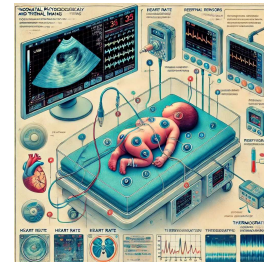


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Neonatal physiological and thermal imaging

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We use this protocol and it's working

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Disclaimer

This protocol for **Neonatal Physiological and Thermal Imaging** is provided for informational and educational purposes only. It is not intended to replace professional medical advice, diagnosis, or treatment. Healthcare providers should consult relevant guidelines and exercise clinical judgment when implementing any medical procedures, including the use of non-invasive monitoring techniques such as ECG patches, thermography, and ultrasound imaging. Strict adherence to local infection control standards and equipment sterilization protocols is essential to ensure patient safety. The protocol outlined here should be adapted to suit individual patient needs, institutional policies, and the latest medical research.

The creators of this protocol disclaim any liability for errors, omissions, or adverse outcomes resulting from the use or misuse of this information. Always seek advice from qualified medical professionals before implementing any healthcare protocols.

Abstract

The "Neonatal Physiological and Thermal Imaging" protocol outlines a comprehensive approach to monitoring critical physiological parameters in neonates through non-invasive, real-time imaging techniques. This protocol integrates continuous heart rate monitoring via ECG patches, respiratory rate assessment using non-invasive sensors, and core temperature measurement with thermography-compatible skin probes. Additionally, regular metabolic panels, blood gas analysis, and Complete Blood Count (CBC) assessments are conducted to evaluate organ function and metabolic health. The protocol also emphasizes infection control, with strict hygiene practices for sterilizing imaging equipment such as ultrasound probes and thermographic devices. By minimizing handling and ensuring patient comfort, this protocol enhances diagnostic accuracy while promoting neonatal safety in clinical settings. The concurrent use of ultrasound and thermographic imaging further enables detailed organ evaluation, optimizing the early detection of potential complications such as infections, hypothermia, and metabolic imbalances, particularly in vulnerable populations like premature infants.

Image Attribution

Image Title: "Neonatal Physiological and Thermal Imaging Protocol Schematic"

Creator: Ababs AlZubaidi, with aid from OpenAI's DALL-E, prompted by ChatGPT (Image AKA Imogen)

Date: October 2024

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Guidelines

Guidelines for the Neonatal Physiological and Thermal Imaging Protocol: Device Calibration and Setup:

Ensure all non-invasive monitoring devices (ECG patches, respiratory sensors, and thermography equipment) are correctly installed and calibrated.

Perform a thorough check to ensure real-time data from all devices is synchronized and displays correctly on monitoring systems.

Data Monitoring:

Continuously monitor heart rate, respiratory rate, and core temperature.

Use integrated thermography for real-time surface temperature monitoring, ensuring alignment with core temperature data.

Set up automated alerts for any deviations from expected ranges.

Infection Control:

Adhere to strict sterilization protocols for all equipment, particularly ultrasound probes and thermographic devices.

Ensure that all staff members involved in the care of neonates are trained in proper hygiene and sterilization techniques.

Sterilize any equipment after every use to prevent cross-contamination between patients.

Handling and Patient Comfort:

Minimize physical handling of the neonate by utilizing non-invasive techniques as much as possible.

Ensure that all equipment is placed comfortably on the neonate without causing irritation or discomfort.

Regularly check the positioning of ECG patches and probes to prevent skin irritation or pressure sores.

Data Review and Reporting:

Schedule regular reviews of all collected data, with a particular focus on heart rate variability, respiratory patterns, and thermal images.

Collaborate with healthcare professionals to promptly address any abnormalities detected through real-time monitoring.

Materials

1. Initial Setup**Install Non-Invasive Monitoring Devices:**Attach ECG patches for continuous heart rate monitoring.

Place respiratory sensors to track breathing activity.

Position skin probes to measure core temperature, ensuring compatibility with thermography equipment.

Ensure Equipment Calibration:Calibrate infrared thermography devices and ultrasound equipment for accurate readings.

Verify that all connected displays (e.g., for real-time monitoring) are correctly synchronized with the devices.

2. Continuous Monitoring

- **Heart Rate and Respiratory Monitoring:**

- Continuously monitor heart rate and respiratory rate using **ECG patches** and respiratory sensors.

-

- Transmit real-time data to a monitoring system.

-

- **Core Temperature and Thermal Imaging:**

- Use skin probes to monitor core temperature and synchronize with **thermography equipment** to assess surface temperature patterns.

- Ensure data integration between thermography and other modalities for consistency.

-

3. Infection Control

- **Sterilization of Imaging Devices:**

- Implement strict **hygiene protocols** by sterilizing **ultrasound probes**, thermography equipment, and any other devices that come into contact with the neonates.

- Follow a detailed sterilization protocol after every use to avoid cross-contamination and infections.

-

4. Data Analysis and Alerts

- **Set Up Real-Time Alerts:**

- Configure alerts for abnormal heart rate, breathing irregularities, or deviations in core temperature.

-

- Automatically flag deviations in **thermal patterns** that may indicate localized infections or temperature anomalies.

-

5. Interdisciplinary Collaboration

- **Collaborate with Healthcare Teams:**



- Ensure that **neonatologists, nurses, and technicians** work together to monitor the equipment, interpret real-time data, and act promptly on any alerts.
-
- Regularly review all monitoring data to detect any potential issues early.
-

6. Periodic Data Reviews

- **Conduct Regular Reviews:**
- Schedule frequent reviews of the **neonatal health metrics**, such as heart rate variability, respiratory function, and thermography results, especially for high-risk or premature infants.
-
- Ensure that any abnormal readings are analyzed and addressed immediately.
-

7. Patient Comfort and Safety

- **Minimize Handling:**
- Use the equipment to reduce handling of the neonate as much as possible, ensuring their comfort and minimizing stress.
-
- Ensure all non-invasive monitoring techniques are functioning optimally to prevent disruptions in data collection.

8. Documentation and Protocol Updates

- **Document Procedures:**
- Maintain detailed records of all **monitoring data**, sterilization procedures, and interventions.
-
- Continuously update the protocol based on the latest advancements in neonatal care and imaging technologies.

Safety warnings

Warnings for the Neonatal Physiological and Thermal Imaging Protocol: Device Misuse:

Warning: Improper placement of monitoring devices, such as ECG patches or skin probes, may result in inaccurate data or incomplete monitoring.

Action: Always follow manufacturer guidelines for placement and usage to ensure accurate and reliable data.

Data Misinterpretation:

Warning: Misinterpreting real-time data, especially from thermography or respiratory sensors, could lead to delayed interventions in critical situations.

Action: Ensure that only trained professionals review and act upon the data, and set up alert thresholds to minimize human error.

Infection Risks:

Warning: Failure to properly sterilize equipment, especially ultrasound and thermography devices, increases the risk of infections in neonates, particularly those with compromised immune systems.

Action: Strictly adhere to sterilization protocols after each use to ensure equipment safety.

Overheating of Devices:

Warning: Prolonged use of certain monitoring devices (e.g., thermographic cameras) may cause overheating, potentially leading to discomfort or burns.

Action: Monitor device temperature and inspect equipment regularly for overheating risks.

Disconnection and Data Loss:

Warning: If devices become disconnected, data collection may stop, leading to gaps in continuous monitoring and missed critical events.

Action: Ensure all devices are securely connected and regularly checked during monitoring. Establish backup systems for data continuity.

Skin Irritation and Probe Damage:

Warning: Prolonged use of skin probes or ECG patches without proper monitoring can lead to skin irritation or damage, especially on delicate neonatal skin.

Action: Periodically check for any signs of skin irritation, and adjust the positioning of probes and patches as needed. Use only skin-friendly adhesives.

Ethics statement

Ethics Statement for the Neonatal Physiological and Thermal Imaging Protocol The **Neonatal Physiological and Thermal Imaging Protocol** is designed with the primary goal of enhancing neonatal care through non-invasive, real-time monitoring techniques. In the development and implementation of this protocol, several ethical principles are prioritized to ensure patient safety, dignity, and the highest standards of medical care.

Patient Safety and Wellbeing:

The protocol emphasizes non-invasive monitoring to minimize physical discomfort and handling of neonates, ensuring that their fragile health is protected.

All procedures, including the use of thermography, ECG patches, and respiratory sensors, must be performed with the utmost care, avoiding unnecessary interventions or distress to the patient.

Informed Consent:

Parents or legal guardians must be fully informed about the use of this protocol, including its benefits, risks, and the nature of the monitoring technologies used. Consent must be obtained before the application of any monitoring devices or diagnostic procedures.

Healthcare providers must ensure that parents understand the real-time data collection and monitoring methods, offering transparency and respecting their right to make decisions on behalf of their child.

Confidentiality and Data Protection:

Any physiological data collected during the monitoring process, including heart rate, temperature, and respiratory patterns, must be securely stored and only accessible to authorized personnel.

The protocol must adhere to strict data protection laws, ensuring that personal and medical information is handled in accordance with regulations such as HIPAA (Health Insurance Portability and Accountability Act) or equivalent local laws, safeguarding patient privacy.

Minimizing Harm:

The use of non-invasive techniques is critical to avoid harm. The protocol avoids unnecessary or risky procedures, and regular monitoring is intended to detect potential health issues early without causing additional harm.

Special attention must be given to infection control protocols, particularly the sterilization of equipment, to prevent hospital-acquired infections.

Equitable Care:

The protocol must be applied equitably to all neonates under care, without discrimination based on factors such as socioeconomic status, race, gender, or parental consent. All infants in need of monitoring should have access to the same high-quality care.

Professional Responsibility:

Healthcare providers implementing this protocol must ensure that they have received the necessary training and are up to date with the latest neonatal care practices and technologies. They are responsible for ensuring that the equipment used is functioning correctly and that data is interpreted accurately.

Continuous Review and Adaptation:

The protocol must be regularly reviewed to incorporate new ethical considerations, medical advancements, and patient feedback. Changes to the protocol should always prioritize patient safety and improved outcomes. By adhering to these ethical principles, the **Neonatal Physiological and Thermal Imaging Protocol** aims to provide comprehensive, safe, and equitable care, while maintaining the highest standards of ethical responsibility in

neonatal healthcare.

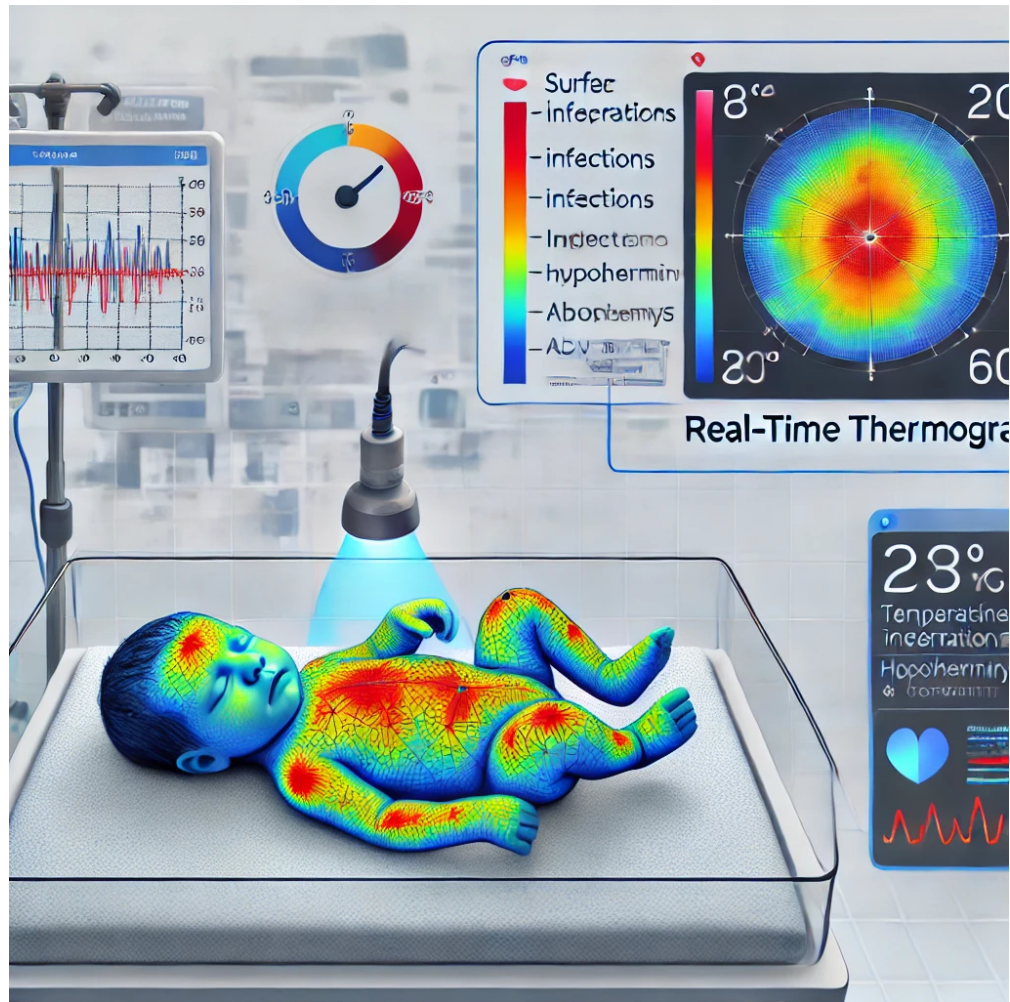


Introduction

- 1 This protocol outlines the comprehensive use of medical thermography for imaging premature neonates in the Neonatal Intensive Care Unit (NICU). The approach integrates real-time thermographic assessments with ultrasound imaging, vital signs monitoring, and clinical lab tests to ensure holistic care for these vulnerable infants. All procedures are conducted following strict adherence to medical ethics, ensuring compatibility with the Helsinki Declaration.

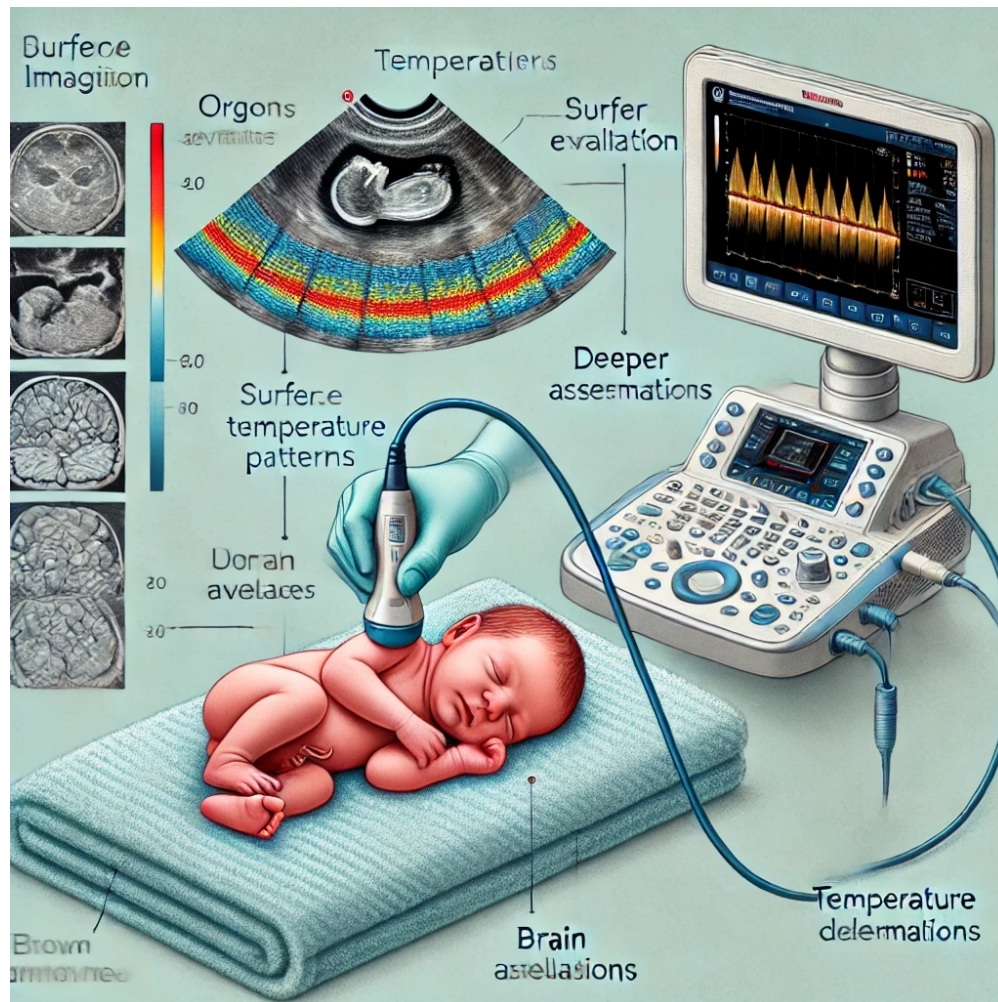
1.1 1. Imaging Modality Integration

- 1.2 **Thermography:** Thermal imaging should be performed in real-time to assess the surface temperature patterns of neonates, identifying temperature deviations which might suggest localized infections, hypothermia, or other abnormalities.



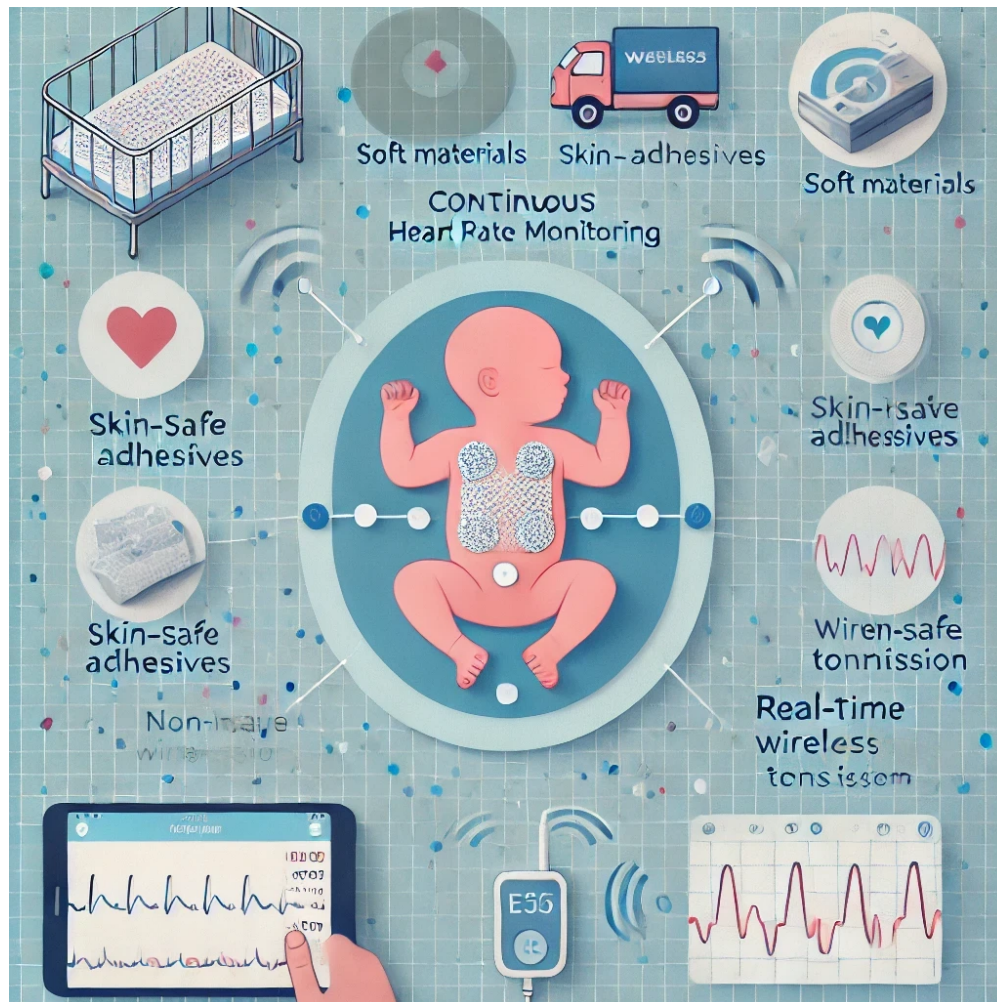
Schematic for **real-time thermography monitoring** of neonates, showing thermal imaging and surface temperature patterns. This schematic highlights how temperature deviations can indicate localized infections, hypothermia, or other abnormalities

- 1.3 **Ultrasound Imaging:** Alongside thermography, ultrasound imaging is to be used for deeper assessments, such as the evaluation of organ function and brain structure. Thermography and ultrasound should be performed concurrently if possible, with special attention given to patient comfort and minimal handling.



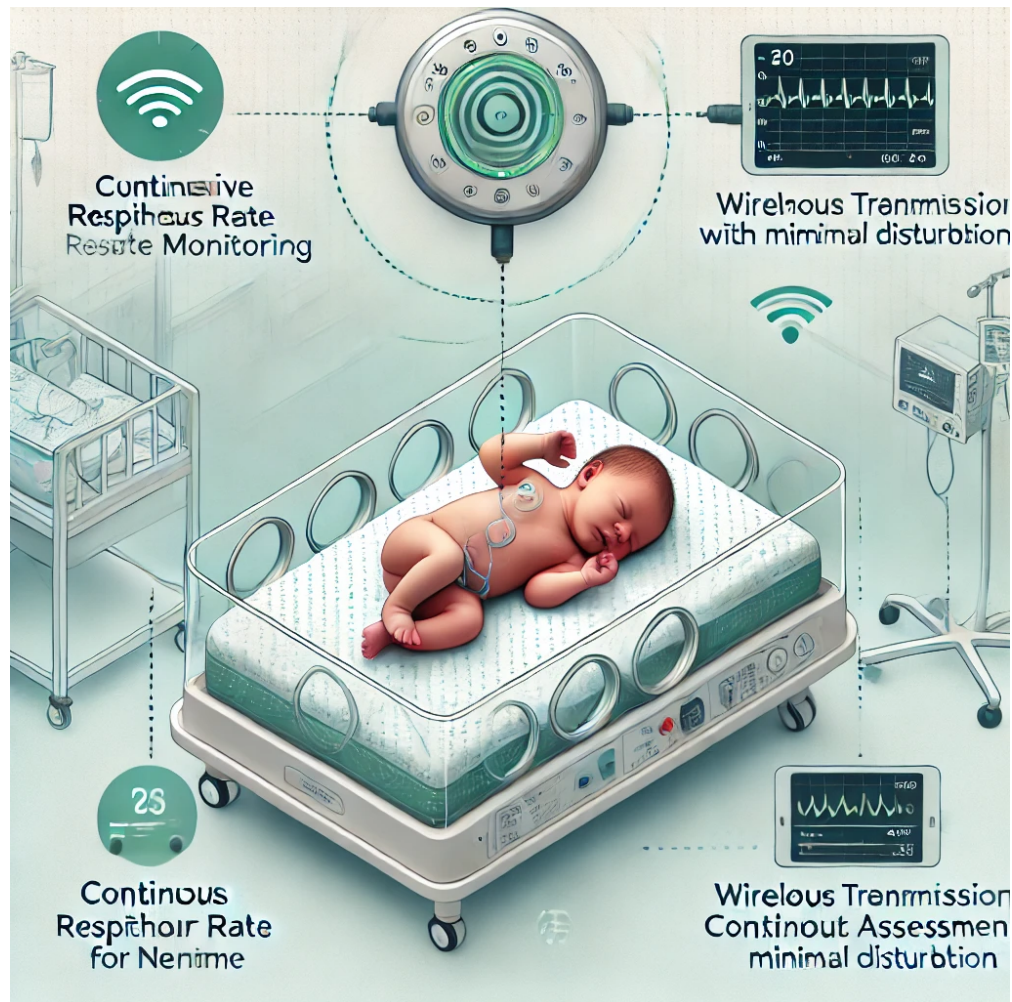
2. Vital Signs Monitoring

- 2 **Heart Rate:** Continuous monitoring of heart rate is mandatory. It should be captured using non-invasive methods such as ECG patches.



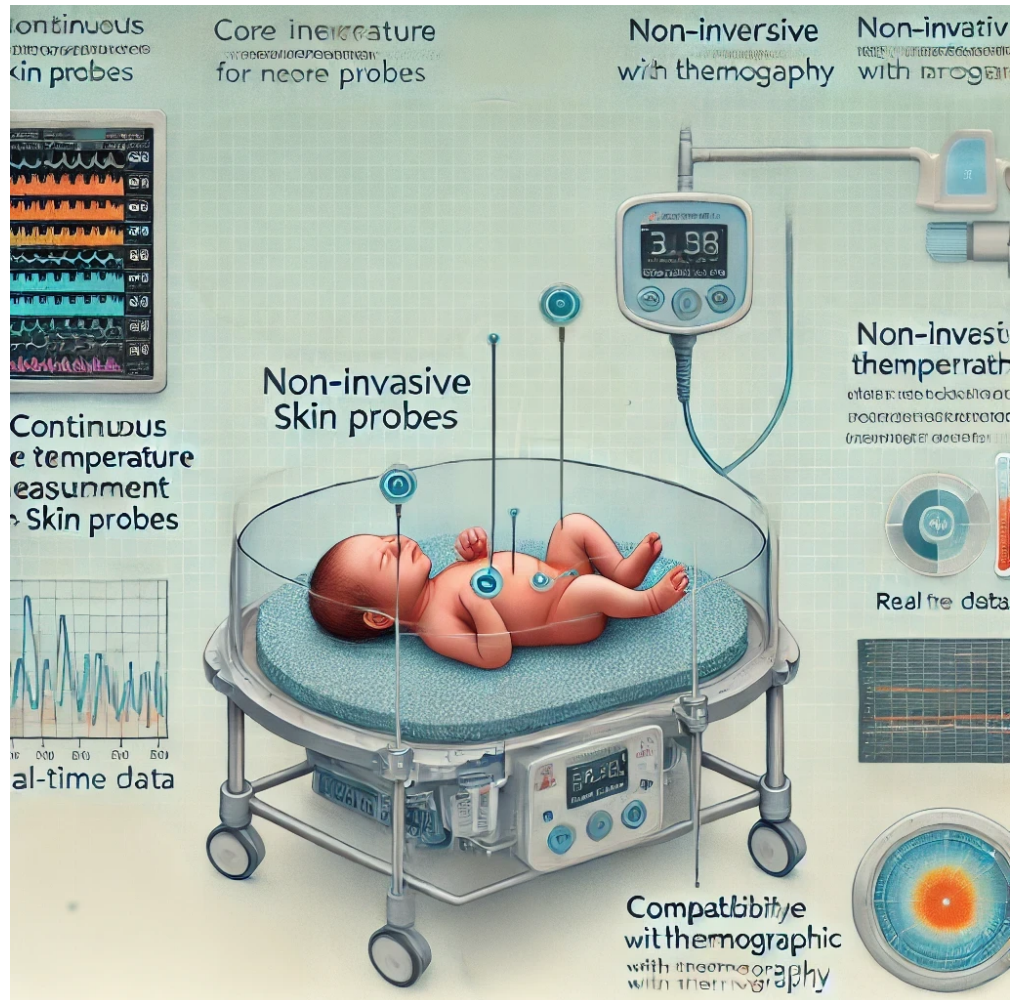
Schematic for continuous heart rate monitoring using non-invasive ECG patches for neonates

- 3 **Respiratory Rate:** Real-time assessment of respiratory activity using respiratory monitors.



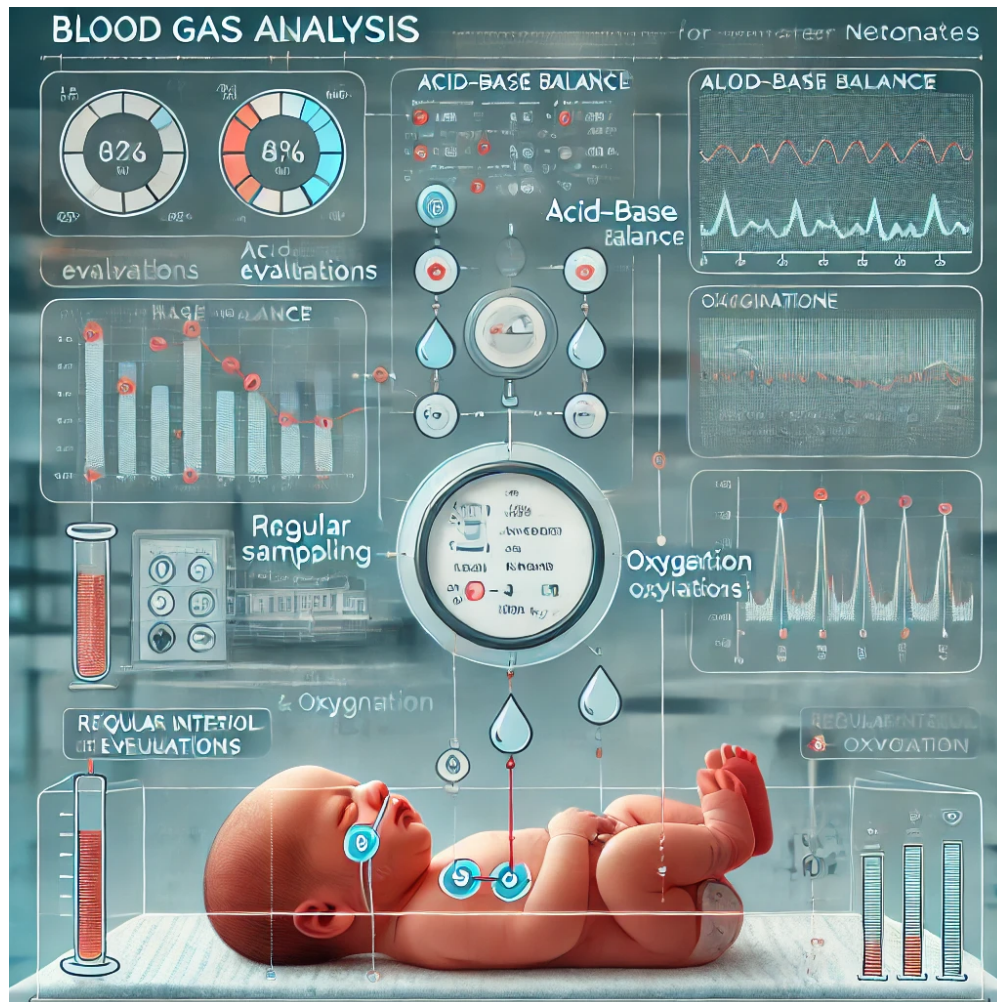
Schematic for **continuous respiratory rate monitoring** in neonates, showing a non-invasive respiratory monitor with real-time data transmission and minimal disturbance.

- 4 **Oxygen Saturation:** Pulse oximetry should be used to assess blood oxygen levels.
- 5 **Temperature:** Core temperature must be measured continuously through skin probes that are non-invasive and compatible with thermographic readings.



3. Clinical Laboratory Tests

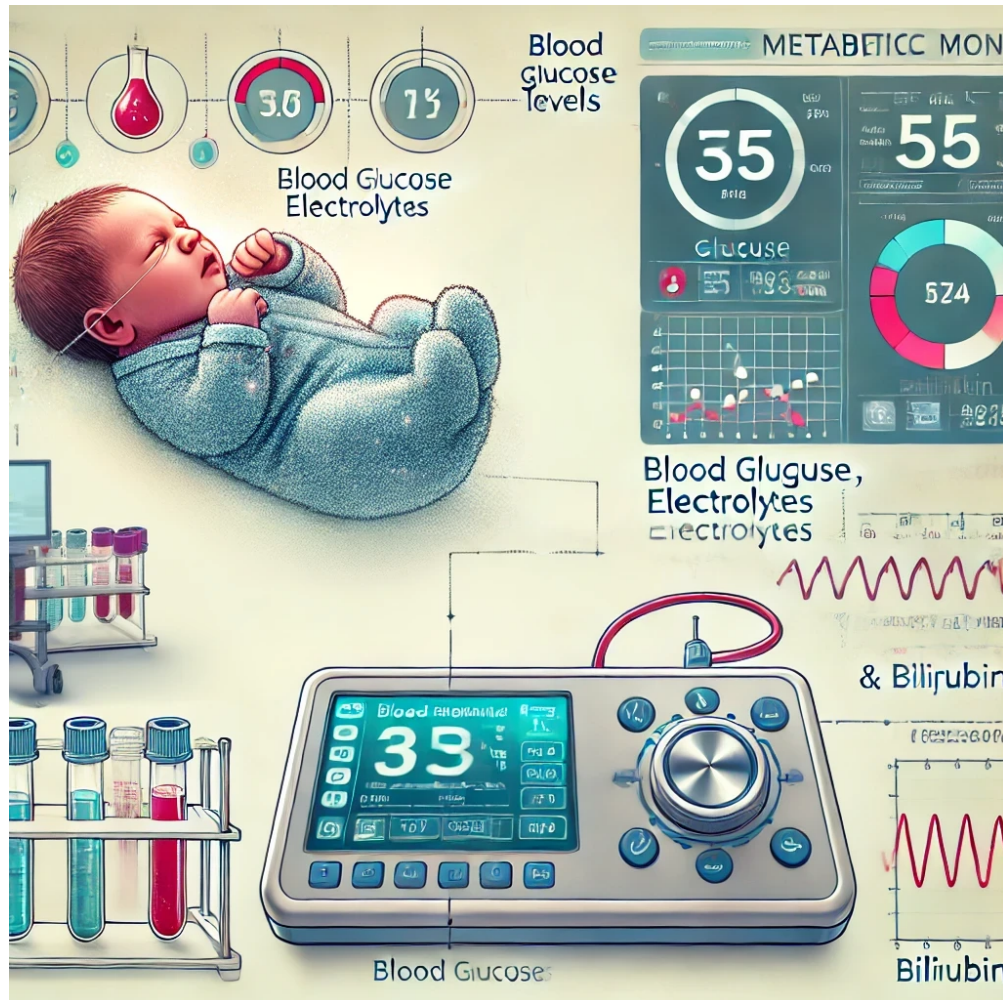
- 6 **Blood Gas Analysis:** Routine blood gas analysis should be performed to evaluate the acid-base status, with particular attention to oxygenation in premature infants.



- 7 **Complete Blood Count (CBC):** Regular CBC should be conducted to monitor hemoglobin levels, infection indicators, and other key metrics.



- 8 **Metabolic Panel:** Tests like blood glucose, electrolytes, and bilirubin should be included to monitor organ function and metabolic balance.

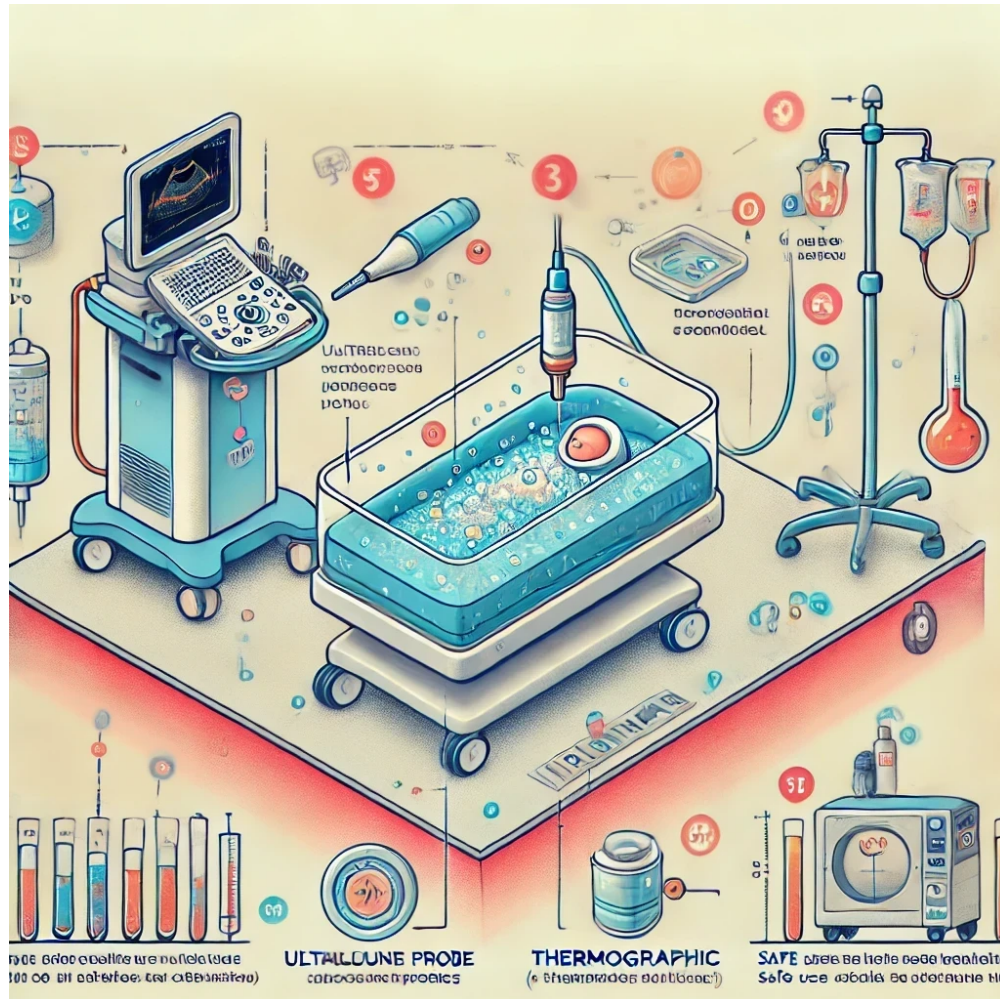


4. Ethical Considerations

- 9 All imaging and monitoring activities must strictly adhere to the ethical standards set out in the Helsinki Declaration.
- 10 **Informed Consent:** Ensure informed consent is obtained from the neonate's legal guardians. The procedure should be clearly explained, covering all possible risks and benefits.
- 11 **Minimizing Discomfort:** Efforts should be taken to reduce discomfort and stress for the neonate. Use warm gel for ultrasound imaging, minimize handling time, and perform all tests at the bedside.
- 12 **Data Privacy:** All images, physiological data, and test results must be handled with confidentiality, accessible only to authorized medical personnel.

5. Safety Measures

- 13 **Infection Control:** Strict hygiene protocols must be observed, including the sterilization of ultrasound probes and thermographic equipment.



- 14 **Calibration and Quality Control:** Thermographic and ultrasound equipment should undergo regular calibration checks to ensure accuracy and reduce the risk of errors.
- 15 **Multidisciplinary Team Involvement:** The imaging process should involve collaboration among neonatologists, radiologists, and NICU nursing staff, ensuring comprehensive care and prompt interpretation of results.

6. Documentation and Reporting

- 16
- Imaging results should be documented in real-time, and any significant findings should be immediately reported to the NICU care team for prompt intervention.
 - Vital signs data and lab test results must be integrated into the neonate's electronic health record (EHR), providing a complete overview of the neonate's condition.

7. Review and Feedback

- 17
- Regular reviews of imaging results, lab tests, and clinical observations should be conducted to assess the efficacy of the protocols. Parent/guardian feedback must also be considered to refine care delivery.

18 Summary

The optimized protocol aims to provide a structured, efficient approach that ensures thorough assessments while prioritizing the neonate's comfort and safety. By integrating imaging modalities, monitoring vital signs, and maintaining ethical standards, this protocol supports a high standard of neonatal care.

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