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August 2013

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We hope that you find the information useful. If you would like the full text of any of the abstracts listed, please let us know.

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“Google can bring you back 100,000 answers, a librarian can bring you back the right one.” — Neil Gaiman

**Literature Search Results**

<table>
<thead>
<tr>
<th>Search completion date:</th>
<th>13th August 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search completed by:</td>
<td>Jan Badcock</td>
</tr>
</tbody>
</table>

**Enquiry Details**

Capillary and arterial blood gases
Disclaimer
Every effort has been made to ensure that this information is accurate, up-to-date, and complete. However it is possible that it is not representative of the whole body of evidence available. No responsibility can be accepted for any action taken on the basis of this information. It is the responsibility of the requester to determine the accuracy, validity and interpretation of the search results.

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Opening Internet Links
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Full Text Papers
Links are given to full text resources where available. For some of the papers, you will need a FREE NHS Athens Account. If you do not have an account you can register by following the steps at: https://register.athensams.net/nhs/nhseng/ You can then access the papers by simply entering your username and password. If you do not have easy access to the internet to gain access, please let us know and we can download the papers for you.

Guidance on Searching within Online Documents
Links are provided to the full text of each of these documents. Relevant extracts have been copied and pasted into these Search Results. Rather than browse through often lengthy documents, you can search for specific words and phrases as follows:

**Portable Document Format / pdf. / Adobe**
Click on the Search button (illustrated with binoculars). This will open up a search window. Type in the term you need to find and links to all of the references to that term within the document will be displayed in the window. You can jump to each reference by clicking it. You can search for more terms by pressing ‘search again’.

**Word documents**
Select Edit from the menu, the Find and type in your term in the search box which is presented. The search function will locate the first use of the term in the document. By pressing ‘next’ you will jump to further references.
Arterial versus capillary blood gases: a meta-analysis.
Zavorsky GS, Cao J, Mayo NE, Gabbay R, Murias JM.
A meta-analysis determined whether capillary blood gases accurately reflect arterial blood samples. A mixed effects model was used on 29 relevant studies obtained from a PubMed/Medline search. From 664 and 222 paired samples obtained from the earlobe and fingertip, respectively, earlobe compared to fingertip sampling shows that the standard deviation of the difference is about 2.5x less (or the precision is 2.5x better) in resembling arterial PO(2) over a wide range of arterial PO(2)’s (21-155 mm Hg ). The lower the arterial PO(2), the more accurate it is when predicting arterial PO(2) from any capillary sample (p<0.05). However, while earlobe sampling predicts arterial PO(2) (adjusted r(2)=0.88, mean bias=3.8 mm Hg compared to arterial), fingertip sampling does not (adjusted r(2)=0.48, mean bias=11.5 mm Hg compared to arterial). Earlobe sampling is slightly more accurate compared to fingertip sampling in resembling arterial PCO(2) (arterial versus earlobe, adjusted r(2)=0.94, mean bias=1.9 mm Hg ; arterial versus fingertip, adjusted r(2)=0.95, mean bias=2.2 mm Hg compared to arterial) but both sites can closely reflect arterial PCO(2) (880 total paired samples, range 10-114 mm Hg ). No real difference between sampling from the earlobe or fingertip were found for pH as both sites accurately reflect arterial pH over a wide range of pH (587 total paired samples, range 6.77-7.74, adjusted r(2)=0.90-0.94, mean bias=0.02). In conclusion, sampling blood from the fingertip or earlobe (preferably) accurately reflects arterial PCO(2) and pH over a wide range of values. Sampling blood, too, from earlobe (but never the fingertip) may be appropriate as a replacement for arterial PO(2), unless precision is required as the residual standard error is 6 mm Hg when predicting arterial PO(2) from an earlobe capillary sample.

Best Bets

Best Bets is a web resource that provides rapid evidence-based answers to real-life clinical questions, using a systematic approach to reviewing the literature. BETs take into account the shortcomings of much current evidence, allowing physicians to make the best of what there is.

Capillary blood gases are comparable to arterial gases in COPD

- Report By: Ross Murphy - Senior Clinical Fellow
- Search checked by Magnus Harrison - Clinical Research Fellow
- Institution: MRI
- Current web editor: Minnie Alexander - Senior Information Officer
- Date Submitted: 8th October 2000
- Date Completed: 8th October 2000
- Last Modified: 18th April 2001
- Status: Green (complete)

Three Part Question
In [a patient with an acute exacerbation of COPD] is [a capillary blood sample as good as an arterial blood sample] at measuring [PaO2, PaCO2 and pH]?

Clinical Scenario
A 60 year old man presents to the Emergency Department with an acute exacerbation of COPD. Analysis of his blood gases is required. You wonder whether a capillary blood sample will be as accurate as an arterial blood sample.
## Search Strategy

Medline 1966-11/00 using OVID interface.

\{[\text{Capillar$.mp$ AND (exp$ blood$ gas$ analysis$ OR$ blood$ gas$.mp$)}$ AND$ ([\text{exp$ arteries$ OR$ arter$.mp$)}$ AND$ (exp$ blood$ gas$ analysis$ OR$ blood$ gas$.mp$)])\} LIMIT$ to$ human$ AND$ english.$

## Search Outcome

280 papers found of which 276 were irrelevant or of insufficient quality. The remaining 4 papers are shown in the table.

## Relevant Paper(s)

<table>
<thead>
<tr>
<th>Author, date and country</th>
<th>Patient group</th>
<th>Study type (level of evidence)</th>
<th>Outcomes</th>
<th>Key results</th>
<th>Study Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Langlands JH and Wallace WF, 1965, UK.</td>
<td>14 patients under investigation for pulmonary disease and 2 normal patients. Arterial blood vs capillary blood from ear.</td>
<td>Diagnostic test</td>
<td>PO2</td>
<td>Mean difference 0.62 mm Hg (SD 4.1) NS</td>
<td>Small numbers No power calculation Do not know if any patients were suffering from COPD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PCO2</td>
<td>Mean difference 1.05 mm Hg (SD 1.6) NS</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>pH</td>
<td>Mean difference 0.006 (SD 0.01) NS</td>
<td></td>
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<tr>
<td>Begin R et al, 1975, USA.</td>
<td>45 patients in acute respiratory distress without circulatory shock. 15 were below age 16. Arterial vs capillary blood from finger.</td>
<td>Diagnostic test</td>
<td>PO2</td>
<td>Mean difference 2.1 mm Hg (SD 4.4) r=0.97</td>
<td>Small numbers No power calculation Do not know if any of these patients were suffering from COPD</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PCO2</td>
<td>Mean difference 1.4 mm Hg (SD 3.2) r=0.98</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>pH</td>
<td>Mean difference 0.006 (SD 0.016) r=0.98</td>
<td></td>
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<tr>
<td>Pitkin AP et al, 1994, UK.</td>
<td>40 patients with chronic lung disease and a variety of arterial blood gas tensions. 29 had COPD and bronchiectasis. Arterial blood vs capillary blood from ear.</td>
<td>Diagnostic test</td>
<td>PO2</td>
<td>Mean difference 0.17 kPa (CI 1.09 to +0.75)</td>
<td>Small numbers No power calculation Patients suffered from a variety of underlying illnesses.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PCO2</td>
<td>Mean difference 0.21 kPa (CI 0.24 to +0.67)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>pH</td>
<td>Mean difference 0.007 (CI 0.008 to +0.022)</td>
<td></td>
</tr>
<tr>
<td>Dar K et al, 1995, UK.</td>
<td>55 patients requiring measurement of blood gases. 22 had exacerbations of COPD. Arterial vs capillary blood from ear.</td>
<td>Diagnostic test</td>
<td>PO2</td>
<td>Mean difference 0.09 kPa (SD 0.59)</td>
<td>Small numbers No power calculation</td>
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<tr>
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<td></td>
<td>PCO2</td>
<td>Mean difference 0.01 kPa (SD 0.3)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>pH</td>
<td>Mean difference 0.007 (SD 0.02)</td>
<td></td>
</tr>
</tbody>
</table>
Comment(s)
Different studies have given slightly different results. There have been no statistically significant differences identified. Moreover the differences that have been seen are clinically insignificant as well. Further research in patients with COPD would be useful.

Clinical Bottom Line
Properly taken capillary blood samples accurately reflect arterial blood gas measures of PO2, PCO2 and pH.
http://bestbets.org/bets/bet.php?id=233

Research
Prediction of arterial blood gas values from arterialized earlobe blood gas values in patients treated with mechanical ventilation

Background/Objective:
Arterial blood gas (ABG) analysis is useful in evaluation of the clinical condition of critically ill patients; however, arterial puncture or insertion of an arterial catheter may sometimes be difficult and cause many complications. Arterialized earlobe blood samples have been described as adequate to gauge gas exchange in acute and chronically ill pediatric patients.

Purpose:
This study evaluates whether pH, partial pressure of oxygen (PO2), partial pressure of carbon dioxide (PCO2), base excess (BE), and bicarbonate (HCO3) values of arterialized earlobe blood samples could accurately predict their arterial blood gas analogs for adult patients treated by mechanical ventilation in an intensive care unit (ICU).

Setting:
A prospective descriptive study

Methods:
Sixty-seven patients who were admitted to ICU and treated with mechanical ventilation were included in this study. Blood samples were drawn simultaneously from the radial artery and arterialized earlobe of each patient.

Results: Regression equations and mean percentage-difference equations were derived to predict arterial pH, PCO2, PO2, BE, and HCO3-values from their earlobe analogs. pH, PCO2, BE, and HCO3 all significantly correlated in ABG and earlobe values. In spite of a highly significant correlation, the limits of agreement between the two methods were wide for PO2. Regression equations for prediction of pH, PCO2, BE, and HCO3- values were: arterial pH (pHa) = 1.81+ 0.76 × earlobe pH (pHe) [r = 0.791, P < 0.001]; PaCO2 = 1.224+ 1.058 × earlobePCO2 (PeCO2) [r = 0.956, P < 0.001]; arterial BE (BEa) = 1.14+ 0.95 × earlobe BE (BEe) [r= 0.894, P < 0.001], and arterial HCO3- (HCO3-a) = 1.41+ earlobe HCO3(HCO3-e) [r = 0.874, P < 0.001]. The predicted ABG values from the mean percentage-difference equations were derived as follows: pHa = pHe × 1.001; PaCO2 = PeCO2 × 0.33; BEa = BEe × 0.57; and HCO3-a = HCO3-e × 1.06.

Conclusions: Arterialized earlobe blood gas can accurately predict the ABG values of pH, PCO2, BE, and HCO3- for patients who do not require regular continuous blood pressure measurements and close monitoring of arterial PO2 measurements.
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2738313/
Capillary-blood gases: To arterialize or not
Chris Higginspuncture.
November 2008 ■ MLO
The gold-standard sample for blood-gas analysis is arterial blood obtained via an indwelling arterial catheter or by arterial puncture. For a number of reasons, capillary blood is an attractive substitute sample that is routinely used in some clinical settings. The purpose of this article is to examine the evidence that blood-gas parameter values (pH, pCO2, and pO2) obtained from a capillary-blood sample accurately reflect arterial blood. There is conflicting opinion that increasing local blood flow (by warming or application of vasodilating agent) prior to capillary-blood sampling is necessary for most accurate results and this controversial issue will be addressed.


The clinical utility of arterialized earlobe capillary blood in the assessment of patients for long-term oxygen therapy.
The prescription of long-term oxygen (LTOT) is underpinned by the measurement of arterial PO2, generally obtained by radial artery puncture. This test is commonly associated with patient discomfort and a test that is reliable, well-tolerated and non-invasive would be advantageous. Cutaneous oximetry has not proved sufficiently accurate. Arterialized earlobe capillary sampling has been proposed, with some authors stating that it is under-utilized. However, to date studies have yielded conflicting results and the clinical utility remains uncertain. Our regional oxygen service based at a specialist respiratory hospital undertook a prospective study of consecutive patients with chronic respiratory disease undergoing assessment for LTOT. Simultaneous radial artery and arterialized earlobe sampling was performed. Rigorous steps were taken to ensure optimal arterialization of the earlobe samples. Agreement between arterial and arterialized PO2 and PCO2 was compared using the Bland-Altman method. One hundred patients were studied. Procedural difficulties (insufficient sample or air in sample) were similar for both procedures, however clotting occurred more frequently in arterialized earlobe samples. Sixty-four sample pairs were available for comparison. The bias and limits of agreement between arterialized and arterial PO2 were wide, mean (+/- 2 SD), -0.48 (-2.05-1.09) kPa. The bias and limits of agreement for PCO2 were smaller. Using the absolute criterion (arterial PO2 < 7.3 kPa), 9/55 (16%) patients would receive oxygen inappropriately based on the arterialized earlobe sample. Conversely, no patients would have been denied LTOT. Radial artery puncture gave rise to significantly greater discomfort (P < 0.0001) and level of concern (P < 0.0001). Patient preference strongly favoured arterialized earlobe sampling. However, despite rigorous attention to arterialization earlobe sampling was insufficiently accurate to replace radial artery puncture in the prescription of LTOT.

Arterial versus capillary sampling for analysing blood gas pressures
BMJ1995;310 Khavar Dar, Tim Williams, Richard Aitken, Kent L Woods, Susan Fletcher, Arterial puncture is carried out to obtain samples for analysis of blood gas pressures. Although painful and not without hazard, arterial puncture is done routinely despite reports that similar information about blood gas pressures can be obtained from capillary samples. We quantified patients’ perception of the discomfort of sampling from radial arteries compared with that of capillary sampling and compared the biochemical data obtained with these two methods. http://www.bmj.com/content/310/6971/24#alternate
Arterialised earlobe blood gas analysis: an underused technique.

BACKGROUND--Techniques for sampling arterialised capillary blood from the finger pulp and the earlobe were first described over two decades ago but, although close agreement between arterial values and earlobe samples has been demonstrated in normal subjects, this technique is not in common usage. METHODS--Forty patients with chronic lung disease and a wide range of arterial blood gas values were studied. Simultaneous earlobe and arterial samples were drawn with the patient at rest and analysed in the same blood gas analyser. The respiratory function laboratory staff in 50 UK hospitals with a respiratory department were telephoned and asked whether the technique was used in their hospital and the reasons, if known, for not adopting it. RESULTS--Earlobe and arterial blood gas tensions agreed closely over a wide range of values of arterial pH, PCO2 (mean difference 0.21, 95% confidence intervals -0.24 to +0.67 kPa) and PO2 (mean difference -0.17, 95% confidence intervals -1.09 to +0.75 kPa), especially at arterial PO2 values lower than 8 kPa. Of 50 UK centres surveyed 18% used the arterialised earlobe technique and 4% had plans to introduce it. Reasons for not using it were lack of knowledge in 64%, no blood gas analyser in 6%, the technique was considered inaccurate in 4%, and insufficient staff in 4%.

CONCLUSIONS--Although earlobe blood gas analysis is sufficiently accurate to be reliably substituted for arterial sampling in routine clinical practice, most centres in the UK do not use the technique. The main reasons for this appear to be lack of knowledge of its existence and uncertainty over its accuracy.


Differences in PO2 and PCO2 between arterial and arterialized earlobe samples.

Arterialized ear lobe blood samples have been described as adequate to gauge gas exchange in acute and chronically ill patients. It is a safe procedure, usually performed by medical technicians. We have conducted a prospective study to verify the validity of this method. One hundred and fifteen consecutive adult patients were studied. Blood samples were drawn simultaneously from arterialized earlobe and radial artery. Values of partial pressure of oxygen (PO2) and of carbon dioxide (PCO2) were measured by means of blood gas electrodes. The correlation coefficients between the two samples were 0.928 for PO2 and 0.957 for PCO2 values. In spite of a highly significant correlation, the limits of agreement between the two methods were wide for PO2. Earlobe values of PO2 were usually lower than arterial values, with larger differences in the range of normal arterial PO2. On the other hand, the error and the limits of agreement were smaller for PCO2. We conclude that, in adult patients, arterialized earlobe blood PO2 is not a reliable mirror of arterial PO2.

http://erj.ersjournals.com/content/9/2/186.full.pdf
Value of capillary blood gas analyses in the management of acute respiratory distress.


Comparative Study
A comparative study of blood gases and acid-base parameters, obtained simultaneously from arterial and finger capillary samples, was performed in 45 patients in acute respiratory distress without circulatory shock. Although small and significant differences were found between the 2 sample pH, Po2, Pco2, and bicarbonate values, the correlations between the 2 were greater than or equal to 0.97 for each variable. It was concluded that although the arterial blood is the preferred sample for evaluation of blood gases and acid-base status of patients in acute respiratory distress, capillary blood appears to be a valid substitute in the management of these patients. This technique is particularly valuable in pediatric practice, where repeated arterial samples are less easily obtained.
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6. The comparison between capillary blood sampling and arterial blood sampling in an NICU ....................... page 5

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Search History

1. MEDLINE; "short burst oxygen".ti,ab; 20 results.
2. EMBASE; "short burst oxygen".ti,ab; 24 results.
3. EMBASE; CAPILLARY BLOOD/; 2172 results.
4. EMBASE; BLOOD GAS/; 5978 results.
5. EMBASE; ARTERIAL BLOOD/; 4051 results.
6. EMBASE; 3 AND 4; 50 results.
7. EMBASE; 4 AND 5; 133 results.
8. EMBASE; 6 AND 7; 6 results.
9. EMBASE; Duplicate filtered: [3 AND 4], [4 AND 5]; 183 results.
10. EMBASE; BLOOD SAMPLING/; 111505 results.
11. EMBASE; 4 AND 10; 206 results.
12. EMBASE; 5 AND 11; 39 results.
13. EMBASE; 3 AND 11; 8 results.
14. EMBASE; 12 AND 13; 3 results.
15. MEDLINE; BLOOD SPECIMEN COLLECTION/; 10300 results.
16. MEDLINE; OXYGEN/; 137619 results.
17. MEDLINE; CAPILLARIES/; 28468 results.
18. MEDLINE; 15 AND 17; 296 results.
19. MEDLINE; 16 AND 18; 36 results.
1. Correlation of simultaneously obtained capillary, venous, and arterial blood gases of patients in a paediatric intensive care unit.

Citation: Archives of Disease in Childhood, February 2004, vol./is. 89/2(176-80), 0003-9888;1468-2044 (2004 Feb)

Author(s): Yildizdas D; Yapicioğlu H; Yilmaz HL; Sertdemir Y

Language: English

Abstract: AIMS: To investigate the correlation of pH, partial pressure of oxygen (PO2), partial pressure of carbon dioxide (PCO2), base excess (BE), and bicarbonate (HCO3) between arterial (ABG), venous (VBG), and capillary (CBG) blood gases. METHODS: Patients admitted to the paediatric intensive care unit (PICU) in Cukurova University between August 2000 and February 2002 were enrolled. RESULTS: A total of 116 simultaneous venous, arterial, and capillary blood samples were obtained from 116 patients (mean age 56.91 months, range 15 days to 160 months). Eight (7%) were neonates. Sixty six (57%) were males. pH, PCO2, BE, and HCO3 were all significantly correlated in ABG, VBG, and CBG. Correlation in PO2 was also significant, but less so. Correlation between pH, PCO2, PO2, BE, and HCO3 was similar in the presence of hypothermia, hyperthermia, and prolonged capillary refilling time. In hypotension, correlation in PO2 between VBG and CBG was similar but disappeared in ABG-VBG and ABG-CBG. CONCLUSIONS: There is a significant correlation in pH, PO2, BE, and HCO3 among ABG, VBG, and CBG values, except for a poor correlation in PO2 in the presence of hypotension. Capillary and venous blood gas measurements may be useful alternatives to arterial samples for patients who do not require regular continuous blood pressure recordings and close monitoring of PaO2. We do not recommend CBG and VBG for determining PO2 of ABG.

Publication Type: Comparative Study; Journal Article

Source: MEDLINE

Full Text: Available from National Library of Medicine in Archives of Disease in Childhood
Available from Highwire Press in Archives of disease in childhood
Available from Highwire Press in Archives of Disease in Childhood


Citation: Respiratory Physiology & Neurobiology, March 2007, vol./is. 155/3(268-79), 1569-9048;1569-9048 (2007 Mar 15)

Author(s): Zavorsky GS; Cao J; Mayo NE; Gabbay R; Murias JM

Language: English

Abstract: A meta-analysis determined whether capillary blood gases accurately reflect arterial blood samples. A mixed effects model was used on 29 relevant studies obtained from a PubMed/Medline search. From 664 and 222 paired samples obtained from the earlobe and fingertip, respectively, earlobe compared to fingertip sampling shows that the standard deviation of the difference is about 2.5x less (or the precision is 2.5x better) in resembling arterial PO2 over a wide range of arterial PO2's (21-155 mm Hg). The lower the arterial PO2, the more accurate it is when predicting arterial PO2 from any capillary sample (p<0.05). However, while earlobe sampling predicts arterial PO2 (adjusted r(2)=0.88, mean bias=3.8 mm Hg compared to arterial), fingertip sampling does not (adjusted r(2)=0.48, mean bias=11.5 mm Hg compared to arterial). Earlobe sampling is slightly more accurate compared to fingertip sampling in resembling arterial PCO2 (arterial versus earlobe, adjusted r(2)=0.94, mean bias=1.9 mm Hg; arterial versus fingertip, adjusted r(2)=0.95, mean bias=2.2 mm Hg compared to arterial) but both sites can closely reflect arterial PCO2 (880 total paired samples, range 10-114 mm Hg). No real difference between sampling from the earlobe or fingertip were found for pH as both sites accurately reflect arterial pH over a wide range of pH (587 total paired samples, range 6.77-7.74, adjusted r(2)=0.90-0.94, mean bias=0.02). In conclusion, sampling blood from the fingertip or earlobe (preferably) accurately reflects arterial PCO2 and pH over a wide range of values. Sampling blood, too, from earlobe (but never the fingertip) may
be appropriate as a replacement for arterial PO(2), unless precision is required as the residual standard error is 6 mm Hg when predicting arterial PO(2) from an earlobe capillary sample.

**Publication Type:** Journal Article; Meta-Analysis; Review

**Source:** MEDLINE

3. Correlation between capillary and arterial blood gas parameters in an ED.

**Citation:** American Journal of Emergency Medicine, February 2013, vol./is. 31/2(326-9), 0735-6757;1532-8171 (2013 Feb)

**Author(s):** Heidari K; Hatamabadi H; Ansarian N; Alavi-Moghaddam M; Amini A; Safari S; Darbandsar Mazendarani P; Vafaee A

**Language:** English

**Abstract:** BACKGROUND AND AIMS: Sampling from arteries for the analysis of blood gases is a common procedure in emergency departments (ED). The procedure is painful for the patients and causes concern for the medical personnel due to possible complications, such as hematoma, infection, ischemia, and formation of fistula or aneurism. The present study compared the results of capillary and arterial blood gases analyses (CBG and ABG) to emphasizing a less aggressive technique with the fewest complications for this procedure. MATERIALS AND METHODS: In the comparative/analytical study, the results of ABG and CBG for 187 patients referring to the ED of a teaching hospital were compared using SPSS 18 statistical software (SPSS, Chicago, IL) in relation to the mean partial pressure of oxygen (Po(2)), partial pressure of carbon dioxide (Pco(2)), base excess (BE), bicarbonate (HCO(3)), serum acidity (pH), and saturation of hemoglobin oxygen (SaO(2)). RESULTS: Saturation of hemoglobin oxygen, HCO(3), pH, Pco(2), Po(2), and BE exhibited significant statistical correlation between ABG and CBG (P = .001). The average correlations between capillary and arterial samples were 0.78 for pH, 0.73 for Pco(2), 0.71 for BE, 0.90 for HCO(3), 0.77 for Po(2), and 0.52 for SaO(2). Comparison of the parameters means did not exhibit significant differences between arterial and capillary samples except for Po(2) and SaO(2) (P > .05). CONCLUSION: There appear to be strong correlation between samples collected from the finger tip capillaries with the arterial blood samples in relation to the analysis of blood gas. Copyright 2013 Elsevier Inc. All rights reserved.

**Publication Type:** Clinical Trial; Comparative Study; Journal Article

**Source:** MEDLINE

4. Comparison of POCT and central laboratory blood glucose results using arterial, capillary, and venous samples from MICU patients on a tight glycemic protocol

**Citation:** Clinica Chimica Acta, October 2008, vol./is. 396/1-2(10-13), 0009-8981 (October 2008)

**Author(s):** Petersen J.R.; Graves D.F.; Tacker D.H.; Okorodudu A.O.; Mohammad A.A.; Cardenas Jr. V.J.

**Language:** English

**Abstract:** Background: Point of care (POC) glucose meters are routinely used to monitor glucose levels for patients on tight glycemic control therapy. We determined if glucose values were different for a POC glucose meter as compared to the main clinical laboratory for medical intensive care unit patients on a tight glycemic protocol and whether the site of blood sampling had a significant impact on glucose values. Methods: Eighty-four patients (114 paired samples) who were on a tight glycemic protocol in the period November 2005 through August 2006 were enrolled. After simultaneous blood draws, we compared the glucose levels for the glucose meter (arterial/venous/capillary), blood gas (arterial/venous), and central clinical laboratory (serum/plasma from arterial/venous samples). Results: The mean glucose levels of all arterial/venous/fingerstick samples using the glucose meter demonstrated a positive bias of 0.7-0.9 mmol/l (12.6-16.2 mg/dl) (p < 0.001) relative to central laboratory venous plasma. There was also a smaller positive (0.1-0.3 mmol/l or 1.8-5.4 mg/dl, p < 0.05) bias for arterial/venous blood gas samples and
laboratory arterial serum/plasma glucose samples. Using Parkes error grid analysis we were able to show that the bias for arterial or venous POC glucose results would have not impacted clinical care. This was not the case, however, for fingerstick sampling where a high bias could have significantly impacted clinical care. Additionally, in 3 fingerstick samples a severe underestimation (< 46% of the central laboratory plasma result) was found. Conclusion: Glucose meters using arterial/venous whole blood may be utilized in the MICU; however, due to the increased variability of results we do not recommend the routine use of capillary blood sampling for monitoring glucose levels in the MICU setting. 2008.

5. Capillary blood gases in the neonate. A reassessment and review of the literature

Citation: American Journal of Diseases of Children, 1990, vol./is. 144/2(168-172), 0002-922X (1990)

Author(s): Courtney S.E.; Weber K.R.; Breakie L.A.; Malin S.W.; Bender C.V.; Guo S.; Siervogel R.M.

Language: English

Abstract: Heel puncture capillary blood gas (CBG) measurements continue to be used in neonates for estimating arterial blood gas values. Review of the literature reveals general agreement that CBG Po\textsubscript{2} values are of little use in predicting arterial Po\textsubscript{2} and that CBG pH values are reliable predictors of arterial pH; opinion varies regarding CBG Pco\textsubscript{2}. We conducted a two-part study comparing postductal arterial and CBG values. First, 50 infants were studied, each only once. All infants had umbilical arterial catheters in place. Blood was obtained simultaneously from the umbilical artery catheter and the warmed heels. Results demonstrated poor predictability of arterial values from CBG pH and Pco\textsubscript{2} as well as for Po\textsubscript{2}. Second, to determine if variation both within and among individuals was similar, repeated measurements were made in 27 additional infants comparable to the first group. We obtained 3 to 28 simultaneous postductal arterial and CBG samples from each infant. A random-effects nested analysis of variance indicated that for pH, variation was largely the result of between-subject or within-subject replicates effects, while for Po\textsubscript{2} and Pco\textsubscript{2}, most variation was explained by differences between the two techniques (umbilical artery catheter vs CBG). The results indicate that CBG measurements do not accurately predict arterial values in neonates. Extreme caution should be used when management decisions are based on CBG values.

6. The comparison between capillary blood sampling and arterial blood sampling in an NICU

Citation: Acta Paediatrica Taiwanica, 2002, vol./is. 43/3(124-126), 1608-8115 (2002)

Author(s): Yang K.-C.; Su B.-H.; Tsai F.-J.; Peng C.-T.

Language: English

Abstract: To study the correlation between the results of blood examination from arterial blood sampling via arterial puncture and capillary blood sampling via heel-stick, 33 premature infants with birthweights ranging from 635 grams to 2500 grams were enrolled in this study. The 33 paired samples of capillary blood sampling via heel-stick and simultaneous arterial blood sampling via arterial puncture were analysed within 3 minutes after collection for hemoglobin, hematocrit, sodium, potassium, chloride, calcium, glucose, lactate, osmolality, and blood gas. The average correlations between capillary and arterial samples were 0.92 for pH, 0.93 for Pco\textsubscript{2}, 0.87 for hematocrit, 0.88 for hemoglobin, 0.86 for sodium, 1.16 for calcium, 1.14 for glucose, 1.01 for lactate, 1.03 for base excess (BE), 1.05 for HCO\textsubscript{3}-, 0.91 for osmolality, 1.35 for PO\textsubscript{2}, 0.28 for O\textsubscript{2} saturation, 0.67 for potassium, and 0.78 for chloride. We concluded
that capillary blood sampling via heel-stick is a rapid, simple, less invasive, and reliable alternative to arterial blood sampling for the evaluation of hemoglobin, hematocrit, sodium, calcium, glucose, lactate, osmolality, and blood gas (pH, pCO<sub>2</sub>, HCO<sub>3</sub>, BE) in premature infants.

**Publication Type:** Journal: Article

**Source:** EMBASE

7. **Comparison of Blood Gas Values in Arterial and Venous Blood**

**Citation:** Indian Journal of Pediatrics, October 2003, vol/is. 70/10(781-785), 0019-5456 (October 2003)

**Author(s):** Kirubakaran C.; Gnananayagam J.E.J.; Sundaravalli E.K.

**Language:** English

**Abstract:** Objective: To compare pH and PCO<sub>2</sub> values of simultaneously obtained arterial, arterialized capillary, and venous blood samples and also to compare oxygen saturation (ASaO<sub>2</sub>) measured in arterial blood and oxygen saturation by pulse oximetry (PSaO<sub>2</sub>). Methods: Prospective study was done in the children admitted in the Pediatric Intensive Care Unit of Christian Medical College Hospital Vellore, requiring critical care. All the three blood gas samples (arterial, capillary and venous) were taken simultaneously and analyzed. Oxygen saturation by pulse oximetry was also recorded. Results: 50 children aged 14 days to 12 years were included in the study. Arterial and capillary pH values were highly correlated (r<sup>2</sup>=0.9024, p<0.0001). Out of 16 children with arterial acidosis 9(56%) were identified by capillary blood gas. Arterial and venous pH values also showed good correlation (r<sup>2</sup>=0.8449, p<0.0001). The PCO<sub>2</sub> values of arterial and capillary blood gases were found to be highly correlated (r<sup>2</sup>=0.9534, p<0.0001). The capillary blood gas accurately reflected the arterial PCO<sub>2</sub> in 41 (82%) patients. Arterial and venous blood gas PCO<sub>2</sub> values had less correlation (r<sup>2</sup>=0.5917, p=0.011). The arterial oxygen saturation (ASaO<sub>2</sub>) and oxygen saturation by pulse oximetry (PSaO<sub>2</sub>) were correlated moderately (r<sup>2</sup>=0.7241, p<0.0001). Conclusion: Even though arterial blood gas analysis is the gold standard, and when an arterial blood gas sample cannot be obtained, a combination of arterialized capillary blood gas and pulse oximetry can be effectively used in acutely ill children of all ages. Venous samples have a good correlation with arterial samples for pH but are not useful for monitoring blood gas status in acutely ill children.

**Publication Type:** Journal: Article

**Source:** EMBASE