SURGICAL INTENSIVE CARE: A UNIVERSITY HOSPITAL EXPERIENCE

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SUMMARY

In 1985, 140 (26.1%) of 536 admissions to the intensive care unit (ICU) were general surgical cases. Retrospective review of 107 of these admissions revealed four factors to be significantly different between survivors and non-survivors, $p < 0.01$. They were duration of stay, organ system failure, sepsis and complications. The role of the surgeon in an ICU where management is interdisciplinary is emphasised.

INTRODUCTION

The rapid growth of scientific knowledge has greatly enhanced the complexity and care of the seriously ill surgical patient.[1] The intensive care unit (ICU), with its concentrated medical, nursing and technological resources, has developed into an ideal facility for the provision of such care. Born of logistic necessity, when Florence Nightingale located sick patients near the nursing station during the Crimean War, the ICU is now a place where laboratory and monitoring methods are brought to the bedside for physiologic evaluation of life threatening clinical problems.[2] This retrospective review records our experience with general surgical cases admitted to the ICU in 1985.

Key Words:
Surgery – intensive care unit – prognosis

MATERIAL AND METHODS

The University Hospital, Kuala Lumpur, a 800 bed teaching hospital encompassing all major medical disciplines. Our ICU is under the purview of the Anaesthesiology Dept. It provides for critical care of patients from all units; except those undergoing open-heart surgery, who are admitted to a separate cardiac intensive care unit. Management is interdisciplinary but involves mainly the admitting clinician and resident anaesthesiologist.

In 1985, 140 (26.1%) out of 536 admissions to the ICU were general surgical patients. Neurosurgical patients were excluded from this study. Case records of107of these admissions were reviewed. One patient was admitted five times while six were admitted twice. Indications for admission, organ-system failure, complications and prognostic factors were analysed. Statistical analysis was performed using the t-test for two independent samples.

RESULTS

POPULATIONS: There were 65 males and 42 females; a ratio of 1.5:1. The age distribution is shown in Table I. The ages ranged from one day to 97 years (mean = 42.0 years).

TABLE I INTENSIVE CARE UNIT SURGICAL ADMISSIONS 1985 AGE DISTRIBUTION (N = 107)

AGE GROUP (YEARS)	NUMBER	PERCENTAGE
0 – 9	25	23.4
10 – 19	2	1.9
20 – 29	12	11.2
30 – 39	8	7.5
40 – 49	8	7.5
50 – 59	19	17.8
60 – 69	20	18.7
70 – 79	6	5.6
80 – 89	6	5.6
90 – 99	1	0.9
TOTAL	107	100.1

INDICATION FOR ADMISSION: There were 42 elective admissions. These were planned admissions whereby a decision was made prior to surgery to provide post-operative care in the ICU. Emergency admissions numbered 48 in patients immediately after surgery. The other 17 cases were admitted from the general surgical wards. They were assessed to be ill, requiring ICU support.

Reviewing the therapeutic indications, 99.1% were admitted for monitoring. 73.8% for mechanical ventilation, 28.0% for intensive physiotherapy, 14.0% after massive peri-operative blood transfusion and 9.3% after prolonged surgery.

ORGAN SYSTEM FAILURE (OSF)

Organ system failures were defined using criteria modified from Knaus et al.[3] These were based on physiologic derangements in six vital systems, defined as follows:

A. Haemodynamic:
   (i). heart rate less than 55 per minute,
   (ii). systolic blood pressure less than 100 mmhg,
   (iii). ventricular tachycardia or fibrillation;

B. Respiratory:
   (i). rate less than five or more than 50 per minute,
   (ii). PaC02 more than 7kPa,
   (iii). on ventilatory support more than 10 days;

C. Renal:
   (i). urine less than 0.5 ml/kg for eight hours or more,
   (ii). creatinine more than 250 mol/L;

D. Haematologic:
   (i). WBC less than 1000/dl,
   (ii). platelet less than 20000/dl
   (iii). haematocrit less than 20%;

E. Hepatic;
   (i). serum bilirubin more than 24 mol/L,
   (ii). prothrombin ratio more than 1.2,
   (iii). serum enzymes (SGOT, SGPT) elevated to more than twice normal;

F. Neurologic Glasgow coma scale less than six points. In 28 patients (26.2%), OSF was present on admission to the ICU while 35 patients (32.7%) developed OSF during ICU stay.

DURATION OF STAY: A majority of patients (65.4%) stayed either one or two days in the ICU while 13.1% stayed for more than one week. The mean duration of stay was 3.7 days.

*In all 43 admissions (40.2%) developed OSF. The number of organ system failure ranged from one to 29 patients (27.1%) with two or more. Haemodynamic failure was the most frequently encountered OSF with 33 admissions (30.8%); followed by respiratory (25.2%), renal (19.6%), haematologic (4.7%), hepatic (4.7%) and neurologic (3.7%).

SEPSIS AND COMPLICATIONS: Sepsis based on bacteriological culture reports were studied in all cases. Twenty patients (18.7%) had foci of infection on admission to the ICU while 32 (29.9%) developed ICU acquired infections. It was found that 29 patients (27.1%) had a single septic focus and 19 patients (17.8%) had multiple foci. The commonest sites of infection were the upper respiratory tract (17.8%), urinary tract (15.0%) and abdomen (8.4%).

The commonest complications of ICU stay were pneumonia and upper gastrointestinal haemorrhage – seen in 12 cases each. Other major complications include disseminated intravascular coagulation (8.4%) and adult respiratory distress syndrome (7.5%). Cardiovascular problems of acute myocardial infarction, congestive cardic failure and hypertensive crisis were rare developments.

INTERVENTION: Various monitoring and indwelling catheters were employed. Foley catheters for continuous bladder drainage were used in 85 cases (79.4%) and 78 cases (72.9%) had endotracheal tubes. Other forms of invasive intervention included central venous catheters (67.3%), nasogastric tubes (63.6%), arterial cannulae (39.3%) and chest tubes (19.6%).

Antibiotics were the commonest group of drugs used in the ICU. Only eight patients (7.5%) were not administered any antibiotic while a majority, 75.7%, had multiple antibiotic therapy. In two cases, seven different antibiotics were used during ICU stays of 21 and 24 days respectively. The other drugs included H_2 antagonists (32.7%), inotropes, mainly dopamine and dobutamine (29.0%), steroids (24.3%), vasodilators (4.8%) and antacids (1.9%).

PROGNOSIS

Ninety one admissions (85.0%) were alive on discharge to the general surgical wards. The ICU mortality rate was 13.1% (14 cases) while two cases with poor prognosis were discharged with facilities for continued ventilation in the general ward. Both died within a day of transfer. Statistical analysis indicated certain factors significantly influenced prognosis of the surgical patient in the ICU ($p < 0.01$). These were duration of stay, number of OSF, number of septic foci and complications (Table II).

TABLE II ICU SURGICAL ADMISSIONS 1985 PROGNOSTIC FACTORS

FACTOR	SURVIVORS	NON SURVIVORS	SIGNIFICANCE
DURATION OF ICU STAY (DAYS)	2.8	9.1	$p < 0.01$
NUMBER OSF	0.6	3.4	$p < 0.01$
NUMBER SEPTIC FOCI	0.6	1.4	$p < 0.01$
NUMBER COMPLICATIONS	0.3	1.3	$p < 0.01$

DISCUSSION

The Intensive Care Unit (ICU) at the University Hospital, Kuala Lumpur provides a vital service to the critically ill. Although the eight beds in this combined medical-surgical ICU compares unfavourably in terms of ICU beds to total hospital beds ratio with certain major centres in the United States,[3] it meets the recommended ratio of 1:100[4] an compares favourably with another teaching hospital in a developing country.[5] In keeping with the current philosophy,[1,2,6,7] surgeons at this centre have played essential roles in the ICU management of all surgical patients. Statistical analysis defined four significant factors which influenced ICU mortality (Table II).

Duration of stay reflected severity of illness. Our average of 3.7 days is similar to that of another centre.[4] The majority of patients (84.9%) stayed for less than one week while 4.7% stayed more than two weeks. The latter figure is marginally greater than that reported by Becker et al.[8] The mean duration of ICU stay for patients alive at discharge was 2.8 days compared with 9.1 days for ICU mortalities.

Various scoring and evaluation systems have been designed to assess ICU patients and predict prognosis.[9,10,11] Shoemaker et al have used physiologic monitoring data to predict outcome and define therapeutic decisions.[12,13] An alternative stratification method is based on organ system failure. This has been preferred by several authors[14,15,16,17] and has been used in this study. We have modified the criteria set by Knaus et al[3] by using data available to us and adding the component of hepatic failure. We believe that these data are readily available in most ICUs in developing countries and hence can be widely utilised. We found prognosis to be directly related to the number of OSF. The mean number of OSF was 0.6 for ICU survivors and 3.4 for non-survivors (Table II).

Rates of infection within selected critical care areas have been reported to be 300% to 400% higher than in the general wards.[18,19] Brown et al reported a total ICU infection rate of 23.5% and an ICU acquired infection rate of 11.2% (20). Our figures of 44.9% and 29.9% respectively were less favourable. We found that the number of culture proven septic foci was significantly different between survivors and non-survivors (Table II). This direct relationship between the number of infections in an individual patient and mortality has been documented.[20,21,22,23,24,25]. The two commonest foci of sepsis were related to the use of indwelling catheters – tracheal secretions and urine. Infection rates of 24.2% and 18.1% were recorded for patients with endotracheal tubes and urinary catheters respectively. The use of a 3-way bladder catheterization system employing antimicrobial rinsing[26] and suprapubic catheters[27] have been demonstrated to reduce urinary tract sepsis. We have not used these routinely. Although infection rates were significantly different between the two groups analysed, the difference in the average number of antibiotics used was not statistically significant ($0.20 > p > 0.10$). Complication rates were significantly greater among non-survivors. Respiratory complications were seen in 20 patients (18.7%). Out of the twelve cases with upper gastrointestinal haemorrhage, only two required surgical intervention.

We believe that the four factors: duration of stay, organ system failure, sepsis and complications, are inter-related parameters indicating severity of illness and hence contribute to prognosis in the surgical ICU patient.

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REFERENCES

1 Spencer FC, Skinner DB. The role of the surgeon in the intensive care unit. The Journal of Thoracic and Cardiovascular Surgery 1984 88 483–485.

[2] Shoemaker WC. Foreword.
Surgical Clinics of North America 1985 65 749–751.

[3] Knaus WA, Draper EA, Wagner DP, Zimmeran JE. Prognosis in acute organ-system failure.
Annals of Surgery 1985 202 685–693.

[4] Tomlin PJ. Intensive care – a medical audit.
Anaesthesia 1978 33 710–715.

[5] Oji A. Intensive care in a developing country: a review of the first 100 cases.
Annals of the Royal College of Surgeons of England 1986 68 122–124.

[6] Longmine WP. Preface.
Surgical Clinics of North America 1985 65 752.

[7] Wait AJ. The training and role of the surgeon in the intensive care unit.
Surgical Clinics of North America 1985 65 753–762.

[8] Becker AJ, Strauch GO, Saranchak HJ. Outcome and cost of prolonged stay in the surgical intensive care unit.
Archives of Surgery 1984 119 1338–1342.

[9] Knaus WA, Draper EA, Wagner DP et al. Evaluating outcome from intensive care: a preliminary multihospital comparison.
Critical Care Medicine 1982 10 491–496.

[10] Cullen DJ, Civetta JM, Briggs BA et al. Therapeutic intervention scoring system: a method for quantitative comparison of patient care.
Critical Care Medicine 1974 2 57–60.

[11] Synder JV, McGuirk M, Grenvik A, Stickler D. Outcome of intensive
care. An application of a predictive model.
Critical Care Medicine 1981 9 598–603.

[12] Shoemaker.WC, Appel P, Bland R. Use of physiologic monitoring to predict outcome and to assist in clinical decisions in critically ill postoperative patients.
The American Journal of Surgery 1983 146 43–50.

[13] Shoemaksr WC, Bland RD, Appel PL. Therapy of critically ill post-operative patients based on outcome prediction and prospective clinical trials.
Surgical Clinics of North America 1985 65 811 833.

[14] Le Gall JR, Buisson-Brun C, Trunet P et al. Influence of age, previous health status, and severity of illness on the outcome from intensive care.
Critical Care Medicine 1982 10 575–577.

[15] Sweet SJ, Glenney CV, Fitzgibbons JP et al. Synergistic effect of acute renal failure and respiratory failure in the surgical intensive care unit.
The American Journal of Surgery 1981 141 492–496.

[16] Knaus WA, Draper EA, Wagner DP et al. Prognosis from combined organ-system failure: a national study, abstracted.
Critical Care Medicine 1984 12 239.

[17] Madoff RD, Sharpe SM, Fath JJ et al. Prolonged surgical intensive care. A useful allocation of medical resources.
Archives of Surgery 1985 120 698–702.

[18] Wenzel RP, Thompson RL, Landry SM et al. Hospital acquired infection in intensive care unit patients: an over view with emphasis on epidemics.
Infection Control 1983 4 371–375.

[19] Daschner FD, Foey P, Wolff G et al. Nosocomial infections in intensive care wards: a multicentre prospective study.
Intensive Care Medicine 1982 8 5–9.

[20] Brown RB, Hosmer D, Chen HC et al. A comparison of infections in different ICUs within the same hospital.
Critical Care Medicine 1985 13 472–476.

[21] Caplan ES, Hoyt N. Infection surveillance and control in the severely traumatised patient.
The American Journal of Medicine 1981 70 638–640.

[22] Dominguez de Villota E, Algora A, Rubio JJ et al. Septicaemia is a medical intensive care unit: clinical, biochemical and microbiologic data of 109 cases.
Intensive Care Medicine 1983 9 109–115.

[23] Thorp JM, Richards W, Telfer ABM. A survey of infection in an intensive care unit.
Anaesthesia 1979 34 643–650.

[24] Teres D, Brown RB, Lemeshow S. Predicting mortality in intensive care unit patients: the importance of coma.
Critical Care Medicine 1982 10 86–95.

[25] Macheido GW, Loverme PJ, McGovern PJ Jr et al. Patterns of mortality in a surgical intensive care unit.
Surgery, Gynecology and Obstetrics 1981 152 757–759.

[26] Findlay CW Jr. Sepsis in the surgical intensive care unit.
Medical Clinics of North America 1971 55 1331–1352.

[27] Shapiro J, Hoffman J, Jersky J. A comparison of suprapubic and transurethral drainage for post-operative urinary retention in general surgical patients.
Acta Chirurgie Scandinavia 1982 148 323–327