# Intensive care unit readmission after cardiac and thoracic surgery.

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**Summary**

Critical care services are one of the most demanding specialties in clinical practice and readmission to the intensive care unit has substantial financial and resource implications. Readmission and use of an expensive intensive care bed may be for a preventable complication. The aim of this study is to determine the readmission rate in the intensive care unit at the National Cardiothoracic Centre, the causes of readmission, the mortality rate and to identify high risk patients who may need readmission. This was a retrospective study which included patients admitted in the intensive care unit between 1st January 2001 to December 31st 2004. The records of all the cases readmitted were retrieved and information regarding the cause of readmission, management and outcome of management were recorded. Six hundred and three patients were admitted over the four year period at the Cardiothoracic intensive care unit (ICU) and there were eighteen readmissions. The readmission rate was 3.1%. The average length of stay of patients admitted in the ICU was 2.05 days and the average length of stay of readmitted patients was 3.9 days. The mortality of patients admitted at the ICU was 2.3% and the mortality of readmitted patients was 27.8%. Congestive cardiac failure and chest infection after open heart surgery form 22.2% and 16.7% respectively of the readmissions and anastomotic leakage after oesophagogastrostomy accounted for 27.8% of the readmissions. Other causes of ICU readmissions were infection of sternotomy wound (16.7%), dislodged electrode after permanent pacemaker implantation (11.1%) and a case of residual ventricular septal defect (5.5%). The study shows that readmission of cardiac and thoracic surgical patients to the ICU are low but are associated with a high morbidity and mortality. The average length of stay of readmitted patients in the ICU was about twice the admitted patients. Elderly patients who had oesophagectomy and intrathoracic oesophagogastrostomy are at a greatest risk of readmission and congestive cardiac failure is the major reason for ICU readmission after cardiac surgery.

**Key words:** Readmission - intensive care unit.

## Introduction

The intensive care unit at the National Cardiothoracic Centre is a six bed unit which caters mainly for postoperative cardiac and thoracic surgical cases. The majority of these cases were admitted after elective surgery. The purpose of an ICU is to continuously monitor a patient's condition so that subtle clinical decompensation can be detected early [1]. An intensive care unit provides the expertise and equipment for the treatment of patients with life threatening or potentially life threatening conditions and provides comprehensive support and care of patients. In the ICU, organ system failure can frequently be reversed by use of highly sophisticated and technologic life support systems. The ICU management of postoperative cardiac and thoracic cases is expensive. Readmission to the ICU is even more expensive especially in our environment where the cost of resources for the management of these patients is not easily affordable.

Many factors are involved in the readmission of patients to the ICU, but the commonly cited reason is discharge of a patient from the ICU to an ordinary ward with less intensive monitoring. Others include complication from the patient's primary disease, the late consequences of the surgical procedure or unrelated clinical events [2]. The decision to discharge a patient from an intensive care unit is complex and frequently influenced by resource demands, ICU leadership, bed capacity and care alternatives [3]. This may affect the average length of stay in the intensive care unit. Patients at high risk of readmission to the ICU may have to be identified to improve the outcome and decrease the cost of readmission.

This study seeks to evaluate the rate of readmission, the profile of patients who fall in the high risk group of readmission and the mortality rate.

## Patients and Methods

In this retrospective study, six hundred and three consecutive patients admitted over a four year period from January 2001 to December 2004 were studied. Eighteen of these were readmissions. These were surgical patients who had cardiac and thoracic surgery. The records of these patients were retrieved; the type of surgery, the length of stay in the ICU and the mortalities were recorded. The profiles of the readmitted patients were also studied. These included the indication for readmission and the mortality. The mortality rate was calculated for admission and readmission respectively.

## Results

A total of 585 patients were admitted over the four year period. The age distribution of the patients is shown in Table I. Forty nine percent of the patients were female and fifty one percent male. The type of surgery and the mortality is shown in Table II. The mortality for the admissions over the period was 2.4%. Cardiac surgery accounts for 33.2% of ICU admissions and the mortality in this group is 4.6%.

**Table I.** *Age distribution of patients.*

| Age (years) | Number of patients |
|---|---|
| 0-10 | 133 |
| 11-20 | 78 |
| 21-30 | 63 |
| 31-40 | 77 |
| 41-50 | 62 |
| 51-60 | 66 |
| 61-70 | 58 |
| 71-80 | 37 |
| 81-90 | 10 |
| 91-100 | 1 |
| **Total** | **585** |

**Table II.** *Type of surgery, number of cases admitted and mortality.*

| Type of surgery | No. of cases( %) | Mortality( %) |
|---|---|---|
| Cardiac surgery | 194 (33.2) | 9 (4.6) |
| Miscellaneous | 145 (24.8) | 1 (0.6) |
| Oesophageal Surgery | 66 (11.3) | 3 (4.5) |
| Pacemaker Implantation | 97 (16.6) | - |
| Thymectomy | 5 (0.8) | - |
| Modified B-T Shunt | 59 (10.1) | - |
| Vascular Surgery | 19 (3.2) | - |
| **Total** | **585 (100)** | **14 (2.4)** |

The indications for readmission at the intensive care unit are shown in Table III. Eighteen patients were readmitted with the mortality of 27.8%. The highest mortality of 60% occurred in patients who developed anastomotic dehiscence after oesophagectomy and intrathoracic oesophagogastrostomy. Congestive cardiac failure after heart surgery forms 22.2% of the readmissions with a mortality of 50%.

The length of stay of patients admitted to the intensive care unit is shown in Table IV. Over 60% of patients who underwent heart surgery were discharged by the third day from the intensive care unit. The average length of stay of patients admitted in the ICU over the four years was 2.05 days and 3.9 days for the readmitted patients.

**Table III.** *Intensive care unit readmission.*

| Indication for readmission | No. of cases( %) | Mortality( %) |
|---|---|---|
| Leakage of anastomosis After oesophgogastrostomy | 5 (27.8) | 3 (60) |
| Sternal wound infection | 3 (16.7) | - |
| Congestive cardiac failure after Heart surgery | 4 (22.2) | 2 (50) |
| Chest infection after heart surgery | 3 (16.7) | - |
| Residual ventricular septal defect | 1 (5.5) | - |
| Dislodged electrode | 2 (11.1) | - |
| **Total** | **18 (100)** | **5 (27.8)** |

**Table IV.** *Number of days of admission at the intensive care unit.*

| Indication for intensive care unit admission | 1day | 2days | 3days | 4-7 days | 8-14 days | >14 days | Total |
|---|---|---|---|---|---|---|---|
| Heart surgery (HS) | 7 | 63 | 70 | 48 | 4 | 2 | 194 |
| Oesophageal surgery | 54 | 10 | - | 1 | 1 | - | 66 |
| Miscellaneous | 128 | 9 | 3 | 5 | - | - | 145 |
| Permanent pacemaker implantation | 93 | 3 | - | 1 | - | - | 97 |
| Thymectomy | 1 | 2 | - | 2 | - | - | 5 |
| Modified Blalock -Taussig shunt | 50 | 4 | 2 | 2 | 1 | - | 59 |
| Thoracic/ Abdominal aortic Aneurysm repair | 4 | 6 | 7 | - | 2 | - | 19 |
| **Total** | **337** | **97** | **82** | **59** | **8** | **2** | **585** |

## Discussion

Many readmitted patients are among the sickest in the ICU and readmission to the ICU has been a great concern for clinicians as it is regarded as a quality improvement indicator, the high cost involved and the high mortality [2].

In this study, the readmission rate was low 3.1 % compared to the USA where the ICU readmission rate varies widely from 5-13% of all admissions [4]. The results of this study is slightly higher than the study by Turkistani [5] with the readmission rate of 2.6% but similar to readmission rate of 3.29% reported by Alexander Kogan et al [4]. Metanalysis of data from multi-institutional studies of ICU outcomes gave a mean ICU readmission rate of 7%, range (4-10%) [3].

In a study by Cooper et al [12] among 38 ICUs, the readmission rate varies from 3.9-9% . Chen et al [3,9] also found out that readmission rate among 7 hospitals ranged from 2.8-5.4%. Both studies found out that teaching hospitals had higher readmission rates than non teaching hospitals. Differences in readmission rates may reflect differences in case mix. Surgical intensive care units readmission rates tend to be lower (4.6-9.4%) than medical readmission rates (9.6-13%) [6].
The indication for readmission in the majority of our patients in this study was anastomotic leakage after Ivor Lewis procedure in elderly patients. This accounted for 27.8% of the readmitted patients. After heart surgery, congestive heart failure was the most frequent indication for readmission in our study. This was followed by pulmonary problems and sternal wound infection. These findings do not agree with other studies where the majority of patients were readmitted for respiratory complication [4,5,6,7]. In a review paper titled Understanding why patients are readmitted to ICUs by A L Rosenberg and C. Watts [3,8], respiratory and cardiac conditions were the most common (30-70%) precipitating cause of ICU readmission. In a case control analysis of readmission to the cardiac surgical intensive care unit, renal failure, respiratory failure and cardiac arrest were the most common indications for ICU readmission [11].

In a similar study by Chen et al [9], cardiovascular and respiratory problems were the most frequent diagnosis among patients readmitted with the same illness. Considering the factors involved in the readmission of patients, support services at the lower setting plays an important role. In our study, the quality of chest physiotherapy including the use of mucolytics, chest vibrations and spirometry at the lower setting may have resulted in the reduced pulmonary problems of our readmitted cases. The ward nurses in the lower setting also have a programme where each nurse rotates in the ICU at least one month every year to update their knowledge on ICU practice. Elsewhere, the intensive care liaison service has also been established to improve patient care and follow up post discharge from the ICU [10]. This service is based on current practices that are already in place in other ICUs in developed countries that have proven results in terms of patient outcomes and readmission rates. The service involves a visit each day by a specialist intensive care nurse who will review and assess every patient that has been discharged to the general wards [10].

The average length of stay in the cases admitted in our ICU over the period studied was 2.06 days. This is significantly lower than the average length of stay of readmitted patients which was 3.9 days. The length of stay in some studies for readmitted patients was at least twice as long as that for patients discharged from the ICU which is similar to our study [2,3,8].

The mortality rate of post surgical admission and readmission were 4.6 % and 27.8% respectively. This is consistent with previous studies where the mortality of readmitted patients vary from 11.3 to 58% [4,5,6,7,9,11,12]. Several factors explain the higher death rates [3,8]. First, readmitted patients appear to be sicker as measured by higher acute physiology score. The higher severity score at ICU discharge may also indicate that readmitted patients may respond less to therapeutic interventions which may have resulted in their subsequent readmission and/or death. Secondly, the higher mortality among patients readmitted to the ICU

may reflect a higher prevalence of patients receiving a form of ineffective care. The severity of illness at readmission was consistently higher in all studies that evaluated matched analyses of initial and second ICU admission. Thirdly, increased mortality may reflect poor quality of care such as premature discharge, defined by clinical instability at the time of ICU discharge. In other settings, it has been shown that premature hospital discharge of patients with unstable vital signs was responsible for a two fold increase in 30 day mortality.

## Conclusion

Patients who underwent Ivor Lewis procedure for carcinoma of the oesophagus had the highest readmission rate due to anastomotic leakage. For patients who had cardiac surgery, congestive cardiac failure was the most frequent cause of readmission in the ICU which may be as a result of poor condition of the patient prior to surgery. Readmitted patients have higher length of stay in the ICU and higher mortality rate.

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