

During cardiopulmonary bypass (CPB), systemic oxygenation levels are affected by hemodilution, which reduces the oxygen-carrying capacity of blood. Perfusionists often compensate by increasing the oxygen partial pressure (PaO₂) >300 mmHg, leading to hyperoxia. While this ensures oxygen delivery during reduced hemoglobin concentrations, sustained hyperoxia may contribute to oxidative stress, endothelial dysfunction, and myocardial injury. This study examines the effects of hyperoxia on vascular resistance, myocardial biomarkers, and postoperative outcomes during and after CPB.

AIMS AND OBJECTIVES

Aims:

To evaluate the cardiovascular effects of hyperoxia during cardiopulmonary bypass (CPB), focusing on vascular resistance, myocardial injury markers, and postoperative outcomes.

Objectives:

1. Investigate the effect of hyperoxia on systemic vascular resistance (SVR).
2. Assess myocardial injury biomarkers (CK-MB, troponin I) after hyperoxia.
3. Compare ICU stay duration and LCOS incidence between normoxia and hyperoxia groups.
4. Evaluate controlled oxygenation strategies to minimize oxidative stress and improve recovery.

Methods:

•Study Design:

A prospective observational study conducted from May to December 2024.

•Participants:

120 adult patients undergoing elective cardiac surgery with cardiopulmonary bypass (CPB).

•Group Stratification:

- **Normoxia Group** (PaO₂: 150–200 mmHg; n=57)
- **Hyperoxia Group** (PaO₂ >200 mmHg; n=63)

•Intraoperative Measurements:

- Hemodynamic parameters: (SVR), myocardial contractility, and oxygen delivery indices.

•Postoperative Measurements:

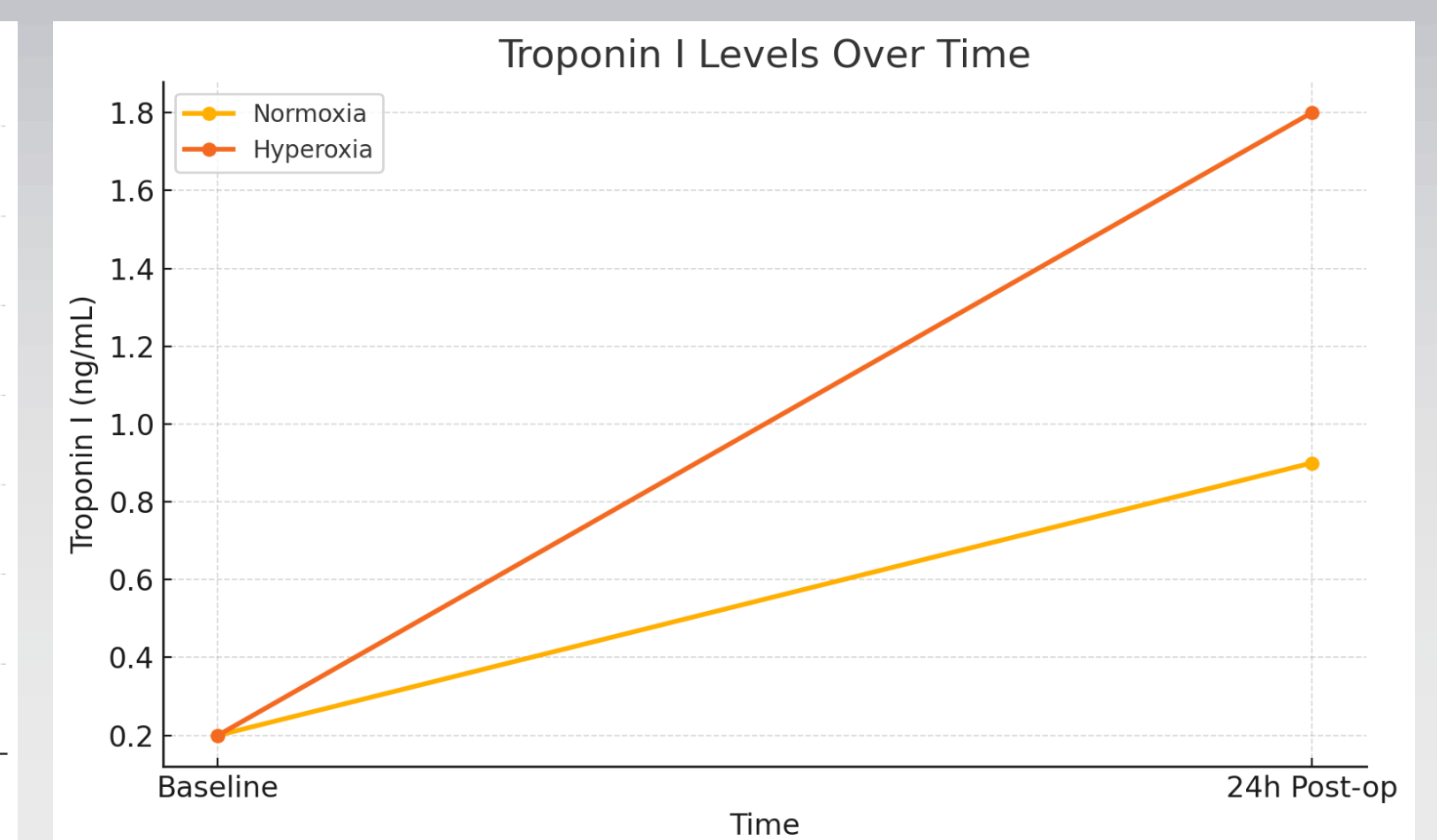
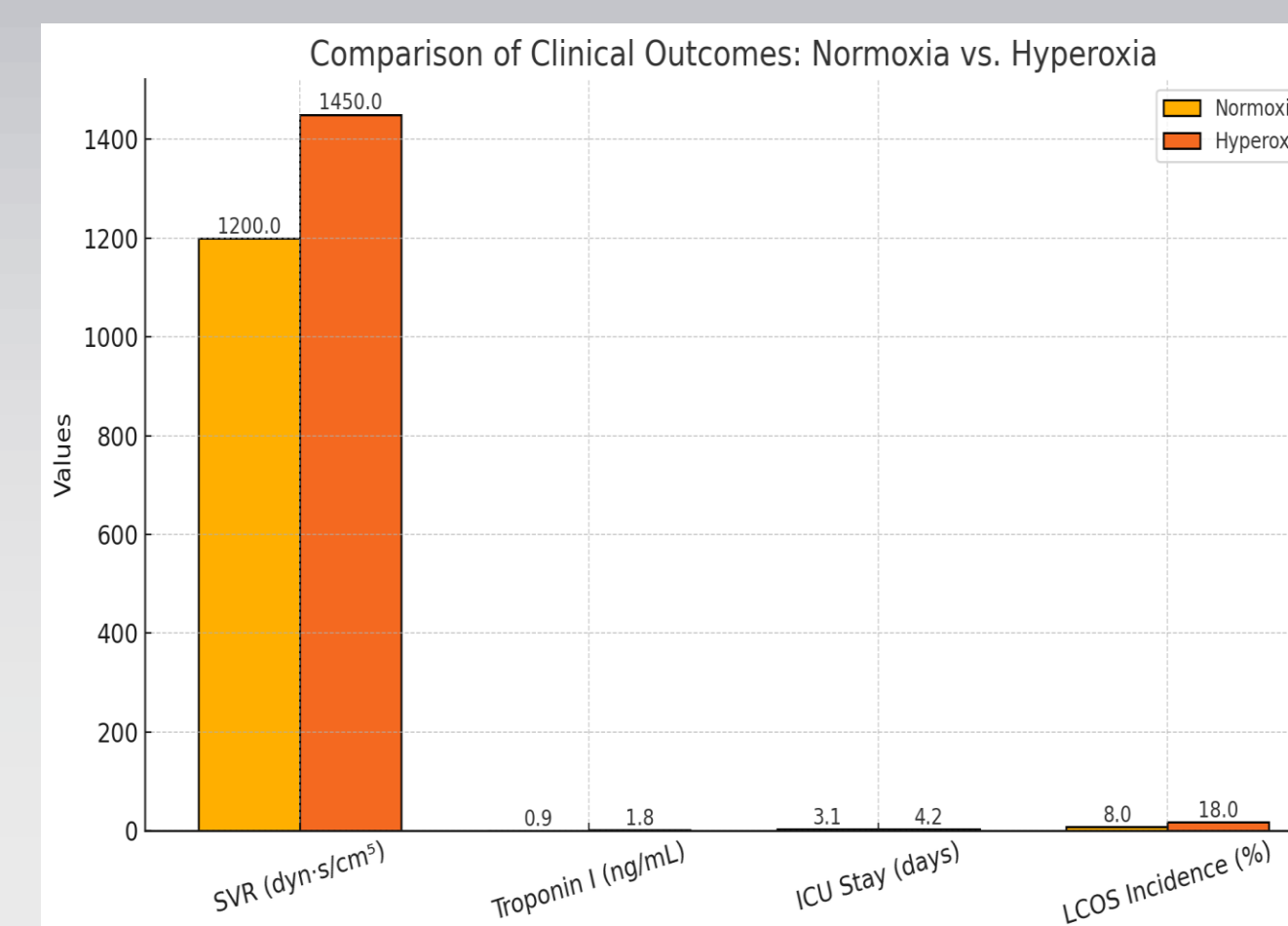
- Myocardial injury biomarkers: CK-MB, Troponin I (measured at baseline and 24 hours post-surgery).

•Statistical Analysis:

- Data presented as mean ± standard deviation.
- Comparative analysis using p-value (p < 0.05 considered significant).

RESULTS

Parameter	Normoxia Group (PaO ₂ : 150-200 mmHg)	Hyperoxia Group (PaO ₂ > 200 mmHg)	p-value
Hemoglobin (g/dL)	8.5 ± 1.0	8.5 ± 1.0	-
Systemic Vascular Resistance (SVR) (dynes·s/cm ⁵)	1200 ± 200	1450 ± 250	< 0.01
Troponin I (ng/mL)	0.9 ± 0.3	1.8 ± 0.5	< 0.01
ICU Stay (days)	3.1 ± 0.9	4.2 ± 1.1	0.02
Low-Cardiac-Output Syndrome (LCOS) Incidence	8%	18%	0.04



Conclusion

While increasing oxygen levels during CPB helps maintain oxygen delivery in the setting of hemodilution, sustained hyperoxia is associated with elevated systemic vascular resistance, increased myocardial injury markers, and poorer postoperative outcomes. **Careful regulation of oxygen levels during bypass is essential to reduce oxidative stress and improve patient recovery.**

References

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