Cost of diagnosis and treatment of syncope in patients admitted to a cardiology unit

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Aims Despite the large number of hospital admissions due to syncope, information on the in-hospital cost of management of these patients remains incomplete.

Methods and results In order to assess such cost, we analysed the clinical histories of the patients suffering from syncope who were admitted to our Unit of Cardiology in 2003. We determined the length of stay (in days) for each inpatient, the number of diagnostic tests performed, and the various therapeutic procedures undertaken. Two hundred and three patients (mean age 68 ± 14, 49% female) were admitted because of syncope. Final diagnoses on discharge were drug-induced syncope in 10 patients, vasovagal syncope in 11, syncope secondary to cardiac ischaemia in 18, valvular disease in 4, rapid supraventricular arrhythmia in 20, ventricular arrhythmia in 19, atrioventricular block in 90, and unexplained syncope in 31 patients. Of these 203 patients, 70 (34.5%) had a previous history of cardiac disease. The global cost for all 203 patients was 2 264 979 €. The overall cost per patient was 11 158 € (range: 1651–31 762) including stay, diagnosis, and treatment. The overall cost of hospital stay per patient was 3718 € (range: 1436–5679). The overall cost per diagnosis of the 203 patients was 1141 € (range: 155–3577), and the cost of the therapeutic procedures required was 6299 € (range: 0–23 115). The most expensive were those cases of syncope secondary to ventricular arrhythmia, the cost of which is 20 times that of drug-induced syncope.

Conclusion The cost per diagnosis and treatment of a patient admitted because of syncope varies widely with important differences depending on the specific cause.

Introduction

Healthcare cost has incurred a tremendous increase in recent years. The cost per diagnosis and treatment of any disease accounts for an important part of such expense. Evaluating healthcare cost requires relatively complicated economic analyses and includes making a distinction between inpatients and outpatients. For example, the cost per diagnosis of a patient admitted to a hospital depends both on direct costs (personnel in charge of the patient, drugs administered, techniques employed, catheters used, etc.) and on indirect costs (light, heat, elevators, administrative staff, cleaners, security, etc.). We must also take into account wide inter-hospital variability, for instance, between a tertiary referral hospital providing the broadest range of acute medical care and a 50-bed private clinic. All this makes it extremely difficult to extrapolate the costs among different facilities and creates the need to perform economic analyses in every hospital.

The aim of this article is to assess the cost of diagnosis and treatment of syncope in our Cardiology Department. To accomplish this, we have analysed the aetiologies, the origin of referral, the length of hospital stay, and the number of diagnostic and therapeutic tests performed as well as their outcome, in the year 2003.

Methods

Study design

The University Hospital Virgen del Rocio is a tertiary referral 1700-bed facility in the southwest of Spain and serves a population of approximately 962 000 patients. We (G.B.-E. and S.G.M.) have reviewed the clinical history of all patients admitted to our unit from 1 January 2003 to 31 December 2003. We have identified patients with the ICD-9-CM diagnostic code: 780.2 (syncope and collapse) either as admission diagnosis or as one of the discharge diagnoses. This method of retrospective identification of patients with
syncope considering the diagnostic code has been previously employed in several studies.1–5

The inclusion criterion was to be admitted to hospital on the basis of a reported syncopal event prior to admission. The admission decision was according to the ethical recommendations of our institution and risk criteria, and not for social reasons, because in those cases of social problems, patients were moved to another institution. Syncope was defined as a transient loss of consciousness accompanied by the inability to maintain upright posture and followed by spontaneous recovery of consciousness. Therefore, patients who were ultimately proved not to have syncope were excluded, therefore all cases of seizures, coma, and resuscitated sudden death are excluded. Syncope was diagnosed as secondary to ischaemic heart disease when patients described chest pain or ischaemic symptoms before syncope, and coronary disease was shown in diagnostic tests. We determined the length of stay (in days) in the various monitored units of our hospital: admissions unit emergency room (ER), intensive care unit (ICU) and intermediate cardiology care unit (ICCU), and in the cardiology ward (CW) from admission to discharge. We determined the tests and their results in each patient, and the therapy prescribed including the discharge medication.

The final diagnosis of each patient written in the discharge summary was used to classify the patients. The authors of this study were the team caring for the patients included. This allowed us to feel confident to use this final diagnosis. In order to perform the calculations, patients were assigned to one of the eight different diagnostic groups. For each group, we have compiled the number of days each patient in the group stayed in each inpatient unit (ER, ICU, ICCU, and CW). Likewise, the diagnostic tests and therapeutic procedures employed for each patient were divided by diagnostic group.

Cost estimate

According to the economic data of our hospital for the year 2003,6 we know the direct cost of the personnel working in each department. This permitted determination of the average cost of hospitalization, which includes indirect costs of personnel and other support services. The term relative value unit (RVU) refers to a unit of relative cost of each department. In departments such as Radiology or Pathology Laboratory, the RVU and costs of each test have already been calculated.

The cost of items or services not already calculated in terms of RVU in our hospital was specifically analysed for this study. In order to accomplish this, we used the methods employed when we analysed the costs of the Department of Cardiology of our hospital in 1994.7 We updated the costs using the retail price index rise from 1994 to 2003, which was provided by the Ministry of Economy. Moreover, we crosschecked our data against the real cost of various devices such as pacemakers, defibrillators, electrodes, angioplasty balloons, and intra-arterial devices (stents). Our findings are summarized in Table 1.

Global costs were divided in terms of stay, diagnostic, and therapeutic portions. The cost of stay in each unit (ER, ICU, ICCU, and CW) comprised all direct and indirect costs. The cost of diagnosis included all diagnostic tests performed in each patient during the hospital stay. The low cost of blood analyses and X-rays made it convenient to pool them and include them in the diagnostic cost. Treatment cost included only the cost of the therapeutic approach performed.

Results

During 2003, 211 patients were admitted to our Cardiology Department because of syncope. A total of 181 patients were referred from the ER, 14 came from another hospital, and 16 were referred from the outpatient clinics.

Eight patients, whose initial diagnosis was syncope, were excluded from the study because their diagnosis at discharge was revised to aborted sudden death. All other final diagnoses were determined to be true syncope. Thus, 203 patients were included in the study (100 females, mean age 68 ± 14) and were divided into the following

| Table 1 | Costs of hospital stay, diagnostic tests, and therapeutic procedures |
|---|---|
| Cost of hospital stay in the CW (per day) | Overall cost |
| Number of hospitalizations in CW in 12 months | 3 987 944€ |
| Laboratory | Overall cost |
| No. of RVU | 728.32€ |
| Blood analyses | |
| No. of RVU | 63 853.21 |
| Radiology | Overall cost |
| No. of RVU | 11 383.28€ |
| X-rays of thorax | No. of RVU |
| brain scans | 1506.22 |
| ECG | |
| 6.62 |
| Hospitalization in monitored units: ER, ICU, and ICCU | 368.94 |
| Stress test | 71.60 |
| Echocardiography | 48.50 |
| 24 h Holter monitoring | 50.10 |
| Tilt testing | 133.10 |
| Diagnostic electrophysiology study | 3868.80 |
| Diagnostic and therapeutic electrophysiology study | 5498.66 |
| Aortic valve replacement | 9042.85 |
| Aorto-coronary bypass (2 vessel) | 4664.80 |
| Pacemaker implantation | 8497.20 |
| Defibrillator implantation | 37 021.10 |
eight diagnostic groups for the purposes of cost analysis: (i) drug-induced syncope (n = 10); (ii) vasovagal syncope (n = 11); (iii) cardiac ischaemia (n = 18); (iv) valvular disease (n = 4); (v) supraventricular arrhythmias with rapid heart rates (n = 20); (vi) ventricular arrhythmias (n = 19); (vii) atrioventricular block (n = 90), and (viii) unexplained syncope (n = 31). Of the 203 patients, 70 (34.5%) presented with a previous history of cardiac disease. The demographic characteristics of each group are shown in Table 2.

The median length of stay of the 203 patients was 0.8 ± 0.9 days in ER, 0.8 ± 2.5 in ICU, 3.0 ± 4.3 in ICCU, and 9.9 ± 9.5 in CW. All patients underwent basic tests, averaging: 8 blood analyses, 10 ECGs, and 2 X-rays. In terms of specific diagnostic tests, echocardiography was performed in 63% of the patients, 24 h Holter monitoring in 14%, tilt testing in 22%, stress tests in 10%, stress echocardiography in 3%, electrophysiological testing in 19%, and diagnostic catheterization in 15%; 7% of the patients underwent brain scans and 4% had electroencephalograms.

Coronary artery bypass grafting (CABG) was performed in 0.5% of the patients, 0.5% underwent valve replacement, 6% stent implantation, 2% ablation of ventricular tachycardias, 45% permanent pacemaker implantation, and 6% defibrillator implantation. We considered that, in calculating the costs, it may be more interesting to divide the tests according to the different diagnostic groups. As a result, comparing those groups we have observed differences in terms of the length of hospital stay in the various inpatient units and also in terms of the number of diagnostic tests and therapeutic procedures (Table 3). We calculated the length of stay (in days) and the number of diagnostic tests and therapeutic procedures performed in all patients included in each group by multiplying the costs of each day of stay and each test. Consequently, we obtained the cost of stay and the cost of the tests for each group. The global cost of stay, diagnosis, and treatment of these 203 patients amounted to 2 264 980 €.

Finally, we have also been able to extrapolate the costs of stay, diagnostic tests, and therapeutic procedures that correspond to each diagnostic group and individual patient (Table 4). This table shows that the overall cost amounts to 11 158 € (range: 1651–31 762) for each of the 203 patients. This amount is divided as follows: the overall cost of hospital stay for each patient is 3718 € (range: 1436–5679), the overall cost of diagnostic tests for each patient is 1141 € (range: 155–3577), and finally, the overall cost of the therapeutic procedures for each patient is 6299 € (range: 0–23 115).

The medication prescribed at discharge was beta-blockers in 52 patients, nitrroglycerin in 37, aspirin in 74, calcium antagonists in 34, statins in 42, acenocoumarol in 28, diuretics in 56, angiotensin-converting enzyme inhibitors in 94, antiarrhythmics in 14, and digoxin in 12 patients. The cost of the drugs prescribed at discharge was not included, as they were not considered to be part of in-hospital cost.

**Discussion**

The most important finding of our study is the high cost of evaluation of syncope patients and the wide range of cost depending on the diagnosis. Obviously, length of stay, diagnostic tests, and therapeutic procedures...
will be different in respect of cause of syncope, and our data show this difference in terms of cost.

The wide spectrum of diseases that may cause syncope is largely responsible for the difficulty in determining the cost of evaluation of this symptom. Only 50% of the patients with syncope visit a doctor, and those attending the ER show a wide range of causes. The fact that our analysis has been conducted in the Cardiology Department has influenced the distribution of causes observed: 4.9% of syncope was drug induced, 5.4% was vasovagal, 74% had a cardiac origin, and only 15% were unexplained. Our data, in contrast with those of another series which describes patients admitted to any hospital department, describe very different percentages of diagnoses such as unexplained syncope (23%), vasovagal syncope (47%), and syncope with a cardiac origin (11%).

Determining the aetiology of syncope in our series sometimes required lengthy hospitalization and a considerable number of diagnostic tests, which demonstrates the high healthcare cost of patients with this presenting symptom. As our series evaluated costs associated with patients admitted to hospital for syncope evaluation, we must consider that we are dealing with critical patients who met the admission criteria and who must be considered to have more serious conditions than those managed as outpatients.

With respect to length of stay, Kapoor et al. in 1982 described an average length of stay of 9.1 days. More recently, however, Farwell et al. reported a shorter period of 4.4 ± 7.5 days (median 2) for all patients with syncope, but a complete comparison was not possible due to differences in admission criteria.

In terms of the cost of hospital stay, there is little information available and the data are disparate. For instance, in our country, we have observed differences in the cost per day of hospital stay which range from 108€ to 267€. In the Netherlands, the cost of admission to a tertiary referral hospital is 340€, but whether the admission is to an inpatient unit or to a monitoring unit remains unknown.

We noted that patients with a final diagnosis of structural cardiac disease or arrhythmias in contrast to patients with more benign causes of syncope were both admitted to monitored units (ICU and ICCU) and stayed longer in the CW, therefore increasing the costs. In fact, the cheapest cost was that of patients with vasovagal syncope (1436€), whereas the most expensive was that of patients with syncope secondary to cardiac ischaemia (5679€).

### Table 3: Overall length of stay (days) in each inpatient unit, and total number of diagnostic and therapeutic tests performed in the 203 patients in all 8 diagnostic groups

| Cause of Syncope | Drug-induced syncope, n = 10 | Vasovagal, n = 11 | Cardiac ischaemia, n = 18 | Valvular disease, n = 4 | Atrial arrhythmias, n = 20 | Ventricular arrhythmias, n = 19 | Atrioventricular block, n = 90 | Unexplained, n = 31 | Total, n = 203 |
|------------------|-----------------------------|-------------------|--------------------------|------------------------|---------------------------|-----------------------------|------------------------|------------------|---------------|
| Length of stay (days) | | | | | | | | | |
| Total | 59 | 68 | 363 | 68 | 290 | 423 | 1364 | 314 | 2949 |
| ER | 7 | 11 | 9 | 2 | 18 | 7 | 99 | 18 | 171 |
| ICU | 84 | 6 | 15 | 54 | 3 | 162 |
| ICCU | 11 | 1 | 79 | 3 | 34 | 41 | 429 | 10 | 608 |
| CW | 41 | 56 | 191 | 57 | 238 | 360 | 782 | 283 | 2008 |

### Number of tests performed

| Test | Analysis | Baseline | Blood analyses—coagulation | Lipid Profiles | Electrocardiogram | X-rays | Echocardiography | 24 h Holter | Tilt test | Stress test | EPS | Catheterization | Brain scan | Monitoring | Electroencephalogram | Stress echocardiography | CABG | Valve replacement | Electrical cardioversion | Pacemaker implantation | ICD Implantation | Radiofrequency ablation | Stent implantation | EPS, electrophysiological study; ICD, implantable cardioverter-defibrillator. See text for other abbreviations.
The cost for each of the various diagnostic tests and therapeutic procedures is similar to that described by other investigators in our geographic area, but different from the cost reported by American authors and above all from Kapoor’s early series. The number of diagnostic tests in our series is higher than that performed in a similar group of patients. For example, 10.6 ECGs and 8.02 blood analyses performed on average per patient in our series are far higher than, respectively, 1.3 and 1.7 performed in the report by Farwell et al. Probably, our number of tests should be reduced. The percentage of echocardiographic studies also shows differences: our 63.05% clearly surpasses the 8.2% reported by Kapoor et al. and the 15% of Farwell et al., whereas our use of head-up tilt tests was less (22.6%) than the 52% reported by Farwell et al.

Drug-induced syncope requires the fewest diagnostic tests and therapeutic procedures and is consequently the cheapest per patient (155 €). In contrast, syncope secondary to ventricular arrhythmia is the most expensive because of the number and expense of diagnostic tests amounting to 3577 € and therapeutic procedures costing 23 115 €.

Analysis of the therapeutic procedures in our series has revealed the most important cost and the greatest differences among groups. The cost of each procedure has been included, but we have not found comparative data on the percentage of pacemakers implanted in these patients. Costs reported appear cheaper than ours: 8497 vs. 4420 ± 148 €. Other reports that do specify the number of tests performed per patient refer to outpatients, and their results cannot be compared with our findings.

Limitations of the present study

Indirect costs vary greatly among hospitals; thus our data can only be applied to tertiary referral hospitals.

Not all patients with aortic valve disease underwent valve replacement during this stay, but were re-admitted a few weeks later, implying higher cost than the referred. Despite the syncope guidelines from the European Society of Cardiology being published in 2001 and updated in 2004, the management of syncope in our hospital during 2003 did not follow the guidelines’ recommendations. Thus, the present study is not intended to analyse whether our hospital complied with the guidelines. In our opinion, close adherence to these guidelines would improve the percentage of satisfactory diagnoses and could reduce the cost of syncope management.

Conclusion

The range of costs for the evaluation of syncope varies 20-fold when comparing the cost of drug-induced syncope with that of syncope secondary to ventricular arrhythmia. Other aspects of cost are likely to be very dependent on the nature of the hospital in which the evaluation is being undertaken. Our data reflect only those in a tertiary referral centre.

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