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Clinical and economic analysis of hospital acquired infections in patients diagnosed with brain tumor in a tertiary hospital

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Summary

***Objectives*. To analyze the relationship between hospital acquired infections and clinical outcomes, duration of stay, and cost per infectious episode in patients diagnosed with brain tumors in our service.**

***Materials and methods*. We conducted a retrospective study on patients diagnosed with brain tumors and admitted to the department of neurosurgery in the Cruces Hospital of the University of the Basque Country between January 1st, 2007 and December 31st, 2007. We collected demographics, responsible pathogens, infection location, length of hospitalization, and costs of various medical and surgical procedures performed.**

***Results*. We reviewed 139 patients that accumulated 210 hospital visits. We found 34 episodes of hospital acquired infections (16.25% of patients). The most frequent infections were that of the lower respiratory tract, urinary tract, and surgical site. We found that patients with HAIs had a significantly lower final KPS score (sig <0.01), greater mean cost of stay (17097€, sig.<0.01), and longer length of stay (15.45 days, sig<0.01). We did not find a significant difference in mortality.**

***Conclusions*. We found significant association between the presence of HAIs and worse clinical outcomes, higher costs, and longer length of stay. The pathogens responsible and infection locations were similar to existing series in the literature. Although variability in study designs in the literature makes interpretation and comparison of results difficult, measures to prevent these complications can improve quality of care and reduce costs.**

KEY WORDS. Brain neoplasms. Infection. Costs.

Análisis clínico económico de las infecciones nosocomiales en los pacientes diagnosticados de tumoración cerebral en un hospital terciario

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Resumen

***Objetivos*. Analizar la relación entre la presencia de infección nosocomial y el resultado clínico final, la duración de la estancia y el coste del episodio en los pacientes diagnosticados de tumoración cerebral en nuestro servicio.**

***Material y método*. Realizamos un estudio retrospectivo incluyendo los pacientes ingresados en el Servicio de Neurocirugía del Hospital Universitario de Cruces con diagnostico de tumoración cerebral en el periodo comprendido entre el 1-1-2007 y el 31-12 del 2007. Recogimos variables demográficas, los microorganismos responsables y la localización de las distintas infecciones, el tiempo de ingreso y los costes de los distintos procedimientos médicos y quirúrgicos realizados.**

***Resultados*. Recogimos 139 pacientes, que acumularon un total de 210 episodios. Encontramos la presencia de infecciones nosocomiales en 34 episodios (16,25%). La localización mas frecuente fue la respiratoria, seguida del tracto urinario y la infección de herida quirúrgica. Encontramos unas diferencias significativas en la situación funcional al alta (sig <0.01), el coste medio de los episodios (17097€, sig.<0.01) y en la estancia media (15.45 días, sig.<0.01). No encontramos diferencias significativas con respecto a la mortalidad.**

***Conclusiones*. Encontramos asociaciones significativas entre la presencia de infección nosocomial, un peor resultado clínico, un mayor coste y una mayor estancia. Los gérmenes responsables y localizaciones fueron similares a las series previamente publicadas. A pesar de que la variabilidad en el diseño de los estudios recogidos en la literatura dificulta la interpretación y comparación de los resultados, las medidas destinadas a la prevención de esta complicación permiten simultáneamente mejorar la asistencia prestada, asi como reducir los costes generados por la enfermedad.**

Abreviations. HAI: Hospital acquired infections. ICU: Intensive Care Units. KPS: Karnofsky Performance Status. LOS: length of stay. SD: standard deviations.

PALABRAS CLAVE. Tumor cerebral. Infección. Costes.

Introduction

Hospital acquired infections (HAI) present a serious problem in patient safety, resulting in increased mortality rates, prolonged hospital stays, and higher costs[4,9,21,22,23,28,29,31,34,36]. HAIs rank as the fifth leading cause of death in acute care hospitals and account for approximately 88,000 deaths annually in the United States[5,24]. The incidence of HAI has increased 36% from 1975 to 1995, indicating that many challenges still exist in prevention and control of HAI[11,32,35].

Healthcare expenditures have experienced double digit growth over the past three decades, with incremental costs of HAI playing a significant role in the decisions of health care managers[31]. Consequently, economic considerations have become an increasingly important component to infection control[8,29]. Because the underlying goal of infection control is to protect the patient as well as others in the healthcare environment in a cost effective manner, the economic implications of HAI prevention for healthcare institutions should be investigated closely[30]. Economic analyses that accurately quantify tradeoffs between patient outcomes and marginal costs are crucial to helping managers make informed decisions[14,29]. However, differences in economic models, hospital characteristics, sample sizes, and case finding methodologies among studies have produced considerable variation in cost estimation techniques[17,27,32].

Brain tumors represent 1-2% of all newly diagnosed tumors and account for 2% of all cancer-related deaths. As with other neurologic diseases, brain tumors are particularly expensive to treat, with HAIs adding to costs[3,12]. In this study we evaluate the epidemiology, additional length of stay, incremental costs and patient outcomes due to hospital-acquired infections in brain tumor patients. We also investigate different sites of infection and causative pathogens.

Materials and methods

The records of all the patients admitted to the Department of Neurosurgery at Cruces Hospital for brain tumors between January 1st and December 31st of 2007. Variables collected were sex, age, total length of stay, responsible microorganisms, number of days in Intensive Care Units (ICU), number of days in the ward, type of the infection (according to CDC criteria and classification), initial and final Karnofsky Performance Status (KPS) score, and cost of procedures. All data was obtained from the Medical Records and Financial Departments of our hospital.

Costs were calculated using the "microcosting" methodology, a technique in which actual costs of the items and services used by individual patients are used rather than average daily costs or cost-to-charge ratios[8,18,27,28].

Medical records were reviewed for hospital acquired infections using the Centers for Disease Control and Prevention Criteria updated in 2008[16,23,27,36]. Patients were considered to have contracted a hospital-acquired infection if symptoms originated from our hospital and were not clinically manifest at the time of admission, with the exception of surgical site infections as they often do not manifest until after discharge[6]. Multi-site infections were considered to be separate infectious incidents[23].

Statistical analysis

Data are expressed as percentages for qualitative variables and arithmetic means and standard deviations (SD) for quantitative variables. Duration of hospitalization was expressed as median and range. The Student's t test, chi-square test, and Kruskal-Wallis test were used for univariate analysis of data. Statistical significance was set at a P value of less than .05. Linear regression models were used to assess the influence of variables on duration of hospitalization, total cost incurred, and final KPS. Association between variables was considered to exist when the coefficient of correlation was greater than 0.5[21,27].

Results

Description of sample

The final cohort was comprised of 139 patients with 210 hospital visits and 168 surgical procedures. 53 (45.3%) of the patients were male and 76 (54.7%) were female. The mean patient age was 56.56 years and the range was 25 to 81 years. We found a total of 69 different infections in 34 (16.2%) visits.

Infection site

The most frequent site of infection was the lower respiratory tract or pneumonia. The surgical site was the third most frequent site of infection, and the urinary tract was the second most frequent site (Table 1). Respiratory tract infections were caused most frequently by *Pseudomonas aeruginosa* (*P. aeruginosa*), and urinary tract infections were caused mostly by *Escherichia coli*. For surgical site infections, the pathogens most frequently responsible were *P. aeruginosa* and *Staphylococcus aureus* (*S. aureus*). Infections of the skin and bloodstream were most often caused by *S. aureus*. Overall, *S. aureus* was the most common pathogen causing infection.

Cost of Visit

The mean total cost of all visits was 13,540.56€