

Therapeutic Modulation of BiLevel Positive Airway Pressure in Cardiogenic Pulmonary Edema

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Objective

To evaluate the therapeutic role of BiPAP in improving clinical outcomes and arterial blood gas values in patients with cardiogenic pulmonary edema.

Methods

Design: ICU-based cross-sectional study
Setting: tertiary care hospital in Lahore
Sample: 123 adults with cardiogenic pulmonary edema
Sampling: non-probability sampling
Study duration: 4 months
Analysis: SPSS 27; repeated measures assessed with Friedman tests where normality was not consistently met.

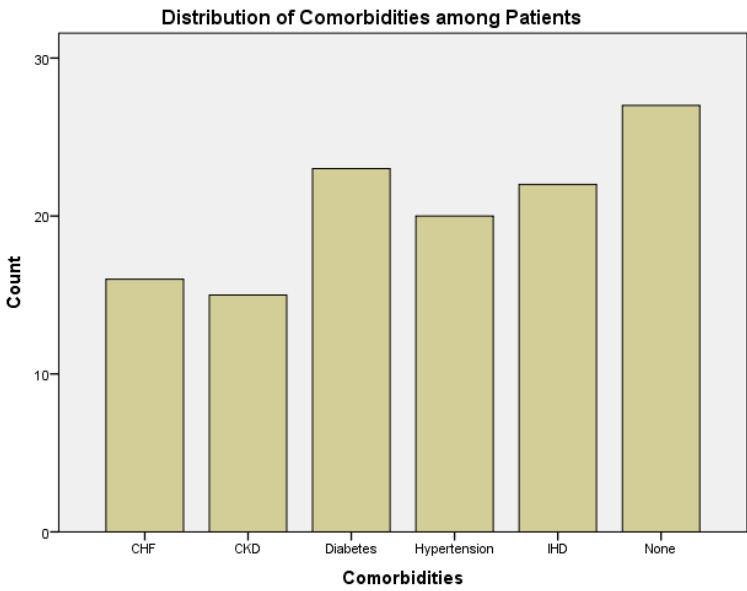
Patient selection

Included: age ≥18 years, clinical CPE diagnosis, SBP ≥90 mmHg without vasopressors, ability to tolerate the BiPAP mask, and consent.
Excluded: severe instability, reduced consciousness, airway protection concerns, facial trauma/recent upper GI surgery, frothy oral secretions, or active hemoptysis.

Study population

Age 25-40: 2 (1.6%)
Age 41-60: 65 (52.8%)
Age >60: 56 (45.5%)
Female: 71 (57.7%)
Male: 52 (42.3%)

Comorbidity profile



Most frequent categories: none, diabetes, IHD, hypertension.

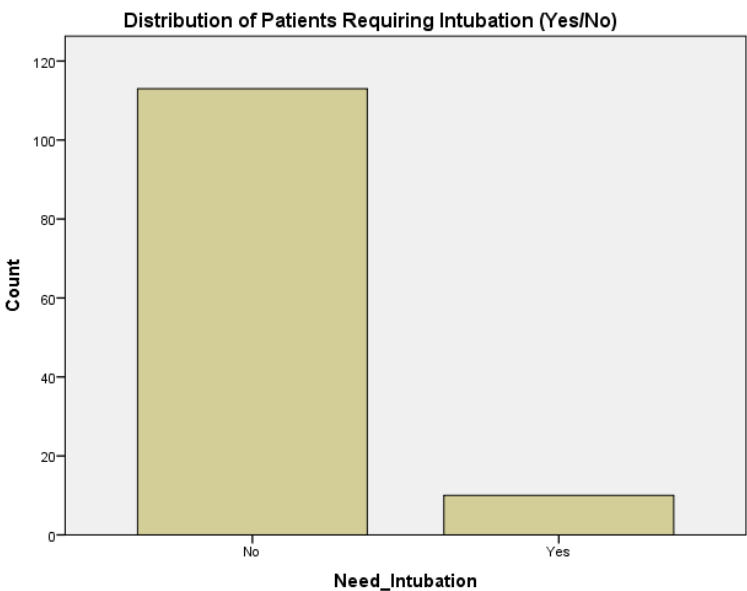
Outcome snapshot

Intubation not required: 113 (91.9%)
Intubation required: 10 (8.1%)
Recovered: 104 (84.6%)
Expired: 19 (15.4%)

Results in brief

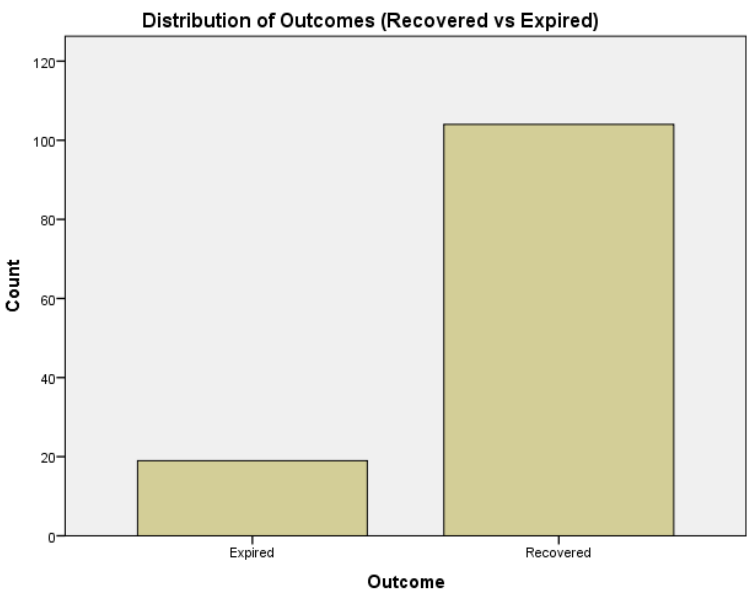
BiPAP was followed by a consistent clinical and ABG response over 24 hours. Oxygenation improved, PaCO₂ declined, pH moved toward normal, and most patients avoided invasive ventilation.

Need for intubation



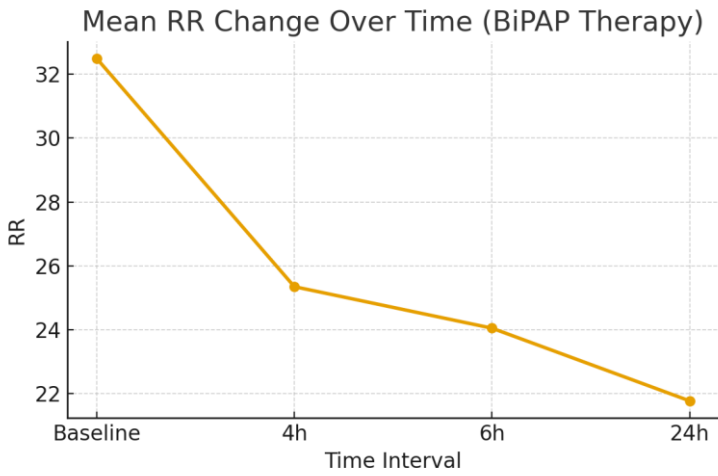
Only 8.1% required intubation.

Final patient outcome



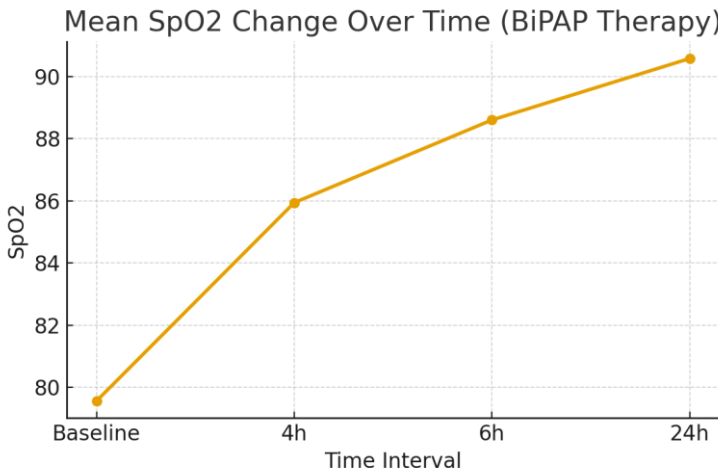
Recovery was recorded in 104 of 123 patients.

Respiratory rate trend



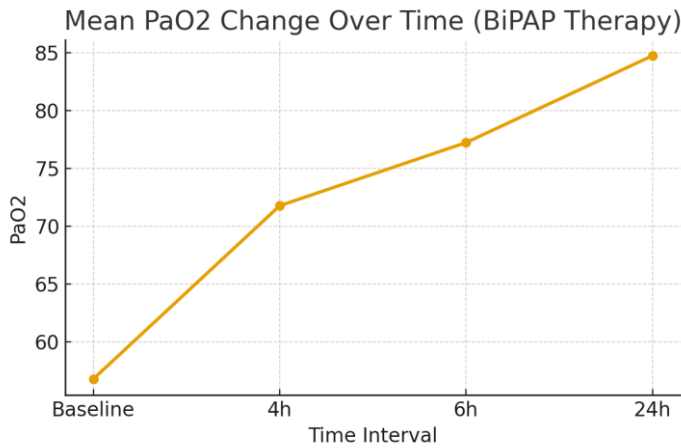
RR fell steadily after BiPAP therapy.

Oxygen saturation trend

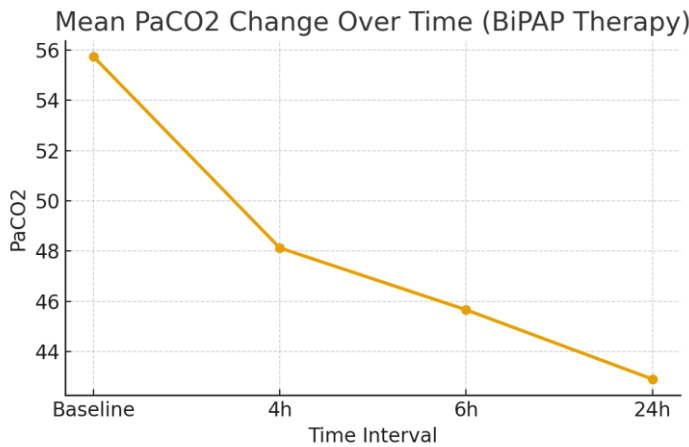


SpO₂ improved during follow-up.

ABG response



PaO₂ increased over time.



PaCO₂ decreased over time.

P values

RR: χ^2 263.049, $p < 0.001$
SpO₂: χ^2 363.585, $p < 0.001$
pH: χ^2 332.889, $p < 0.001$
PaO₂: χ^2 335.806, $p < 0.001$
PaCO₂: χ^2 332.786, $p < 0.001$

All repeated measures showed statistically significant change after BiPAP therapy.

Interpretation

The findings point in the same direction: BiPAP improved oxygenation and ventilation, while also reducing the need for invasive airway support in this cohort.

Conclusion

In adults with cardiogenic pulmonary edema, BiPAP gave early and clinically useful respiratory support. Over 24 hours, respiratory rate and ABG parameters improved, and only a small proportion required intubation. The results support early BiPAP use in stable, carefully monitored patients.

Recommendations

- Start BiPAP early when the patient is stable enough for NIV.
- Follow RR, SpO₂ and ABGs closely during the first hours.
- Escalate without delay if work of breathing, acidosis or consciousness worsens.
- Larger multicentre studies can help refine local protocols.

Selected references

Abubacker et al., 2021; Fernando et al., 2023; Rodrigues, 2024; Uz et al., 2021; Rittayamai et al., 2023.