OD among patients consecutively hospitalised with CAP is a risk factor for readmission and mortality 31–180 days and 181–360 days after discharge.

2. Material and methods

2.1. Study design

From 1 September 2013, to 31 March 2014, a cross-sectional study with longitudinal follow-up enrolled 170 patients hospitalised with pneumonia at the Department of Respiratory Medicine in the North Denmark Regional Hospital. Details of recruitment, study design and methods have been described elsewhere (Melgaard et al., 2016). The inclusion criteria were patients over 18 years, a temperature above 38°C, a new infiltrate on chest x-ray, increased C-Reactive Protein (CRP), and one of the clinical criteria: cough, dyspnea, pleuritic chest pain, expectoration, or tachypnea. The included patients were diagnosed with CAP and OD.

2.2. Measures

During hospitalisation, the following data were obtained:

- Patient characteristics in terms of age, gender, admission date, and discharge date.
- Medical information in terms of temperature, urea, CRP, respiratory rate, blood pressure by hospitalisation, confusion as well as medication by discharge was obtained.
- Nutritional status was assessed by body mass index (BMI), circumference of the lower leg (15 cm above the lower edge of the patella), circumference of the upper arm (lateral epicondyle + 10 cm),
and circumference of the waist (2 cm above the navel). Also, data of the level of oral health and hand strength (measured by the Jamar Hand Dynamometer) were collected.

The severity of pneumonia was assessed by the CURB65, which is used as a part of the usual routine assessment by the physician to describe (Capelastegui et al., 2006; Lim et al., 2003). The CURB65 score consists of five factors: confusion, urea, respiratory rate, blood pressure, and age 65 years or older. Each factor scores one point on a scale of a score of 0–5 points.

Comorbidity was assessed with the Charlson Comorbidity Index (CCI) (Charlson, Szatrowski, Peterson, & Gold, 1994), which consists of 19 disease groups. Each group has a significant mortality risk like cancer, COPD, or myocardial infarct; the higher the score, the higher the risk of mortality.

The functional level before hospitalisation was assessed with the Modified Rankin Scale (MRS). The patients reported their level of indoor, outdoor, and during shopping walking ability from the week before being hospitalised. Each activity was scored from 0 to 3 and cumulated to a score between 0 and 9, with high scores indicating a high level of activity (Kristensen, Bandholm, Foss, Ekdahl, & Kehlet, 2008).

Barthel-20 was used to assess performance in daily activities and mobility. A higher score is associated with a higher independence in daily living (Mahoney & Barthel, 1965).

OD was assessed by a trained occupational therapist using the Volume-Viscosity Swallow Test (V-VST). The test is designed to evaluate the safety of the swallow (changes in voice, cough or decrease in oxygen saturation ≥ 3%) to detect silent aspiration and the efficiency of the swallow (impaired labial seal, oral or pharyngeal residue or piecemeal deglutition) when ingesting different types of viscosity and different volumes (Clavé et al., 2008). Bolus volume was 5, 10, and 20 ml. Bolus viscosity was liquid viscosity, nectar viscosity was created by adding 1.2 g of the thickener Resource ThickenUp (Nestlé HealthCare Nutrition) to 100 ml water, and pudding viscosity was created by adding 6.0 g of the thickener Resource ThickenUp to 100 ml water. Mineral water at room temperature 25°C was used.

After hospitalisation, data on the main outcomes readmission and mortality within 31–180 days and 181–360 days after discharge were obtained from the National Patient Register. In this study rehospitalisation was limited to the Northern Region of Denmark.

According to Danish legislation, this study not being an intervention study did not need approval by the North Denmark Region Committee on Health Research Ethics (N-20130058). The study was approved by the Danish Data Protection Authority (2008-58-0028).

2.3. Statistical analysis

Descriptive statistics included the number and percentage of patients for categorical variables, and the mean for continuous variables. Differences between the two groups of rehospitalised/not rehospitalised and death/alive were analyzed using Fisher’s Exact Test for categorical variables, and a two-sample t-test for continuous variables. The variables of handgrip and BMI were not normal distributed, and are reported with a median (IQR) and analyzed with the Wilcoxon Rank Sum Test. The statistical analyses were performed with Stata Version 13.1 (Stata Corporation, College Station, TX, USA), and throughout the analyses 95% confidence intervals (CI) were reported and a p-value < 0.05 was considered statistically significant.

3. Results

As illustrated in Figure 1, 30 days after discharge, 36 patients (72.2% male, mean age 80.9 years (SD ± 10.5)) with OD were alive and followed for 360 days. As seen in Table 1, the group of 36 patients was characterized by a relatively high mean age with many living in nursing homes (27.8%).
Further, 42.9% suffered from COPD. 69.5% of the patients were moderately to severely disable and the mean Barthel-20 score was 13.3.

3.1. Readmission

As illustrated in Table 2, 18 (50%) of the patients were re-hospitalised 31–180 days after discharge. This group of patients was characterized by a significantly higher Barthel-20 score, which indicated a higher functional level. As illustrated in Table 2, there were non-significant differences between the groups regarding the other parameters. The group of re-hospitalised patients had a lower frequency of dementia, and the patients had a 2.5 days Length of stay (LOS) in the hospital.

In the period between 181 and 360 days, 17 (60.7%) were rehospitalised. Characteristics of these patients were a significantly higher Barthel-20 score, and concerning other parameters, the difference was non-significant. The rehospitalised patients had a 1.7 day longer LOS than patients not rehospitalised.
Table 1. Baseline demographics and clinical characteristics

| Category                                      | N = 36 (34.4%) |
|-----------------------------------------------|-----------------|
| Gender—male                                   | 26 (72.2%)      |
| Age—mean                                      | 80.9 (±10.5)    |
| <50                                           | 0               |
| 50–69                                         | 6               |
| 70–79                                         | 9               |
| 80+                                           | 21              |
| Point of origin                               |                 |
| House/apartment                               | 26 (72.2%)      |
| Nursing home                                  | 10 (27.8%)      |
| Civil status                                  |                 |
| Married/living together                       | 28 (52.8%)      |
| Single                                        | 25 (47.2%)      |
| Rentier                                       | 100%            |
| CURB65—mean                                   |                 |
| Confusion (yes)                               | 15 (44.1%)      |
| Urea (carbamide > 7 mmol/L)                   | 24 (70.6%)      |
| Respiratory rate ≥ 30/min                     | 5 (15.2%)       |
| Blood pressure <90 mm Hg syst or ≤60 mm Hg diast | 63 (8.8%)    |
| ≥65 years                                     | 32 (88.9%)      |
| CURB65—mean                                   | 2.34 (0.9)      |
| 0                                             | 0 (0%)          |
| 1                                             | 3 (9.1%)        |
| 2                                             | 21 (63.6%)      |
| 3                                             | 7 (21.2%)       |
| 4                                             | 1 (3.0%)        |
| 5                                             | 1 (3.0%)        |
| Charlson Comorbidity Index                    |                 |
| Mean                                          | 5.5 (±1.6)      |
| Comorbidity                                   |                 |
| Dementia                                      | 7 (20.0%)       |
| COPD                                          | 15 (42.9%)      |
| Diabetes                                      | 3 (8.6%)        |
| Hemiplegic                                    | 4 (11.4%)       |
| CRP                                           | 95.25 (82.4)    |
| Smoker                                        |                 |
| Smoker                                        | 7 (19.4%)       |
| Former smoker                                 | 17 (47.2%)      |
| Never smoked                                  | 6 (16.7%)       |
| Unknown                                       | 6 (16.7%)       |
| Use of oxygen                                 |                 |
| Yes                                           | 3 (8.3%)        |
| No                                            | 29 (80.6%)      |
| Unknown                                       | 4 (11.1%)       |
| Modified Rankin Scale                         |                 |

(Continued)
3.2. Mortality

During 31–180 days after discharge, 8 (22.2%) patients died. These patients were significantly older ($p = 0.008$) and most were male ($p = 0.076$) than patients who stayed alive. As seen in Table 3, there were no other significant differences between the two groups. From 181 to 360 days after discharge, 13 (46.4%) patients died. Patients who died in this period after discharge had a significantly higher Charlson Comorbidity Index ($p = 0.043$) and a significantly weaker handgrip ($p = 0.027$). There were no other significant differences between the two groups.

Of the 53 patients with OD and CAP, 38 were dead at follow-up, which gives a 1-year mortality rate of 71.7% (95%CI: 57.7; 83.2). For the 101 patients with only CAP, 20 were dead at follow up and the 1 year- mortality rate was 19.8% (95%CI: 12.5; 28.9).
Table 2. All causes of rehospitalisation within 31–180 days and 181–360 days after discharge

|                      | 31–180 days after discharge | 181–360 days after discharge | p-value | 31–180 days after discharge | 181–360 days after discharge | p-value |
|----------------------|----------------------------|-----------------------------|---------|-----------------------------|-----------------------------|---------|
|                      | Rehospitalised             | Not rehospitalised          |         | Rehospitalised              | Not rehospitalised          |         |
|                      | N = 18 (50%)               | N = 18 (50%)                | 0.528   | N = 17 (60.7%)              | N = 11 (39.3%)              | 0.574   |
| **Age**              |                            |                             |         |                             |                             |         |
| Mean                 | 80.6                       | 78.4                        | 0.528   | 78.5                        | 76.1                        | 0.574   |
| 95% CI (75.5; 85.7)  | 95% CI (72.9; 83.8)        |                             |         | 95% CI (73.1; 84.0)         | 95% CI (68.4; 83.7)         | 0.653   |
| <70y                 | 2 (11.1%)                  | 4 (22.2%)                   | 0.658   | 3 (17.7%)                   | 3 (27.3%)                   | 0.653   |
| ≥70y                 | 16 (88.9%)                 | 14 (77.8%)                  |         | 14 (82.4%)                  | 8 (72.7%)                   |         |
| **Gender**           |                            |                             |         |                             |                             |         |
| Male                 | 12 (66.7%)                 | 14 (77.8%)                  | 0.711   | 11 (64.7%)                  | 7 (63.6%)                   | 1.000   |
| Female               | 6 (33.3%)                  | 4 (22.2%)                   |         | 6 (35.3%)                   | 4 (36.4%)                   |         |
| **Barthel-20**       | 16.1                       | 10.5                        | 0.007   | 15.9                        | 9.7                         | 0.015   |
| 95% CI (14.1; 18.2)  | 95% CI (7.1; 14.0)         |                             |         | 95% CI (13.5; 18.3)         | 95% CI (5.3; 14.1)          |         |
| **CURB65**           |                            |                             |         |                             |                             |         |
| Mean                 | 2.51                       | 2.11                        | 0.124   | 2.41                        | 2.0                         | 0.137   |
| 95% CI (2.0; 3.0)    | 95% CI (1.8; 2.4)          |                             |         | 95% CI (2.0; 2.9)           | 95% CI (1.6; 2.4)           |         |
| 0                    | 0 (0%)                     | 0 (0%)                      | 0.707   | 0 (0%)                      | 0 (0%)                      |         |
| 1                    | 1 (6.3%)                   | 2 (11.8%)                   |         | 1 (7.1%)                    | 2 (18.2%)                   |         |
| 2                    | 9 (56.3%)                  | 12 (70.6%)                  |         | 7 (50.0%)                   | 7 (63.6%)                   |         |
| 3                    | 4 (25.0%)                  | 3 (17.7%)                   | 0.683   | 6 (42.9%)                   | 2 (18.2%)                   |         |
| 4                    | 1 (6.3%)                   | 0 (0%)                      | 0.00    | 1 (7.1%)                    | 0 (0%)                      |         |
| 5                    | 1 (6.3%)                   | 0 (0%)                      | 0.00    | 0 (0%)                      | 0 (0%)                      |         |
| **CCI**              | 5.5                        | 5.5                         | 0.958   | 5.7                         | 4.9                         | 0.215   |
| 95% CI (4.6; 6.4)    | 95% CI (4.7; 6.2)          |                             |         | 95% CI (4.6; 6.7)           | 95% CI (4.1; 5.7)           |         |
| **Dementia**         | 2 (11.1%)                  | 5 (29.4%)                   | 0.228   | 2 (12.5%)                   | 4 (36.4%)                   | 0.187   |
| **Handgrip**         | 8.5 (6.8–14.1)             | 13.7 (7–26)                 | 0.632   | 8.5 (6.7–23.2)              | 7.3 (7.0–10.2)              | 0.991   |
| **Nursing home**     | 5 (27.8%)                  | 5 (27.8%)                   | 1.000   | 4 (23.5%)                   | 4 (36.4%)                   | 0.671   |
| **MRS**              |                            |                             |         |                             |                             |         |
| No symptoms.         | 0 (0%)                     | 1 (5.6%)                    | 0.00    | 1 (5.9%)                    | 0 (0%)                      |         |
| No significant disability. | 1 (5.6%) | 1 (5.6%) | 0.00 | 1 (5.9%) | 0 (0%) |         |
| Slight disability    | 4 (22.2%)                  | 2 (11.1%)                   | 0.668   | 1 (5.9%)                    | 1 (9.1%)                    | 0.654   |
| Moderate disability  | 6 (33.3%)                  | 3 (16.7%)                   |         | 4 (23.5%)                   | 3 (27.3%)                   |         |
| Moderately severe disability | 5 (27.8%) | 6 (33.3%) | 3 (27.3%) | 4 (23.5%) | 3 (27.3%) |         |
| Severe disability    | 1 (5.6%)                   | 4 (22.2%)                   |         | 1 (5.9%)                    | 3 (27.3%)                   |         |
| Unknown              | 1 (5.6%)                   | 1 (5.6%)                    | 0.668   | 1 (5.9%)                    | 1 (9.1%)                    | 0.654   |
| **BMI**              | 21.6 (16.6–27.2)           | 25.1 (21.4–26.7)            | 0.186   | 24.5 (21.4–25.6)            | 26.7 (25.1–28.0)            | 0.232   |
| **LOS**              | 10.7                       | 8.2                         | 0.261   | 9.2                         | 6.4                         | 0.541   |
| 95% CI (5.7; 14.9)   | 95% CI (4.8; 10.3)         |                             |         | 95% CI (5.4; 14.9)          | 95% CI (4.4; 13.6)          |         |

Note: CCI = Charlson Comorbidity Index, MRS = Modified Rankin Scale, BMI = Body mass index, LOS = Length of Stay.

1 missing value.

2 missing values.

3 missing values.
|                          | Alive | Dead | p-value | Alive | Dead | p-value |
|--------------------------|-------|------|---------|-------|------|---------|
| **31–180 days after discharge** |       |      |         |       |      |         |
| Age                      |       |      |         |       |      |         |
| Mean                     | 77.6  | 86.2 | 0.008   | 74.9  | 80.6 | 0.164   |
| 95% CI (73.4; 81.7)      | 95% CI (81.2; 91.3) |
| <70y                      | 6 (21.4%) | 0 (0%) | 0.302 | 4 (26.7%) | 2 (15.4%) | 0.655 |
| 70y                       | 22 (78.6%) | 8 (100%) |       | 11 (73.3%) | 11 (86.6%) |       |
| Gender                   |       |      |         |       |      |         |
| Male                     | 18 (64.3%) | 8 (100%) | 0.076 | 11 (73.3%) | 7 (64.3%) | 0.433 |
| Barthel-20               | 13.4  | 12.8 | 0.822   | 15.5  | 13.2 | 0.889   |
| 95% CI (11.0; 115.8)     | 95% CI (6.7; 18.8) |
| CURB65                   |       |      |         |       |      |         |
| Mean                     | 2.2   | 2.4  | 0.744   | 2.1   | 2.5  | 0.192   |
| 95% CI (1.9; 2.5)        | 95% CI (1.5; 3.3) |
| 0                        | 0 (0%) | 0 (0%) |       | 0 (0%) | 0 (0%) |       |
| 1                        | 3 (12.0%) | 0 (0%) |       | 3 (21.4%) | 0 (0%) |       |
| 2                        | 14 (56.0%) | 7 (87.5%) |       | 7 (50.0%) | 7 (63.6%) |       |
| 3                        | 7 (28.0%) | 0 (0%) |       | 4 (28.6%) | 4 (36.4%) |       |
| 4                        | 1 (4.0%) | 0 (0%) | 0.364  | 0 (0%) | 1 (9.1%) |       |
| 5                        | 0 (0%) | 1 (12.5%) |       | 0 (0%) | 0 (0%) | 0.325 |
| CCI                      | 5.4   | 5.9  | 0.400   | 4.7   | 6.1  | 0.043   |
| 95% CI (4.7; 6.1)        | 95% CI (4.7; 7.0) |
| Dementia                 | 6 (22.2%) | 1 (12.5%) | 1.000 | 2 (14.3%) | 4 (30.7%) | 0.385 |
| 95% CI (1.1; 5.4)        | 95% CI (1.2; 1.7) |
| Handgrip                 | 8.3 (7.0–17.4) | 12.1 (10.8–16.2) | 0.580 | 17.3 (8.3–26.0) | 6.7 (2.2–7.3) | 0.039 |
| Nursing home             | 8 (28.6%) | 2 (25.0%) | 1.000 | 4 (26.7%) | 4 (30.8%) | 1.000 |
| MRS                      |       |      |         |       |      |         |
| No symptoms              | 1 (3.6%) | 0 (0%) |       | 1 (6.7%) | 0 (0%) |       |
| No significant disability| 1 (3.6%) | 1 (12.5%) |       | 0 (0%) | 1 (7.7%) |       |
| Slight disability        | 6 (21.4%) | 0 (0%) |       | 5 (33.3%) | 1 (7.7%) |       |
| Moderate disability      | 7 (25.0%) | 2 (25.0%) |       | 2 (13.0%) | 5 (38.5%) |       |
| Moderately severe disability | 7 (25.0%) | 4 (50.0%) |       | 5 (33.3%) | 2 (15.4%) |       |
| Severe disability        | 4 (14.3%) | 1 (12.5%) |       | 2 (13.3%) | 2 (15.4%) |       |
| Unknown                  | 2 (7.2%) | 0 (0%) | 0.615  | 0 (0%) | 2 (15.4%) | 0.143 |
| BMI                      | 25.1 (21.4–27.2) | 17.9 (16.8–18.5) | 0.225 | 25.1 (21.8–27.2) | 21.4 (18.2–27.4) | 0.764 |
| LOS                      | 7.9   | 9.8  | 0.571   | 9.2   | 6.4  | 0.963   |
| 95% CI (4.6;13.6)        | 95% CI (7.2;12.4) |
| 95% CI (4.2;13.6)        | 95% CI (4.4;14.9) |
4. Discussion
We wanted to characterize the group of patients who were rehospitalised or died in 31–180 days and 181–360 days after discharge. Another aim was to determine whether OD among patients consequentially hospitalised with community-acquired pneumonia (CAP) is a risk factor for readmission and mortality 31–180 days and 181–360 days after discharge.

The 53 patients with OD and CAP compared with the 101 patients with CAP alone, showed a significant difference regarding age, dementia, functional level before hospitalization, Barthel 20 score at hospitalization, handgrip strength, circumference of the lower leg, BMI and more were living in a nursing home (Melgaard et al., 2016).

Evidence shows that OD is a risk factor for rehospitalisation (Cabre et al., 2014; Melgaard et al., 2016), and this study confirms a high frequency of rehospitalisation in patients with CAP and OD. Our results document that patients who are rehospitalised have a significantly higher level of functioning as measured with Barthel-20 than patients not rehospitalised. This differs from studies showing that it is the weakest who are hospitalised with OD (Cabre et al., 2014; Melgaard et al., 2016) and therefore it would be expected that the weakest group were more often readmitted. This finding may indicate the doctor’s delay to admit elderly, frail patients who stay at home or in the nursing home and get their treatment. Another explanation can be the fact that patients with a higher level of functioning live independently and decide what they want to eat and drink, and patients with a low level of functionality are dependent on what is served. The group of rehospitalised patients also had a higher LOS at the initial admission compared to patients not rehospitalised. Although, except for the Barthel-20 score, there was no significant difference according to the CCI, handgrip strength, dementia, admission from nursing home.

One-year mortality is high in patients with OD (Carrión et al., 2015; Rofes et al., 2010), and this study equals these results with a 1-year mortality of 71.7% for patients with CAP and OD. Patients who died had a significantly higher Charlson Comorbidity Index, age and weaker handgrip, and these parameters are related to frailty and overall cause of death (El Solh, Pineda, Bouquin, & Mankowski, 2006; Leong et al., 2015).

5. Limitations and strengths
The limitation of the study is that the small sample size can lead to a type II error, as well as less precise estimates, which may be the case in this study, illustrated by the width of the confidence intervals. The strength of the study is that the patients were included consecutively.

The used assessment of OD is also a limitation. We used a standardized bedside screening tool as recommended in the National Guideline for Assessment of Dysphagia (Danish Health Authority, 2015). V-VST is a validated and recommended bedside screening tool (Kertscher, Speyer, Palmieri, & Plant, 2014), but it has not yet been validated in Denmark. V-VST uses a decrease in oxygen saturation greater than or equal to 3% to detect silent aspiration. A fall in oxygen, as a fall in oxygen saturation, is not a reliable indicator of silent aspiration (Ramsey, Smithard, & Kalra, 2005). Pharyngeal residue is one of the signs of swallowing disorders, which can be visualized in a videofluoroscopy but is impossible to visualize in a bedside screening. However, in our clinical setting, it was not possible to use the objective assessments video fluoroscopy or fiberoptic endoscopic evaluation of swallowing.

More factors like social relationships, family interactions and environments may influence the end of life care decisions and this may have impacted on outcome (Sagha Zadeh et al., 2017). In this study, these factors have not been explored.

Finally, the definition of CAP remains vague and unclear, and there is a risk that some of the patients were hospitalised with aspiration pneumonia (Komiya, Ishii, & Kadota, 2014; Marik, 2001).
Results of this study demonstrate that patients with OD and CAP have a high frequency of rehospitalisation and that the long-term mortality is very high (71.7%) for patients hospitalised with CAP and OD. The group of patients rehospitalised has a significantly higher level of functionality than patients’ not rehospitalised do. Patients who died 31–360 days after discharge had a significantly higher frequency of comorbidity and a weaker handgrip than patients who stayed alive. There is a big discrepancy between this high mortality and the resources dedicated to assessing and treating OD.

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Competing Interests
The authors declare no competing interest.

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References
Adamuz, J., Viasus, D., Jiménez-Martínez, E., Isla, P., García-Vidal, C., Dorca, J., & Carroţalá, J. (2014). Incidence, timing and risk factors associated with 1-year mortality after hospitalization for community-acquired pneumonia. Journal of Infection, 68(6), 534–541. doi:10.1016/j.jinf.2014.02.006
Almirall, J., Bolívar, I., Vidal, J., Saura, G., Coll, P., Niklasson, B., … Balanzó, X. (2000). Epidemiology of community-acquired pneumonia in adults: A population-based study. European Respiratory Journal, 15(4), 757–763. https://doi.org/10.1183/09031936.0001521x
Almirall, J., Rofes, L., Serra-Prat, M., Icart, R., Palomera, E., Arreola, V., & Clavé, P. (2013). Oropharyngeal dysphagia is a risk factor for community-acquired pneumonia in the elderly. European Respiratory Journal, 41(4), 923–928. doi:10.1183/09031936.00019012
Bohanon, R. W., & Maljanian, R. D. (2003). Hospital readmissions of elderly patients hospitalized with pneumonia. Connecticut Medicine, 67(10), 599–603.
Cabré, M., Serra-Prat, M., Force, L., Almirall, J., Palomera, E., & Clavé, P. (2010). Oropharyngeal dysphagia is a risk factor for readmission for pneumonia in the very elderly persons: Observational prospective study. The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences, 69A(3), 330–337. doi:10.1093/gerona/gil099
Cabré, M., Serra-Prat, M., Palomera, E., Almirall, J., Pallares, R., & Clavé, P. (2010). Prevalence and prognostic implications of dysphagia in elderly patients with pneumonia. Age and Ageing, 39(1), 39–45. doi:10.1093/ageing/afp100
Capelastegui, A., Espina, P. P., Quintana, J. M., Arelló, J., Gorordo, J., Eguírola, M., & Bilbao, A. (2006). Validation of a predictive rule for the management of community-acquired pneumonia. European Respiratory Journal, 27(1), 151–157. doi:10.1183/09031936.00019012
Carrión, S., Cabré, M., Monteis, R., Roca, M., Palomera, E., Serra-Prat, M., … Clavé, P. (2013). Oropharyngeal dysphagia is a prevalent risk factor for malnutrition in a cohort of older patients admitted with an acute disease to a general hospital. Clinical Nutrition, 34(3), 436–442. doi:10.1016/j.clnu.2014.04.014
Charlson, M., Szatrowski, T. P., Peterson, J., & Gold, J. (1994). Validation of a combined comorbidity index. Journal of Clinical Epidemiology, 47(11), 1245–1251.
https://doi.org/10.1016/0895-4356(94)90129-5
Clavé, P., Arreola, V., Romea, M., Medina, L., Palomera, E., & Serra-Prat, M. (2008). Accuracy of the volume-viscosity swallow test for clinical screening of oropharyngeal dysphagia and aspiration. Clinical Nutrition, 27(6), 806–815. doi:10.1016/j.clnu.2008.06.011
Danish Health Authority. (2015). National clinical guideline for oropharyngeal dysphagia - screening, assessment and selected initiatives. Copenhagen: Danish Health Authority.
El Solh, A., Pineda, L., Bouquin, P., & Mankowski, C. (2006). Determinants of short and long term functional recovery after hospitalization for community-acquired pneumonia in the elderly: Role of inflammatory markers. BMC Geriatrics, 6, 1642. doi:10.1186/1471-2318-6-12
Fedlund, J. (1995). Community-acquired pneumonia requiring hospitalisation. Factors of importance for the short-and long term prognosis. Scandinavian Journal of Infectious Diseases. Supplementum, 97, 1–60.
Holtz, J. C., Ueland, T., Jennum, P. A., Muller, F., Brunborg, C., ... Holter, J. C., Ueland, T., Jennum, P. A., Muller, F., Brunborg, C., Froland, S. S., ... Hegelund, L. (2016). Risk factors for long-term mortality after hospitalization for community-acquired pneumonia: A 5-year prospective follow-up study. PLoS One, 11(2), e0148741. doi:10.1371/journal.pone.0148741
Jackson, M. L., Nelson, J. C., & Jackson, L. A. (2009). Risk factors for community-acquired pneumonia in immunocompetent seniors. Journal of the American Geriatrics Society, 57(5), 882–888. doi:10.1111/j.1532-5415.2009.02223.x
Johnstone, J., Eurich, D. T., Majumdar, S. R., Jin, Y., & Marrie, T. J. (2009). Long-term morbidity and mortality after hospitalization with community-acquired pneumonia: A population-based cohort study. Medicine, 87(6), 329–334. doi:10.1097/MD.0b013e318190f644
Juthani-Mehta, M., De Rekenenere, N., Allore, H., Chen, S., O’Leary, J. R., Bauer, D. C., ... Kritchevsky, S. (2013). Modifiable risk factors for pneumonia requiring hospitalization of community-dwelling older adults: The health, aging, and body composition study. Journal of the American Geriatrics Society, 61(7), 1111–1118. doi:10.1111/jgs.12325
Kertscher, B., Speyer, R., Palmieri, M., & Plant, C. (2014). Bedside screening to detect oropharyngeal dysphagia in patients with neurological disorders: An updated systematic review. Dysphagia, 29(2), 204–212. doi:10.1007/s00455-013-9430-9

Klausen, H. H., Petersen, J., Lindhardt, T., Bandholm, T., Hendriksen, C., Kehlet, H., & Andersen, O. (2012). Outcomes in elderly Danish citizens admitted with community-acquired pneumonia. Regional differences, in a public healthcare system. Respiratory Medicine, 106(12), 1778–1787. doi:10.1016/j.rmed.2012.08.010

Kornjyo, K., Ishi, H., & Kodota, J. (2014). Healthcare-associated pneumonia and aspiration pneumonia. Aging and Disease, 6(1), 27–37. doi:10.14336/AD.2014.0127

Kristensen, M. T., Bandholm, T., Foss, N. B., Ekdahl, C., & Kehlet, H. (2008). High inter-tester reliability of the new mobility score in patients with hip fracture. Journal of Rehabilitation Medicine, 40(7), 589–591. doi:10.2340/16501977-0217

Leong, D. P., Teo, K. K., Lindhardt, T., Bandholm, T., Avezum, Jr., A., Orlandini, A., … Prospective Urban Rural Epidemiology (PURE) study. (2015). Prognostic value of grip strength: Findings from the Prospective Urban Rural Epidemiology (PURE) Study Investigators. (2015). Prognostic value of grip strength: Findings from the Prospective Urban Rural Epidemiology (PURE) Study Investigators. The Lancet, 386(9990), 266–273. doi:10.1016/S0140-6736(14)62000-6

Lim, W. S., van der Eerden, M. M., Loing, R., Boersma, W. G., Karalus, N., Town, G. I., & Macfarlane, J. T. (2003). Defining community acquired pneumonia severity on presentation to hospital: An international derivation and validation study. Thorax, 58(5), 377–382. https://doi.org/10.1136/thorax.58.5.377

Loeb, M., McGeer, A., McArthur, M., Walter, S., & Simor, A. E. (1999). Risk factors for pneumonia and other lower respiratory tract infections in elderly residents of long-term care facilities. Archives of Internal Medicine, 159(17), 2058–2064. https://doi.org/10.1001/archinte.159.17.2058

Loeb, M., Neupane, B., Walter, S. D., Hanning, R., Carusone, S. C., Lewis, D., … Marrie, T. J. (2009). Environmental risk factors for community-acquired pneumonia hospitalization in older adults. Journal of the American Geriatrics Society, 57(6), 1036–1040. doi:10.1111/j.1532-5415.2008.01897.x

Mahoney, F. L., & Barthel, D. W. (1965). Functional evaluation: The barthel index. Maryland State Medical Journal, 14, 61–65.

Manoebe, T., Teramoto, S., Tamiya, N., Okochi, J., & Hizawa, N. (2013). Risk factors for aspiration pneumonia in older adults. PLoS One, 10(10), e0140060. doi:10.1371/journal.pone.0140060

Morik, P. E. (2001). Aspiration pneumonitis and aspiration pneumonia. New England Journal of Medicine, 344(9), 665–671. doi:10.1056/NEJM200103133440908

Morik, P. E. (2003). Aspiration pneumonia and dysphagia in the elderly. Chest, 124(1), 328–336. https://doi.org/10.1378/chest.124.1.328

Melgaard, D., Bandrup, U., Bogsted, M., Bendtsen, M. D., & Hansen, T. (2016). The prevalence of oropharyngeal dysphagia in danish patients hospitalised with community-acquired pneumonia. Dysphagia. doi:10.1007/s00455-016-9765-z

Prescott, H. C., Sjöding, M. W., & Iwashyna, T. J. (2014). Diagnoses of early and late readmissions after hospitalization for pneumonia: A systematic review. Annals of the American Thoracic Society, 11(7), 1091–1100. doi:10.1513/AnnalsATS.201404-1420C

Ramsey, D., Smithard, D., & Kalra, L. (2005). Silent aspiration: What do we know? Dysphagia, 20(3), 218–225. doi:10.1007/s00455-005-0018-9

Restrepo, M. I., Faverio, P., & Anzueto, A. (2013). Long-term prognosis in community-acquired pneumonia. Current Opinion in Infectious Diseases, 26(2), 151–158. doi:10.1097/QCO.0b013e3282ceed

Rofes, L., Arreola, V., Romea, M., Palomera, E., Almirall, J., Cabre, M., … Clave, P. (2010). Pathophysiology of oropharyngeal dysphagia in the frail elderly. Neurogastroenterology and Motility: The Official Journal of the European Gastrointestinal Motility Society, 22(8), 1511–1520. doi:10.1111/j.1365-2982.2010.01521.x

Sagha Zadeh, R., Sheshman, P., Setia, J., Kennedy, L., Hon, E., & Basora, A. (2017). Environmental design for end-of-life care: An integrative review on improving quality of life and managing symptoms for patients in institutional settings. Journal of Pain and Symptom Management. doi:10.1016/j.jpainsymman.2017.07.033

Teramoto, S., Fukuchi, Y., Sasaki, H., Sato, K., Sekizawa, K., Matsuse, T., & Japanese Study Group on Aspiration Pneumonia. (2008). High Incidence of aspiration pneumonia in community- and hospital-acquired pneumonia in hospitalized patients: A multicenter, prospective study in Japan. Journal of the American Geriatrics Society, 56(3), 577–579. doi:10.1111/j.1532-5418.2008.01597.x

Thomsen, R. W., Riis, A., Norgaard, M., Jacobsen, J., Christensen, S., Mcdonald, C. J., & Sorensen, H. T. (2006). Rising incidence and persistently high mortality of hospitalized pneumonia: A 10-year population-based study in Denmark. Journal of Internal Medicine, 259(4), 410–417. doi:10.1111/j.1365-2796.2006.01629.x

Torres, A., Peertmans, W. E., Viegí, G., & Blasi, F. (2013). Risk factors for community-acquired pneumonia in adults in Europe: A literature review. Thorax, 68(11), 1057–1065. doi:10.1136/thoraxjnl-2013-204282

van der Maarel-Wierink, C. D. (2011). Risk factors for aspiration pneumonia in frail older people: A systematic literature review. Journal of the American Medical Directors Association, 12(5), 344–354. https://doi.org/10.1016/j.jamda.2010.12.099

Vila-Corcoles, A., Ochoa-Gondar, O., Rodriguez-Blanco, T., Rago-Luria, X., Gomez-Bertomeu, F., & EPIVAC Study Group. (2009). Epidemiology of community-acquired pneumonia in older adults: A population-based study. Respiratory Medicine, 103(2), 309–316. doi:10.1016/j.rmed.2008.08.006

Wirth, R., Dziwoks, R., Beck, A. M., Clave, P., Hamdy, S., Hepner, H. J., … Volkert, D. (2016). Oropharyngeal dysphagia in older persons - from pathophysiology to adequate intervention: A review and summary of an international expert meeting. Clinical Interventions in Aging, 11, 189–208. doi:10.2147/CIA.S97481
