MEDICAL INTENSIVE CARE UNIT UTILIZATION IN AN ACUTE TEACHING HOSPITAL

A C K Fok, Y T Tan, Y Y Ong

ABSTRACT

To ascertain the profile of medical intensive care unit (MICU) utilization in the Singapore General Hospital, a prospective survey studying 162 consecutive patients admitted to MICU was conducted over a four-month-period spanning September through December 1990.

While there was no racial predilection, male admissions (n=98) outnumbered female (n=64) by a ratio of 3:2. Male admissions averaged 56.7 ± 1.9 years (mean ± SEM) vs 56.4 ± 2.69 years in female (p=0.98). Sepsis comprised 25.3% (n=41) of admissions during this period of which chest infection (n=26) made up 63%. The superinfection rate was 3% comprising colonization of endotracheal and peritoneal dialysis tubes by Candida and Acinetobacter. There was a surprisingly high number of culture negative infections. These amounted to 43.9% (n=18) out of 41 admissions for sepsis as the primary indication and 57.1% of admissions in which sepsis was an accompaniment of the main indication.

The mean duration of ICU stay was 7.17 ± 1.5 days for sepsis vs 4.7 ± 0.5 days for admissions other than sepsis. Although this did not reach statistical significance (p=0.79) it corroborates the prevalent impression that patients with sepsis tend to require longer intensive care. The overall mortality was 37% (n=60). The mortality for septic patients (42.5%) is alarmingly high. This contrasts with a mortality rate of 34.7% for non-septic patients.

The issue of culture negative sepsis needs to be addressed. As it stands, septic patients stay longer than non-septic ones. Empirical treatment in the face of the culture negativity is not necessarily ideal and may contribute to longer ICU stay in such patients.

Keywords: Intensive care, critical care, sepsis, mortality, utilization.

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INTRODUCTION

Intensive care unit resources are a precious commodity in acute teaching hospitals. To be able to optimize ICU usage and upgrade and maintain the critical care infrastructure, data on admission trends, length of stay, diagnoses and patient outcome have to be constantly updated and reviewed. This paper reports the results of one such review conducted over a four-month-period in a 1500 bedded acute teaching hospital in which the *medical* bed complement totalled 300.

MATERIALS AND METHODS

Intensive Care Unit Setup

Data was collected from patients admitted to the Medical Intensive Care Unit of the hospital. This eight bedded facility at the time of the review served two general medical units with a bed complement of approximately 300, and in addition received patients from the nephrology, haematology and oncology services of the same institution. One of the medical units was staffed by physicians whose specialities were in neurology and endocrinology while the other department comprised staff whose specialities were in respiratory medicine, gastroenterology and infectious diseases.

The medical staff of the ICU comprised a resident medical office and registrar/senior registrar drawn alternately on monthly rotation from the two medical units. The intensive care facility accepted patients identified for critical care from the general medical units and allied subspecialties as well as direct admissions from the Emergency department of the hospital. On occasion, it also accepted coronary care patients from the department of cardiology which runs an eight-bedded coronary care unit. After office hours, the unit was manned by a similar complement of staff from the medical unit on active admitting duty. While a physician of consultant grade drawn in rotation from the medical units was designated to be in overall charge of the intensive care facility, resident staff were at liberty to call on the services of any specialty in the hospital deemed essential for optimal patient management.

Data Collection

The study period spanned the months of September through December 1990. All patients incumbent in the medical intensive care unit on 1st September 1990 were excluded from review. Consecutive patients gaining admission to the MICU during the aforesaid period were followed up till they were either discharged from the unit or perished from their illness. Clinical and demographic data was recorded by one of the authors (ACKF) who during the review period was not involved in the management of patients in MICU. A primary admission diagnosis and secondary diagnoses were recorded from each patient. Alphanumeric data (eg diagnoses, bacteriology and culture results) were transformed to numeric format at the end of the review period for analysis. Numeric and transformed alphanumeric data were subjected to analysis on the microcomputer based SPSS/PC+ (SPSS Inc, Chicago, Illinois, USA) statistical package.

RESULTS

Data from a total of 162 admissions was available for analysis. The distribution of patients by race was 117 (72.2%), 24 (14.8%), 9 (5.6%) and 12 (7.4%) for Chinese, Malay, Indian

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and Others respectively corresponding to the racial distribution of the country. Male admissions (n=98) outnumbered female (n=64) by a ratio of 3:2. Male admissions averaged 56.7 ± 1.9 years (mean ± SEM) vs 56.4 ± 2.69 years in female (p=0.98). The profiles of patient characteristics analyzed according to primary indication for MICU admission (ie sepsis and non-sepsis) are shown in Tables I, II and III.

Among non-septic admissions, acute pulmonary oedema (18.2%) was the single most common indication for admission followed by chronic obstructive lung disease (13.2%), coronary artery disease (13.2%) and haematological malignancy (9.9%) respectively (Table IV). Among these four main indications, patients with coronary artery disease had the shortest duration of ICU stay (1.4 days, $p < 0.05$) while patients with haematological malignancy were the youngest (34.9 years, $p < 0.01$) (Table V).

Table I - Patient Characteristics - All Admissions

	Non-Sepsis	Sepsis	p
Number	121 (74.7%)	41 (25.3%)	
Age (year)	56.3 ± 1.8	57.5 ± 3.3	ns
ICU Stay (days)	4.75 ± 0.5	7.17 ± 1.6	ns

Table II - Non-Septic Admissions

	Male	Female	p
Number	69 (57.1%)	52 (42.9%)	
Age (year)	55.3 ± 2.3	57.7 ± 2.8	ns
ICU Stay (days)	5.17 ± 0.7	4.19 ± 0.8	ns

Table III - Septic Admissions

	Male	Female	p
Number	29 (70.7%)	12 (29.3%)	
Age (year)	60.2 ± 3.5	50.8 ± 7.4	ns
ICU Stay (days)	7.27 ± 2.1	6.58 ± 2.0	ns

Table V - Age and ICU Stay for Main Non-septic Admissions

Diagnosis	Age (yrs)	ICU Stay (d)
Acute Pulmonary Oedema	68.2 ± 2.4	4.0 ± 0.8
COLD	73.0 ± 1.6	5.0 ± 0.9
AMI/IHD	65.6 ± 3.1	1.4 ± 0.1*
Haematological Malignancy	34.9 ± 5**	5.1 ± 1.4

*$p < 0.05$ **$p < 0.01$

Sepsis comprised 25.3% (n=41) of admissions during this period of which chest infection (n=26) made up 63% (Table VI). The superinfection rate was 3% comprising colonization of endotracheal and peritoneal dialysis tubes by Candida and Acinetobacter. There was a surprisingly high number of culture

Table VI - Infections in MICU

Sources of Sepsis	n	%	ICU Stay (d)	Mortality
Respiratory tract infection	26	63.4	7.3 ± 2.1	50.0%
Septicaemia	7	17.0	9.0 ± 5.8	66.6
Central nervous system	3	7.3	7.0 ± 0.5	33.3
Hepato-biliary sepsis	2	4.9	5.0	50.0
RE system (malaria)	2	4.9	4.0 ± 1.0	0
Urinary tract	1	2.4	2.0	0
	41	100.0	7.17 ± 1.5	42.5

Table IV - Age, ICU Stay and Mortality of Non-Septic Admissions

Diagnosis	Age (yrs)	ICU Stay (d)	n	%	Mortality %
Acute Pulmonary Oedema	68.2±2.4	4.0±0.8	22	18.2	31.8
COLD	73.0±1.6	5.0±0.9	16	13.2	37.5
AMI/IHD	65.6±3.1	1.4±0.1	15	13.2	26.7
Haematological Malignancy	34.9±5.0	5.1±1.4	12	9.9	75.0
Congestive Heart Failure	72.2±3.0	2.6±0.9	8	6.6	25.0
CNS Disease (non CVA)	37.7±4.5	15.5±4.2	7	5.7	14.3
Bronchial Asthma	35.1±5.5	2.8±0.9	7	5.7	0
Diabetic Keto-acidosis	62.6±5.1	5.1±2.0	6	5.0	33.3
Drug Overdose/Poisoning	29.3±4.0	5.0±3.4	6	5.0	16.6
Renal Failure	43.4±6.9	6.6±2.1	5	4.1	40.0
Hepatic Failure	53.3±6.7	16.3±9.5	3	2.5	66.7
Near Drowning	22.3±5.1	2.0±0.5	3	2.5	0
Non-Haemat Malignancy	56.3±2.4	2.6±1.6	3	2.5	33.3
Cerebrovascular Accident	70.5±3.5	3.0±1.0	2	1.7	50.0
Epilepsy	38.0±2.1	1.0±0.0	2	1.7	0
Miscellaneous	61.6±9.2	2.7±0.8	3	2.5	0
	56.3±1.8	4.7±0.5	121	100.0	34.1

negative infections. These amounted to 43.9% (n=18) out of 41 admissions for sepsis as the primary indication (Table VII) and 57.1% of admissions in which sepsis was an accompaniment of the main indication.

Table VII - Culture Negativity in Septic Admissions

Source of sepsis	Culture - ve	%
Chest infection	11/26	42.3
Septicaemia	4/6	66.6
Central nervous system	1/3	33.3
Hepato-biliary sepsis	1/2	50.0
RE system	0/2	0
Urinary Tract	1/1	100.0
	18/41	43.9

The overall mortality was 37% (n=60). The mortality for septic patients (42.5%) is alarmingly high. This contrasts with a mortality rate of 34.7% for non-septic patients.

DISCUSSION

Admission to an intensive care facility is premised on the view that technologically advanced, competent care made available to the critically ill favourably influences the outcome of such illness[1]. This perception however has not been substantiated locally as there is little data presently available to validate superior outcomes for such patients treated in intensive care facilities. To address these issues, we have, as a start, sought to establish the demographic features of patients requiring intensive care management and characterize intensive care practice in this hospital.

Treatment of sepsis was found to be a major component of ICU practice, accounting for 25.3% of all admissions, of which almost two-thirds were due to pneumonia. Practically all patients with chest infection required ventilator support for varying periods of time but despite such intervention, a high mortality rate of 50% resulted. The same experience is shared by Sorenson[2] and Stevens[3] who reported similar mortality of 47% and 50% amongst patients with pneumonia treated in critical care units.

An aetiological diagnosis for pneumonia was established in 57.7% (15/26) of cases. This compares with Sorenson's[2] and Ortqvist's experience of 50% and 53% respectively. The need to establish an aetiological diagnosis cannot be overemphasized. Empirical treatment in the face of culture negativity is often viewed to be to the detriment of critically ill patients with pneumonia. It is tempting to speculate that patients treated empirically because of negative cultures fare worse than patients treated with the assistance of culture and sensitivity profiles. Data from this study however do not support such a contention in that mortality is not significantly prejudiced by culture negativity. The explanation of this observed phenomenon is presently speculative. Nevertheless this does not absolve the physician from adopting a more aggressive attitude towards establishing an aetiological diagnosis[4].

Among non-septic patients receiving critical care, cardiovascular related (acute pulmonary oedema 18.2%, myocardial infarction/ischaemic heart disease 15%, congestive heart failure 6.5%) disorders accounted for the majority (39.7%) of the admissions. These figures are startling as a separate 8-bedded coronary care unit (CCU) exists in the hospital. While the majority of the coronary related disorders gaining admission to the medical intensive care unit originated from the medical departments, occasions have arisen where coronary patients from the cardiology department have been lodged in MICU due to bed shortages in CCU. This reflects the prevalence of cardiovascular disease in the inpatient hospital population; our experience is similar to Knaus'[5] who reported on the outcome from the intensive care in 13 major medical centres.

Respiratory failure (n=16, 13.2%) was found to be a common indication for intensive care. These were in the main patients with acute on chronic respiratory failure requiring mechanical ventilation. This was associated with high mortality of 37.5% which while not significantly different from the experience of others[6,7] raises the issues of whether patients with terminal bouts of respiratory failure should be ventilated. If these are excluded from intensive care, mortality figures would improve significantly as one series[8] has shown. This is a contentious issue in which no clear answers have emerged[9].

Two major goals of the ICU health care team are to save the salvageable and to help the dying have a dignified death[10]. Many patients admitted to ICU have bleak prospects for recovery and questions concerning withholding extraordinary life support will be raised. The cognizance of survival data for systemic illness in intensive care practice will contribute to the attainment of these goals and reduce costs for both the patient and hospital.

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