Diabetes team consultation: Impact on length of stay of diabetic patients admitted to a short-stay unit

J. Puig a,*, A. Superviá b, M.A. Márquez b, J. Flores a, J.F. Cano a, J. Gutiérrez b

a Department of Endocrinology, Hospital del Mar, Passeig Marítim 25-29, 08003 Barcelona, Spain
b Department of Emergency Medicine, Hospital del Mar, Barcelona, Spain

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Abstract

Objective: To assess the impact of endocrinology team consultation on hospital stay and clinical outcomes of diabetic patients admitted with a primary non-diabetes-related diagnosis in a short stay unit (SSU).

Methods: Patients admitted to the SSU between 2001 and 2005. Between 2001 and 2003 there was no endocrinology team consultation available and the management of hyperglycemia was handled by the SSU team alone. From 2003 until 2005 an endocrinology team was in charge of diabetes care. We compared in both periods: prevalence of diabetes, length of hospital stay, mortality, early readmissions and number of patients requiring conventional hospitalization.

Results: In period 2001–2003, 1023 patients were admitted, among which 212 were diabetic (20.7%). Over the years 2003–2005, 892 patients were hospitalized, 223 were diabetic (25%). Clinical characteristics of diabetic patients from both periods were comparable, but glycaemia at admission was higher on the second period (217 mg/dl versus 198 mg/dl). The length of stay of diabetic patients in the second period decreased from 5.49 to 4.90 days. There were no significant differences in mortality (1.4% versus 0.4%) or in early re-admissions among the two periods.

Conclusions: The intervention of a diabetes team diminished the average length of stay of diabetic patients.

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Keywords: Length of stay; Diabetes team; Short stay unit

1. Introduction

Diabetes Mellitus is a chronic disease with a strong socio-economic burden that affects the health and well-being of people who suffer it [1] and has a major impact on the public health system, ranking four in a list of most costly medical issues [2–5].

The inpatient costs of diabetes are over a million euros per 100,000 habitants/year [2,4,6,7]. These costs are owed, partly, to the fact that diabetic patients as a group have more hospital admissions, readmissions and longer hospital stays than non-diabetic subjects [8–10]. The increase of morbi-mortality and the cost of in-hospital diabetic patient care can be reduced with intensive, specialized assistance. Previous studies demonstrated that endocrinology consultation for diabetic patients admitted at a conventional unit reduces the average length of stay [11–14]. There is also evidence that tight glycemic control in critically ill patients reduces their morbi-mortality [15,16].

Short stay units (SSU) are hospitalization units, commonly located adjacent to the emergency department, that accommodate patients with acute or...
exacerbated chronic diseases that require a brief period of inhospital care [17]. This type of unit improves the assistencial burden of the emergency rooms and increases the availability of conventional hospital beds required by other pathologies.

No studies have evaluated the prevalence of diabetes in patients admitted in a SSU or the impact of diabetes on the average length of stay (ALOS) and on the clinical outcomes of the pathologies attended. The purpose of this study is to answer these questions and to evaluate the impact of endocrinology team consultation on clinical outcomes of diabetic patients admitted with a primary non-diabetes-related diagnosis.

2. Material and methods

All patients admitted in the SSU, in an urban hospital with 416 beds, over a 4-year period (Nov-2001 to May-2005) were included.

The SSU was operative from November till May. The criteria for admission to the SSU was established by the emergency staff and it was based on the following criteria: pathology requiring in-hospital attention, hospital stay expected to be of less than 7 days, acute or exacerbated chronic pathology that would not require complex examinations and where serious complications were not expected.

Over the period November 2001 to May 2003, diabetic patients were managed by the staff in charge of the SSU. From Nov-2003 a specialized endocrinology team (endocrinologist and diabetes nurse educator) was incorporated as a consultation resource to the SSU. This team provided diabetes management and educational services no matter what pathology caused the admission on the SSU. When the staff in charge of the SSU detects hyperglycemia demands a consultation from the endocrinology team. The endocrinologist was in charge of glycaemic control and coordinated diabetes education with a specialized nurse.

During our study, there were no changes in the number of hospital beds, in the case-mix of attended pathology or in the hospital admission protocols.

We considered a patient diabetic when he/she presented a previous diagnose of diabetes or a serum glucose level over 200 mg/dl at admission or during hospitalization.

All patients admitted in SSU remained under 12 h in emergency. The stay at the emergency ward was not included in the overall length of stay. For all subjects admitted to the SSU, the following information was recorded: sex, age, principal diagnosis, past medical history, physical examination, serum glucose levels at admission, average length of stay, inhosptial mortality, need of conventional hospitalization in other departments and early readmissions (first 7 days after discharge from SSU). All decisions regarding discharge were made by the emergency staff. The criteria for discharging a patient were: stabilization of the disease that caused admission and glycemic control in diabetic patients. Euglycemia was required for discharge.

Diabetic patients admitted on the two periods (2001–2003 and 2003–2005) were compared. They were also compared with the non-diabetic patients admitted in the same period.

To calculate expenses, we have used structural cost, which only included the cost per bed and medical assistance. Costs of complementary tests (X-rays, laboratory studies, ...) were not included. In the comparative analysis, the global cost was obtained as the product of the structural cost times the number of hospitalization days per patient. The approximate cost was €128.6 per hospitalization day.

The analysis was performed using the SPSS statistical program (v12.0) for windows. The data are presented as mean ± S.D. and confidence interval 95%. The Komorov-Smimov test was performed to identify which variables were normally distributed. Comparisons between groups were performed by a Student t-test (with a Bonferroni correction) or Mann–Whitney U-test for normally and non-normally distributed variables, respectively. A p-value <0.05 was considered statistically significant.

3. Results

During the 4-year period, a total of 1915 patients were admitted in the SSU, 435 were diabetic (22.7%; CI 95%: 20.8–24.6). Between Nov-2001 and May-2003 (control period) 1023 patients were admitted, among which 212 were diabetic (20.7%). In the intervention period, the total number of patients was 892, and 223 were diabetic (25%).

No differences were observed in age, sex and other clinical characteristics, nor in the admitting cause between the two periods of the study (Table 1). The average length of stay for all patients admitted in the SSU was 5.05 ± 2.95 days on the first period and 4.75 ± 2.5 days on the intervention period (p < 0.05). There were no significant differences in mortality or in the number of readmissions, but the number of admissions in a conventional hospitalization unit was increased in the second period (74 cases versus 94 cases) (p = 0.01) (Table 1).

The cause of readmission for both groups was exacerbation of their baseline disease and not related with diabetes.

The analysis of diabetic patients admitted during both periods of study showed no differences in the initial clinical features except for the venous glycaemia at admission that was significantly higher in the diabetic patients admitted on the 03–05 period (217.8 ± 108.7 mg/dl versus 198.5 ± 82.7 mg/dl, p < 0.05) (Table 2). The average hospital stay for diabetic patients was 5.49 ± 3.1 days on the period 01–03
and was reduced to $4.9 \pm 2.27$ days on the intervention period ($p < 0.05$). Although slightly reduced, there were no significant differences in mortality nor in the number of early emergency readmissions (10 cases in both groups). The number of patients requiring conventional hospitalization in other departments was slightly increased (16 versus 18) (Table 2).

Comparing diabetic and non-diabetic patients outcomes in the intervention period (2003–2005), no significant differences were found on the hospital stay ($4.9 \pm 2.27$ days in diabetics versus $4.7 \pm 2.6$ days in non-diabetics) even though the diabetic group was older than the non-diabetics ($75.7 \pm 9.6$ years versus $71.9 \pm 16.8$ years). Although without statistical significance, there were a low rate of complications among diabetic groups (Table 3).

In both groups, diabetics and non-diabetics, the most frequent admitting diagnosis was exacerbated chronic obstructive pulmonary disease (COPD). Analyzing specifically the patients attended because of exacerbated COPD we observed that the group of diabetic patients showed the most important reduction in average hospital stay, from $6.1 \pm 2.8$ days on the first period to $5.1 \pm 2.4$ days in the period with endocrinology consultation ($p = 0.021$).

The total expense per diabetic patient was obtained adding the costs of all services for each patient, adjusted for each period of time. It was significantly lower

### Table 1
Baseline characteristics, average length of stay (ALOS) and complications of patients in both periods of study

<table>
<thead>
<tr>
<th></th>
<th>Patients 2001–2003 ($n = 1023$)</th>
<th>Patients 2003–2005 ($n = 892$)</th>
<th>Differences and CI 95%</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (% male)</td>
<td>49.7</td>
<td>53.4</td>
<td>3.7 (–0.69 to 8.27)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Age (years)</td>
<td>72.9 ± 15.2</td>
<td>72.9 ± 15.4</td>
<td>0 (–0.36 to 0.36)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Principal diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic respiratory disease</td>
<td>550 (53.7%)</td>
<td>508 (56.9%)</td>
<td>3.20 (1.26 to 7.66)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Heart failure</td>
<td>213 (20.8%)</td>
<td>191 (21.4%)</td>
<td>0.60 (–3.06 to 4.26)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>95 (9.3%)</td>
<td>81 (9.1%)</td>
<td>–0.20 (–2.79 to 2.39)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Other infections</td>
<td>90 (8.8%)</td>
<td>65 (7.3%)</td>
<td>–1.50 (–3.93 to 0.93)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>75 (7.3%)</td>
<td>47 (5.3%)</td>
<td>–2.00 (–4.17 to 0.17)</td>
<td>n.s.</td>
</tr>
<tr>
<td>ALOS (days)</td>
<td>5.05 ± 2.95</td>
<td>4.75 ± 2.52</td>
<td>–0.30 (–0.68 to 0.08)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Mortality</td>
<td>16 (1.56%)</td>
<td>11 (1.23%)</td>
<td>–0.33 (–1.38 to 0.72)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Conventional hospitalization</td>
<td>74 (7.23%)</td>
<td>94 (19.54%)</td>
<td>12.28 (9.23 to 15.33)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Readmission</td>
<td>42 (4.1%)</td>
<td>36 (4.03%)</td>
<td>–0.07 (–1.7 to 1.84)</td>
<td>n.s.</td>
</tr>
</tbody>
</table>

### Table 2
Comparison of diabetic patients in both periods of the study

<table>
<thead>
<tr>
<th></th>
<th>Diabetic patients 2001–2003 ($n = 212$)</th>
<th>Diabetic patients 2003–2005 ($n = 223$)</th>
<th>Differences and CI 95%</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (% male)</td>
<td>39.6</td>
<td>49.8</td>
<td>10.2 (0.90 to 19.5)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Age (years)</td>
<td>75.5 ± 9.7</td>
<td>75.7 ± 9.6</td>
<td>0.2 (0.38 to –0.78)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Blood glucose (mg/dl)</td>
<td>198.5 ± 82.7</td>
<td>217.8 ± 108.7</td>
<td>19.3 (18.1 to 20.54)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>ALOS (days)</td>
<td>5.49 ± 3.11</td>
<td>4.90 ± 2.27</td>
<td>–0.59 (–0.07 to –1.13)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Mortality</td>
<td>3 (1.42%)</td>
<td>2 (0.90%)</td>
<td>–0.52 (–2.54 to +1.49)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Conventional hospitalization</td>
<td>16 (7.55%)</td>
<td>18 (8.07%)</td>
<td>+0.52 (–5.56 to +4.52)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Readmission</td>
<td>10 (4.72%)</td>
<td>10 (4.48%)</td>
<td>–0.24 (–4.18 to 3.7)</td>
<td>n.s.</td>
</tr>
</tbody>
</table>

### Table 3
Comparison of diabetics and non-diabetic patients over the intervention period

<table>
<thead>
<tr>
<th></th>
<th>Non diabetic ($n = 669$)</th>
<th>Diabetic ($n = 223$)</th>
<th>Differences and CI 95%</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (% male)</td>
<td>54.9</td>
<td>49.6</td>
<td>–5.1 (–12.7 to 2.47)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Age (years)</td>
<td>71.9 ± 16.8</td>
<td>75.7 ± 9.6</td>
<td>3.8 (3.42 to 4.18)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>ALOS (days)</td>
<td>4.70 ± 2.6</td>
<td>4.90 ± 2.27</td>
<td>0.2 (–0.52 to 0.12)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Mortality</td>
<td>9 (1.35%)</td>
<td>2 (0.90%)</td>
<td>–0.45 (–1.96 to 1.07)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Conventional hospitalization</td>
<td>74 (11.1%)</td>
<td>20 (8.97%)</td>
<td>–2.13 (–6.57 to 2.31)</td>
<td>n.s.</td>
</tr>
<tr>
<td>Readmission</td>
<td>10 (4.71%)</td>
<td>29 (4.48%)</td>
<td>–0.24 (–3.43 to 2.96)</td>
<td>n.s.</td>
</tr>
</tbody>
</table>
(mean: €629.7) in the intervention period compared with those of control period (mean: €706.1), which constitutes a 10% reduction on the global cost per patient.

4. Discussion

Progressive population ageing and the growing problem of chronic conditions are affecting the demand for healthcare. In response to these trends, several strategies have been developed in order to cope with demand for emergency care.

Short stay units are an alternative to conventional hospitalization whose objective is to reduce cost, inappropriate admission to conventional medical units, and inappropriate discharges from emergency departments [17].

A review of the literature shows important differences in the model of these units in different countries [18–23]. Some groups consider them as observation units located in the emergency ward, whose objective is to administer treatment and discharge once stabilization is achieved (usually in less than 24 h). In others, they are designated areas that assist patients that require a continuous care, generally exacerbated chronic pathologies, for more than 2 days. This is the model of SSU established in our hospital.

The global prevalence of diabetes in our SSU was 22.7% (CI 95\%: 20.8–24.6), with variations on the two periods of study (20 and 25\%, respectively). In Catalonia (7.3 million inhabitants) a population survey showed a diabetes prevalence of 10.3\% (CI 95\%: 9.1–11.6\%) reaching 24\% in people 70 years or older [24]. Moreover, in elder people impaired glucose tolerance was present in 21.3\%.

Thus, the high prevalence of hyperglycemia in our study could be explained by the high average age of the population attended and also by the significant number of patients under steroid treatment as a result of the pathology that caused the admission (COPD, asthma). The prevalence found in our study closely matches a report by Carral (17\% of in-hospital adult population and 30\% in-patients aged over 65 years) [25].

In our study, during the pre-intervention period the fact of been diabetic was significantly associated with a longer hospital stay (Fig. 1). The introduction of an endocrinology consultation team for diabetes management reduced the ALOS to that extent of non-diabetic patients, without an increase in the number of early hospital readmissions or complications. There were no relevant differences in the clinical characteristics of the diabetic patients analyzed in each period of our study that could justify changes in the hospital stay.

The use of historical controls induced a bias. In most hospitals ALOS has been reduced in the last years due to financial pressure, nevertheless in the present study there were no differences between no diabetic patients admitted at the SSU in the two study periods (data not showed). The decline is not a time effect.

Staff of the emergency ward were not informed of the presence of the endocrinology team at the SSU, and there was not a generalized greater awareness about the importance of blood glucose control in reducing ALOS for all patients.

Published studies have already shown that SSU reduces length of stay and improve the efficiency of emergency departments [20]. However, the majority of reports were about SSU for patients with chest pain, coronary events, asthma or accidents and we were not able to find any about diabetes.

![Comparison of average length of stay](image.png)

Fig. 1. Comparison of average length of stay among study groups.
In a different assistance setting, other authors already proved the efficiency of the diabetes team on the reduction of the average length of stay of the diabetic patients admitted in a hospital conventional unit [11,26].

Probably, the complexity in the management of diabetic patients, often treated with drugs that increase glucose levels, is partly responsible for the longer length of hospital stay. Supporting this hypothesis is the fact that patients admitted for acute exacerbation of COPD, treated with high doses of corticoids, were the group that had the most significant reduction on hospital stay (1 day, CI 95% −0.3/−1.7). A diabetes team in charge of these patients could prevent metabolic imbalances through an early intensification of treatment. And moreover, the presence of a diabetes nurse educator facilitates the acquisition of diabetes-related skills (insulin injection, home glucose monitoring, nutrition habits) favoring a shorter hospital stay and reducing the number of early re-admissions related with diabetes.

Our report may have potential limitations, such as study design and the influence of glycemic control. Studies with a before-and-after design are predisposed to be influenced by time related changes such as altered case-mix or increased number of hospital beds [20]. But none of these possible major confounders happened in our hospital. Tighter glucose control would have a positive effect on the evolution of the pathology responsible for admission [15,16]. Unfortunately, in our study we did not evaluate differences on the degree of metabolic control achieved in diabetic patients treated in the two periods. Another limitation of the present study is the lack of data on the HbA1c at admission which would have helped to differentiate previous diabetic patients from those presenting secondary hyperglycemia due to stress or corticotherapy.

In conclusion, considering the high prevalence of diabetes our experience supports the participation of a diabetes team in SSU to improve the efficiency of emergency departments and the cost-effectiveness.

Conflict of interest

There are no conflicts of interest.

References


