An Early Screening Tool for Discharge Planning Shortened Length of Hospital Stay for Elderly Patients with Community-Acquired Pneumonia

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Abstract

Background: Community-acquired pneumonia is one of the most common diseases in elderly persons and usually results in a prolonged hospital stay. Discharge planning plays an important role in reducing the length of hospitalization. This study was designed to determine whether early screening for risk factors for delayed discharge could improve the quality of discharge planning.

Methods: This retrospective, observational study was conducted in two medical facilities from January 2016 to December 2018. Hospital A used a screening tool on admission (screening group): screening for risk factors for delayed discharge and initiating discharge planning immediately for those for whom it was applicable, and discharge planning in the stable phase for those for whom it was not applicable; and Hospital B initiated discharge planning without screening (usual group). Propensity score-matched pneumonia patients in the two groups were then compared. The primary outcome was length of hospital stay.

Results: A total of 648 patients were enrolled in this study. After adjusting for age, sex, aspiration, comorbidity, pneumonia severity index, and key person, 118 pairs underwent analysis. Length of stay was significantly different (20 days vs 13 days, p<0.001) between the groups. There were no differences in duration of antibiotic treatment, in-hospital mortality, and 30-day readmission (9 days vs 9 days, p=0.744; 10 (8.5%) vs 10 (8.5%), p=1.000; 10 (8.5%) vs 9 (7.6%), p=0.811, respectively).

Conclusions: Early screening for delayed discharge improved the quality of discharge planning by reducing the length of stay in pneumonia patients.

Background

People worldwide are living longer, and the proportion of the world’s population over 60 years of age is predicted to nearly double by 2050. The aging of populations around the world has been associated with increases in morbidity and mortality attributable to lung diseases [1]. The annual incidence of community-acquired pneumonia (CAP) in the United States has recently been estimated as 248 cases per 10,000 adults [2].

Most patients who die from pneumonia are elderly, whereas surviving patients face the additional problem of decreased functional status. Functional decline may lead to an increased need for services, lower levels of autonomy, readmission to hospital, or nursing care facility admission [3]. Approximately one-fifth of all hospital discharges are delayed for non-medical reasons such as complex social needs, preparation of applications for facility placement, and discharge destination planning [4]. Discharge planning (DP) promotes safe and timely transfer of patients between levels of care and across care settings, especially during patient discharge from a hospital or skilled-nursing facility to a home or community setting, decreasing length of stay (LOS) and hospital readmission [5,6].

A discharge plan should usually be developed by a registered nurse (RN), social worker, or other appropriately qualified personnel, and it should be initiated as soon as possible after admission. Impeding timely and secure DP are high workloads of RNs [7]. The patient's discharge destination plays an important role in increased LOS, since DP for facility placement can require more planning and coordination by hospital staff than a discharge directly home [8]. This study was designed to determine whether early screening for risk factors for delayed discharge could improve the quality of DP in pneumonia

Methods

This was a retrospective, observational study of inpatients admitted to a community-based hospital and a teaching hospital in Japan from January 2015 to December 2018. This study was approved by the institutional review boards of the Yokohama City University and Kanto Rosai Hospital (reference numbers: B190600008 and KR2018-29, respectively) and conformed to the provisions of the Declaration of Helsinki (as revised in Brazil 2013). Written informed consent was obtained from participants before starting the study.

Patients in the two hospitals were enrolled in this study. In Hospital A, a screening tool for risk factors for delayed discharge was used on admission. DP was initiated immediately for those who were at risk of delayed discharge, with DP in stable condition for patients without a risk of delayed discharge; this was the screening group. In Hospital B, DP was performed without screening; this was the usual group.

The screening tool for risk factors for delayed discharge is shown in Table 1. There were 23 minor items for the major items 1 to 6 and 7 minor items for major items 7 to 8. Patients with 3 or more minor items that were from major items 1 to 6, or even only 1 minor item from major items 7 to 8 were identified as at risk of delayed discharge.

Patients

All enrolled cases had been diagnosed with CAP according to the definitions of the American Thoracic Society/Infectious Diseases Society of America guideline [9]. Patients who fulfilled all of the following inclusion criteria were enrolled in the study: 1) age >64 years; 2) symptoms compatible with pneumonia (e.g., fever, cough, sputum, pleuritic chest pain, or dyspnea); and 3) appearance of new pulmonary infiltrates consistent with pneumonia on chest X-ray or computed tomography. To ensure that all eligible cases were enrolled, the study investigators screened the hospital database for International Classification of Diseases, 10th revision (ICD-10) codes and reviewed hospital medical records.

Exclusion criteria

Cases of healthcare-associated pneumonia (HCAP) and hospital-acquired pneumonia (HAP) were excluded [10].

Outcomes

The primary outcome was the LOS. Demographic information, comorbidities, pneumonia severity index (PSI) [11], duration of antibacterial treatment, waiting duration (duration between the end of antibacterial treatment and discharge), in-hospital mortality, site of acquisition for survivors, and all-cause 30-day readmission in the same hospital were also collected. Comorbidities were identified according to the Charlson Comorbidity Index (CCI) [12]. The PSI score was calculated based on data obtained at the time of admission.

Statistical analyses

The results are presented as numbers and percentages or medians and interquartile ranges unless otherwise indicated. Groups were compared using Wilcoxon rank-sum tests. In order to reduce bias affecting LOS, population demographics and characteristics of patients in the two hospitals were compared. Propensity score matching was performed for age, sex, aspiration, CCI, PSI, and key person in order for the standardized differences of all matching factors to be less than 0.25 in matched pairs [13]. The effect of DP was analyzed in propensity score-matched pairs by adjusting for age, sex, aspiration, CCI, PSI, and key person. In all instances, two-tailed values of $p<0.05$ were considered significant. Data analysis was performed using JMP software (version 15.0; SAS Institute, Cary, NC).

Results

A total of 1,866 patients diagnosed with pneumonia were identified. Of these, the following were excluded: 278 due to age <65 years; 612 due to outpatient treatment; 113 due to HCAP or HAP; and 203 due to incomplete data. Of the 648 cases, 118 matched pairs in two groups were included in the study after propensity score-matching based on age, sex, aspiration, CCI, PSI, and key person (Figure 1).

Before matching, the participants were 433 men (64.8%) and 215 women (35.2%), with a median age of 76 years (68–83 years), as shown in Table 2. The background characteristics of these patients are summarized in Table 1. Age, aspiration, rate of enrollment in rehabilitation, CCI, PSI, and key person were significantly different. Sex, BMI, and dementia were not significantly different between the two hospitals. Patients in hospital B were younger than in hospital A, but patients in hospital A had higher categories of CCI and PSI and, thus, higher hospital mortality (5.2% vs 10.8%, respectively; $p<0.001$).

Detailed information for the matched pairs is shown in Table 3. The standardized difference of all variables was less than 0.25, and matching was considered to be effective. LOS was longer in the usual group than in the screening group (19.5 days vs 13 days, respectively; $p<0.001$). The duration of antibacterial treatment (9 days vs 9 days, respectively; $p=0.744$) and in-hospital mortality (8.5% vs 8.5% respectively; $p=1$) showed no significant differences between the two groups. Among survivors, patients showed a high rate of discharge home in the screening group (57.4% vs 63.9%, respectively; $p<0.001$, overall). The screening group showed lower medical costs due to reduced LOS ($5476 vs $4985, respectively; $p=0.035$). The all-cause 30-day readmission rate was not significantly different (8.5% vs 7.6%, respectively; $p=0.811$). There were 77 (65.2%) patients at risk of delayed discharge, and most of them were due to acute respiratory infections, unplanned admission, and households of older couples.

The wait times between end of antibacterial treatment and discharge to different destinations are shown in Table 4. The wait times for discharge to home, nursing home, facility, and hospital were significantly different between the two groups (8 vs 2, 9 vs 4, 30 vs 9, and 35 vs 11, respectively, $p<0.001$, each).

Discussion

In this retrospective, case-controlled trial, LOS was significantly lower when a screening tool for DP was used on admission, whereas duration of antibacterial treatment and in-hospital mortality were not significantly different between the two groups. After propensity score-matching, the differences in background characteristics, treatments, and outcomes of CAP patients between the two groups were almost eliminated, and the reduction of LOS in the screening group seemed reliable. This finding was consistent with previous studies showing that DP started at the beginning of hospitalization plays a key role in increasing efficiency and improving quality of life for vulnerable elderly persons needing continuity of care [14,15].

Patients in the screening group had an increased rate of discharge home overall, without an increased rate of all-cause 30-day readmission. One high-quality way to deal with the demand for hospital beds is to reduce LOS by discharging people early to receive health care at home with lower rates of 30-day hospital readmission [16,17]. Using a screening tool for DP might be an effective tool to meet the two demands of reduced LOS and a low readmission rate as usual DP. Wait times were shorter in the screening group than in the usual group for all 4 categories of discharge destinations. Improving hospital patient flow is important to optimize the use of limited healthcare resources efficiently and minimize iatrogenic adverse events, and it may ensure patient-centered care [18]. A screening tool for DP would make the transition of care from the hospital to the next destination more effective.

Immediate DP was initiated in about 65% of patients in the screening group with risk factors for delayed discharge. Focusing on these patients could make DP more effective than initiating DP for all patients at admission. Patients without a risk of delayed discharge underwent DP in a stable condition. This could reduce the burden of nurses doing all of the work at one time on admission, since nursing is a stressful occupation, especially with increasing amounts of overtime [19,20]. It is important to focus on the work environment of nurses to improve their job satisfaction and retention, and thereby decrease healthcare costs by increasing efficiency [21].

Limitations

Some limitations to this study need to be considered when interpreting the present results. First, this study was limited to two medical facilities, and quality of DP might differ in the two facilities. Second, only CAP patients were included, and DP for HCAP or HAP is also important for elderly patients, but it was not examined. Third, there were other factors that could affect DP that were not included in this study, such as exercise, social issues, and economic situation. Fourth, the sensitivity and specificity of screening tools for delayed discharge were not evaluated.

Conclusions

Early screening for delayed discharge could improve the quality of DP by reducing LOS in pneumonia patients.

Abbreviations

CAP: community-acquired pneumonia; DP: Discharge planning; RN: registered nurse; ICD-10: International Classification of Diseases, 10th revision; HCAP: healthcare-associated pneumonia; HAP: hospital-acquired pneumonia; CCI: Charlson Comorbidity Index; PSI: Pneumonia Severity index; DOC: disorder of consciousness; BMI: body mass index; CI: confidence interval.

Declarations

Ethics approval and consent to participate

Ethical approval for the study was obtained from the institutional review boards of Yokohama City University and Kanto Rosai Hospital (reference numbers B190600008 and K2018002, respectively).

Consent for publication

Not applicable.

Availability of data and material

The raw data are available by email on reasonable request to the corresponding author.

Competing interests

The authors declare that they have no competing interests.

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Authors’ contributions

HC, YH, and NH conceived the study and participated in its design. YS did the main statistics. HC, YH, NH, YS, and TK did critical reviews of the whole manuscript. HC interpreted the data and was a major contributor to writing the manuscript. All authors read and approved the final manuscript.

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Tables

Table 1. Checklist of risk factors for delayed discharge

Major items	Minor items			
1. Disease/medical condition	☐	Terminal stage of malignant disease		
	☐	Acute respiratory infections such as aspiration pneumonia		
	☐	dementia		
	☐	Cerebrovascular disease		
	☐	Diseases/conditions result in ADL decline or continuous medical treatment		
2. Hospitalization	☐	Readmission within 1 month		
	☐	Unplanned admission		
3. Family structure	☐	Living alone		
	☐	Households of older couples (generally, over 75 years of age)		
4. Activities of daily living	☐	Nursing or support will be required at discharge		
	☐	Insufficient self-care		
5. Nursing status at home	☐	Care services necessary but not applied		
	☐	No caregiver		
	☐	Caregivers was fatigued, or no desire to care		
	☐	Caregivers' care skill was inadequate		
	☐	Home visit doctor/nursing is required		
6. Continued medical treatment required	☐	Ventilator	☐	Parenteral nutrition
	☐	Tracheostomy	☐	Home oxygen therapy
	☐	Self-injection	☐	Tube feeding
7. Economic situation	☐	Uninsured		
	☐	Worried about paying medical expenses		
	☐	Worried about living expenses		
8. Social issues	☐	Child/elderly abuse	☐	Unspecified address
	☐	Absence of discharge destination	☐	Absence of key person
Early discharge planning performed if 3 or more minor items from major items 1 to 6 were applicable, or even 1 minor item from major items 7 to 8.				

Table 2. Population demographics, characteristics, and outcomes of the two groups				
	Total	**Usual group**	**Screening group**	
	n=648	n=325	n=323	p-value
Age (yearr)	76(68-83)	79(71-84)	73(66-81)	<0.001
Male/Female	433/215	1113/212	102/221	0.389
BMI	19.3(16.6-22.3)	18.7(16.5-22.1)	19.6(16.9-22.4)	0.220
Dementia	71(11.0%)	41(6.3%)	30(4.6%)	0.175
Bedsore	16(2.5%)	6(0.9%)	10(1.5%)	0.305
Aspiration	135(20.8%)	38(5.9%)	97(15.0%)	<0.001
CCI score				<0.001
≤1	198(30.6%)	135(41.5%)	63(19.5%)	
2	191(29.5%)	100(30.8%)	91(28.2%)	
≥3	259(40.0%)	90(27.7%)	169(52.3%)	
PSI category				<0.001
II	57(8.8%)	38(11.7%)	19(5.9%)	
III	128(19.8%)	107(32.9%)	21(6.5%)	
IV	259(40.0%)	143(44.0%)	116(35.9%)	
V	204(31.5%)	37(11.4%)	167(51.7%)	
DOAT	9(7-12)	8(7-12)	9(7-13)	0.135
LOS	15(9-24)	16(10-27.5)	13(9-22)	<0.001
Survived				0.011
At home	381(63.9%)	198(64.3%)	183(63.5%)	
Nursing home	121(22.3%)	74(24.0)	47(16.3%)	
Facility	50(8.4%)	19(6.2%)	31(10.8%)	
Hospital	44(7.4%)	17(5.5%)	27(9.4%)	
In-hospital mortality	52(8.0%)	17(5.2%)	35(10.8)	0.009
Key person				<0.001
Children	250(38.6%)	167(51.4%)	83(25.8%)	

Spouse	324(50.1%)	127(39.1%)	197(61.2%)
Others	73(11.3%)	31(9.5%)	42(13.0%)

BMI, body mass index; CCI, Charlson Comorbidity Index; PSI, Pneumonia Severity Index; DOAT: duration of antibiotic treatment; LOS: length of stay

Table 3. Matched pairs in the two groups				
	Usual group	**Screening group**		
	n=118	n=118	p-value	std-diff
Age (year)	79(70-83)	76.5(67-84)	0.268	0.145
Male/Female	87/31	75/43	0.092	0.219
Aspiration	24(20.3%)	25(21.2%)	0.873	0.021
CCI			0.161	
≤1	42(35.6%)	45(38.1%)		0.052
2	27(22.9%)	37(31.4%)		0.192
≥3	49(41.5%)	36(30.5%)		0.231
PSI score			0.175	
II	6(5.1%)	12(10.2%)		0.193
III	14(11.9%)	17(14.4%)		0.074
IV	66(55.9%)	53(44.9%)		0.221
V	32(27.1%)	36(30.5%)		0.075
Key person			0.971	
Children	46(39.0%)	47(39.8%)		0.016
Spouse	61(51.7%)	61(51.7%)		0
Others	11(9.3%)	10(8.5%)		0.028
LOAT (day)	9(7-14)	9(6-12)	0.744	0.043
LOS (day)	19.5(11-32)	13(8-22)	<0.001	0.410
Survived			0.011	
At home	62(57.4%)	69(63.9%)		0.133
Nursing home	35(32.4%)	17(15.7%)		0.398
Facility	4(3.7%)	12(11.1%)		0.286
Hospital	7(6.5%)	10(9.3%)		0.104
In-hospital mortality	10(8.5%)	10(8.5%)	1.000	0
Readmission	10(8.5%)	9(7.6%)	0.811	0.033
Early discharge	Not applicable	77(65.2%)		

Cost (▯)	5476 (3830-8299)	4985 (3542-7295)	0.035	0.282

std-diff: standardized difference; CCI, Charlson Comorbidity Index; PSI, Pneumonia Severity Index; LOAT: length of antibiotic treatment; LOS: length of stay

Table 4. Details of waiting time after antibacterial treatment for different discharge destinations

	Usual group	Screening group	p value
Home (day)	8(3-15)	2(1-5)	<0.001
Nursing home (day)	9(2-17)	4(2-10)	<0.001
Facility (day)	30(7-23)	9(1-23)	<0.001
Hospital (day)	35(12-59)	11(2-24)	<0.001
Overall (day)	9(2-17)	2(1-9)	<0.001

Figures

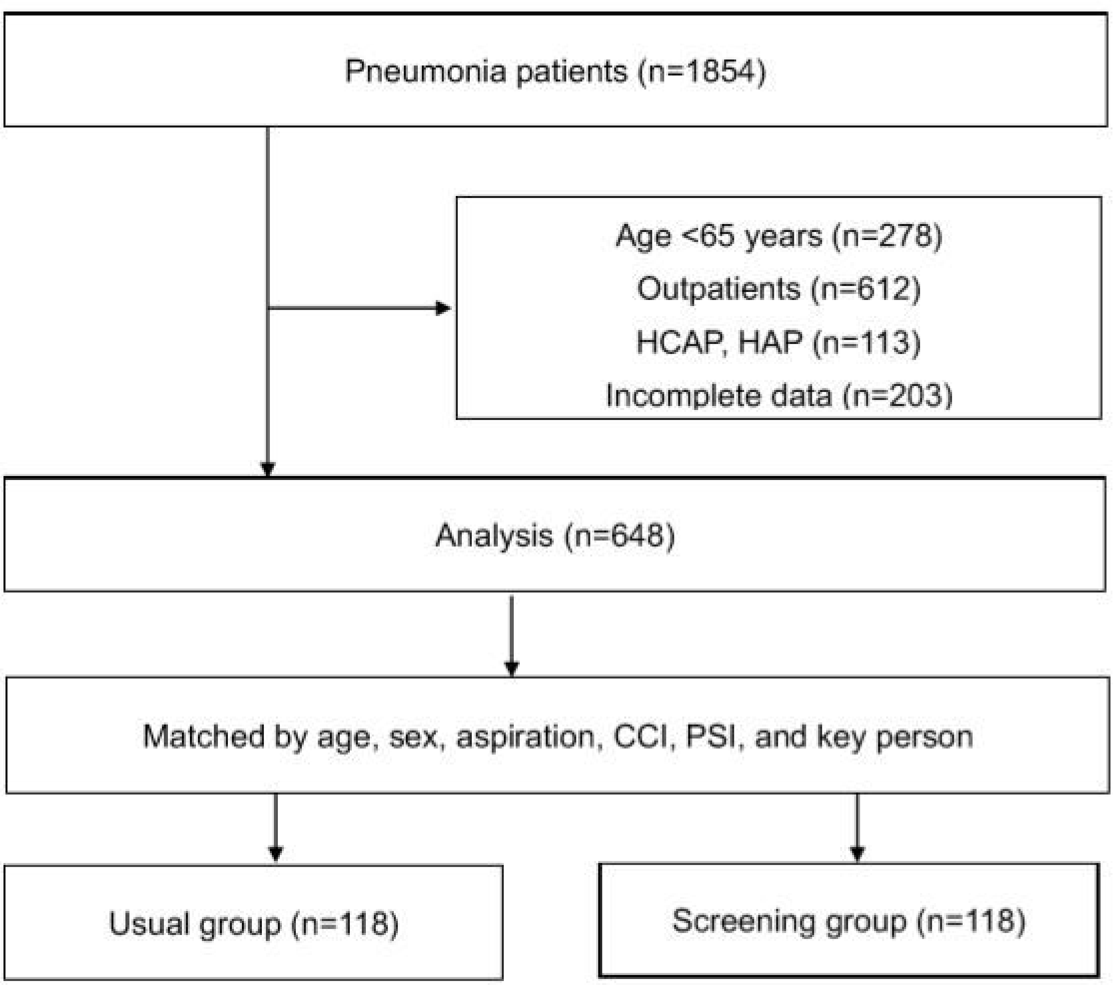

Figure 1

Flowchart of the study HCAP, healthcare-associated pneumonia; HAP, hospital-acquired pneumonia; CAP, community-acquired pneumonia.

Supplementary Files

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