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A TECHNOLOGICAL SOLUTION TO MAINTAIN THE RELIABILITY OF ARTERIAL BLOOD GAS SAMPLE PRIOR TO ARTERIAL BLOOD GAS ANALYSIS

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Background: Arterial Blood Gas (ABG) Analysis is used in medical wards to investigate acid-base status, hemoglobin concentration, blood glucose and electrolyte levels of a patient's arterial blood sample. The sample must be transported to the laboratory as soon as possible for analysis within 15-30 minutes of collection. For accurate analysis, sample integrity must be maintained during transport. Temperature variations can significantly alter the composition of the sample, producing unreliable results. To address this issue, this study developed a unique device that monitors and regulates the temperature of ABG samples.

Methodology: First existing ABG temperature-monitoring methods were evaluated to identify the key limitations. Based on the identified limitations a new device was designed to maintain temperature stability and ensure adequate mixing. A prototype was developed and tested in real conditions to confirm the design's effectiveness after simulation based testing.

Deliverables: Blood syringes for temperature monitoring are safely held in a specially designed 3D-printed plastic syringe compartment. The interior temperature is maintained by the insulation provided by the rigid foam box in which it is contained. Aluminum nets provide effective heat transfer to the syringes while preventing direct ice contact, while ice compartments are placed at the top and bottom of the box to cool the interior environment. The system is developed to maintain the optimal temperature throughout the study of ABG.

Conclusion: This study addresses the essential requirement of maintaining the integrity of ABG samples since temperature variations frequently impair reliability. To stabilize samples during transportation, a temperature sensor-equipped prototype device was created. Future improvements include using glass syringes for better thermal conductivity, integrating a hospital system or mobile app for wireless temperature monitoring, and incorporating an active cooling container with a thermoelectric cooler and digital display for precise temperature control.

Keywords: Arterial Blood Gas, Sample Integrity, Temperature Monitoring, Transport Stability