Long-Term Outcome from Intensive Care. A One Year Follow-Up of Acute Admissions at Hawke’s Bay Hospital

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Abstract

Background: This study aimed to collect information about long-term survival and independence of patients requiring acute hospital admissions and care in Intensive Care Unit (ICU) and High Dependency Unit (HDU) in a non tertiary setting.

Setting: An 11-bed multidisciplinary co-located ICU and HDU, a JFICM level 2 unit, providing all intensive care services for a non-tertiary (secondary) New Zealand District Health Board Hospital.

Method: All acute adult admissions presenting to ICU/HDU between 1 Jan 2001 and 31 Dec 2001 were studied. Admission demographic and physiological data was collected. From a review of the hospital records, NZ death registry, and the ICU database of published obituary notices, dates of death were identified. After the first anniversary of their initial ICU admission, discharged patients in whom death had not been confirmed, were contacted. Patients surviving ICU were surveyed to determine their independence. The age and gender adjusted annual survival for the general population was compared to observed survival following ICU/HDU admission.

Main Results: Adult acute admissions comprised 586 (68.5%) of the total of 855 ICU/HDU admissions in 2001 (86 paediatric [<15 years] and 169 elective admissions excluded). Acute adult admissions (M 49.9%; F 50.1%) had a median age of 58 years, an ICU survival of 86.3%, and a hospital survival of 82.7%. Long-term outcome was established in 94% of admissions. One year post admission 73.2% were confirmed as alive. Increased age decreased survivorship, with only 35.3% of the >85 years old group surviving one year. After ICU admission, one year survival was lower than that of the general population. Age-group matched survival was from 93% to 32% for males and 60.2% to 90.4% for females of the general population survival rate. 94.4% of survivors were independent.

Conclusions: Following acute admission, ICU patients have a lower level of survivorship than the general population, but the vast majority of the 73.2% patients that survive one year remain independent. Generally the quality of life at one year is acceptable to survivors.

Background and Setting

Intensive care is an expensive and, in many societies, a restricted commodity. Intensive Care Units (ICUs) are designed to efficiently manage critically ill patients, providing therapy intended to save lives. Some patients perish, and some survivors are left with physical dependency. Increasing costs, aging populations and increasing demands for services, coupled with the
Attrition of ICU patients after discharge has raised concerns about the benefit of ICU care and stimulated interest in studying longer-term ICU outcomes [1-4]. The majority of previous studies have focused on survival from larger tertiary units, with high volumes and high severity of illness [3-14].

Survival is not the only outcome of interest. To justify the human, fiscal and resource costs of ICU survivors need to have a quality of life acceptable to the patients and independent high levels of care [3,4,7,14,15].

The purpose of this study was to assess the outcome of patients admitted to an ICU, using a prospective 1-yr follow-up using a telephone interview to confirm vital status and independence at one year after the Intensive Care admission to a non tertiary hospital.

Hawke’s Bay Hospital Intensive Care Services is the sole local provider of intensive care service for the Hawke’s Bay, serving a 150,000 population. Hawke’s Bay Hospital provides secondary level services to its community in relative geographical isolation to tertiary services and provides an opportunity to study the long-term outcome from patients admitted to an ICU in a “secondary” hospital in provincial New Zealand.

The ICU comprises an 11-bed unit in the Hawke’s Bay Hospital, staffed by registered nurses, and by ICU consultants, with no ICU resident medical officers. Hospital admission and intensive care services are funded from public funds. All patients requiring intensive care are admitted to ICU. A separate coronary care unit treats patients with primary cardiac disease not requiring other organ support. The ICU is a closed unit; patients requiring admission are transferred to the care of attending intensivists.

Hawke’s Bay Hospital is situated 300 km from the tertiary referral centre and intensive care transfers are only undertaken to access services not available at Hawke’s Bay Hospital.

**Method**

A prospective evaluation was undertaken of all patients admitted to the ICU during the 12-month period from 1 January 2001. Follow-up commenced in January 2002.

Patients with repeated admissions to the ICU entered the study only once, on their first ICU admission. Patients were excluded if they were less than 15 years of age, or if they were an elective hospital within admission.

**Data Collection**

- Demographics - age and gender
- Admission status, chronic health and acute physiology, and diagnostic codes (for APACHE II)
- APACHE II Score using the AORTIC database
- Discharge status
  - Hospital and ICU length of stay (LOS)
  - Hospital and ICU mortality

A “Post ICU Mortality” database (PIMD) was established of ICU patients who died in ICU, in hospital, or after hospital discharge. These events were identified from:

- Death notification in the newspaper
- Reported to the hospital
- In-hospital deaths on subsequent admissions
- Deaths reported to the NZ registry of deaths

At the anniversary of the discharge to ICU, the PIMD was checked. If no death was recorded, contact with the patient was initiated by phone.

Contact was made with the patient (or a caregiver) confirming vital status. A questionnaire, the Katz Index of independence in activities of daily living, was completed [16].

**Analysis**

For analysis, patients were grouped in three ways. Firstly by age groups, with ten-year age bands. Secondly grouped by predicted risk of death as calculated using APACHE II data and diagnosis in groups of 10% increases in predicted risk of death.

Thirdly by survivor status, with patients grouped using vital status at day 365 (1 year) after ICU admission.
Observed mortality was displayed from each group. ICU, in-hospital, and daily mortality up to day 365 were calculated using the Aortic database and the PIMD. Vital status was confirmed by the telephone interview.

LOS: ICU and Hospital LOS were categorized by age groups and by one year survivor status.

Prediction of survival: The predicted hospital mortality (using APACHE II) was compared to the observed ICU, hospital mortality, and one year mortality, and to the dependency of patients in each of the ten predicted mortality groups [17].

Intensive care/hospital 28 day, and one year survival was compared with APACHE II data grouped by age group. The expected and observed death rates were correlated.

Post ICU survival compared to the general population: For each ICU survivor an age and gender matched risk of death from the general population data using the NZ gender and age mortality tables was created and compared to the observed rate in each group [18].

Results

Between 1 January 2001 and 31 December 2001, a total of 855 patients were admitted to Intensive Care Services. Eighty-six ICU patients were under 15 years of age and 169 adults were from elective hospital admissions. These patients were excluded from further analysis. A further 14 admissions were readmissions. In these patients only data from the first acute admission was used. There were 586 remaining acute adult patients admitted representing 68.5% of the total admissions (Figure 1).

The median age was 60 with an average age of 58 years (median 60, quartile range (IQR) 39-74). Thirty eight patients were transferred to another ICU during the study period, all of whom were included in the analysis.

Of the 553 patients followed up, 277 were males and 276 female. The median age was 58 years (mean 60), the median APACHEII score was 15 (mean 15.8), and median APACHE II risk of death was 14.6% (mean 24.7%).

There were 80 deaths in ICU (13.7% of acute admissions) with 477 live discharges (86.3%) from ICU. After discharge from ICU, 21 died while in hospital and 457 (82.7%) were subsequently discharged from hospital. Of those discharged to the community, a further 56 were confirmed to have died within the year. Thirty-three patients were unable to be contacted to confirm vital status, date of death or complete the survey (Figure 2).

Cumulative mortality by gender and age are displayed in Figures 3 and 4. The 28-day and one-year outcome status by age (in decade cohorts) are displayed in Figure 5, while the 28-day and one-year outcome by age cohort is displayed in Figure 6.

The standardized mortality ratio (using APACHEII) was 0.75. Age, APACHE II Score and Estimated Risk of Death Score was lower in one year survivors group compared to the non-survivor group (p <0.001 in all cases) (Figure 7).

LOS: ICU cost is a function of both the intensity of therapy and the duration. The ICU LOS was not difference in different age groups, and the elderly group had a reduced length of hospital stay. However, there was no difference in the one year “Survivor” and “Non-survivor” groups in intensive care or hospital LOS (Figures 8 and 9) (p =0.35). Both groups had a median of 2 and 7 days for ICU and hospital LOS respectively (Figures 8 and 9).

APACHE II: When patients were grouped, APACHE II in risk of death categories the correlation of the estimated risk of death categories with the observed death rates at ICU discharge, hospital discharge, one year and with the one year “death or dependency rate” was r >0.96 (Figure 10 and Table 1).

Age: When patients were grouped in age groups, the correlation between estimated risk of death and observed death rate at ICU discharge and one year was high (r >0.90) but lower for hospital and 28-day mortality (Figure 11 and Table 2).
General population: When patient who survived ICU (live discharges from ICU) longer term survival outcomes were compared to the expected survival for the same age and gender group in the New Zealand population, this ranged between 68.5 and 100.2% for the different classes (Figure 12).

Discussion

These results demonstrate death rates in excess of that of the general population in the year after intensive care admission, even in patients who have survived ICU. Discharged ICU patients have additional risk from the underlying disease and co-morbidity than a standardized population. The 73.2% overall survival and the low level of dependency, especially amongst the very elderly is encouraging and is comparable to other studies [1,3,11,12,19]. The product of ICU appears to be likely to survive and be independent.

One year survivors as a group, were younger, had lower APACHE II scores and lower estimated risk of death than non survivors. APACHE II was designed as predictor of inpatient mortality [17]. In our population and case mix it APACHEII appears to be a reasonable predictor of one year outcome, both of overall survival and independent survival.

The patients from the age of 55 to 84 years appear to a remarkably similar one year survival. The younger groups have a better survival and it is only in the “oldest old” that the prognosis at one year appears guarded. However nearly one third survives the year, similar to findings in other studies [11,12,19].

The overall low level of dependency was encouraging but small numbers thwarted full analysis of this group. The elderly survivors of intensive care appear to be reasonably independent.

Age did not increase LOS either in intensive care or in hospital. The elderly admitted to the general wards have more prolonged hospital stay, but this does not appear to be true of the elderly admitted to our unit. The factors that are known to lead to prolonged LOS in the elderly, such as cognitive impairment, would also influence triage decisions in these patients [20]. The length may have been influenced by high early mortality. It is not clear whether the withholding or limitation of therapy (including admission to Intensive Care) influenced this finding. However, the oldest group, having survived ICU, had markedly decreased survival compared to their generation in the general population, and to other younger ICU survivors.

This study has several limitations, some of which are related to tool use assess independence. The Katz score is limited to functional independence and does not measure perceived quality of life, or other factors (such as chronic pain) [9]. Time in the interview was minimized to encourage full compliance. Additional information may have altered our perception of the satisfactory, independent outcome in 94% of survivors [9]. Havill and colleagues reported that 19% of ICU survivors had decreased quality of life and that in 7% this was severely reduced [14]. Other studies have demonstrated a poorer quality of survival with increasing of age [3,12]. Age generally increased the proportion of dependent patients in our study. However, in the >85 year-old group only 6% of the survivors were dependent, lower than in the younger cohorts. The lack of increased dependency in the very elderly has been noted in other studies of intensive care outcomes [12,21]. This may reflect poor survival in the community of the elderly with dependency or an ICU admission and treatment selection bias, where elderly patients with potential for dependent outcomes are excluded from ICU.

Another concern was the 5.6% failed follow-up despite using multiple search strategies to locate patients. The failure rate is similar to other long-term follow-up studies [4,6,7,9]. Review of the NZ death registry database provided to the hospital, did not increase the number patients identified as deceased. However, the official database has a long lead time from death to registration and some deaths we identified had not yet been recorded on the NZ registry. It is possible that some failed follow-ups may have migrated to another jurisdiction (e.g. Australia), and subsequent death would not be notified. However, it is reasonable to assume that the migrating group was at a lower risk of death than a non-migrating group. Review of the
demographics and diagnosis of those not followed up suggests that they were at low risk of death.

**Conclusions**

Following ICU admission, there is a lower level of survivorship than the general population, with 73.2% of the population being alive at one year. Of those who survive, 94% are independent. Although one year survivors are younger and had lower APACHE II scores than the non survivors, ICU and hospital LOS was not different.

Acknowledgements: We would like to thank the staff of Hawke's Bay ICU for their efforts in data collection, in particular Pam Lumsden, Liz Thomas and Sharyn Flynn for their work in maintaining the databases.
Figure 3. PERCENTAGE SURVIVAL IN DAYS BY GENDER

Figure 4. PERCENTAGE SURVIVAL IN DAYS, BY AGE

Figure 5. 28 DAY AND ONE YEAR MORTALITY BY AGE
Figure 6. OUTCOME OF PATIENTS AT ONE YEAR, BY AGE

Figure 7. SURVIVORS AND NON SURVIVORS AT ONE YEAR VS APACHE II SCORE, APACHE II RISK OF DEATH AND AGE
Figure 8. MEDIAN ICU AND HOSPITAL LENGTH OF STAY BY AGE

Figure 9. INTENSIVE CARE UNIT LENGTH OF STAY (DAYS) VS ONE YEAR SURVIVAL (%)

Figure 10. PREDICTED VS OBSERVED MORTALITY (WITH PLACEMENT AT TIME OF DEATH) OR DEPENDENCY AT ONE YEAR
Figure 11. APACHE II PREDICTED MORTALITY VS OBSERVED MORTALITY GROUPED BY AGE

Figure 12. OBSERVED SURVIVAL OF ICU SURVIVORS AT ONE YEAR AS % OF PREDICTED SURVIVAL (AGE AND GENDER MATCH TO GENERAL POPULATION)
Table 1. Correlation between APACHE II predicted risk of death and observed mortality, when patients are grouped by increasing predicted risk of death

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Table 2. Correlation between APACHE II risk of death and observed deaths when patients are grouped in age cohorts (ten years). [Pearson correlation]

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References