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KLİNİK ÇALIŞMA
RESEARCH ARTICLE

Economic burden of nosocomial pneumonia in non-intensive care clinics

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SUMMARY

Economic burden of nosocomial pneumonia in non-intensive care clinics

Introduction: Almost all data on the cost of nosocomial pneumonia (NP) in the literature is associated with ventilator-associated pneumonia. This study aims to determine the economic burden of nosocomial pneumonia in clinical inpatients.

Materials and Methods: Data on costs of the 154 adult patients (97 male, 57 female; mean age 64.53 ± 14.92) who were hospitalized in non-intensive care clinics and developed NP were recorded prospectively. The control group consisted of 148 patients without pneumonia matched for age (mean age 65.66 ± 13.86), sex (94 male), diagnosis, and hospitalization date. Data obtained from both groups of patients for the number of hospitalization days and the data obtained from the hospital automation program (Avicenna) for costs were compared using the Mann-Whitney U test.

Results: While the mean duration of hospitalization was 32.8 days in patients with NP, it was 9.8 ($p < 0.0001$) in the control group. The cost of hospital beds was \$631 for NP patients and \$153 for the controls ($p < 0.0001$). The total cost was \$6241 for NP patients and \$1117 for the controls ($p < 0.0001$).

Conclusion: NP is a high-cost condition that increases the duration of hospitalization 3.5-fold, hospital-bed cost 4-fold, and the total cost 5-fold.

Key words: Non-intensive care, nosocomial pneumonia, cost

ÖZET

Yoğun bakım dışı kliniklerde gelişen hastanede gelişen pnömoninin mali yükü

Giriş: Literatürdeki hastanede gelişen pnömoniler (HGP) ile ilişkili maliyet verilerinin hemen hepsi ventilatörle ilişkili pnömonili hastalarla yapılan çalışmalardan elde edilmiştir. Bu çalışmada amaç hastane kliniklerinde yatan hastalarda pnömoni gelişmesinin mali yükünü saptamaktır.

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Materyal ve Metod: Yoğun bakım dışı kliniklerde pnömoni gelişen yaş ortalaması 64.53 ± 14.92 olan 97'si erkek toplam 154 HGP'li erişkin hastaya ait maliyet verileri prospektif olarak kaydedildi. Karşılaştırma için aynı tarihler arasında aynı tanılar ile hastanede yatan, yaşı (ort: 65.66 ± 13.86) ve cinsiyeti (94'ü erkek) benzer olup ($p > 0.05$) hastanede yattığı süre içinde pnömoni gelişmemiş olan 148 olgu da kontrol grubuna alındı. Her iki gruptaki hastaların hastanede yattıkları gün sayıları ve hastane otomasyon programından (Avicenna) elde edilen maliyet verileri Mann-Whitney U testiyle karşılaştırıldı.

Bulgular: HGP'li hastalarda ortalama yatış gün sayısı 32.8 iken kontrol grubunda 9.8 idi ($p < 0.0001$). Yatak maliyeti HGP'li hasta grubunda ortalama 631\$ iken kontrol grubunda 153\$ olarak hesaplandı ($p < 0.0001$). Toplam maliyet HGP'li grupta ortalama 6241\$ iken kontrol grubunda 1117\$ olarak tespit edildi ($p < 0.0001$).

Sonuç: HGP, yatış süresini yaklaşık 3.5, yatak maliyetini 4, toplam maliyeti 5.5 kat artıran mali yükü yüksek bir hastalıktır.

Anahtar kelimeler: Yoğun bakım dışı, hastanede gelişen pnömoni, maliyet

INTRODUCTION

Nosocomial pneumonia (NP) remains a major cause of morbidity and mortality despite all preventive measures and the use of wide spectrum antibiotics (1). In addition, NP prolongs the duration of hospitalization and increases associated costs (2).

Almost all studies on the cost of NP include ventilator-associated pneumonia (VAP) (3-10). The studies on NP in non-intensive care clinics are very limited and only include specific groups of patients (11-13). This study aims to determine the economic burden of NP on developed clinics of the hospital.

MATERIALS and METHODS

Patients

The demographic data and surveillance rates of patients with NP hospitalized in the our hospital have been published elsewhere (14). NP diagnoses in those patients were made according to national and international guidelines (1,15). Immunosupressed patients who developed pneumonia and cases with NP in intensive care units were excluded.

This study analyzes the data on costs of the above-mentioned patients. This was designed as a case-control study. To establish a control group, age-, sex- and diagnosis- matched patients who were hospitalized on the same dates were listed using the hospital automation program (Avicenna). The list was reviewed, and those patients who had not developed pneumonia were included in the control group.

Study Protocol

Patients with NP and control patients were followed-up until death or discharge from the hospital. The number of hospitalization days was recorded. Data on costs were obtained from the hospital automation program (Avicenna). Costs for both groups were assessed under the following topics:

- Hospital bed costs
- Caregiver costs
- Costs of antibiotics used for non-pneumonia conditions (surgical prophylaxis, other infections, etc.)
- Non-antibiotic treatment costs
- Microbiological test costs for isolation of pathogens
- Laboratory costs (blood chemistry, complete blood count)
- Consultation costs
- Total costs

In addition, the costs of antibiotics used to treat pneumonia in NP patients were calculated.

The costs in Turkish lira was converted to US dollars based on the Central Bank of the Turkish Republic's US dollar exchange rates on the day of discharge from the hospital (16).

Statistical Methods

The numeric results were expressed as mean \pm SD, and categorical results were expressed as a number (percentage). Normality distribution of the variables was tested using one sample Kolmogorov Smirnov test. Differences between groups were assessed using the Mann-Whitney U test. The chi-square test was used to compare the differences of categorical variables between the groups. A p value < 0.05 was considered as statistically significant. Statistical 7.0 (Stat Soft Inc. Tulsa, OK, USA) statistical software was used for statistical analyses.

RESULTS

Patient Characteristics

Of the 154 NP patients, 57 (37%) were female, and 97 (63%) were male. The mean age was 64.53 ± 14.92 . In the control group comprising 148 cases, 54

(36.5%) were female (36.5%) and 94 (63.5%) were male and the mean age was 65.66 ± 13.86 . The two groups were similar in terms of gender ($p= 0.92$) and mean age ($p= 0.49$). Of the patients with NP, 71.4% were hospitalized in internal medicine clinics and 28.6% in surgical clinics. The mean number of hospitalization days was 32.85 ± 27.33 in NP patients and 9.85 ± 7.08 in control cases ($p < 0.0001$) (Table 1).

Table 2 shows the diagnoses at hospitalization for NP patients and controls. The control group comprised 148 patients, six fewer than the NP patients, because six NP patients had no control case with an identical diagnosis. They were myasthenia gravis, Guillain-Barre syndrome, peptic ulcer, nasopharyngeal carcinoma, tongue base carcinoma, and suprarenal cancer.

Cost Analyses

The costs for the NP group were significantly higher than for the control group for all parameters except antibiotics used for non-pneumonia conditions ($p= 0.11$). The total cost of hospital beds was $\$631.11 \pm 610.14$ for the NP group and $\$153.45 \pm 190.36$ for the controls. The overall cost was $\$6240 \pm 6041.49$ in the NP group and $\$1117.26 \pm 1028.9$ for controls (Table 3). The mean cost of antibiotics for pneumonia was $\$1062.83 \pm 1241.47$.

DISCUSSION

The nosocomial pneumonia rate is second among nosocomial infections and first among intensive-care unit infections (17). Almost all studies on NP costs include intensive care unit patients with NP. The studies on NP in non-intensive care clinics are very limited.

In a study analyzing the economic burden of NP on the insurance system, the cost of one episode was calculated at $\$5800$ (18). However, that study, including 33 patients with NP and 11 control cases, is not comparable to this study, which has a signifi-

Table 2. Diagnosis at hospitalization for patient and control groups

Diagnoses	Patients (n= 154)	Controls (n= 148)
Cerebrovascular disease	58	58
Trauma	13	13
Lung cancer	7	7
Subarachnoidal hemorrhage	7	7
Cardiac failure	6	6
Acute myocardial ischemia	6	6
Chronic renal failure	4	4
Peripheral artery disease	3	3
Peptic ulcer	3	2
Intracranial mass	3	3
Laryngeal cancer	3	3
Colon tumor	3	3
Chronic obstructive lung disease	3	3
Other	35	30

cantly higher number of cases. Moreover, the data in that study were obtained exclusively from the health insurance database.

Another study investigating the costs of NP patients in medical clinics calculated the cost-effectiveness of invasive procedures for isolation of pathogens and had a different design than this study (13).

A study assessing the outcomes and costs of patients who underwent intraabdominal surgery and developed NP suggested that postoperative pneumonia increased costs (11). However, the study did not report whether the postoperative pneumonia developed in the intensive care unit or the clinic.

In a study investigating nosocomial infections following head and neck surgery, pneumonia was suggested to increase the duration of hospitalization for 17 days and the cost to $\$19.000$ (12). That study included not only postoperative pneumonia but also surgical wound infections.

This study differs from the others in that it was a large-scale study assessing all patients with NP in 23 departments, including all internal medicine and surgery clinics except intensive care and pediatrics in a university hospital. The mean number of hospitalization days was 32.8 and 9.8, the mean hospital bed cost was $\$631$ and $\$153$, and the mean total cost was $\$6241$ and $\$1117$ in the NP and control groups, respectively.

Table 1. Demographic data and days of hospitalization

	Patients (n= 154)	Controls (n= 148)	p
Age (mean \pm SD)	64.53 ± 14.92	65.66 ± 13.86	0.49
Gender (M) (n, %)	97 (63%)	94 (63.5%)	0.92
Days of hospitalization			
Mean \pm SD	32.85 ± 27.33	9.85 ± 7.08	< 0.0001
Median (range)	25 (3-150)	9 (1-49)	

Table 3. Comparison of costs in NP patients and control cases

		Median (min-max) (\$)	Mean (\$)	Std. Dev. (\$)	p
Hospitalization cost	NP	433.5 (26-3466)	631.11	610.143	< 0.0001
	Control	86 (9- 1137)	153.45	190.361	
Caregiver	NP	63 (6-908)	117.27	131.110	< 0.0001
	Control	30 (5-189)	46.21	44.766	
Non-pneumonia antibiotic	NP	190.5 (6-4073)	434.63	633.272	0.11
	Control	153 (11-957)	212.90	237.311	
Non-antibiotic treatment	NP	1589.5 (68-28992)	2789.32	3714.121	< 0.0001
	Control	275 (4-5210)	543.39	753.630	
Microbiology	NP	244 (24-2081)	310.00	266.078	< 0.0001
	Control	67.5 (13-307)	84.30	60.840	
Radiology	NP	224.5 (6-1389)	269.29	215.180	< 0.0001
	Control	110.5 (5-899)	152.94	149.872	
*Laboratory	NP	501.5 (38-6014)	729.68	666.693	< 0.0001
	Control	159.5 (7-691)	187.27	135.068	
Consultation	NP	46 (4-904)	63.42	81.179	< 0.0001
	Control	24 (3-405)	29.98	42.907	
Total cost	NP	4518 (556-53592)	6240.95	6041.499	< 0.0001
	Control	823.5 (98-7274)	1117.26	1028.900	

NP: Nosocomial pneumonia
* Blood chemistry and complete blood count.

In a meta-analysis assessing the clinical and economic outcomes of patients with VAP, VAP increased the duration of hospitalization for 6.1 days and the cost for \$410.019 (4).

A study from Turkey reported the duration of hospitalization as 8 and 2.5 days and the costs \$2832.2 and \$868.5 in patients with VAP and control cases, respectively (5). The lower costs compared to other studies from Europe and the US was attributed to the low cost of hospital beds in Turkey.

Hospital bed costs, consultation costs, and costs of invasive procedures are significantly lower in Turkey than in other countries. For example, the price of a hospital bed was \$8-10, and the consultation price was \$5-6 while we ran our study. Thus, comparison of costs in Turkey with the costs in other countries, even based on US dollars, would be inappropriate. We rather would like to emphasize the increase in cost with NP compared to controls.

The major limitation in our study was that, although NP and control cases were matched for age, gender, diagnosis, and hospitalization dates, the severity of their primary conditions were not considered. This may be attributed to the retrospective design of the study and the scattered distribution of control patients in various clinics with various diagnoses. Assessment

of scoring systems for severity of disease is much easier in studies including VAP patients because they are routine and critical assessments in such patients.

In conclusion, NP is a high-cost disease that increases the duration of hospitalization 3.5-fold, hospital-bed cost 4-fold, and total cost 5.5-fold. All of the increasing cost not only explain to NP but it is important part of the economic burden. It is essential to take measures for the prevention of NP considering its high cost.

CONFLICT of INTEREST

None declared.

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