

SNS COLLEGE OF ALLIED HEALTH SCIENCE
Affiliated to The Tamil Nadu Dr MGR Medical University, Chennai



DEPARTMENT OF CARDIOPULMONARY PERFUSION CARE
TECHNOLOGY

COURSE NAME: CPB and Perfusion Technology

UNIT : I

TOPIC : Metabolic Aspects of Heart and Lung Bypass

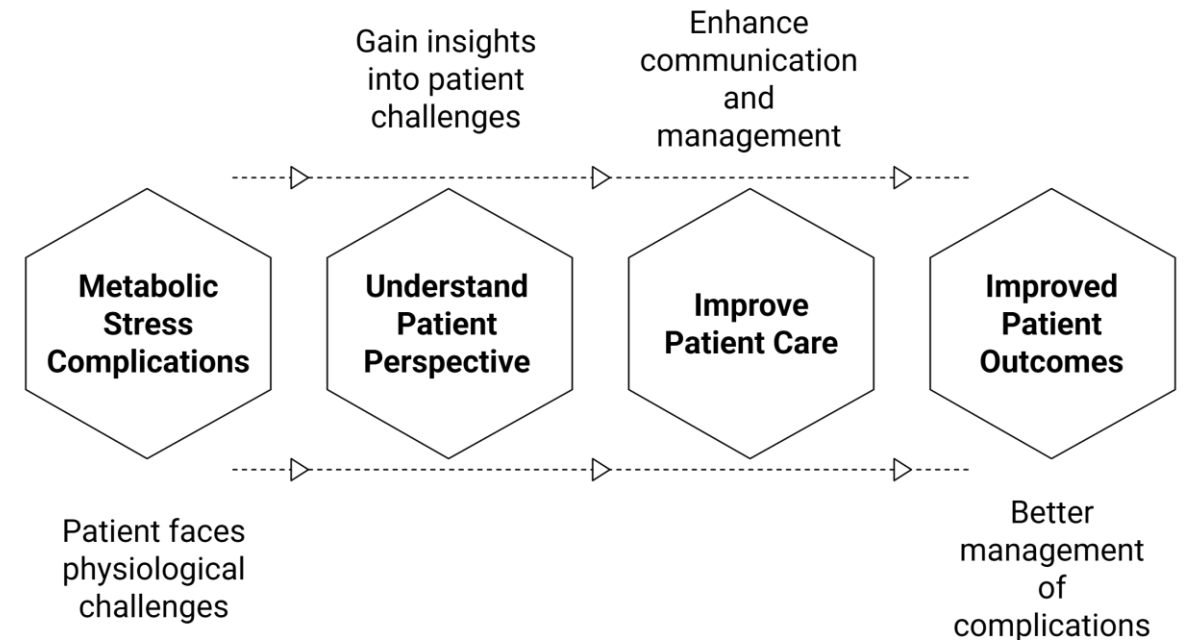
FACULTY NAME: Mrs. Saranyaa Prasath

Empathize — Understanding Patient Challenges During Heart-Lung Bypass

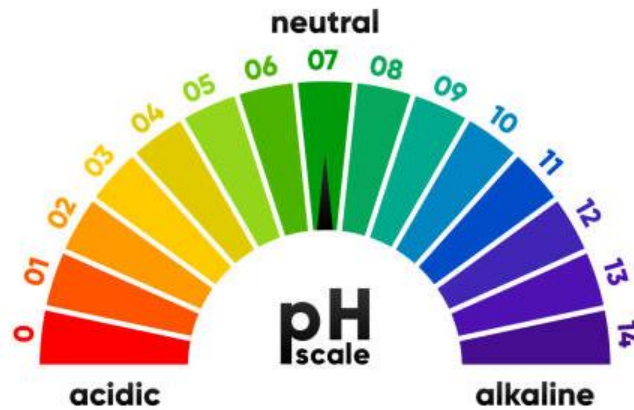
Case Study:

- **Patient Background:** 60-year-old male scheduled for cardiac surgery with cardiopulmonary bypass (CPB)
- **Clinical challenges:** Hypoperfusion, fluid shifts, acid-base imbalance, electrolyte disturbance during bypass

Prioritizing Patient Experience in CPB

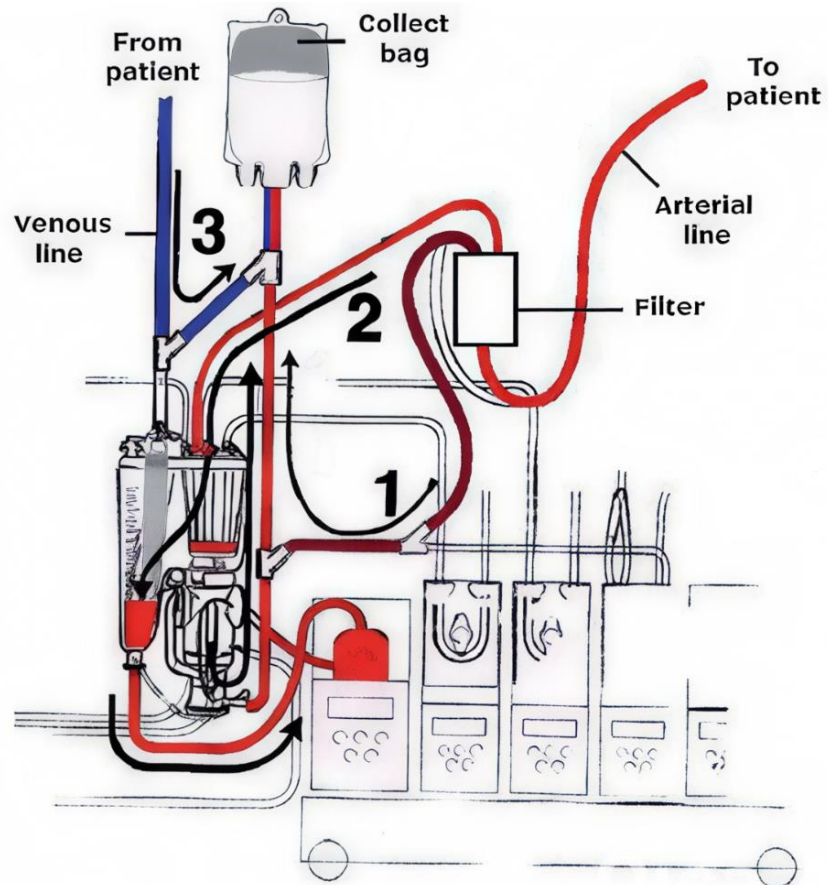


Define — Core Metabolic Challenges in CPB

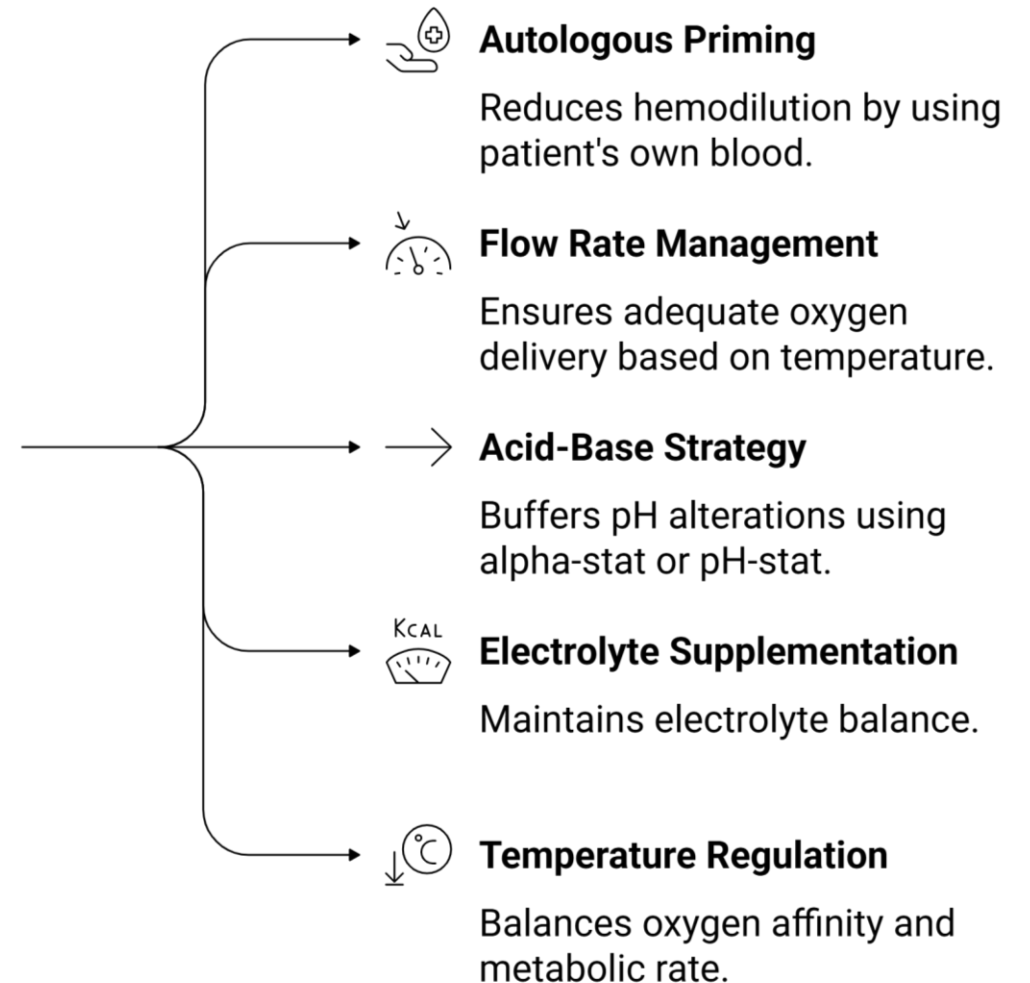


- **Fluid priming effects:** Hemodilution causing decreased hematocrit and plasma proteins
- Organ hypoperfusion and oxygen delivery inadequacy
- **Acid-base imbalances** (respiratory/metabolic acidosis and alkalosis)
- **Electrolyte disturbances:** potassium, calcium, magnesium, phosphate
- Temperature-related metabolic demand changes

Ideate — Metabolic Management Strategies



**How to manage
netabolic stress
during CPB?**

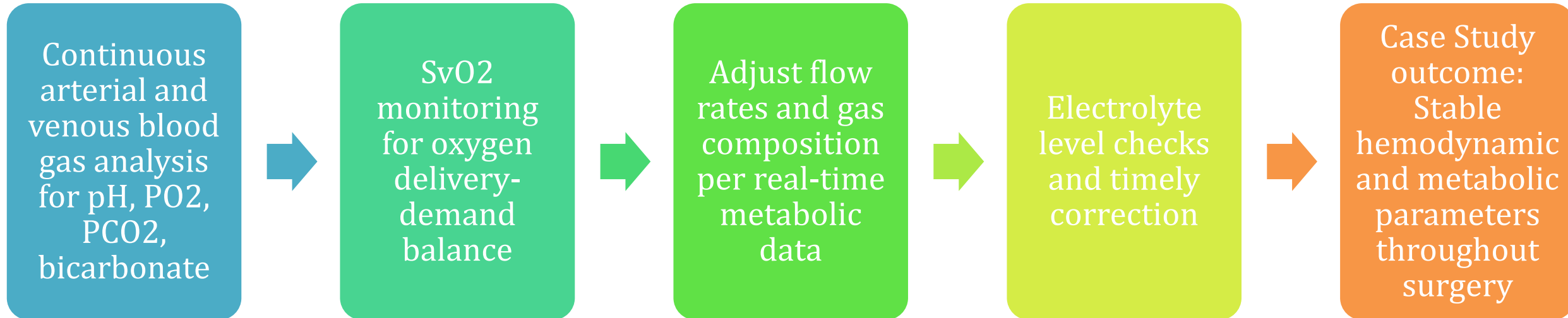


Prototype — Metabolic Management Protocol for CPB

- **Prime CPB circuit** partially with patient's blood (autologous priming)
- **Use ultrafiltration** to concentrate blood and preserve coagulation factors
- **Correct acid-base imbalances:** adjust sweep gas and administer sodium bicarbonate



Test — Monitoring and Feedback During CPB



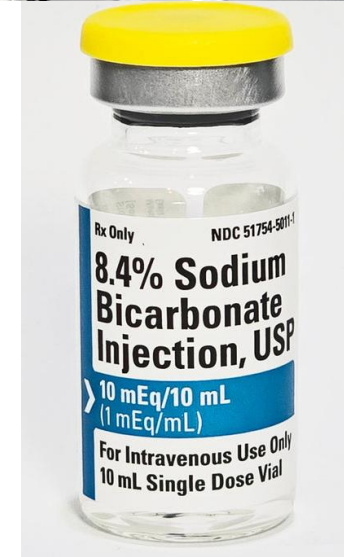
Case Study Detailed Data and Intervention

- **Interventions:** ultrafiltration, electrolyte correction, temperature regulation, acid-base balancing
- Patient's metabolic parameters stabilized, facilitating successful surgery and recovery

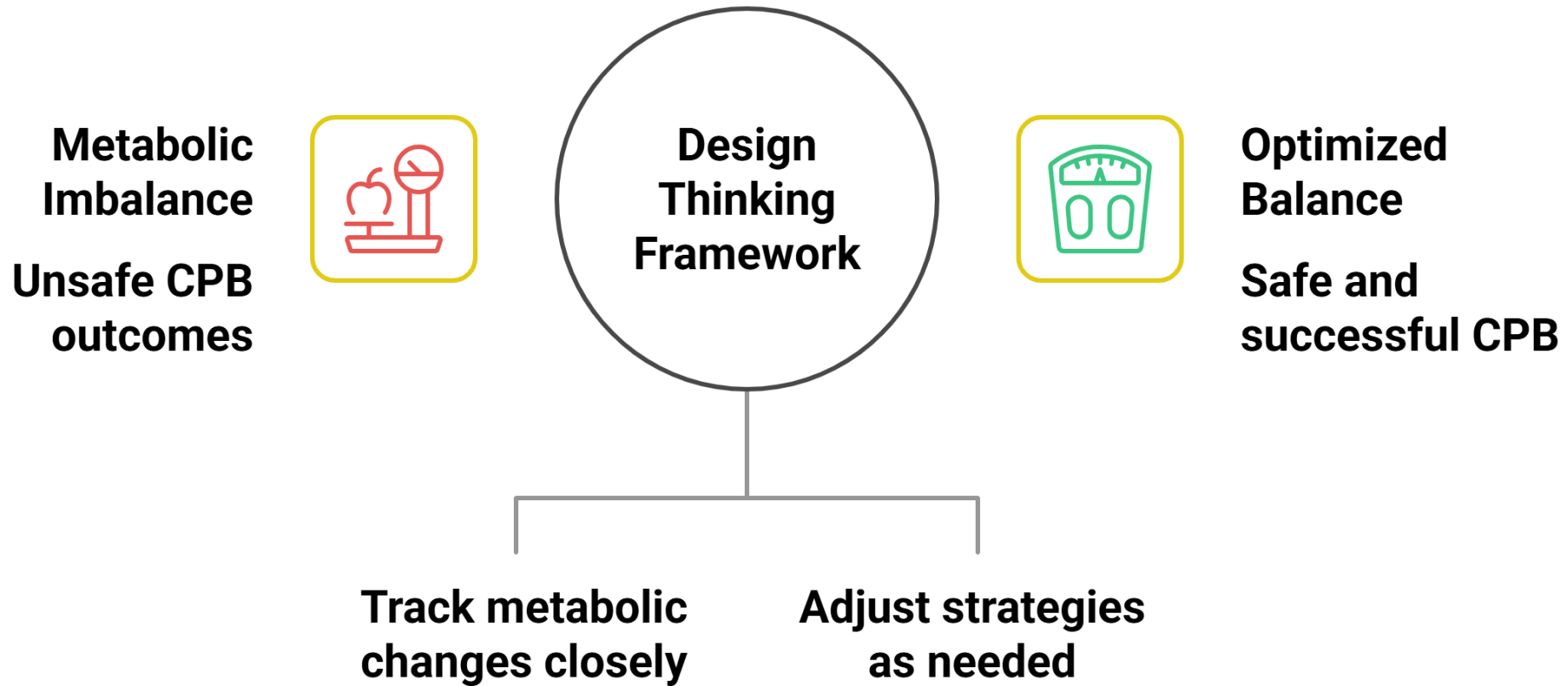
Parameter	Normal Range	Units
pH	7.35 – 7.45	-
PaO ₂ (Partial pressure of oxygen)	80 – 100	mm Hg
PaCO ₂ (Partial pressure of carbon dioxide)	35 – 45	mm Hg
HCO ₃ ⁻ (Bicarbonate)	22 – 26	mEq/L
SaO ₂ (Oxygen saturation)	95 – 100	%
Base Excess (BE)	-2 – +2	mEq/L

Key Metabolic Concepts in CPB

- Hemodilution leads to decreased oxygen carrying capacity and colloid osmotic pressure
- Hypothermia reduces metabolic oxygen demand but affects oxygen affinity (left shift of curve)
- Metabolic acidosis mainly due to hypoperfusion increases lactate; corrected by flow and bicarbonate
- Electrolyte imbalances critical to monitor to avoid cardiac arrhythmias and complications



Summary



References

- "Guidelines for Perioperative Care in Cardiac Surgery," American Heart Association, 2024, available at <https://www.heart.org>
- "Metabolic and Acid-Base Balance in Cardiopulmonary Bypass," Journal of Cardiothoracic Surgery, 2023.
- Cambridge Core: Metabolic Management During CPB, 2009.
- AHA: Diagnosis and Management of Metabolic Syndrome, 2005.
- Journal of Biomedical Engineering: Advances in CPB Technology, 2024

THANK YOU