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Original Article

Pleural infection – An indicator of morbidity and increased burden on health care

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Visual abstract

Key question

What is the prognosis following pleural infections during extended follow-up?

Key findings

Patients have high mortality rates and represent a significant burden for health care.

Take-home message

The development of pleural infection is an indicator of consequential morbidity and inferior prognosis.

Abstract

Objectives: Patients with pleural infections frequently have several comorbidities and inferior long-term survival. We hypothesized that these patients represent a vulnerable cohort with high rates of hospitalization and frequent use of healthcare services. The study aim was to ascertain the need for and causes of treatment episodes after pleural infections during long-term follow-up.

Methods: Patients treated for pleural infections at Tampere University Hospital between January 2000 and December 2008 (n=191, 81% male, median age 58) were included and compared to a demographically matched population-based random sample of 1,910 controls. Seventy percent of the pleural infections were caused by pneumonias and 80% of the patients underwent surgery. Information regarding later in-hospital periods and emergency room and out-patient clinic visits, as well as survival data were obtained from national registries and compared between patients and controls.

Results: Patients treated for pleural infections had significantly higher rates of hospitalizations (8.19 vs 2.19), in-hospital days (88.5 vs 26.6), emergency room admissions (3.18 vs 1.45), out-patient clinic visits (41.1 vs 11.8), and procedures performed (1.26 vs 0.55) per 100 patient-months when compared to controls during five-year follow-up, in addition to having increased mortality (30% vs 11%), $p<0.00001$ each. Particularly episodes due to respiratory and digestive diseases, malignancies, and mental disorders were more frequent. The patients' comorbidities, such as alcoholism or chronic pulmonary disease, were associated with more frequent use of health care services.

Conclusions: Patients treated for pleural infections have high rates of hospitalizations, emergency room admissions, and out-patient clinic visits during follow-up.

Keywords: empyema; infection; pleura

Introduction

The incidence of pleural infections, mostly caused by pneumonias, has been increasing and the disease causes a significant burden on health care [1–3]. Other important etiologies include cancer, trauma, and iatrogenic causes [4–6]. Pleural infections may be successfully treated with antibiotics and drainage, but they also often require surgery [6,7]. Contemporary patients have several comorbidities and an inferior prognosis [1,8,9]. The long-term outcomes of these patients have not been thoroughly described. We hypothesized that, due to the high rates of comorbidities, these patients represent a vulnerable cohort that is a significant burden on the health care system. The objective of the present study was to ascertain the need for and causes of in-patient and out-patient hospital treatment in patients treated for pleural infections during long-term follow-up and to compare them to those of demographically matched controls.

Material and Methods

This study followed the ethical principles of the Declaration of Helsinki and was approved by the institutional review board (24th January 2017, institutional review board approval number R17506). All adult patients both surgically and conservatively treated for pleural infections at Tampere University Hospital, between January 2000 and December 2008 were included in the study. Tampere University Hospital is a tertiary academic referral center and the second largest hospital in Finland with a catchment area exceeding one million residents. Over the study period, the study center provided approximately 60,000 hospitalizations and more than 200,000 in-hospital days annually and was the only center with comprehensive on-call thoracic surgery services in the hospital district. The patients were identified from the institutional database by retrieving all cases associated with code 'J86' or any subclass thereof, in the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10). The required data was collected by reviewing the medical records and laboratory results of each patient. The clinical picture of a pleural infection, as well as radiological and/or perioperative findings and results indicating an infection from the pleural fluid sample (pH <7.2, lactate dehydrogenase level >1,000 IU/L, and/or positive bacterial stain or culture) were required to confirm the diagnosis of a pleural infection.

This study comprised patients with grade II and III pleural infections according to the American Thoracic Surgery classification [10]. The clinical course of the disease was recorded, including the type of treatment given. A random sample of 10 age-, sex-, and location of residence–matched controls from the Finnish population were obtained for each study patient, as were the survival rates for patients and controls, from the Finnish Population Register Center, a national registry that also provides large demographically matched control materials for research purposes. The number and length of hospitalizations, the frequency of visits to the emergency department and outpatient clinics, the numbers and types of procedures performed, as well as the diagnosis codes associated with the episodes occurring after the first in-hospital day of the treatment episode for pleural infections and the corresponding index date in controls, were obtained from the National Institute for Health and Welfare database that contains data on all treatment episodes in

specialized medical care in Finland. The follow-up lasted until the 31st of December 2016. Episodes that occurred or began within 30 days after the treatment of a pleural infection were excluded.

The main objective of the study was to ascertain the rates and types of later treatment periods of patients with pleural infections, occurring within five years of the initial hospitalization, and to compare them to those of the controls. The secondary objectives of the study were to describe the diagnoses related to the treatment episodes and the types of procedures performed during follow-up, as well as to define patient-specific risk-factors. The cumulative total number of in-hospital periods, emergency room admissions, out-patient clinic visits, in-hospital days and procedures performed, as well as the cumulative follow-up patient-time and corresponding patient-time rates with 95% confidence intervals, were calculated. The patient-time rates of both all patients and those with pneumonia-related pleural infections were compared to those of the controls. Statistical analysis was performed with IBM SPSS for Windows statistical software version 24.0 (IBM Corp. Armonk, New York, US). To correct for multiple testing, the Bonferroni correction was applied: to control for a total of 82 tests, the statistical significance was set at $p<0.05/82$, i.e. $p<0.00061$. The Chi-Squared and Fisher's Exact tests were used for categorical variables and the Mann-Whitney U-test for non-normally distributed variables.

Results

The study material comprised a total of 191 patients and 1,910 matched controls—81% male and a median age of 58 years—with available follow-up data. The median follow-up time in the study was 134 months (range 96–203, interquartile range 109–159) and the cumulative total number of person years under follow-up was 1,767 for patients and 18,297 for controls. The demographics and comorbidities of included patients as well as the causes of pleural infections are shown in Table 1. Eighty percent of patients underwent surgical treatment, and 20% were treated conservatively, with or without chest tube drainage. Surgery was performed through open thoracotomy in 92% and by video-assisted thoracic surgery in 8% of the surgically treated patients.

The surgical procedures entailed simple canalization in 16%, canalization and decortication in 38%, and more extended procedures, such as lung and/or thoracic wall resections, pleurectomies, or open fenestrations in 46% of the cases. In 55% of the patients who were operated on, chest tube drainage was attempted before referral for surgery. The mortality rates of patients at one, three, and five years were 15%, 24%, and 30%, respectively, while the corresponding rates for controls were 2.3%, 6.8%, and 11% ($p<0.00001$ each), respectively.

The rates of hospitalizations, in-hospital days, emergency room admissions, and out-patient clinic visits during the follow-up among patients and controls are shown in Table 2, while the associated diagnosis codes and the types of procedures that were performed are presented in Table 3. The overall rates of each type of treatment episode that were analyzed were significantly higher in patients than in controls. Particularly episodes associated with respiratory and digestive system disorders as well as psychiatric causes were more frequent. Malignancy-related episodes were more common in patients when analyzing all cases, but there were no significant differences when only cases with pneumonia-associated pleural infections and controls were compared. A significantly higher number of procedures, particularly those involving the chest, were also performed on patients than on controls. Treatment episodes associated with pleural infections accounted for less than 2% of all episodes during the follow-up, with no significant differences between patients and controls. The associations of patient characteristics with later treatment episodes are shown in Table 4. Particularly the rates of hospitalizations and in-hospital days were significantly higher in patients of an advanced age or with comorbidities, such as alcoholism and cardiovascular or chronic pulmonary diseases.

Discussion

Thoracic empyema affects up to 65,000 patients each year in the US and the UK, causing an estimated annual cost of 500 million dollars [11]. The long-term outcomes of these patients and the burden they subsequently inflict on the health care system is poorly described in the current

literature. In this study, we report significantly higher rates of hospitalizations, in-hospital days, emergency room visits, and out-patient clinic visits among these patients when compared to demographically matched controls in long-term follow-up. In addition, we describe the causes of the later treatment episodes.

The most frequent causes of emergency room admissions and hospitalizations in patients with pleural infections were respiratory diseases, indicating a significant and consequential corresponding disease burden in these patients. Previously, chronic pulmonary diseases and smoking have been reported to be common in patients with pleural infections [1,12]. While the number of procedures performed during follow-up was relatively low, those involving the chest were more frequent among patients. Digestive disease–related treatment periods were also more numerous. In a previous study, which described the long-term survival and causes of death of these patients in more detail, we have shown that malignancy-associated and digestive disease–related deaths were significantly more common in patients with pleural infections when compared to controls [9]. It would seem that definitive curative treatment of the pleural infection was well achieved in the majority of study patients, as later treatment episodes associated with pleural infections were rare even in long-term follow-up. More contemporary treatment with, for example, a higher proportion of video-assisted surgery may not significantly affect the number of later treatment episodes, as they appeared to be related to the patients' other morbidities.

The proportion of surgically treated patients in our series was quite high compared to other reports most likely due to local treatment protocols and customs as well as a degree of patient selection, as those who were not good candidates for surgical treatment were probably not referred from the district hospitals [4,7]. Also, some programs frequently utilize pleural space lysis to avoid surgery, which, in turn, was rarely performed in our hospital. The benefits of pleural lysis are controversial, and some authors argue that better short-term results might be achieved by primary treatment with surgery [6,13–15]. In the present study conservative treatment with or without chest drainage was associated with an increased number of in-hospital days during follow-up, probably reflecting a higher overall disease burden and morbidity among the patients in whom conservative treatment was chosen in our series. All in all, some caution is warranted in the

interpretation of our results, as our material and results are more representative of patients with pleural infections that require surgical treatment than of cases that can be treated conservatively.

Since the vast majority of later treatment periods were unrelated to pleural infections, the increased use of health care services among patients with pleural infections was probably mostly due to a higher prevalence of consequential comorbidities, overall frailty, and perhaps immunodeficiencies among these patients—a likely reason for the development of pleural infections in the first place and for which the onset of the pleural disease might serve as a surrogate marker. The long-term prognosis of these patients appears to be severely impacted as well [8,9]. Importantly, the prevalence of active smoking was exceedingly high in patients when compared to the general public [16]. Not surprisingly, alcoholism was associated with frequent visits to the emergency department and a higher hospitalization rate among patients. Overall, alcoholism is common in patients with frequent admissions to the emergency department [17], and the prevalence of alcohol-related emergency room visits has been increasing [18,19]. While advanced age and most comorbidities appeared to be associated with higher rates of later hospitalizations in pleural infection patients, smoking did not, somewhat surprisingly, appear to increase the risk, possibly due to limited statistical power in the subgroup analyses. Interestingly, mental disorders were a frequent cause of both out-patient clinic visits and hospitalizations in patients with pleural infections. We suspect that this is probably related to the lower socioeconomic status and substance abuse of these patients. Alcoholism and drug abuse have been prevalent in earlier studies as well [5,12].

The most significant limitations of this study were its retrospective and single-center setting. The number of included patients as well as their poor prognosis, particularly in some subgroups, limit the feasibility of some secondary analyses. Some conservatively treated patients may have been missed, which limits the generalizability of our results. The treatment protocols have evolved since the inclusion of patients for the present study, which may impact the outcomes of contemporary patients. Differences in health care systems must be borne in mind when considering our results in other countries. The control group was included to allow comparisons with a presumedly standard population with matching demographics and to better illustrate the degree of long-term morbidity

in pleural infection patients. While the exact numbers of comorbidities in the control group were not available for analysis, they should, due to the large and random sample, accurately reflect the standard population with an average prevalence of comorbidities and not only completely healthy individuals. The strengths of the study entail the inclusion of a cohort of consecutive patients, both surgically and conservatively treated, encompassing a nigh-decade experience in a university hospital, the accurate registries available in our country, and a lengthy follow-up time.

Conclusion

We report that patients treated for pleural infections are a significant burden on health care even after successful treatment of the disease, with a clearly higher rate of later in- and out-patient treatment periods and an inferior prognosis when compared to matched controls. The most frequent indications of later treatment and follow-up were respiratory, digestive, and psychiatric diseases. The morbidity and frailty of these patients should be considered when planning their treatment and follow-up.

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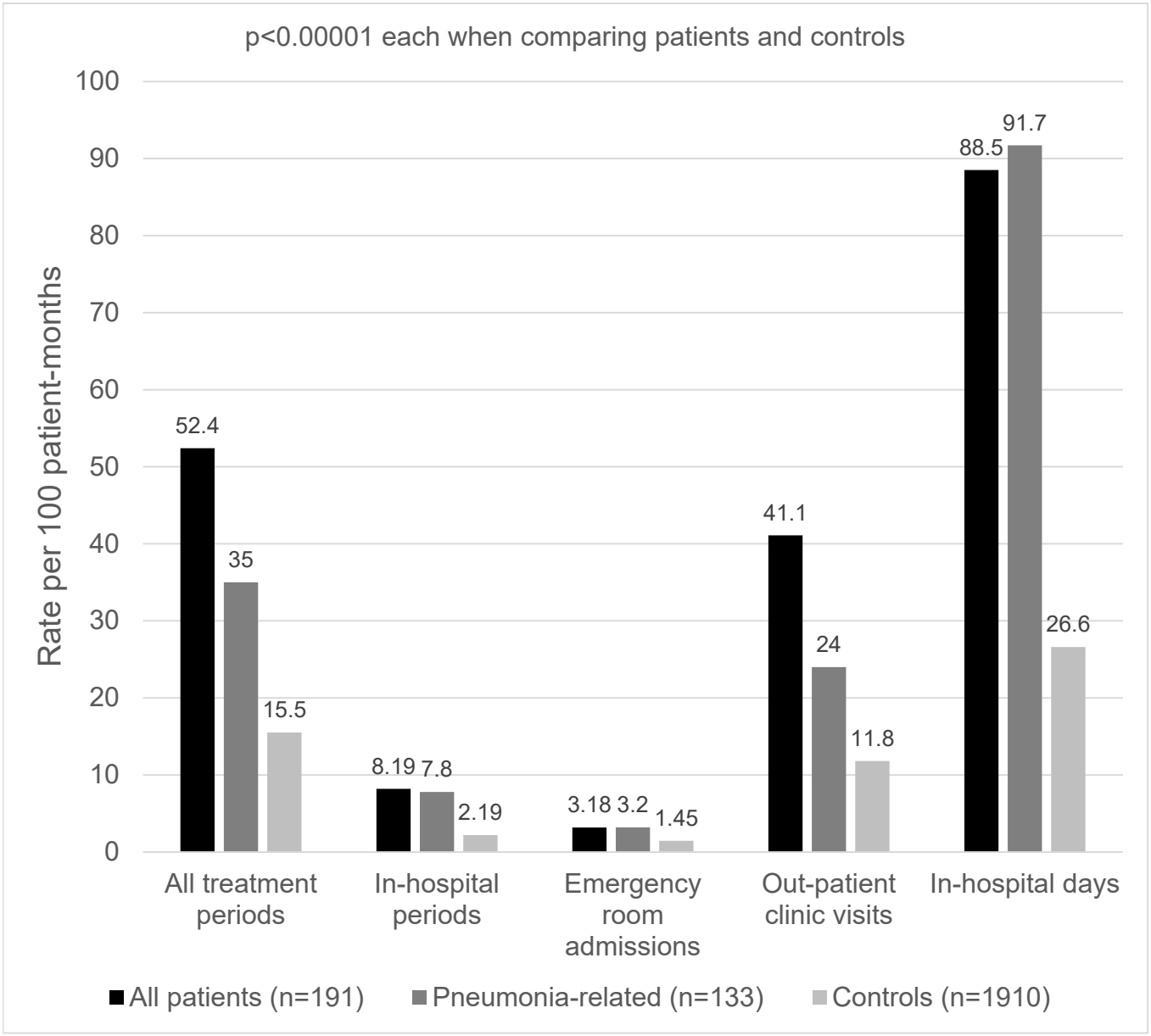
Author contribution statement: All authors have significantly contributed to the paper. Antti Lehtomäki was the principal writer of the manuscript and took part in the designing of the study and the curation of the material. Jahangir Khan assisted in the writing of the manuscript, took part in the designing of the study, conducted the statistical analyses, and took part in the curation of the material. Jari Laurikka and Vesa Toikkanen took part in the designing of the study and assisted in the writing of the manuscript. Riikka Nevalainen analyzed the imaging studies of each patient and assisted in the critical revision of the paper. Jaakko Nieminen and Emilia Pohja took part in the curation of the material and the critical revision of the paper.



Central image. The rates of treatment periods during follow-up in patients with pleural infections and controls.

Tables

Table 1. The demographics of the study population, the medical history of patients and the etiology of pleural infections.

	Patients	Controls
Total number	191	1910
Demographics		
Male	81%	81%
Median age (interquartile range)	58 (47-69)	58 (47-69)
Medical history		
Coronary disease	11%	
Diabetes	14%	
Chronic lung disease	11%	
Hypertension	21%	
Dyslipidemia	7.9%	
Smoking	38%	
Alcoholism	16%	
Immunosuppression	5.8%	
Etiology		
Pneumonia	70%	
Trauma	5.2%	
Malignancy	4.2%	
Procedural complication	9.4%	
Other or unknown	12%	

Table 2. The rates per 100 patient-months of all later treatment episodes, in-hospital days and procedures performed following the treatment of pleural infections in all patients, in patients with pneumonia-related pleural infections, and in a population-based random sample of demographically matched controls during five-year follow-up.

	All patients (n = 191)		Pneumonia-related (n = 133)		Controls (n = 1,910)	
N of Patient-months	9,069		6,715		108,046	
	Total n	Rate per 100 patient-months (95% confidence interval)	Total n	Rate per 100 patient-months (95% confidence interval)	Total n	Rate per 100 patient-months (95% confidence interval)
All treatment periods	4,754	52.4 (50.9–53.9)*	2,349	35.0 (33.6–36.4)*	16,698	15.5 (15.2–15.7)
In-hospital periods	743	8.19 (7.61–8.80)*	524	7.80 (7.15–8.50)*	2,366	2.19 (2.10–2.28)
Emergency room admissions	288	3.18 (2.82–3.56)*	215	3.20 (2.79–3.66)*	1,565	1.45 (1.38–1.52)
Out-patient clinic visits	3,723	41.1 (39.7–42.4)*	1,610	24.0 (22.8–25.2)*	12,767	11.8 (11.6–12.0)
In-hospital days	8,022	88.5 (86.5–90.4)*	6,157	91.7 (89.4–94.0)*	28,718	26.6 (26.3–26.9)
Procedures	114	1.26 (1.04–1.51)*	78	1.16 (0.92–1.45)*	590	0.55 (0.50–0.59)

*p<0.00001 when compared to controls

Table 3. The rates per 1,000 patient-months of the most frequent main classes of ICD-10 diagnoses associated with emergency room admissions, in-hospital periods, and out-patient clinic visits, as well as the types of procedures performed according to the main groups in the Nordic Classification of Surgical Procedures among pleural infection patients, patients with pneumonia-related pleural infections, and in a population-based random sample of demographically matched controls during five-year follow-up.

	All patients (n = 191)		Pneumonia-related (n = 133)		Controls (n = 1,910)	
N of patient-months	9,069		6,715		108,046	
	Total n	Rate per 1,000 patient-months (95% confidence interval)	p	Total n	Rate per 1,000 patient-months (95% confidence interval)	p	Total n	Rate per 1,000 patient-months (95% confidence interval)
Emergency room admissions								
K	26	2.87 (1.87–42.0)	<0.00001	22	3.28 (2.05–4.96)	<0.00001	74	0.68 (0.54–0.86)
J	49	5.40 (4.00–7.14)	<0.00001	44	6.55 (4.76–8.80)	<0.00001	93	0.86 (0.69–1.05)
S	27	2.98 (1.96–4.33)	0.008	22	3.28 (2.05–4.96)	0.006	175	1.62 (1.39–1.88)
R	31	3.42 (2.32–4.85)	0.044	22	3.28 (2.05–4.96)	0.125	252	2.33 (2.05–2.64)
I	20	2.21 (1.35–3.41)	0.304	12	1.79 (0.92–3.12)	0.126	302	2.80 (2.46–3.07)
In-hospital periods								
K	50	5.51 (4.09–7.27)	<0.00001	36	5.36 (3.75–7.42)	<0.00001	169	1.56 (1.34–1.82)
F	130	14.3 (12.0–17.0)	<0.00001	117	17.4 (14.4–20.9)	< 0.001	147	1.36 (1.15–1.60)
C	54	5.95 (4.47–7.77)	<0.00001	19	2.83 (1.70–4.42)	0.343	244	2.26 (1.98–2.56)
J	147	16.2 (13.7–19.1)	<0.00001	109	16.2 (13.3–19.6)	<0.00001	200	1.85 (1.60–2.13)
I	73	8.05 (6.31–10.1)	0.001	50	7.45 (5.23–9.82)	0.0170	566	5.24 (4.82–5.69)
Out-patient clinic visits								
M	168	18.5 (15.8–21.6)	<0.00001	77	11.5 (9.05–14.3)	<0.00001	781	7.23 (6.73–7.75)
N	199	21.9 (19.0–2.52)	<0.00001	164	24.4 (20.8–28.5)	<0.00001	1,162	1.08 (1.02–1.14)
I	92	10.1 (8.18–1.24)	0.003	34	5.06 (3.51–7.08)	<0.00001	1,511	14.0 (13.3–14.7)
F	437	48.2 (43.8–52.9)	<0.00001	306	45.6 (40.6–51.0)	<0.00001	1,507	14.0 (13.3–14.7)
C	262	28.9 (25.5–32.6)	<0.00001	121	18.0 (15.0–21.5)	0.148	1,697	15.7 (15.0–16.5)
Type of procedure								
G	20	2.21 (1.35–3.41)	<0.00001	10	1.49 (0.71–2.74)	<0.00001	21	0.19 (0.12–0.30)
K	10	1.10 (0.53–2.03)	0.146	6	0.89 (0.33–1.95)	0.510	67	0.62 (0.48–0.79)
J	10	1.10 (0.53–2.03)	0.191	3	0.45 (0.09–1.31)	0.729	71	0.66 (0.51–0.83)
F	13	1.43 (0.76–2.45)	0.158	9	1.34 (0.61–2.54)	0.324	96	0.89 (0.72–0.11)
N	32	3.53 (2.41–4.98)	<0.00001	26	3.87 (2.53–5.67)	<0.00001	160	1.48 (1.26–1.73)

Statistical comparisons were performed between patient groups and controls.

ICD-10 diagnosis codes: C = malignant neoplasms; F = mental and behavioral disorders; G = diseases of the nervous system; I = diseases of the circulatory system; J = diseases of the respiratory system; K = diseases of the digestive system; M = diseases of the musculoskeletal system and connective tissue; N = diseases of the genitourinary system; R = symptoms, signs and abnormal clinical findings, not elsewhere classified; S = injury, poisoning and certain other consequences of external causes.

Nordic classification of surgical procedures: G = procedures involving the chest wall, pleura, mediastinum, diaphragm, trachea, bronchus, and lung; K = urinary system, male genital organs and retroperitoneal space; J = digestive system and spleen; F = heart and major vessels, N = musculoskeletal system

Table 4. Associations of patient characteristics, the etiology of pleural infection, and the type of treatment with the rates per 100 patient-months of later treatment periods and in-hospital days during five-year follow-up in patients with pleural infections. Subgroups with less than 20 patients, i.e. those with dyslipidemia, immunosuppression, and malignant, iatrogenic, or traumatic etiology for the disease, were excluded from the analysis. Statistically significant differences (p<0.00061 following Bonferroni correction) between opposing patient subgroups—for example, between males and females, those with or without chronic lung disease, and alcoholics and non-alcoholics—are highlighted in boldface.

	All treatment periods n	In-hospital days Rate per 100 patient-months (95% confidence interval)	In-hospital periods Rate per 100 patient-months (95% confidence interval)	Emergency room admissions Rate per 100 patient-months (95% confidence interval)	Out-patient clinic visits N per 100 patient-months (95% confidence interval)	All treatment periods N per 100 patient-months (95% confidence interval)
All patients	4,754	88.5 (86.5–90.4)	8.19 (7.61–8.80)	3.18 (2.82–3.56)	41.1 (39.7–42.4)	52.4 (50.9–53.9)
Male (n = 154, 7,365 patient-months)	4,063	**90.6 (88.5–92.9)**	**8.74 (8.08–9.45)**	3.23 (2.83–3.67)	**43.2 (41.7–44.7)**	**55.2 (53.5–56.9)**
Female (n = 37, 1,704 patient-months)	691	**79.0 (74.8–83.3)**	**5.81 (4.72–7.07)**	2.93 (2.18–3.87)	**31.8 (29.2–34.6)**	**40.6 (37.6–43.7)**
Age ≥60 years (n = 79, 3,066 patient-months)	1,699	**167 (162–172)**	**12.6 (11.4–13.9)**	2.94 (2.36–3.61)	39.9 (37.7–42.2)	55.4 (52.8–58.1)
Age <60 years (n = 112, 6,003 patient-months)	3,055	**48.3 (46.6-50.1)**	**5.93 (5.33-6.58)**	3.30 (2.86-3.79)	41.7 (40.1-43.3)	50.9 (49.1-52.7)
Coronary disease (n = 21, 752 patient-months)	893	**198 (188–209)**	**19.2 (16.2–22.5)**	2.93 (1.83–4.43)	**96.7 (89.8–104)**	**119 (111–127)**
No coronary disease (n = 170, 8,317 patient-months)	3,861	**78.5 (76.6-80.5)**	**7.20 (6.64-7.80)**	3.20 (2.83-3.61)	**36.0 (34.7-37.3)**	**46.4 (45.0-47.9)**
Diabetes (n = 26, 1,171 patient-months)	1,148	**196 (188–204)**	**16.7 (14.5–19.3)**	2.48 (1.66–3.56)	**78.8 (73.8–84.1)**	**98.0 (92.5–104)**
No diabetes (n = 165, 7,898 patient-months)	3,606	**72.5 (70.7-74.4)**	**6.93 (6.36-7.53)**	3.28 (2.89-3.70)	**35.5 (34.2-36.8)**	**45.7 (44.2-47.2)**
Chronic lung disease (n = 21, 701 patient-months)	431	**213 (203–224)**	**14.4 (11.7–17.5)**	3.14 (1.97–4.75)	43.9 (39.2–49.1)	61.5 (55.8–67.6)
No Chronic lung disease (n = 170, 8,368 patient-months)	4,323	**78.0 (76.1-79.9)**	**7.67 (7.09-8.29)**	3.18 (2.81-3.59)	40.8 (39.5-42.2)	51.7 (50.1-53.2)
Hypertension (n = 40, 1,700 patient-months)	1,315	**160 (154–166)**	**14.4 (12.6–16.3)**	1.94 (1.34–2.73)	**61.1 (57.4–64.9)**	**77.4 (73.2–81.7)**
No hypertension (n = 151, 7,369 patient-months)	3,439	**71.9 (70.0-73.9)**	**6.77 (6.19-7.39)**	3.46 (3.05-3.91)	**36.4 (35.1-37.8)**	**46.7 (45.1-48.3)**
Smoking (n = 72, 3,346 patient-months)	1,961	**79.2 (76.2–82.3)**	7.23 (6.35–8.20)	3.53 (2.92–4.22)	**47.9 (45.5–50.3)**	**58.6 (56.0–61.3)**
No smoking (n = 119, 5,723	2,793	**93.6 (91.4-96.4)**	8.75 (8.00-9.56)	2.97 (2.54-3.45)	**37.1 (35.5-38.7)**	**48.8 (47.0-50.7)**

patient-months)						
Alcoholism (n = 31, 1,283 patient-months)	502	**169 (162–176)**	**12.8 (10.9–14.9)**	**6.16 (4.88–7.67)**	**20.2 (17.8–22.8)**	**39.1 (35.8–42.7)**
No alcoholism (n = 160, 7,786 patient-months)	4,252	**75.2 (73.3-77.2)**	**7.44 (6.84-8.07)**	**2.68 (2.33-3.07)**	**44.5 (43.0-46.0)**	**54.6 (53.0-56.3)**
Etiology						
Pneumonia (n = 133, 6,715 patient-months)	2,349	**91.7 (89.4–94.0)**	7.80 (7.15–8.50)	3.20 (2.79–3.66)	**24.0 (22.8–25.2)**	**35.0 (33.6–36.4)**
Non-pneumonic etiology (n = 58, 2,354 patient-months)	2,405	**79.2 (75.7–82.9)**	9.30 (8.11–10.6)	3.10 (2.43–3.90)	**89.8 (86.0–93.7)**	**102 (98.1–106)**
Type of treatment						
Surgery (n = 153, 7,399 patient-months)	4,174	**76.7 (74.7–78.8)**	8.03 (7.40–8.70)	3.22 (2.82–3.65)	**45.2 (43.7–46.7)**	**56.4 (54.7–58.2)**
Non-surgical (n = 38, 1,670 patient-months)	580	**140 (135–146)**	8.92 (7.55–10.5)	2.99(2.22–3.95)	**22.8 (20.6–25.2)**	**34.7 (32.0–37.7)**

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