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Original Research Article

ICU Outcomes and Quality of Life in Lung Transplant Patients Readmitted to Intensive care

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Abstract: Admission to the ICU is relatively common in lung transplant recipients. The ICU mortality rate has been reported to be around 37% per admission. The aim of our study was to assess patient characteristics, ICU outcomes and QOL of lung transplant patients who required ICU readmission. ICU data from the first ICU readmission were collected retrospectively. QOL was assessed using SF36v2 tool prospectively. Cardiopulmonary transplant centre Participants: 63 lung transplant recipients who were readmitted to ICU formed the study group. 66 patients selected by computer random number generator software who underwent transplant at the same time but were not readmitted to ICU after transplant formed the control group. The response rate to the questionnaire was 70%. Mean ICU LOS was 4.53 (SD 4.68) days. Mean duration of mechanical ventilation was 3.83 (SD 4.03) days. Overall mortality was 21% in the study group and 9% in the control group (p = 0.08). SF36v2 scores were lower in the study population compared to Australian norms. The mean PCS summary scores for study group and control groups were 42.21 (SD 12.81) and 45.32 (SD 11.28) respectively (p = 0.267) and that for the mean MCS were 45.68 (SD 12.37) and 47.79 (SD 9.25) respectively (p= 0.410). Lung transplant patients requiring ICU readmission had higher overall mortality (p= 0.08). Those patients who survived had good ICU outcomes and similar QOL scores compared to those who did not require ICU readmission.

Keywords: Lung transplant, Quality of life, ICU readmission, ICU outcomes, SF-36, mortality after lung transplant.

INTRODUCTION

Lung transplantation has proven to be an effective treatment option for patients with end-stage lung disease with positive effects on both survival and health-related quality of life (HRQOL). In one study the 1, 3, and 5 year survival rates were 77, 70, and 63%, respectively [1]. In a cross sectional study of lung transplant patients, recipients had significantly better Quality of Life (QOL) scores, which reflected an enhanced QOL compared with the reference value for patients with obstructive pulmonary disease. Seventy-six percent of lung transplant patients were highly satisfied with the transplant outcome and 92% would opt for the procedure again [2]. Although lung transplant patients are subjected to the side effects of immunosuppression, they report a good QOL with regard to physical and emotional well-being and social and sexual function [2]. Short-term survival has improved, but lung transplant recipients remain at high risk for a variety of complications that can necessitate Intensive care unit (ICU) admission.

Admission to the ICU is relatively common in lung transplant recipients. ICU care, including mechanical ventilation, is associated with a poor prognosis in lung transplant recipients [3]. The ICU mortality rate has been reported to be around 37% per admission [3, 4]. Respiratory failure and sepsis are the predominant causes of ICU admission [4]. Not much is known about the QOL of these survivors. In this study, our aim was to gain a better understanding of ICU outcomes and QOL in this group of patients. Specifically, purpose of our study was to describe patient characteristics, ICU outcomes and QOL of lung transplant patients who required ICU readmission and compare this to the lung transplant recipients who did not require ICU readmission.

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MATERIALS AND METHODS

The study was conducted in a single cardiopulmonary transplant center. We included patients who received either bilateral, single, or heart-lung transplant between January 2000 and December 2006. Human Research Ethics Committee approval was obtained before the commencement of the study (H07/066). ICU readmission was defined as any patient episode which required care in the intensive care after discharge from ICU following the initial transplant surgery.

Data from the first ICU readmission following lung transplant including age, gender, indication for transplant, time since transplant, number of admissions to ICU, ICU length of stay (LOS), indication for admission, whether infection or rejection occurred, APACHE (acute physiology and chronic health evaluation) II scores, SOFA scores, non- pulmonary organ dysfunction and duration of mechanical ventilation were collected.

Study and control group patients were sent a SF36v2 questionnaire along with the patient information statement and consent form by post. The SF-36 is a multi-purpose, short-form health survey with 36 questions. It measures eight domains of health: physical functioning (PF), role limitations due to physical health (RP), bodily pain (BP), general health perceptions (GH), vitality (VT), social functioning (SF), role limitations due to emotional problems (RE), and mental health (MH). It yields scale scores for each of these eight health domains, and two summary measures of physical and mental health, the Physical Component Summary (PCS) and the Mental Component Summary (MCS).

The SF-36 was judged to be the most widely evaluated generic patient assessed health outcome measure in a bibliographic study of the growth of "quality of life" measures.[5] Australian norms including age and sex specific SF36v2 scores are available for comparison.[6]

Statistical Methods

Data from the completed SF 36v2 questionnaire were entered into an Excel spreadsheet. A statistician using SF36v2 SPSS scoring software calculated the t-scores for individual patients. Missing data were estimated for 4 patients (2 in study group and 2 in control group) on multi-item scales using the half-scale rule as recommended by the User's Manual for the SF-36v2 Health Survey. As per SF36v2 guidelines, when considering group-level data, it is recommended that scores within 0.3 standard deviation, or 3 NBS points of the mean be considered within the 'average' or 'normal' " (5 NBS is required when looking at individual level data) [7, 8].

ICU data were entered into an Excel spreadsheet and total number, mean, standard deviation or percentage was calculated as appropriate. Continuous data were analysed using t test. Categorical data were analysed using Fisher's exact and Chi square tests with 2x2 contingency table (GraphPad QuickCalcs statistical calculator).

RESULTS

238 patients underwent lung transplant surgery between the years 2000 and 2006. 63 patients (26.5%) who required admission to ICU from the time of their lung transplant until 2007 formed the study group. Of these, 10 died prior to commencement of the study and three died after the study commencement. Out of the three who had died after the study commencement, two had returned their completed SF36v2 questionnaires. Of the remaining 175 patients, 66 patients were selected using random number generator software to form the control group. Of these 66 patients, 6 patients had died prior to study commencement.

Patient characteristics are described in Table 1. Patients in both the study and control group were relatively young with cystic fibrosis being the commonest indication for lung transplant. Number of patients who underwent lung transplant during the study period was steady ranging from 32 to 38 per year. Fewer patients whose transplant operation occurred in more recent years required ICU readmission. Even though fewer patients were getting readmitted, the total number of patients admitted to ICU had increased over the years, presumably from a cumulative effect Table 2.

Table 1: Demographics and clinical characteristics

Variables	**Study group,** n = 63	**Control group,** n = 66	**p value**
Age in years, mean (SD)	47.43 (14.36)	46.39 (14.95)	0.689
Sex (Male), n (%)	34 (53.9%)	33 (50%)	0.725
Indications for transplant, n (%)			
Cystic fibrosis	31 (49.2%)	24 (36%)	0.157
Emphysema	21 (33.3%)	17 (25%)	0.440
Pneumonia	1 (1.5%)	5 (8%)	0.209
Pulmonary fibrosis	5 (8%)	9 (14%)	0.399
Eisenmenger's syndrome	0 (0%)	4 (6%)	0.120
Other	5 (8%)	7 (11%)	0.764

Type of transplant surgery, n (%)			
Bilateral lung transplant	56 (89%)	52 (79%)	0.154
Single lung transplant	5 (8%)	10 (15%)	0.274
Heart-lung transplant	2 (3%)	4 (6%)	0.679
Overall mortality, n (%)	13 (21%)	6 (9%)	0.083

Table 2: Number of patients with first ICU readmission over the years

Year	No. of patients
2000	4
2001	3
2002	8
2003	5
2004	8
2005	16
2006	8
2007	11

Indications for ICU admissions are described in Table 3. Indications for ICU admissions varied and the majority (76%) were related to infection, rejection or other graft related indications Table 3. Most patients (77.8%) had only one ICU admission. The maximum number of admissions was 5 (1 patient) Table 3. 55% of patients had their admission within one year of their transplant surgery. The mean APACHE II score was 17.73 (SD 7.35) and the mean ICU LOS was 4.53 (SD 4.68) days. 24 patients (38%) required invasive mechanical ventilation. The mean duration of ventilation was 3.83 (SD 4.03 days). There were two ICU deaths, one during the first and another during the second ICU admission representing an overall ICU mortality of 3% Table 3.

Table 3: Characteristics of patients admitted to ICU

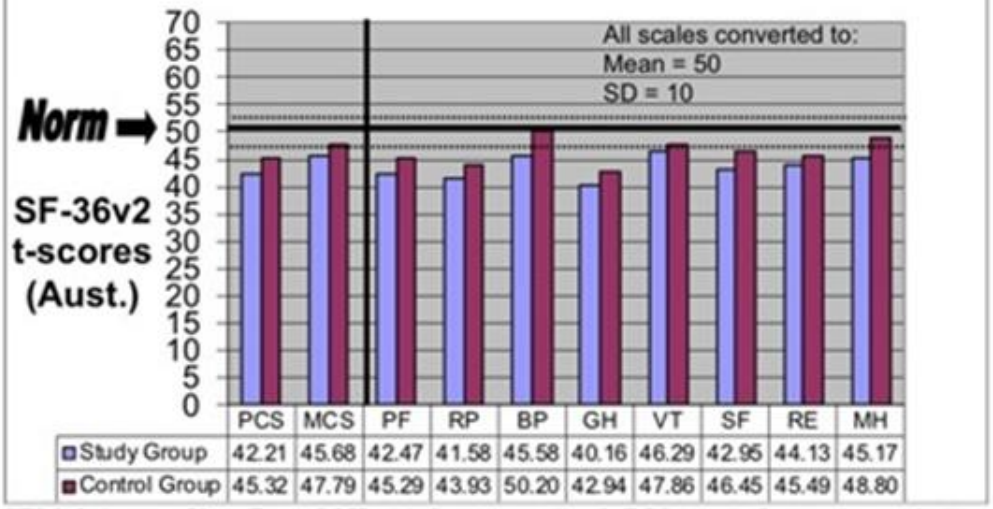
Indication for ICU admission, n (%)	
Infection	12 (19%)
Rejection	3 (4.8%)
Other graft related[a]	33 (52.4%)
Non-graft related[b]	15 (23.8%)
Type of admission, n (%)	
Elective	24 (38%)
Emergency	39 (62%)
Number of ICU admissions, n (%)	
1	49 (77.8%)
2	6 (9.5%)
3	4 (6.3%)
4	3 (4.8%)
5	1 91.6%)
Total ICU admissions	90
ICU Length of stay in days, mean (SD)	4.53 (4.68)
APACHE II scores, mean (SD)	17.73 (7.35)
Mechanical ventilation, n (%)	24 (38%)
Duration of mechanical ventilation in days, mean (SD)	3.83 (4.03)
Organ failure, n	
Cardiac failure	4
Renal failure	8
Gut failure	2
Liver failure	2
ICU deaths, n	2

SD is standard deviation. APACHE II denotes Acute Physiology and Chronic Health Evaluation version II. A) Other graft related indications include all graft-related complications, except infection or rejection e.g. pneumothorax, complication following bronchoscopy, sternal wound debridement etc. B) Non-graft related indications include post- operative admission following extra-thoracic surgery such as gastric fundoplication, neurological complications from calcineurin inhibitors, arrhythmias etc. that were not directly related to the graft.

33 of 53 patients (62%) in the study group and 46 of 60 control group patients (77%) returned their completed questionnaires. The overall response rate in the study was 70%.

The mean PCS summary scores for study group and control groups were 42.21 (SD 12.81) and 45.32 (SD 11.28) respectively (p = 0.267) and that for the mean MCS were 45.68 (SD 12.37) and 47.79 (SD 9.25) respectively (p= 0.410) Figure1, Table 4 PCS stands for psychometrically based physical component summary and MCS stands for mental component summary scores. These together provide valid information about the functional health and wellbeing from the patient's point of view. There was no statistically significant difference in QOL scores between the study and the control group in any of the 8 domains of the SF36 score. Overall, SF36v2 scores were lower compared to Australian norms.

Figure 1. SF36v2 Quality of life outcomes (summary scores and health scale scores) for the study and control groups, using t-scores based on Australian norms scores. The Australian average (or Norm) and the average range (+/- 0.3 SD or 3 points) are highlighted.



SF36v2 denotes Short Form 36 Health Survey version 2. PCS stands for psychometrically based physical component summary and MCS stands for mental component summary scores.PF(physical functioning), RP(role limitations due to physical health), BP (bodily pain), GH (general health perception), VT (vitality), SF (social functioning), RE (role limitations due to emotional problems), and MH (mental health) are eight domains of health scale scores measured by SF36v2. These together provide valid information about the functional health and wellbeing from the patient's point of view.

Table 4: Quality of life outcomes (SF36v2 summary scores)

	Study group, n = 33	**Control group,** n = 46	**p value**
Mean PCS summary scores (SD)	42.21 (12.81)	45.32 (11.28)	0.267
Mean MCS summary scores (SD)	45.68 (12.37)	47.79 (9.25)	0.410

SF36v2 denotes Short Form 36 Health Survey version 2. PCS stands for psychometrically based physical component summary and MCS stands for mental component summary scores.

DISCUSSION

Principal Findings

In this study, QOL scores after ICU readmission in lung transplant patients were similar to those patients who did not require ICU readmission. ICU outcomes in this study were better than other published data [3, 4].

Comparison with Other Studies

Patients in both the study and control group were relatively young with cystic fibrosis being the commonest indication for lung transplant Table 1. This is consistent with other published studies [9-11]. Survivors after ICU readmission had an acceptable QOL that compared favourably with those patients who did not require ICU readmission. To our knowledge this is the first study, which investigates the QOL in this patient group. It is to be noted that SF36v2 scores are lower in the study population compared to Australian norms. This is consistent with the earlier studies which showed that though scores improve substantially after

lung transplant, there is still a deficit compared with the normal population [12-15].

Strengths and Limitations of the Study

We had a total of 129 patients in our study. Though numbers are small, sample size in this study is larger compared to other studies? Most studies looking in to QOL of lung transplant patients in general have included similar or lower number of patients [2, 3, 16-21]. This study looks into a subgroup of patients (those lung transplant recipients who required readmission to ICU following initial transplant), but has one of the largest numbers of patients reported. To our knowledge this is the first study, which investigates the QOL in this patient group.

Findings of the study should be considered in the light of the study's limitations. These include: the small number of patients studied, patient groups not matched for age, sex, diagnosis, variable time interval between admission and completion of questionnaire and a lower response rate in the study population compared to control group. The time interval between ICU admissions to the completion of questionnaire was not constant. Whether this has any effect on the results of the study is debatable. Previous studies have shown that when patients are grouped by time since transplant, pathological performance of lung transplant patients improves slowly, with performance levelling at 12 months after surgery [12, 22]. This suggests time interval stratification is not essential after one year. In our study, most of the patients (73 of 79 patients, 92%) who completed the SF36v2 questionnaire did so more than 1 year after their lung transplant.

The overall mortality was also lower in our study compared to published data.[1] The overall mortality was 21% in the study group and 9% in the control group (p = 0.08). Combined 1, 3 and 5-year survival were 99%, 95% and 89% respectively. The reason for this lower mortality is unknown, possible reasons include improvement in post-transplant and ICU care since those studies were conducted.

Significance and Implications for Policy Makers

ICU outcomes in this study are better than published data and QOL scores compared favorably with those patients who did not require ICU readmission. Although further confirmatory studies are needed, the findings of this study suggest that ICU admission in selected group of lung transplant patients might be worthwhile. Even though fewer patients are getting readmitted, the total number of patients admitted to ICU had increased over the years representing a cumulative increase in transplant population. This suggests that transplant centers will have to factor in these readmissions when predicting future ICU activity. Interestingly fewer patients whose transplant operation occurred in more recent years required ICU readmission. Reasons for this could be improvement in surgical technique, better post- transplant management including better immunosuppression.

CONCLUSION

Patients requiring readmission to ICU following their initial lung transplant surgery have an overall higher mortality compared to control group of lung transplant patients (21% vs 9%, p = 0.08). Survivors have good ICU outcomes. Though SF36v2 scores are lower than that of the Australian norms, QOL scores are similar compared to those who did not require ICU readmission. Although further confirmatory studies are needed, the findings of this study suggest that ICU admission in selected group of lung transplant patients might be worthwhile.

CONFLICT OF INTEREST

This study was funded by the author himself (RS) and there is no conflict of interest to disclose.

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AUTHORS' CONTRIBUTIONS

Conceptualization, methodology, software, validation, formal analysis, investigation, data curation: All by Dr Rajesh Mohan Shetty

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