Assessment of Inappropriate Hospital Stays in a Cardiology Department
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One of the fundamental ways of increasing hospital efficiency is to ensure that unnecessary hospital stays are avoided. To date, no study on this topic has been published by any cardiology department in Spain. We performed a retrospective, observational, analytical study to determine the rate of unnecessary hospital stays. Data were collected in accordance with the Appropriateness Evaluation Protocol (AEP). The rate of inappropriate stays was 27 per 100 patient-days. Multivariate analysis showed that the factors associated with inappropriate stays were older age-group, stays longer than 7 days, and days during the last third of the stay. The most frequent causes of inappropriate stays were delays in performing diagnostic and therapeutic procedures and stays for procedures that could have been performed without hospital admission.


Evaluación de las estancias inadecuadas en un servicio de cardiology

Una medida esencial en la búsqueda de la eficiencia hospitalaria es evitar estancias inadecuadas. No se ha publicado ningún estudio en este sentido realizado en un servicio de cardiología de nuestro país. Para conocer la tasa de inadecuación de estancias hospitalarias, hemos realizado un estudio observacional, analítico, retrospectivo. La recogida de datos se realizó conforme al Appropriateness Evaluation Protocol (AEP). La tasa de inadecuación fue de 27 estancias cada 100 pacientes-día. En el análisis multivariable, los factores relacionados con estancias inadecuadas fueron los grupos de mayor edad, las estancias mayores de 7 días y los días correspondientes a los últimos tercios de estancia. Las causas más frecuentes de estancias inadecuadas estuvieron relacionadas con el retraso en procedimientos diagnósticos o terapéuticos y con que estos procedimientos podrían haberse hecho sin ingreso.


INTRODUCTION

The increasing demand for hospital care and concern regarding the quality of the services provided justify improving hospital efficiency by determining what constitutes inappropriate use of hospitalization and its possible correction.1 To make this assessment, methods have been developed to measure the appropriateness of hospital stays, the best known of which is the Appropriateness Evaluation Protocol (AEP).2,3 The model is valid and reliable,4 and is useful for identifying inappropriate stays in acute hospitals and the causes.5,6

Inappropriate stays in Spain represent between 15% and 44% of all hospital stays.7 Among the factors that determine appropriateness of stay is the type of department providing the care.8 For this reason, analysis of the factors that cause inappropriate stays for each specialty can provide valuable information for implementing specific corrective measures. This analysis has not been carried out previously in any cardiology department in Spain.

The objective of the present study was to determine the rate of inappropriate stays and associated factors in patients hospitalized in our cardiology department, with the goal of establishing and developing a strategy for decreasing their frequency.
Inappropriate stays are defined as those for which none of the criteria for appropriateness are met, in which case the causes of inappropriateness are recorded. Data collection was carried out by 6 researchers, among whom a kappa concordance index was obtained. Explanatory variables considered were: sex, type of admission (emergency or elective), and duration of hospital stay. Quantitative variables were recoded prior to their inclusion in the regression model. The duration of each admission was divided into three thirds and this variable was included in the analysis. Each patient’s time at risk was calculated as well as inappropriate stays for each one of them. From this data the inappropriateness rate (IR) was calculated, which was the outcome variable of interest.

**Statistical Analysis**

A gross analysis was carried out where the null hypothesis of no association between different explanatory variables and the inappropriateness rate was contrasted, with a confidence level of $\alpha=.05$. Finally, a multivariate analysis was performed using a generalized linear model assuming a Poisson distribution, obtaining adjusted estimates of the odds ratio for each of the variables and 95% confidence intervals (CI) with an over-dispersion correction factor.
DISCUSSION

Our study highlights a 27% rate of inappropriateness in our cardiology department. Although a priori this may seem high, it is within the range published by other authors in other hospital contexts.\textsuperscript{9,13} In fact, this rate is low compared with other departments at our center (general rate, 34% [95% CI, 33-35]).\textsuperscript{8} This is the first study utilizing the AEP for a cardiology department in Spain. Despite its limitations, this is an objective tool that is useful for comparisons between departments and, above all, for comparing a single department against itself at different points in time. We must point out that when cataloguing a stay as inappropriate, neither the appropriateness nor the quality of care given is assessed, but only that this care could have been provided at a lower level of care or in a shorter period of time.

Various aspects of the results obtained are worthy of discussion. First, the inappropriateness rates were higher for older age-groups. This may be due to delays in discharging elderly patients for social reasons not specified in the clinical history or also to the higher incidence of comorbidities in this patient group, not reflected in the AEP criteria. Second, the likelihood that a day of stay may be inappropriate increases with prolonged stays. It could be argued that prolonged stays are due, in many cases, to

\begin{table}[!h]
\centering
\begin{tabular}{|c|c|c|c|c|}
\hline
Group & IR (95% CI) & OR (95% CI) & AOR (95% CI) & \textit{P} \\
\hline
Sex & & & & \\
Women & 23 (17.7-29.3) & & & \\
Men & 29.2 (24.8-34.1) & 1.27 (0.95-1.7) & 1.24 (0.79-1.95) & .349 \\
Age, y & & & & \\
<45 & 10 (2.7-25.6) & & & \\
45-65 & 24.5 (18.6-31.6) & 2.45 (0.89-6.74) & 2.84 (0.62-13.1) & .185 \\
>65 & 29.4 (25-34.3) & 2.94 (1.09-7.93) & 2.85 (0.64-12.8) & .174 \\
Type & & & & \\
Elective & 24.8 (19.7-30.8) & 1.15 (0.88-1.51) & 0.86 (0.56-1.33) & .500 \\
Emergency & 28.5 (24-33.7) & & & \\
Hospital stay & & & & \\
Less than 7 days & 15.4 (11.7-20.3) & 2.55 (1.65-3.09) & 1.91 (1.15-3.17) & .015 \\
More than 7 days & 34.7 (29.9-40.3) & & & \\
Thirds & & & & \\
First & 15.6 (11.8-20.2) & & & \\
Second & 31.6 (24.9-39.4) & 2.03 (1.42-2.9) & 1.81 (1.08-3.06) & .028 \\
Third & 40.2 (31.9-50) & 2.57 (1.81-3.68) & 2.21 (1.31-3.74) & .004 \\
Total & 27 (23.6-30.8) & & & \\
\hline
\end{tabular}
\caption{Rates of Inappropriateness Based on the Different Study Variables and 95\% Confidence Intervals (CI). Gross Analysis and Analysis Adjusted for the Remainder of the Variables of the Odds Ratio, 95\% CI, and Statistical Significance. Cardiology Service of the Clinical University Hospital of Valladolid, 2004}
\end{table}

The data analysis was performed using the R 2.5.0\textsuperscript{b} program. The percentages of the principal causes of inappropriateness were calculated in each of the thirds of the hospital stay.

RESULTS

During the study period 202 admissions to the cardiology department were assessed, which corresponded to a total of 818 days of stay. The mean (standard deviation) age of the patients was 65 (10.5) years and 127 (63\%) were men. Seventy percent of the admissions were elective (n=142). The mean admission stay was 4.5 (5.4) (median, 2) days and 1.1 (3) (median, 0) days were inappropriate. The mean general kappa concordance index was 0.71, with a maximum agreement level of 0.76 (0.23) and a minimum agreement level of 0.67 (0.15).

The general inappropriateness rate in the study period was 27 (95\% CI, 23.6-30.8) inappropriate stays each 100 patient-days (Table 2). Multivariate analysis (Table 2) shows that the main risk factors of inappropriate stays were older age-groups, stays of more than 7 days and days during the last third of the hospital stay. Sex and type of admission (emergency or elective) did not influence inappropriateness of stay. The main causes of inappropriateness are shown in Figure.
San Román JA et al. Appropriateness Hospital Stays in a Cardiology Department

Variations in the inappropriateness rates are a limitation in this study, since random sampling was performed over one year. One limitation that could have affected the results is the loss of statistical power derived from the fact that the number of stays analyzed was lower than expected and gave excessively broad CI results. Nonetheless, the magnitude of the risk and the CI range indicate that the results were not affected.

Finally, with regard to causes of inappropriateness, two of the most frequent causes (Figure) are closely related (pending tests and scheduling problems), and would be resolved by performing diagnostic tests more quickly once ordered, fundamentally catheterization and echocardiograms. Identifying measures for improvement with this objective and putting them into practice would most likely reduce the rate of inappropriate stays. Another frequent cause of inappropriate stays is that the diagnostic or therapeutic process could be carried out in an outpatient setting. In this respect, performing invasive procedures without hospital admission and starting up short-term care units should improve the rate of inappropriate stays.

REFERENCES