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Feature Article

Nursing home-acquired pneumonia, dysphagia and associated diseases in nursing home residents: A retrospective, cross-sectional study



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ABSTRACT

Background: Nursing home-acquired pneumonia (NHAP) is a common infection among nursing home residents. There is also a high prevalence of dysphagia in nursing home residents and they suffer more often from comorbidity and multimorbidity. This puts nursing home residents at higher risk of (mortality from) NHAP. Therefore it is important to gain more insight into the incidence of NHAP and the associated medical conditions in nursing home residents with dysphagia.

Objective: To investigate possible associations between NHAP and dysphagia in nursing home residents and to search for a medical risk profile for NHAP.

Design: A retrospective cross-sectional study.

Setting: Three nursing homes in The Netherlands.

Participants: 416 electronic medical files of nursing home residents aged 65 or older living in 3 nursing homes.

Methods: Data about age, gender, diagnosis of dysphagia and/or pneumonia, medical diagnosis and possible cause of death of the nursing home residents were extracted from electronic medical files.

Results: The data of 373 electronic medical files were analyzed. A significant difference in the prevalence of dysphagia was found between the nursing homes ($p < 0.001$). The incidence of NHAP was 5–12% in the participating nursing homes. Statistically significant higher incidence of NHAP was found in residents with dysphagia ($p = 0.046$). Residents with dysphagia had statistically significantly more diseases compared to residents without dysphagia ($p = 0.001$). Logistic regression analyses revealed no statistically significant associations between NHAP and the number of diseases and the ICD-10 diseases.

Conclusions: Dysphagia was found to be a risk factor for NHAP. Awareness of the signs of dysphagia by nurses and other care providers is important for early recognition and management of dysphagia and prevention of NHAP.

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Abbreviations: ACP, advance care planning; ADL, activities of daily living; CAP, community-acquired pneumonia; COPD, chronic obstructive pulmonary disease; CVA, cerebrovascular accident; FEES, fiberoptic endoscopic evaluation of swallowing; ICD-10, International Classification of Diseases-10; NHAP, nursing home-acquired pneumonia; OPES, oro-pharyngo-esophageal scintigraphy; SDM, shared decision making; VFS, videofluoroscopy.

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Introduction

Pneumonia is the second-most common infection among nursing home residents.¹ The incidence of nursing home-acquired pneumonia (NHAP) is believed to be six to ten times the incidence of community-acquired pneumonia (CAP).² Previous studies have shown estimated incidences of NHAP of between 48.6% and 61.2%.^{3–5} In general, NHAP patients suffer from a more severe pneumonia with

more complications and these patients are likely to have one or more neurological diseases, cerebrovascular diseases and diabetes mellitus, compared to CAP patients.^{3,5–8} Furthermore, other factors such as advanced age, male gender, tracheotomy tube and inadequate oral health care have been associated with NHAP.^{5,9–11}

Pneumonia in nursing home residents that occurs as a result of aspiration of oropharyngeal or gastric contents may be caused by dysphagia.¹² Aging causes a number of significant changes in the swallowing process, putting elderly people at higher risk of dysphagia.^{13,14} Dysphagia may also be induced by stroke, dementia or Parkinson's disease.^{15–17} Reported prevalence of dysphagia in nursing home residents varies between 38 and 69.6%.^{15,18–20} Additionally, dysphagia increases the risk of aspiration, which may lead to aspiration pneumonia.^{9,11,21–23}

A previous study of nursing home residents in The Netherlands found that the risk of aspiration is a relevant care problem. In this study, speech therapists assessed the risk of aspiration found no difference between physically disabled and cognitively impaired residents.²² Nonetheless, cognitive decline or impairment, such as dementia, will influence the individual ability of nursing home residents and nurses to interpret the symptoms of swallowing problems.²⁴ Furthermore, residents of Dutch nursing homes did recognize their swallowing problems (subjective dysphagia), but considered their swallowing problems to be a natural symptom of aging or of their diseases.²⁵ Owing to this decreased ability to interpret symptoms and the perception of swallowing problems as a natural symptom of aging, dysphagia might not be recognized in time, which increases the risk of aspiration pneumonia amongst these people. Several studies suggest that a standard swallowing assessment, prior to or soon after admission to a nursing home, with adequate treatment of dysphagia, should be included routinely in nursing care.^{15,26,27}

Owing to the high incidence of NHAP among residents with dysphagia, there is a need to gain better understanding of the underlying comorbidities that may be contributing to this problem. These insights will help nurses and other medical professionals to recognize dysphagia earlier and to help prevent NHAP. Therefore, the aim of the present study was to investigate potential associations between NHAP and dysphagia for nursing home residents and to search for a medical risk profile for NHAP.

Methods

Design, setting, participants and data collection

A retrospective cross-sectional study was carried out in three nursing homes in The Netherlands. The participating nursing homes were located in three regions of the country.

Because data were collected from residents' electronic medical files and no medical research experiment took place among these residents, in The Netherlands this study is not defined as a medical research experiment.²⁸ Therefore, ethical approval from a medical evaluation board was not required. However, to be allowed access to the residents' electronic medical files, approval for this study was sought and received from the nursing homes' medical ethics committees.

The first step was to identify medical electronic files of residents who were eligible for inclusion in the study. Only the medical electronic files of residents who were aged 65 or older when the study started in the respective nursing homes were included. Next, from the included residents' electronic medical files the following details were extracted: gender, diagnosis of dysphagia, diagnosis of pneumonia, starting date of (the first) pneumonia episode, additional medical diagnoses according to the International Classification of Diseases-10 (ICD-10) index and

the potential date of death. Diagnosis of dysphagia was considered if dysphagia was present in the examination period or prior to an occurrence of NHAP. Dysphagia was determined on the basis of a registration of dysphagia in the electronic medical file. In case of any ambiguity related to the diagnosis of dysphagia, the nursing home's speech therapist and elderly care physician were consulted for additional information. For residents who died during the examination period, the cause of death was registered and considered as an additional medical diagnosis. The diagnosis of pneumonia was determined by the physician, based on the clinical characteristics that were present in the resident. Each registered diagnosis of pneumonia was considered as NHAP.

The study period in each nursing home comprised a period of 1 year. Data were collected from the period April 2011 to April 2012 (nursing home 1), in the period April 2012 to April 2013 (nursing home 2) and in the period April 2013 to April 2014 (nursing home 3). Collecting data from three different examination periods reduced the risk that the data were influenced by medical, social and economic events, such as a flu epidemic.

The residents' electronic medical files revealed that four (diagnostic) methods had been used in the nursing homes to diagnose dysphagia: 1.) standard swallowing assessment by a speech therapist at the resident's admission; 2.) evaluation of the swallowing process by a speech therapist after a cerebrovascular accident or in case of a history of cerebrovascular accident at the time of admission; 3.) swallowing assessment after reported clinical symptoms of or complaints about swallowing problems; and 4.) previously registered signs and symptoms in the electronic medical file before admission. Only nursing home 1 performed a standard swallowing assessment at admission.

To enhance the alignment between the researchers in the process of the data extraction, two investigators explored the residents' electronic medical files simultaneously in nursing home 1, by following the predetermined standardized collection instruction. If relevant data were missing or had been described inaccurately, or if a resident had been discharged from the nursing home during the examination period, the resident was excluded. After the collection of data in nursing home 1, the data-collection procedure was critically evaluated and discussed by the investigators. After it was agreed that the data collection did not need adjustments, three other investigators carried out the data collection in nursing homes 2 and 3 following instructions from the investigators of the first nursing home.

The International Classification of Diseases (ICD-10)

The medical diagnoses and conditions derived from the residents' electronic medical files were arranged and clustered using The International Classification of Diseases (ICD-10).²⁹ The chapters 'Pregnancy, childbirth and the puerperium (O00–O9A)' and 'Conditions originating in the Perinatal period (P00–P96)' were excluded, because they are not applicable to nursing home residents.

Statistical analyses

Statistical analyses were performed using SPSS version 20.0 (SPSS INC, Chicago, IL, USA), including descriptive frequency distributions for all variables. Student's *t*-test and the chi-square test were used for testing differences between groups. Multiple logistic regression analyses were used to explore associations of NHAP with the diseases classified according to ICD-10. In these models, NHAP was the dependent variable and the respective diseases were the independent variables. Odds ratios (OR) with 95% confidence intervals (95% CI) were calculated. All ORs were corrected for gender and diagnosed dysphagia.

Results

A total of 416 residents' electronic medical files were analyzed. Out of these, 43 electronic medical files were excluded because these residents had been discharged from the nursing home during the examination period. Table 1 presents the residents' gender and age distribution for each nursing home.

Table 2 presents numbers and percentages of residents diagnosed with dysphagia and NHAP, for each nursing home. NHAP was diagnosed in 4 (5%) residents of nursing home 1, in 4 (5%) residents of nursing home 2 and in 24 (12%) residents of nursing home 3. This difference was not statistically significant (chi-square test; $p = 0.067$). Dysphagia was diagnosed in 30 (38%) residents of nursing home 1, in 12 (14%) residents of nursing home 2 and in 17 (8%) residents of nursing home 3. The prevalence of dysphagia was significantly different between the nursing homes (chi-square test; $p < 0.001$).

Dysphagia was diagnosed in 59 (16%) residents, of which the majority were women (71%). However, there was no statistically significant gender difference between the residents diagnosed with or not diagnosed with dysphagia (chi-square test; $p = 0.787$) as shown in Table 3. The mean age of residents with dysphagia was almost equal to the mean age of residents without dysphagia (82.2 ± 9.1 versus 83.5 ± 7.8). Nine (15%) residents out of the 59 residents with dysphagia were diagnosed with NHAP; the incidence of NHAP in residents without dysphagia was 7% ($n = 23$). This difference was statistically significant (chi-square test; $p = 0.046$). The overall mortality was 23% during the examination period. No difference was found between residents with (20%) and without diagnosed dysphagia (23%; $p = 0.625$). Residents with dysphagia had a statistically significantly higher mean number of diagnosed diseases (2.8 ± 1.4) than residents without dysphagia (2.3 ± 1.1 ; t -test: $p = 0.001$). Logistic regression analysis between NHAP and number of diagnosed diseases showed no statistically significant association ($p = 0.917$; OR 0.98; 95% CI 0.71–1.36, not in table). Details of other diagnosed diseases are presented in Table 4. Forty percent of the recorded diagnosed other diseases were diseases of the circulatory system, of which 31 (53%) occurred in residents with dysphagia and 117 (37%) in those without dysphagia. Ninety-nine residents (27%) had a (history of) cerebrovascular accident (CVA), of which 28 (48%) occurred in residents with dysphagia and 71 (23%) in residents without dysphagia.

Logistic regression analyses revealed no statistically significant associations between NHAP and the respective ICD-10 diseases (Table 5). Extensive variation in diseases in the ICD-10 category "Symptoms, signs not elsewhere classified" made statistical analyses impossible.

Discussion

The incidence of NHAP in this study varied between 5 and 12% and the difference between its occurrence in residents with dysphagia and those without dysphagia was statistically significant ($p = 0.046$). This finding confirms that nursing home residents with dysphagia are at a higher risk of pneumonia, as has been shown by previous studies.^{9,11,21,25} Compared to other studies, the incidence of NHAP found in this study was rather low. This relatively low incidence could be explained by differences in characteristics of the nursing

Table 1

Number, gender and mean age of the participating residents of the 3 nursing homes.

Nursing home	1	2	3	Total
Number of residents	80 (21.4%)	86 (23.1%)	207 (55.5%)	373
Men/Women	30/50	20/66	63/144	113/260
Mean age \pm sd	79.2 \pm 7.6	85.2 \pm 5.4	84.2 \pm 8.6	83.3 \pm 8.0

Table 2

Occurrence and percentage of diagnosed dysphagia and NHAP in the participating residents of the 3 nursing homes.

Nursing home	1	2	3	Total	p -value
Dysphagia	30/50 (38%)	12/74 (14%)	17/190 (8%)	59/314 (16%)	<0.001 ^a
yes/no					
NHAP	4/76 (5%)	4/82 (5%)	24/183 (12%)	32/341 (9%)	0.067 ^a
yes/no					

^a Chi-square test.

home residents of the present study, who were younger and less activities of daily living (ADL) dependent and impaired, compared to nursing home residents in another study that investigated nursing home residents in different European countries.³⁰ Lower functional status may be associated with a higher incidence of NHAP.^{3,5}

An overall lower prevalence of dysphagia (16%) was found, compared to previous studies, which found a prevalence of 21–70%.^{15,20,22,24} In addition to this relatively low overall prevalence of dysphagia, a statistically significantly higher prevalence of dysphagia (38%; $p = 0.000$) was found in nursing home 1 compared to nursing homes 2 and 3. A possible explanation for these findings is the underestimation of dysphagia in nursing homes 2 and 3. In contrast to nursing homes 2 and 3, in nursing home 1 all residents had undergone a swallowing assessment at the time of admission to the nursing home. Probably, as a result of this standard dysphagia assessment, the prevalence of dysphagia was found to be higher. The nursing homes' use of different methods for diagnosing dysphagia may have influenced the prevalence of dysphagia and therefore can be considered a study limitation. Although a standard swallowing assessment was not performed in each nursing home, the differences in incidence of NHAP between the participating nursing homes were not significant ($p = 0.067$).

To avoid under-diagnosis of dysphagia, it is suggested that bedside screening or clinical swallowing assessment by a speech therapist be introduced for each new nursing home resident. If there are doubts about the diagnosis, objective methods such as videofluoroscopy (VFS), fiberoptic endoscopic evaluation of swallowing (FEES) and oro-pharyngo-esophageal scintigraphy (OPES) can be used.³¹ However, in order to perform these tests, expensive (radiological) equipment is needed, which is not available in all nursing homes. Moreover, not all nursing home residents can be transported to a radiology department.^{27,32} VFS, FEES or OPES have especially added value to establishing the safety of swallowing and determining the effectiveness of an intervention or the cause of an inexplicable swallowing problem.

Speech therapists are challenged to deliver interventions that support autonomy, facilitate positive health outcomes and reduce risks in nursing home residents.³³ In order to decrease the risk of residents aspirating food due to dysphagia, diet modification has been suggested. Food modifications may have significant impacts

Table 3

Number of residents (%) with and without diagnosed dysphagia according to gender, NHAP, mortality, mean of age and number of medical diseases of residents in each group.

	Dysphagia	No dysphagia	p -value	Total
Number of residents	59 (16)	314 (84)		373
Women	42 (71)	218 (69)	0.787 ^a	260 (70)
NHAP	9 (15)	23 (7)	0.046 ^a	32 (9)
Mortality	12 (20)	73 (23)	0.625 ^a	85 (23)
Mean age \pm sd	82.2 \pm 9.1	83.5 \pm 7.8	0.253 ^b	83.3 \pm 8.0
Mean number of diseases \pm sd	2.8 \pm 1.4	2.3 \pm 1.1	0.001 ^b	2.3 \pm 1.1

^a Chi-square test.

^b t -Test.

Table 4
Percentage of residents (*n*) with a disease from the ICD-10 classification, overall and separated by dysphagia status.

ICD-10 classification	Dysphagia <i>N</i> = 59 %(<i>n</i>)	No dysphagia <i>N</i> = 314 %(<i>n</i>)	Total <i>N</i> = 373 %(<i>n</i>)
I. Certain infectious and parasitic diseases	–	–	0
II. Neoplasms (cancer)	5 (3)	5 (18)	6 (21)
III. Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	–	7 (5)	1 (5)
IV. Endocrine, nutritional and metabolic diseases (excl. diabetes mellitus)	3 (2)	2 (6)	2 (8)
V. Mental and behavioral disorders	9 (5)	11 (36)	11 (41)
VI. Diseases of the nervous system	31 (18)	25 (78)	26 (96)
VII. Diseases of the eye and adnexa	5 (3)	3 (2)	1 (5)
VIII. Diseases of the ear and mastoid process	2 (1)	–	0.3 (1)
IX. Diseases of the circulatory system (excl. CVA)	53 (31)	37 (117)	40 (148)
X. Diseases of the respiratory system	7 (4)	10 (31)	9 (35)
XI. Diseases of the digestive system	3 (2)	2 (6)	2 (8)
XII. Diseases of the skin and subcutaneous tissue	–	1 (4)	1 (4)
XIII. Diseases of the musculoskeletal system and connective tissue	19 (11)	8 (25)	10 (36)
XIV. Diseases of the genitourinary system	9 (5)	18 (57)	17 (62)
XVII. Congenital malformations deformations and chromosomal abnormalities	–	–	0
XIX. Injury, poisoning and certain other consequences of external causes	7 (4)	4 (13)	5 (17)
XVIII. Symptoms, signs abnormal clinical and laboratory findings not elsewhere classified	14 (8)	0.3 (1)	2 (9)
CVA	48 (28)	23 (71)	27 (99)

on residents' physical and emotional wellbeing.^{33,34} Some patients may not accept diet modification or may not adhere to the treatments identified by the interdisciplinary team. Autonomy is a primary ethical consideration that is relevant to the refusal of treatment recommendations.³⁴ Shared decision making (SDM) can

Table 5
Relation between ICD-10 classifications and NHAP by multiple logistic regression with correction for gender and dysphagia diagnosed previously.

ICD-10 classification	OR	95% CI	<i>p</i> -value
II. Neoplasms (cancer)	0.487	[0.133–1.782]	0.277
III. Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	0.279	[0.029–2.655]	0.267
IV. Endocrine, nutritional and metabolic diseases (excl. diabetes mellitus)	0.644	[0.072–5.742]	0.693
V. Mental and behavioral disorders	0.787	[0.258–2.399]	0.674
VI. Diseases of the nervous system	0.756	[0.340–1.681]	0.493
IX. Diseases of the circulatory system (excl. CVA)	1.917	[0.847–4.337]	0.118
X. Diseases of the respiratory system	0.479	[0.169–1.358]	0.166
XI. Diseases of the digestive system	0.659	[0.077–5.642]	0.704
XIII. Diseases of the musculoskeletal system and connective tissue	1.825	[0.408–8.159]	0.431
XIV. Diseases of the genitourinary system	1.210	[0.402–3.641]	0.735
XIX. Injury, poisoning and certain other consequences of external causes	0.677	[0.143–3.199]	0.623
CVA	1.335	[0.562–3.174]	0.513

be used to approach aspects of dysphagia management, such as autonomy, positive health outcomes and risk reduction.³³

In The Netherlands, it is common practice to constrain artificial nutrition and hydration in nursing home residents with dementia.³⁵ Interventions such as feeding of artificial food or fluids may not prolong survival or improve quality of life and professional care givers should respond early to (palliative) care needs, which may help to improve comfort.^{35–37}

In the management of dysphagia and what to do when an aspiration pneumonia occurs, advance care planning (ACP) is essential for including residents' personal values and preferences in their (palliative) care needs.³⁸ ACP interventions have been shown to increase concordance between preferences for care and the care that is delivered.³⁹ These factors suggest that ACP and SDM are needed for managing the ethical dilemmas that arise in providing care for nursing home residents with dysphagia.^{33,34}

The multiple logistic regression analysis showed no statistically significant diseases or conditions, that were associated with the incidence of NHAP. This meant that a medical risk profile based on ICD-10 codes could not be established. A possible explanation for not establishing a medical risk profile based on ICD-10 codes is the wide variety of diseases and conditions that was found in these residents. In general, nursing home residents have an extensive prevalence of chronic health problems, with a wide range of diseases and conditions in different patterns.^{40,41} A better understanding of the epidemiology and the complexity of multimorbidity is necessary for developing adequate (multi-professional) interventions.⁴²

This study shows several limitations and strengths. One limitation is that this study was performed in one country with a specific health care system this might bias the outcomes. Moreover, only three Dutch nursing homes participated, which were selected on the basis of convenience. In addition the retrospective character of the study meant that no inter-rater and intra-rater reliability test and calibration with the local speech therapists were possible, which might have revealed differences in diagnosing dysphagia. The external validity of the outcomes is therefore considered limited. The retrospective character of this study also makes it difficult to determine whether the diagnoses of pneumonia and dysphagia were all based on clear and unambiguous criteria.

One of the strengths of this study was that data were extracted from medical electronic files covering three different examination periods. Thus, these results were less subject to a possible disease outbreak in the given period. Furthermore, these data were collected from residents of three different nursing homes, which offer a broader perspective on dysphagia and pneumonia among nursing home residents. Despite the limitations of the present retrospective study, outlines of daily practice of nursing home care concerning dysphagia and NHAP were given, which made proposals for certain care improvements possible.

Early dysphagia assessment may contribute to preventing death. On top of that, dysphagia is mostly present in cases of a great number of comorbidities, which can lead to increased risk of mortality.⁴³ Nurses and other medical professionals have to be aware of these factors in order to improve their early recognition and prevention of dysphagia and NHAP. Overall, it can be concluded that the presence of dysphagia can be seen as a risk factor of NHAP.

Conclusion

Dysphagia was found to be a risk factor for NHAP. Awareness of the signs of dysphagia by nurses and other care providers is important for the early recognition and management of dysphagia and prevention of NHAP.

Ethical approval

Ethical approval for this retrospective data analysis was received from the medical ethical committees of Amstelring Zorggroep and Birkhoven Zorggoed.

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Conflict of interest

The authors declare no conflict of interest.

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