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Outcomes in elderly Danish citizens admitted with community-acquired pneumonia. Regional differencties, in a public healthcare system

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Summary
Objectives: To evaluate regional differences in and risk factors for admission, length of stay, mortality, and readmission for community-acquired pneumonia in elderly Danish patients.
Methods: National registry study on elderly Danish citizens with an acute admission in 2009 owing to community-acquired pneumonia. We studied differences among hospitals in length of stay, in-hospital mortality, mortality within 30 days of discharge, and readmission within 30 days after discharge using Cox regression models with adjustments for age, sex, ventilatory support, and co-morbidity by Charlson's index score.
Results: A total of 11,332 elderly citizens were admitted with community-acquired pneumonia. Mortality during admission and 30-days from discharge were 11.6% and 16.2%, respectively. Readmission rates within 30 days of discharge were 12.3%. There were significantly differences between hospitals in length of stay. A high Charlson index score and advanced age were significantly risk factors for death during admission and within 30 days of discharge. Male sex and high Charlson index score were significant risk factors for readmission. Admission to large bed capacity hospital was a significant risk factor for death and readmission within 30 days of discharge.

Abbreviations: CAP, Community-acquired pneumonia; HR, Hazard ratio; ICD, International Classification of Diseases; LOS, Length of stay; NIV, Non-invasive ventilation; SIR, Standardized incidence rate.

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Conclusions: Length of stay, rate of admission, mortality and readmission in elderly Danish patients with community-acquired pneumonia follows international findings. There are regional differences between hospitals. In depth investigation in regional differences could reveal potential feasible clinical interventions with an improvement of readmission-, mortality rates and cost.

Introduction

In industrialized countries, the population of elderly (aged ≥65 years) is growing, and the number of chronic diseases is rising.[1] This is an economical- and capacity-challenge for all parts of the health service. Community-acquired pneumonia (CAP) is one of the five main reasons for acute admission[2] and the third main reason for acute readmission[3] in elderly Danish citizens. The incidence and admission rates for CAP are rising.[4,5] Admission comprises up to 90% of all expenses for CAP.[6] For CAP, as for other acute diseases, the presence of co-morbidities poses a challenge to length of stay (LOS), readmission and costs. We have only found few publications addressing the impact of admission for CAP on mortality and readmission in elderly persons who have multiple co-morbidities.[7–10] Even though treatment of CAP follows international recommendations outcomes can differ between hospitals due to different management of the complexity of the older medical patient.[11,12] National evaluation of the clinical management of the older patients with CAP and their outcomes are essential for identification of potential feasible interventions with improvement of mortality, readmission and cost effectiveness.

We hypothesis that volume of CAP admissions, hospital size and hospital administration have impact on the management of the older medical patient with CAP.

Patients and methods

Setting

Denmark has a public healthcare system, which provides feeless, tax-paid treatment for primary medical care, hospitals, and homecare services uniformly for all citizens. The few Danish privately-funded hospitals have no acute patient intake. The hospitals in Denmark are organized within five regions with decentralised administration. All hospitals are obligated to pass a national accreditation program "The Danish Healthcare Quality Programme".

All citizens in Denmark have a unique civil registry number, which makes it possible to follow citizens in different national registers. Moreover, the hospitals are paid for delivering information about their admissions to the National Patient Registry, which enables information to be gathered about all admissions to Danish hospitals. This information includes diagnosis for the primary cause of admission and co-morbidities, which are recorded using the International Classification of Diseases (ICD) system. The ICD-10 was used in 2009.

The guidelines for treating CAP are set by the Danish Society of Respiratory Medicine, and follow international recommendations.[13–15]

Population

We identified all admissions for patients aged ≥65 years, where pneumonia (ICD10; DJ09.0—DJ18.9 but excluding pulmonary mycosis: DJ17.2C and DJ17.2; and viral pneumonia, DJ12.2, DJ12.8, DJ12.9 and DJ17.1) was the primary cause of admission in 2009 in Denmark. Only acute admissions were recorded, and only the first admission for pneumonia for each patient was used for indexing.

The following information was recorded from the National Patient Registry: age, sex, admission and discharge dates, hospital, municipality of the patient, primary cause of admission, co-morbidities, date of first acute readmission within 30 days of discharge, and ventilatory support by invasive and/or non-invasive ventilation (NIV). Two admissions occurring less than one day apart were recorded as one admission so as not to overestimate the number of readmissions. If the patient was transferred to another hospital, the admission was recorded for the hospital where the patient was first admitted. Data regarding death during admission and within 30 days after admission and discharge were recorded in the Danish Civil Registration.

The Charlson index score was calculated to determine the number and impact of co-morbidities. The Charlson co-morbidity index was developed to predict mortality, and consists of 17 indicators, each representing a disease group with a significant mortality risk, and a score representing the risk severity.[16] The ICD-10 codes were transformed to the 17 disease groups, using the method of Quan et al. 2005.[17] All Charlson index scores >4 were categorized as being equal to 4.

When naming the hospitals, two letters were used, the first identifying the region in which the hospital was placed, and the second identifying the specific hospital within the region.

Statistical methods

Descriptive unadjusted comparisons between hospitals were made graphically for LOS for patients who survived to discharge (Fig. 1), death during admission, death within 30 days from discharge for patients who survived to be discharged, death within 30 days from admission for all patients (Fig. 2), and finally readmissions within 7, 14, and 30 days after discharge (Fig. 3).