

Characteristics of Patients Requiring Prolonged Length of Stay in a Surgical Intensive Care Unit in Barbados

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ABSTRACT

Objective: To evaluate the clinical characteristics and costs incurred for patients who stayed for a prolonged period in a surgical intensive care unit (ICU)

Design and Methods: Data of all patients admitted to a surgical ICU in Barbados during the period of two years from July 1999 to June 2001 were prospectively collected. Demographic data, diagnoses on admission and Acute Physiology and Chronic Health Evaluation (APACHE II) score were recorded. Costs for treatment were calculated from using a cost block model. The characteristics of patients who had a prolonged stay (> 14 days) were compared with a concurrent cohort of patients who stayed less than 14 days.

Results: Of 438 admissions, 58 (13.2 %) stayed in the ICU for more than two weeks. The overall age, hospital outcome, APACHE II scores in the prolonged stay group were significantly higher than that of the patients who stayed less than two weeks. Cost analysis showed about six times more expenditure in the long stay patients (\$US 3 800 vs \$US2 4000). Of the prolonged stay ICU patients, 29.2% would have required only a step-down unit due to less severity of illness as evidenced by their low mean APACHE II scores [7.3 ± 2.6 (SD)] compared to overall mean APACHE II score 10.7 ± 7.5 (SD).

Conclusion: The study highlighted the need for a step-down unit and a protocol to transfer eligible patients to such a unit.

Características de los Pacientes que Requieren una Prolongada Estancia en una Unidad Quirúrgica de Cuidados Intensivos en Barbados

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RESUMEN

Objetivo. Evaluar las características clínicas y costos en que incurren los pacientes que permanecen un periodo prolongado de tiempo en una unidad quirúrgica de cuidados intensivos (UCI).

Diseño y métodos. Los datos de todos los pacientes ingresados en una UCI en Barbados durante el período de dos años de julio de 1999 a junio de 2001 de junio, fueron recopilados de manera prospectiva. Se registraron los datos demográficos, los diagnósticos al momento del ingreso, y la puntuación APACHE II. Se calcularon los costos del tratamiento mediante un modelo de bloques del costo. Las características de los pacientes que tuvieron una estancia prolongada (> 14 días) fueron comparadas con una cohorte concurrente de pacientes que permanecieron menos de 14 días.

Resultados: De 438 admisiones, 58 (13.2%) permaneció en la UCI por más de dos semanas. La edad general, el resultado hospitalario y la puntuación APACHE II fueron significativamente más altos en el grupo de estancia prolongada que en el de los pacientes que permanecieron menos de dos semanas. El análisis del costo mostró aproximadamente seis veces más gastos en relación con los pacientes de estancia prolongada (\$3800 usd vs. 2 4000 usd). El 29.2% de los pacientes que tuvieron una estancia prolongada en la UCI, habrían requerido sólo un área de recuperación de fase II con una labor menos intensiva (step-down) debido al carácter menos severo de la enfermedad, tal cual lo pone de manifiesto la media baja de sus puntuaciones APACHE II [7.3 ± 2.6 (SD)] en comparación con la media general de la puntuación APACHE II (10.7 ± 7.5 (SD)).

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Conclusión: *El estudio puso de relieve la necesidad de una unidad de recuperación de fase II (step-down) y un protocolo para transferir a los pacientes elegibles para esa unidad.*

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INTRODUCTION

“Chronically critically ill” is currently being recognized as a separate sub-group of patients in the critical care setting (1). Developed countries have the facilities to cope with this group of patients who require quasi-intensive care support for a longer period of time by transferring them to High Dependency Units, Respiratory Care Units and rehabilitation units, especially because of the cost involved in managing them in the ICU (2). Most hospitals in the Caribbean lack these specialized care units for managing long-term critically ill patients. These patients also have unique problems to be dealt with during the course of their illness and stay in ICU (3). Changing severity of illness, increase in morbidity and hospital mortality, ethical dilemmas and resource allocation are some of the many problems in managing the chronically critically ill. We evaluated the situation in Barbados with data collected from patients admitted to the surgical ICU of the Queen Elizabeth Hospital (QEH) over a period of two years.

The QEH is a 650-bed tertiary care centre, affiliated to the University of West Indies and a referral centre for several Caribbean countries. The surgical ICU in the QEH is a six-bed open unit admitting patients from all surgical specialties. Admission to the unit is primarily decided by an in-house anaesthesiologist in consultation with the requesting surgical colleague. Decision-making regarding discharge of a patient from the unit is done as teamwork; however, most often admitting units are hesitant to transfer patients to general wards due to unavailability of intensive nursing care.

METHODS

Approval of the Hospital Ethics Committee was obtained prior to the study. All the patients admitted consecutively to the surgical ICU over a period of two years from July 1999 to June 2002 were included for prospective collection of data.

Demographic data such as the age and gender of the patients, the diagnoses, hospital outcome and the length of stay were recorded for all patients. Patients were grouped into one of three categories namely ‘emergency surgical’, ‘elective surgical’ and ‘non-operative’ groups. Acute Physiology and Chronic Health Evaluation (APACHE) II score was recorded on admission for the non-cardiac surgery patients to define the severity of illness (4). From the data, patients were selected who required prolonged (> 14 days) ICU stay and compared their characteristics with the concurrent cohort of patients who stayed less than two weeks in the ICU. Although there have been many different suggestions regarding the exact definition of “prolonged” ICU stay (5), studies have recommended and used 14 days and above

as the appropriate duration to categorize intensive care patients into this group (6).

The cost of ICU treatment was calculated from a previously published study (7) which utilized a “cost block” model developed in the United Kingdom (8). The costs were broken down into six blocks, namely: capital expenditure, estate, non-clinical support services, clinical support services, consumables and staff. The authors followed the definitions of each block, and obtained data from annual budgetary information of the Administration and Accounts Department of the hospital. The cumulative costs of all the blocks gave the annual costs of the ICU, from which was calculated the average daily costs. The mean length of stay was used to calculate the total costs of each category of patients. Since ICU treatment is offered free of cost to the citizens of Barbados, this method of computing the costs as an ‘average’ of the total expenditure was suitable rather than activity based costing.

The case notes of those patients requiring prolonged ICU stay were subjected to further detailed analysis. The events of their complete stay in the ICU were recorded, which included the reason for the prolonged stay. For obvious reasons, there has been no recommendation of a fixed duration for considering a patient to be fit to be transferred to a step-down unit. However, for study purposes, we considered the criterion of an ICU-stay of more than two weeks after discontinuation of mechanical ventilation, to further categorize those patients who would have benefitted from a step-down unit, since ventilation is considered one of the indicators of ICU resource utilization (9).

The number of days of ICU-stay of these patients after they were considered fit to be transferred to a step-down unit and the reason for their continued stay in the ICU were also noted.

Continuous variables such as age, APACHE II score and costs were analyzed by Students-t test between the groups.

RESULTS

During the period of study, 438 patients were admitted to the surgical ICU, of which 62 patients died (overall mortality rate 14.2%). Of these patients, 380 (86.8%) stayed for less than two weeks and 58 (13.2%) patients stayed more than two weeks in the ICU. The comparison of demographic data, APACHE II scores, observed mortality, and the cost of treatment between these two categories of patients are given in Table 1. The age, APACHE II scores, and mortality of the prolonged stay patients were significantly higher than that of the patients who stayed less than two weeks in the ICU.

Table 1: Demographic data, APACHE II scores and costs

Variable	Overall (n = 438)	< 14 days stay (n = 380)	> 14 days stay (n = 58)
Age (Mean ± SD)	50.9 ± 20.5	50.2 ± 20.2	55.9 ± 21.4*
Gender (n) (%)			
Male	241 (55)	205 (54)	36 (62)
Female	197 (45)	175 (46)	22 (38)
Hospital mortality (n) (%)	62 (14.2)	44 (11.6)	18 (31)†
APACHE II (Mean ± SD)	10.7 ± 7.5	9.9 ± 7.3	21.2 ± 6.2‡
Average cost of treatment (Barbados dollars)¶	11799.16	7770.58	49074.98‡

* p = 0.04 (t-test); † p < 0.001 (t-test); ‡ p < 0.0001 (t-test); ¶ 1 US dollar = 2 Barbados dollars

The mean cost of treatment for the prolonged stay patients was US\$24 500 when compared to US\$3 800 spent for the shorter stay patients. Table 2 shows the overall

Table 2: Overall distribution of patients

Aetiology/specialty	Elective surgery (n = 214)	Emergency surgery (n = 175)	Non-operative (n = 49)
Laparotomy for gastrointestinal disorders	11	75	–
Trauma (multiple and head injuries)	–	44	22
Cardiothoracic and vascular surgery	131	7	2
Neurosurgery	44	11	3
Obstetrics and Gynaecology	5	23	–
Otolaryngology	6	4	14
Urology	7	–	1
Orthopaedics	5	1	–
Miscellaneous*	5	4	7

* Includes acute pancreatitis, septic shock, respiratory and cardiac failure in patients admitted to surgical wards

distribution of all the patients according to their specialty and/or aetiology during the study period. Majority of patients belonged to the elective surgical group, contributed mainly by cardiothoracic surgical patients, followed by neurosurgical patients. In the emergency surgical group, patients belonging to General Surgery who underwent laparotomy for gastrointestinal disorders such as intestinal obstruction, colonic carcinoma and gangrenous bowel formed the major category of patients. Trauma patients who sustained multiple and head injuries were the second largest number, followed

by Obstetrics and Gynaecology patients, who were admitted to the unit following Caesarean section with a diagnosis of pre-eclampsia/ eclampsia. In the non-operative group, patients with trauma and angio-oedema formed the major number of patients. There were a number of patients who were admitted initially to the surgical wards, developed conditions such as acute pancreatitis, sepsis syndrome, cardiac, respiratory, and renal failure and were subsequently admitted to the ICU. These patients were categorized as “Miscellaneous” based on diagnosis.

Table 3 shows the characteristics of the patients who required prolonged (>14 days) length of stay (n = 58). Gastrointestinal surgery was the most common diagnosis in the group who stayed for more than two weeks in the ICU, followed by cardiothoracic surgery, trauma and neurosurgery.

Table 3: Characteristics of patients requiring prolonged (>14 days) length of stay (n = 58)

Aetiology/specialty	Number and percentage of total admissions in each category	Length of stay (days) (Mean ± SD)
Gastrointestinal surgeries (n = 86)	21 (24)	31.7 ± 17.4
Cardiothoracic and vascular surgery (n = 140)	10 (7)	40.2 ± 22.6
Multiple trauma (n = 66)	9 (14)	28.4 ± 11.4
Neurosurgery (n = 58)	9 (16)	29 ± 17.5
Cervical spine injury (n = 4)	4 (100)	26.8 ± 5.9
Obstetrics and Gynaecology (n = 28)	2 (7)	30.5 ± 14.8
Otolaryngology (n = 24)	2 (8)	80.2 ± 27.6
Acute renal failure (n = 1)	1 (100)	32

By analyzing the prolonged stay patients’ case notes in detail, it was found that 17 (29.3%) patients stayed in the ICU two weeks after their mechanical ventilation was discontinued. These patients were not receiving inotropic or any other form of support during the major portion of their ICU-stay and all patients stayed in the ICU primarily for neurological monitoring, nursing care of the paralyzed, strict intake-output measurements and similar reasons which strictly do not necessitate stay in an ICU. The mean admission APACHE II score of this group of patients who were deemed fit to be transferred to a step down unit was 7.3 ± 2.6 (SD), which was lesser than even the mean APACHE II score of patients who stayed less than two weeks in the ICU [9.9 ± 7.3 (SD)].

Figure 1 shows the diagnoses of patients who were staying in the ICU, even though they would have benefitted

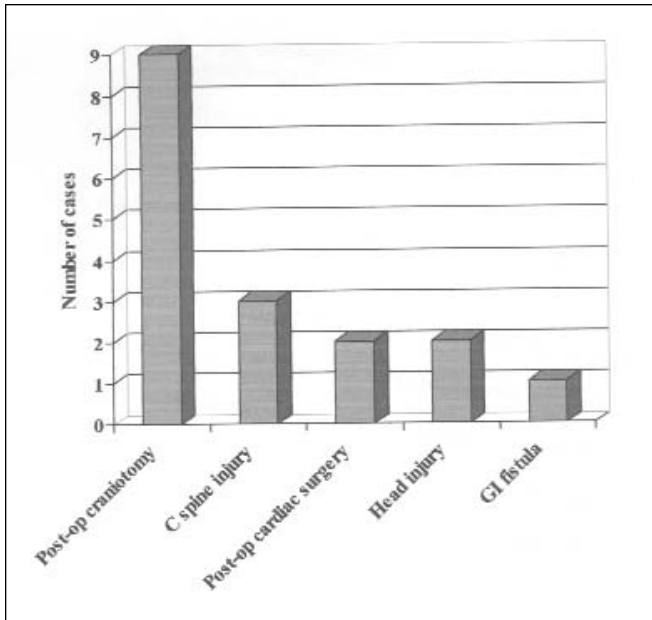


Figure: Diagnoses of patients who would have benefitted from a step-down unit.

from a step-down unit. The majority of patients who belonged to this group were neurosurgical patients. Post-craniotomy, cervical spine injury and vegetative state following head trauma were the diagnoses in these patients. There was one patient who had a duodenal fistula following laparotomy and stayed in the ICU for 40 days, mainly because the fistula was draining large amounts of fluid, complicating fluid balance. This patient's admission APACHE II score was 3.

DISCUSSION

Length of stay in the ICU is considered to be one of the most important factors which determine the outcome of ICU care (10). It has been shown consistently that longer stays in ICU correlates closely with worse outcome of the patient (11–14). Although the severity of illness during admission to ICU influences the overall length of stay, there are many occasions where even after recovering from the initial critical illness, it may be necessary to retain patients in the ICU for a longer time to provide supportive therapy. The incidence of this category of patients admitted to an ICU is reported to be around 5 to 10% in North America (15). When an extended care facility is not available to take care of these chronically critically ill patients, they continue to stay in the ICU. Elsewhere such patients are managed in various types of units namely the intermediate care unit or the high-dependency unit, step-down and rehabilitation units in accordance with the diagnosis, severity of illness and the support they need (15). Even patients who are on prolonged mechanical ventilatory support are being transferred to specialized units such as the “weaning centres” (16). This study does not aim to evaluate patients who could have been treated at such high technological specialized step-down units, but attempts

to study the characteristics of patients who would have benefitted from a simple intermediate care unit, after weaning from mechanical ventilatory support. Hence, an ICU- stay of two weeks after discontinuation of mechanical ventilation was considered the criterion to categorize patients who would have benefitted from a step-down unit.

The majority of ICU admissions in Barbados follow elective surgery, because almost all the cardiac surgery is done on an elective basis. Patients with angio-oedema are admitted to the surgical ICU, primarily for observation and prompt airway management when needed. Hence, the majority of these patients had a shorter stay in the ICU. During the study period, only two patients required readmission to the unit after their discharge to a general ward. This readmission was following re-operation. Given the fact that many patients stay in the ICU for a longer duration, it is not surprising that the readmission rate to the unit is very negligible.

Prolonged length of stay in the ICU has many adverse effects on patients, most notably on the morbidity. Increased incidence of nosocomial infections, especially with multi-drug resistant and unusual organisms, is one of the most important problems caused by long stay in an ICU (17–19) which may have its own cost implications.

Other studies have shown that patients who stay longer consume more of the expenditure compared to the shorter stay patients (20, 21). The present study also shows that the morbidity, mortality and cost of treatment of patients who stayed for more than two weeks are significantly higher than those who stayed for shorter periods in the ICU. Although it has been proposed that with the help of scoring systems such as the APACHE II, it is possible to predict ICU outcome in groups of patients (4), it cannot be used as a strict criterion to accurately predict the outcome of ICU therapy in an individual patient (22).

On the other side of the coin, it is also true that many patients survive the critical illness and get discharged despite all the disadvantages of the long ICU-stay (11). Hence it is impossible to triage patients primarily on the basis of length of stay for the purpose of discontinuing one or more modes of therapy. Additionally, there are a number of ethical problems unique to chronically critically ill patients (23). The ethical issues are further complicated in Barbados where there is no statute which allows a physician to discontinue treatment even in patients who are considered to be receiving medically futile treatment (24).

Since ICU treatment is offered free of cost to the citizens of Barbados, the cost implications of a prolonged stay are not apparent to the treating physicians as well as the patients and their relatives. Therefore, the most appropriate solution in this situation is to establish and stringently follow a protocol to transfer the patients who do not require the intensive therapy of an ICU but do require a little more care and support than a general ward, to an intermediate-care ward which may be less expensive than the ICU. The results

of this study show that about one-third of patients who stayed in the ICU for more than two weeks, were eligible to have been transferred to such an intermediate care unit. Many patients in this cohort belonged to neurology, with a diagnosis of either cervical spine injury or vegetative state, which again stresses the need for a psychiatry/rehabilitation unit which would have been the more appropriate team to manage such patients (25). Of course a cadre of critical care nurses would be vital to such a unit.

Our cost figures with respect to cost per day and the cost of treatment for shorter and prolonged stay in the ICU closely resemble the figures of a study by Heyland *et al*, although that report was published five years earlier. Because of the inability to withdraw support in Barbados, this study could not address the cost benefit of withdrawal of therapy as was done by Heyland *et al* (26). Another study used the APACHE II scoring system to classify patients who could benefit from a high-dependency unit and showed the cost benefits of such units (27). The main drawback of the present study is that there is no cost evaluation of an intermediate care unit because of the absence of an established unit in the hospital and hence the authors were unable to determine precisely how much revenue was saved. Nevertheless, the present study gave us the opportunity to look into the clinical characteristics and the overall costs of patients requiring prolonged ICU stay which highlights the need of a step-down unit, facilitate appropriate resource allocation and clear the ICU beds for sicker patients.

In summary, prolonged stay in the ICU has adverse outcomes and the costs involved in treating such patients are six times more than that incurred in shorter stay patients. Since a considerable number of the surgical patients could have benefited from just an intermediate care unit/rehabilitation unit, the study highlights the need for establishing such units and a protocol to transfer such patients to the most appropriate unit. An experienced critical care team would be required and attractive packages to minimize migration of critical care nurses would be needed.

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