

## **Nasopharyngeal pneumococcal carriage for people who live in nursing home and evaluation of the risk factors.**

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### **Abstract**

**Objective:** Nasopharyngeal pneumococcal carriage creates a significant risk factor for the spread of resistant strains in society and the occurrence of invasive disease. In this study it was intended to investigate the rates of nasopharyngeal pneumococcal carriage of individuals living in nursing homes in our area and to determine the rates of the resistance to penicillin in these strains and risk factors.

**Methods:** 92 people over the age of 60 who live in nursing homes were taken in our study. It was investigated demographic characteristics and potential risk factors for carriage in these people. The isolation and characterization of *Streptococcus pneumoniae* made with traditional culture methods. It was examined resistance to penicillin in these strains using oxacillin disk and the values of penicillin minimal inhibitory concentration (MIC) in oxacillin -resistant strains determined by E-test method.

**Results:** In 16.3% of the participants were found pneumococcal carriage. In two strains (13.3%) isolated from pneumococcal mid-level resistance to penicillin (ODPD) were detected, there were not any high-level resistance (YDPD) strain found. Also it was found a statistically significant correlation between the presence of chronic diseases (diabetes, hypertension, etc.) with the pneumococcal carriage ( $p=0.038$ ). Evaluated in terms of risk factors that affect resistance to penicillin it was found a statistically significant relationship between the use of antibiotic in people with pneumococcal carriage with stay in hospital in the last 6 months ( $p<0.05$ ).

**Conclusion:** As a result it is intended to contribute to the creation of regional guidelines which will be used in the treatment of pneumococcal infections by the development of regional data on pneumococcal carriage and resistance to penicillin in our province.

**Keywords:** *Streptococcus pneumoniae*, Nursing home, Carriage, Penicillin resistance, Risk factors

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### **Introduction**

*Streptococcus pneumoniae* is a gram-positive, alpha-hemolytic, aero tolerant, anaerobic, immobile, spore-free and capsulated member of the genus *Streptococcus*. It is one of the main culprits of pneumonia, sepsis and meningitis in adults. Especially in children, elderly or patients with chronic conditions, SP can cause diseases like community acquired pneumonia, bacteremia, acute sinusitis and acute otitis media.

Main sources for pneumococcal infections which have an important morbidity and mortality rate are asymptomatic carriers [1]. *Pneumococcus* infections usually start with

nasopharyngeal colonization [2]. This bacterial colonization is an important risk factor for invasive disease.

Although it's common to think that the main reason for this colonization is the age, crowded living spaces, socioeconomical status, smoking, antibiotics usage, climate, environmental and genetic factors are also thought to play a role [3].

In studies done in Turkey, nasopharyngeal carrier rate is between 13-43% depending on age, geographical area and population [4-7].

*Pneumococcus* infections used to be treated successfully with penicillin until today but resistance rates are rising. In strains with penicillin resistance, resistance to other antibiotics is also developing. The presence of penicillin and multi-drug resistant strains in healthy carriers poses a threat to empiric treatment [8,9].

Since *pneumococcus* strains cause serious infections, knowing the resistance rates of those microorganisms are very important for treatment planning and choice of antibiotics. Patterns of resistance change between areas and sometimes even in the same area with time.

In this study, we studied the nasopharyngeal pneumococcus carrier rates of the people living in nursing homes around our area in order to define the rate of penicillin resistance and pinpoint risk factors.

## Materials and Methods

This study was conducted in Ordu Social Services Dept. Ahmet Celal Mağden Nursing Home between October-November 2012 on 92 nursing home residents for pneumoniae. Subjects were asked about present chronic conditions, upper respiratory infections in the last 3 months, antibiotic usage, and hospitalization in the last 6 months, *pneumococcus* vaccinations, splenectomy history and smoking habits in addition to demographic values such as age, sex and so on.

Nasopharyngeal samples were taken from the subjects eligible for the study using sterile Dacron tipped swabs by professionals. The samples taken were transferred to Ordu University Medicine Faculty Training and Research Hospital's Microbiology lab packed in a nutrient-rich environment for bacteria.

The samples are seeded in 5% sheep-blood agar in 37°C temperature and 5-10% CO<sub>2</sub> autoclave for incubation in 24-48 hours. After incubation, alpha-hemolysis, Gram stain, catalase activity, optochin susceptibility (5 µg Bioanalyse OP) and dissolution in bile in addition to typical view of pneumococcal colonies were researched [10,11].

**Table 1:** Penicillin sensitivity tests in *S.pneumoniae* strains (2008 CLS MIC values)

Antibiotic	Sensitive	Low Level Resistance	High Level Resistance
Penicillin (Oral)	≤0,06	0,12-1	≥2
Penicillin (Parenteral)	-	-	-
Infection other than CNS	≤2		≥8
CNS infection	≤0,06	4	≥0,12

Oxacillin disk screening test (1µg) (Bioanalyse) assess penicillin sensitivity. Areas ≥20 mm were considered as penicillin sensitive and ≤19 mm were considered as resistant to penicillin. Penicillin-resistant strains were verified using E-Test (Liofilchem, Italy).

Table 1 shows penicillin sensitivity tests in *S.pneumoniae* strains and their comments, as per CLSI criteria.

All data was entered into SPSS 16.0 program and Pearson's Chi-Square test was used for statistical analysis. Confidence interval was p<0.05 in all counts.

## Results

We included a total of 92 patients which 55 were male (59,7%) and 37 were female (41,3%). Ages were 60-69 in 13 (14,1%), 70-79 in 46 (50%) and 80 and over in 33 (35,9%) patients.

15 patients out of 92 living in nursing home were *pneumococcus* carriers (16,3%). M/F ratio was 7/8. In isolated *pneumococci*, 2 strains were moderately resistant (13,3%) to penicillin while there were no highly resistant strains.

In our study, chronic disease presence (diabetes, hypertension etc.) and pneumococcus carrier states were statistically linked to each other (p=0.038) meanwhile other factors such as antibiotic usage, previous upper respiratory system infections, hospitalization, smoking, number of people sharing the room were not connected to penicillin resistance (p>0.05).

When risk factors for penicillin resistance were reviewed, there was a statistically significant relationship between antibiotic usage in *pneumococcus* carriers and hospitalization in the last 6 months (p<0.05).

## Discussion

Pneumoniae infections usually start by nasopharyngeal colonization and this is an important predisposing factor for invasive illness [12]. Even though penicillin was the first treatment of choice in such infections for 50 years, medium resistant strains in 1969 and high resistant strains after 1970's were seen all around the world. One isolate strain showed multi drug resistance in addition to penicillin in 1977 and frequency of such isolates started to increase all around the globe [13].

*Pneumococcus* and similar infections are often seen in crowded and closed spaces such as nursing homes. That's why high-risk groups have to be checked for nasopharyngeal carrier state and for infections regularly and epidemiological properties of the people living in the nursing home should be recorded. Carrier state might pose a risk for pneumococcal infections in elderly, chronically ill and immune-compromised patients. In our study, nasopharyngeal pneumococcal carrier rate was 16.3%, in which isolated specimens 13.3% were moderately resistant to penicillin with no highly resistant strains. In a similar study done in Turkey by Yıldırım et al [14], 11.6% of patients over 65 from 3 different nursing homes in Ankara were pneumococcus carriers and 41% of these strains were mildly resistant to penicillin, with no highly resistant strains in any of these cases.

In Gezici's 2002 study, nursing homes from Thrace area were screened for pneumococcus and the rate was 4%. There was also a statistically significant relation detected between carrier

state and age, sex and antibiotics usage. Again at the same year, Baysal et al [16] found 4.8% carrier rate in nursing homes and 1.2% in children in kindergartens of Konya. 4% of isolated strains showed resistance to penicillin. Orhan et al [17] recent 2012 study found 2 (28%) moderately resistant strains in nursing homes and 4 (22%) in kindergarten children with no highly resistant strains in both groups. In this study, 12% of males in nursing homes were carriers with no women with nasopharyngeal pneumococcus carrier state. The relationship between sex and carrier status was statistically significant.

Even though there were no highly penicillin resistant *S.pneumoniae* strains were detected in any of these studies, increasing resistance to drugs still poses a threat. On the first study where resistant strains were reported in Turkey, 26.3% moderate resistance and 7.3% high resistance was detected in selected strains [18]. In the following years, many studies reported moderate resistance levels up to 51% but high resistance studies were never over 15% [19].

In multicentric SOAR study done between 2002-2003, penicillin resistance of *S.pneumoniae* was 25.3% (1.3% HRS, 24% MDR) and in 2004-2005 resistance levels were detected as 32.2% (7.6% HRS, 24.6% MRS) which changed with the regions.

In pneumococcus, penicillin resistance changes with countries and geographical regions. That's why local data must be used in treatment protocol planning. In order to do this, decent and continuous surveyance studies are necessary. Doing surveyance studies on pneumococcus will support the development of local guidelines against resistant strains that cause invasive diseases and to gather the data for resistance.

Considering the high treatment costs and even mortality of invasive pneumococcal diseases in elderly patients, protective measures are important in high-risk groups.

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