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# Ninety Day Post Discharge Outcome in Acute Exacerbation of Chronic Obstructive Pulmonary Disease Using the PEARL Score

Aishana Joshi,[1] Tirtha Man Shrestha,[2] Pankaj Pant,[3] Yogendra Man Shakya[2]

## ABSTRACT

**Background:** Chronic obstructive pulmonary disease exacerbation is a leading cause of frequent hospitalizations imposing substantial global health burden. The 90 day post discharge period has been associated with higher readmission rates and substantial risk of death. The aim of this study was to assess post discharge 90 day outcome in patients admitted with acute Chronic obstructive pulmonary disease exacerbation using the PEARL score.

**Methods:** A longitudinal study was conducted at Tribhuvan University Teaching hospital from February 2019 to November 2019. Patients admitted in respiratory ward with acute Chronic obstructive pulmonary disease exacerbation were stratified into low, intermediate and high risk groups using PEARL score and post discharge 90 day outcome was assessed. Data entry and analysis was done in SPSS version 20.0. Descriptive and inferential statistics were performed.

**Results:** A total of 102 patients were included for final analysis. Mean age of patients was 70.54 ± 10.85 years. There were 53.9% male. Intermediate and high risk PEARL groups had the highest proportion of readmission within 90 days of discharge which was found to be 23 (52.3%) and 9 (50%) respectively. High risk PEARL group had the highest proportion of death within 90 days (11.1%). The difference in these outcomes among three PEARL groups was found to be statistically significant (p-value < 0.05).

**Conclusions:** PEARL score is a simple tool that can be applied at bedside in assessing 90 dayrisk of readmission or death in acute Chronic obstructive pulmonary disease exacerbation. This can be beneficial in post-discharge planning and early referral especially in resource limited health care setting where advanced facilities are not available.

**Keywords:** COPD; ninety day outcome; PEARL score

## INTRODUCTION

Chronic obstructive pulmonary disease (COPD) exacerbation is a leading cause for frequent hospitalizations and readmissions worldwide.[1,2] The global burden of COPD exacerbation is associated with substantial increase in health care utilization, adverse quality of life and increased risk of death.[3-6] Among the patients hospitalized with COPD exacerbation, one third are found to be readmitted within 90 days of discharge.[7]Several studies have reported in-hospital and post-discharge mortality among acute COPD exacerbations with proportions varying from 2.5% to 30%.[8-10]

Globally, several tools like BODE, CODEX, ADO, PEARL have been developed to prognosticate risk of post discharge readmission or mortality in hospitalized COPD exacerbations.[11-13] Timely assessment of post-discharge prognosis is vital for clinical decision making, post-discharge planning and follow-up. However, evidence regarding prognostic implication of such tools in Nepalese health care setting is very limited.

We aimed to assess post-discharge 90 day outcome in patients admitted with acute COPD exacerbation using the PEARL score.

## METHODS

This is a hospital based longitudinal study conducted in respiratory ward of Tribhuvan University Teaching Hospital (TUTH), Kathmandu, Nepal from February 2019 to November 2019. Ethical approval was taken from Ethical Review Board, Nepal Health Research Council (NHRC). The sample size calculated was 102. Simple random sampling technique was used. Patients admitted in respiratory ward with acute exacerbation of COPD were included. Patients with new onset COPD, known malignancies, chronic co-morbidities likely to limit survival and those who had in-hospital mortality were excluded.

**Correspondence: Dr Aishana Joshi, Methinkot hospital, Kavrepalanchowk, Nepal.**
**Email: aishanajoshi@gmail.com, Phone: +9779841678434.**

Data were collected using semi-structured questionnaires, patient charts and hospital records. PEARL score[12] of each patient was obtained at the time of admission. PEARL score comprised of five components; previous hospital admission (P), extended medical research council dyspnoea (eMRCD) score[14], age (A), right heart failure (R) and left heart failure (L)with score ranging from 0 to 9(Table 1). Patients were further stratified into three sub-groups using the PEARL score obtained as low risk group with score 0-1, intermediate risk group with score 2-4 and high risk group with score 5-9. The cohort of these patients was followed up for a period of 90 days after discharge from hospital and the 90 day post discharge outcome was compared among the three PEARL sub-groups. The primary outcome after 90 days comprised of survival, readmission and death. Survival group was defined as patients without readmission or death within 90 days after discharge from hospital. The information on post-discharge 90 day outcome following discharge from hospital was obtained by telephonic interviews with patient and/or nearest family member and through review of hospital records. Informed consent was obtained from each participant using pre-approved informed consent form in Nepali.

Data entry and analysis was done in SPSS version 20.0. All statistical tests were performed at 95% Confidence Interval (CI). Univariate analysis was performed using frequency, proportion, mean and standard deviation. Bivariate analysis was performed using one way ANOVA (Analysis of Variance) test and Chi-square test.

Table 1. The PEARL score components.

| PEARL Score | Components | Score |
|---|---|---|
| P | Previous admissions:<br>< 2 admissions within past year<br>≥ 2 admissions within past year | <br>0<br>3 |
| E | eMRCDscore:<br>eMRCD 1-3<br>eMRCD 4<br>eMRCD 5a<br>eMRCD 5b | <br>0<br>1<br>2<br>3 |
| A | Age:<br><80<br>≥80 | <br>0<br>1 |
| R | Right heart failure (cor pulmonale):<br>Absent<br>Present | <br>0<br>1 |
| L | Left heart failure:<br>Absent<br>Present | <br>0<br>1 |
| | Total PEARL score | 9 |

## RESULTS

A total of 102 patients were included for final analysis. The mean age of the patients was 70.54 ± 10.85 years with range from 45 to 98 years. The study population comprised of 53.9% (n= 55) male and 46.1% (n=47) female. The highest number of patients were in age group 66 to 75 years in both sex (Figure 1).

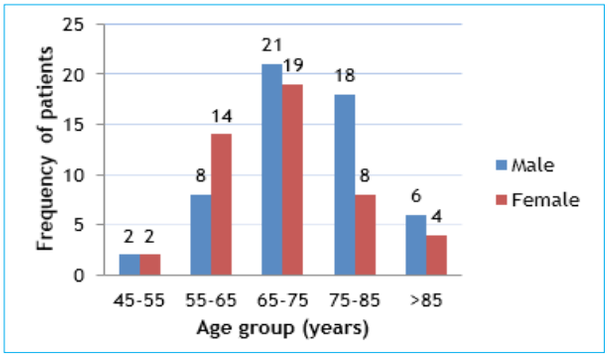


Figure 1. Age distribution of the patients (N= 102).

Table 2. Patient distribution in low, intermediate and high risk PEARL groups (N= 102).

| PEARL group | n (%) |
|---|---|
| Low risk (0-1) | 40 (39.2) |
| Intermediate risk (2-4) | 44 (43.1) |
| High risk (5-9) | 18 (17.6) |

The intermediate risk PEARL group had the highest number of patients (43.1%) followed by low risk PEARL group with 40% of patients while high risk PEARL group had the least number of patients (17.6%) (Table 2).

Table 3. Baseline characteristics of patients in low, intermediate and high risk PEARL groups (N= 102).

| Patient Characteristics (Mean ± SD) | Low risk PEARL (n=40) | Inter-mediate risk PEARL (n=44) | High risk PEARL (n=18) | p-value |
|---|---|---|---|---|
| Age (years) | 65.42 ± 8.37 | 74.95 ± 10.78 | 71.11 ± 11.49 | < 0.05 |
| BMI (kg/m$^2$) | 21.90 ± 4.33 | 20.40 ± 3.03 | 22.09 ± 4.08 | 0.121 |
| Smoking (pack year) (n=89) | 9.89 ± 6.79 | 15.04 ± 13.87 | 11.20 ± 6.01 | 0.11 |
| Duration of COPD diagnosis (years) | 8.45 ± 6.77 | 8.50 ± 6.26 | 9.44 ± 6.50 | 0.84 |

Table 4. Baseline characteristics of patients in low, intermediate and high risk PEARL groups (N= 102).

| Patient Characteristics n (%) | Low risk PEARL (n=40) | Intermediate risk PEARL (n=44) | High risk PEARL (n=18) | p-value |
|---|---|---|---|---|
| **Sex** | | | | |
| Male | 22 (40) | 24 (43.6) | 9 (16.4) | |
| Female | 18 (38.3) | 20 (42.6) | 9 (19.1) | 0.934 |
| **Smoking status** | | | | |
| Current | 9 (47.4) | 9 (47.4) | 1 (5.3) | |
| Past | 23 (32.9) | 32 (45.7) | 15 (21.4) | |
| Never smoked | 8 (61.5) | 3 (23.1) | 2 (15.4) | 0.174 |
| **Use of domiciliary oxygen** | | | | |
| Yes | 5 (16.1) | 12 (38.7) | 14 (45.2) | |
| No | 35 (49.3) | 32 (45.1) | 4 (5.6) | <0.01 |
| **Pneumococcal and influenza vaccination** | | | | |
| Yes | 4 (33.3) | 6 (50) | 2 (16.7) | |
| No | 36 (40) | 38 (42.2) | 16 (17.8) | 0.87 |
| **Co-morbidities** | | | | |
| None | 32 (50) | 26 (40.6) | 6 (9.4) | |
| Diabetes mellitus (DM) | 1 (20) | 3 (60) | 1 (20) | |
| Hypertension (HTN) | 2 (12.5) | 9 (56.2) | 5 (31.2) | |
| Both DM and HTN | 1 (10) | 4 (40) | 5 (50) | |
| Cardiac illness | 4 (57.1) | 2 (28.6) | 1 (14.3) | 0.012 |

Majority of the baseline characteristics did not vary significantly among the three PEARL groups. However, age, domiciliary oxygen and co-morbidity showed significant variation among three PEARL groups with p-value < 0.05 (Table 3 and 4).

As the PEARL grading increased, the length of hospital stay; and the need for non-invasive ventilation and intensive care unit (ICU) also increased significantly with p-value < 0.05 (Table 5).

Table 5. In-hospital course of patients in low, intermediate and high risk PEARL groups (N= 102).

| In-hospital course | Low risk PEARL (n=40) | Inter-mediate risk PEARL (n=44) | High risk PEARL (n=18) | p-value |
|---|---|---|---|---|
| Need for non-invasive ventilation n (%) | 6 (15) | 7 (15.9) | 8 (44.4) | 0.022 |
| Need for ICU n (%) | 4 (10) | 6 (13.6) | 12 (66.7) | < 0.05 |
| Length of hospital stay in days (Mean ± SD) | 8.10 ± 3.12 | 11.18 ± 4.05 | 15.72 ± 5.52 | <0.001 |

Table 6. Ninety days post discharge outcome of hospitalized COPD patients in low, intermediate and high risk PEARL groups (N= 102).

| PEARL strata | Outcome | | | | p value |
|---|---|---|---|---|---|
| | Survival (%) | Readmission (%) | Death (%) | Total | |
| Low risk (n=40) | 30 (75) | 6 (15) | 4 (10) | 40 | 0.005 |
| Inter-mediate risk (n=44) | 19 (43.2) | 23 (52.3) | 2 (4.5) | 44 | |
| High risk (n=18) | 7 (38.9) | 9 (50) | 2 (11.1) | 18 | |
| Total | 56 (54.9) | 38 (37.3) | 8 (7.8) | 102 | |

Highest proportion of survival was seen in low risk PEARL group (75%). Higher risk of readmission was observed in both intermediate and high risk PEARL groups; 52.3% and 50% respectively while it was significantly less in low risk PEARL group (15%). The risk of death was lowest in the intermediate risk PEARL group (4.5%) while similar proportions were observed in low and high risk PEARL groups; 10 and 11.1% respectively (Table 6).

## DISCUSSION

We assessed post-discharge 90 day outcome in 102 COPD patients using the PEARL score; a tool described by Echevarria C et al[12] for use in patients admitted with acute COPD exacerbation to assess risk of readmission or death within 90 days of discharge. The major finding

of this study was that the 90 day risk of readmission or death after hospitalization was considerably higher in the intermediate (n=23, 52.3%) and high risk PEARL groups (n=9, 50%). This finding is consistent with study done in the European National audit by Hartl S et al[6] which found the 90 day post discharge readmission in patients hospitalized with COPD exacerbation to be 54.3%. The readmission rates are similar to study done by Echevaria C et al[12] done to predict 90 day readmission or death after hospitalization following acute exacerbation of COPD using the PEARL score which found considerably higher risk of readmission or death within the intermediate (42.1%) and the high risk (66.4%) PEARL groups. In current study, the high risk PEARL group had the least proportion of survival (38.9%) while the highest proportion of death (11.1%) among the three PEARL groups within 90 days of discharge. In contrast, other studies have detected a high mortality rate following hospital admission for acute COPD exacerbations ranging from 22–43% after one year to 36–49% after two years depending on the severity of COPD patients.[10,15,16] The low proportion of death as seen in our study could be due to smaller sample size, shorter duration of follow-up and a relatively low sample of patients in high risk PEARL group as compared to low and intermediate risk PEARL groups. Patients with higher PEARL score had least chances of survival during the 90 day post discharge period while a higher chance of readmission or death.

The need for non-invasive ventilation during hospitalization was significantly lower in the low risk PEARL group; with the risk increasing among the intermediate and high risk PEARL groups. This could be correlated with potential prevalence of hypercapnia and type II respiratory failure in these groups although, the arterial blood gas (ABG) parameters at admission was not taken into account in this study. Chu CM et al[17] reported hypercapnic respiratory failure as an important predictor of post discharge readmission and mortality among COPD patients. In addition, the high risk PEARL group patients needed longer hospital stay (15.72 ± 5.52 days) and need for ICU admission (66.7%) than the intermediate and low risk PEARL groups. This indicates higher severity of disease in high risk PEARL groups with need for high dependency respiratory unit and ICU; with potential need of ventilator support in these patients. Further large multi-centre studies are recommended to establish correlation between COPD severity based on spirometric values as per Global Initiative for Chronic Obstructive Lung Disease (GOLD)[18] staging and PEARL score to establish post-discharge outcome based on disease severity.

PEARL score is a new scoring system that implies an important conceptual step towards a multidimensional approach to COPD patients beyond the traditional assessment based on spirometric evidence of airway obstruction.[12] The readmission and mortality findings from current study indicate that patients with high PEARL score had severe form of disease increasing the chances of readmission or death within 90 days of post discharge period. This could have specific implication for clinicians to identify patients at particular risk in post-discharge planning, strengthening post-acute care among high risk patients and early referral especially in rural health care setting where ICU and high dependency respiratory facilities are not available.

## CONCLUSIONS

PEARL score is a simple and highly valuable tool that uses routinely available indices in risk stratification to assess 90 day post discharge readmission or death in patients admitted with acute exacerbation of COPD. PEARL score can effectively guide clinicians to identify high risk patients for clinical decision making, appropriate resource allocation and post-discharge planning.

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**Author Affiliations**

[1]Methinkot hospital, Kavrepalanchowk, Nepal

[2]Department of General Practice and Emergency Medicine, Tribhuvan University Teaching Hospital, Institute of Medicine, Maharajgunj, Kathmandu, Nepal

[3]Department of Pulmonology and Critical Care, Tribhuvan University Teaching Hospital, Institute of Medicine, Maharajgunj, Kathmandu, Nepal

**Competing interests:** None

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