AARC clinical practice guidelines: capillary blood gas sampling for neonatal and pediatric patients.

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American Association for Respiratory Care (AARC)

Evans DL, Volsko TA, Capellari E, Strickland SL. AARC clinical practice guidelines: capillary blood gas sampling for neonatal and pediatric patients. Respir Care. 2022 Sep;67(9):1190-1204. [58 references] PubMed

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Overview

Guideline Objective

To provide guidance for the collection, handling, and interpretation of blood obtained from an arterialized capillary sample

Patient Population

Neonatal and pediatric patients with cardiorespiratory conditions who require blood gas sampling

Recommendations

Recommendation Statements

Population Intervention Comparator Outcome (PICO) Question 1: How do blood gas and pH results from a blood sample obtained from a capillary site differ from the results obtained from venous or arterial sites?

In the absence of an indwelling arterial catheter, capillary and venous blood gas measurements may be useful alternatives to arterial blood samples for infants and children who require close monitoring of pH and partial pressure of carbon dioxide (P_{CO2}) but not partial pressure of oxygen (P_{O2}) measurements (**Evidence level B; median appropriateness score 8, range 7–8**); in the presence of alterations in body temperature, blood pressure, or peripheral perfusion, a correlation of a capillary or venous blood gas with an arterial sample is needed to determine whether changes in these physiologic conditions reduce reliability. (**Evidence level B; all committee members responded 8**)

PICO Question 2: How does the collection and handling of blood obtained from a capillary site affect the results and interpretation of blood gas and pH values vs blood obtained intravascularly (arterial and/or venous)?

Perfusion to the sample site should be assessed, and preference given to blood gas sampling from a well-perfused site to minimize the propensity for pre-analytical errors (**Evidence level B; median appropriateness score 8, range 6–8**); regardless of the sampling site (i.e., arterial, venous, capillary), when the blood gas or analyte result interpretation does not align with the patient's clinical presentation, consideration to redrawing the blood gas sample should be given before clinical decision making occurs (**Evidence level B; median appropriateness score 9, range 8–9**); a pneumatic tube system can be reliably used to transport blood gas samples collected in a syringe and capillary tube to a clinical laboratory from analysis. (**Evidence level B; median appropriateness score 9, range 8–9**)

PICO Question 3: What impact do pre-analytic errors have on blood gas and pH errors?

Samples should be analyzed within 15 min of collection to avoid pre-analytic errors (**Evidence level C; all committee members responded 8**); samples collected in plastic capillary tubes should not be iced (**Evidence level C; median appropriateness score 8,**

range 7–8); gentle mixing of the sample at the time of collection and immediately before analyzing for effective coagulation (**Evidence level C; median appropriateness score 8, range 7–8**); expel all air bubbles at the time of collection. (**Evidence level C; all committee members responded 7**)

PICO Question 4: What impact does the collection technique have on the incidence of patient complication?

The capillary puncture procedure should be minimized when possible to reduce the cumulative pain effect and risk of complications (**Evidence level B; all committee members responded 9**); non-pharmacologic interventions should be used when performing heel puncture for capillary blood sampling to reduce the pain response (**Evidence level B; median appropriateness score 7, range 7–8**); automatic lancets are preferred to manual lancets to reduce the pain response, procedure time, number of heel sticks, and bruising (**Evidence level A; all committee members responded 8**); use caution when applying heat to avoid cutaneous burns. (**Evidence level C; all committee members responded 9**)

PICO Question 5: What impact does the presence of dyshemoglobins have on blood gas and pH results?

Because there were no studies extracted from the systematic review that directly related to the impact that the presence of dyshemoglobins have on pH, P_{CO2}, and P_{O2}, there are no recommendations at this time.

Evidence Rating Scheme

Level of Evidence Supporting the Recommendation

- **A**: Convincing scientific evidence based on randomized controlled trials of sufficient rigor
- **B**: Weaker scientific evidence based on lower levels of evidence, such as cohort studies, retrospective studies, case-control studies, and cross-sectional studies
- **C**: Based on the collective experience of the committee

Recommendation Rating Scheme

Committee members reviewed the first draft of evidence tables, systematic reviews, recommendations, and evidence levels. They individually rated each recommendation for those supported by evidence levels A and B by using a Likert scale of 1 to 9, with 1 meaning expected harms greatly outweigh the expected benefits and 9 meaning expected benefits greatly outweigh the expected harms. The scores were returned to the committee chair. Because the first ratings were done with no interaction among the committee members, a conference call was convened, during which time the individual committee rankings were discussed. Particular attention was given to the discussion and justification of any outlier scores. Recommendations and evidence levels were revised with committee member input.

Strong agreement required all committee members to rank the recommendation ≥7. Weak agreement meant that one or more members rated the recommendation <7, but the median vote was at least 7. For recommendations with weak agreement, the percentage of those who rated ≥7 was calculated and reported after each weak recommendation.

Related Content

Supporting Documents

- Appendix A. Search Strategies by Database.
- Appendix B. Studies of Outcomes.

Implementation Tools

No implementation tools available.

Patient Education

No patient education materials available.

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TRUST Scorecard

Composition of Guideline Development Group (GDG)

Multidisciplinary GDG Members	**Yes**
Methodologist Involvement	**No**
Incorporation of Patient and Public Perspective	★☆☆☆☆

Systematic Review of Evidence

Literature Search	★★★★★
Study Selection	★★★★★
Evidence Synthesis	★★★★★

Foundations for Recommendations

Strength of Evidence Grade	★★★☆☆
Description of Benefits and Harms of Recommendations	★★★★☆
Summary of Evidence Supporting Recommendations	★★★★★
Strength of Recommendations Rating	★★★☆☆
Clear Articulation of Recommendations	★★★★☆

Funding Source

No

Disclosure and Management of Financial Conflicts of Interests

★★★☆☆

External Review

★★☆☆☆

Updating

★☆☆☆☆