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Search details
Radial artery sampling, femoral artery sampling, arterial gas sampling, procedures, complications, contraindications (reason for withholding medical treatment).

Resources searched
NHS Evidence, TRIP, Nursing Reference Center, BestBETs, EMBASE, Medline,

**Database search terms:** exp ARTERIAL GAS, ("arterial blood gas" OR ABG OR "arterial blood gas samp!" OR "arterial samp!" OR "arterial gas"), exp BLOOD GAS ANALYSIS, "blood gas analysis", exp RADIAL ARTERY, ("radial artery" OR "radial arter* samp*" OR "radial arter* blood sampl*"), exp FEMORAL ARTERY, ("femoral artery" OR "femoral arter* samp!" OR "femoral arter* blood samp!"), exp TREATMENT CONTRAINDICATION, exp TREATMENT INDICATION, exp COMPLICATION, ("treatment indication" OR indication* OR procedure* OR protocol* OR guid* OR complication* OR "treatment contraindication" OR contraindication* OR risk*)

**Google search string:** ("arterial blood gas" OR "arterial blood gas sampling" OR "arterial sampling") ("radial artery" OR "femoral artery") (indication OR procedure OR protocol OR guideline OR complication OR contraindication OR risk) -agenda -minutes -meeting -PCT -"primary care" 2001..2011

Summary
Femoral artery access can cause small bowel perforation. 1

Closed loop arterial sampling system could be the solution for preventing hypoglycaemia caused by glucose containing flush solutions being attached to the arterial line. 2

Radial artery psuedoaneurysm is a rare complication. 3, 7, 8. Arterial sampling sites can contract infection including MRSA. 10 Careful attention to detail and appropriate care of the patient can prevent these complications. Early diagnosis and a surgical approach can prevent complications developing further. 6

Removal of the radial artery line can lead to a subtle degree of hand ischemia in conditions of sustained muscular effort. This may affect the selection of patients based on their
Involvement with manual activities. 4, 9

**Guidelines**

**Nursing Reference Center**
Arterial Blood Gases: Interpreting Results, 2010
Skills Competency Checklist
Specimen Collection: Arterial Blood Sampling, 2010
Specimen Collection: Arterial Blood Sampling, 2010
Skills Competency Checklist

**Evidence-based reviews**

**BestBETs**
Local anaesthetic infiltration reduces the pain of arterial blood sampling, 2001
Local anaesthetic infiltration prior to arterial puncture significantly reduces the pain of the procedure without affecting success rates

**Journal of Nursing Care Quality**
Harmonization of practice among different groups of caregivers: a guideline on arterial blood gas utilization, 2005
In conclusion, we showed that the quality improvement program on ABG appropriateness with the implementation of a guideline, combined with audit sessions and feedback, induced significant modifications of practice. The 3 groups of caregivers modified differently their practice. Less experienced caregivers modified their practice the most, joining more experienced professionals. This expected harmonization of the practice among the 3 different groups was achieved after 10 months in the last (consolidated) period.

**NHS Economic Evaluation Database**
Use of a pulse oximeter in an adult emergency department: impact on the number of arterial blood gas analyses ordered, 1998
The availability of SpO2 reduced the number of unnecessary ABG measurement ordered without any detriment to the patient. The reduction of unjustified ABG measurements was mainly due to the decrease of useless ABG determinations performed for miscellaneous nonrespiratory disorders.

**Published research**

1. Small bowel perforation after drawing a blood sample in the femoral artery: a case report.
Author(s): Ara C, Coban S, Isik B, Ozcan CC, Yilmaz S
Citation: Ulusal Travma ve Acil Cerrahi Dergisi = Turkish Journal of Trauma & Emergency Surgery: TJTES, May 2010, vol./is. 16/3(275-6), 1306-696X (2010 May)
Publication Date: May 2010
Abstract: Small bowel perforation is a rare complication of femoral artery access in cases of femoral hernia. A 48-year-old woman was admitted to the intensive care unit due to pulmonary insufficiency. After a routine femoral arterial blood gas analysis, severe abdominal pain and nausea began. She underwent emergency laparotomy due to acute abdomen. Laparotomy revealed small bowel perforation. Segmental resection and end-to-end anastomosis were performed. The femoral canal was closed using plaque mesh. Special attention is needed during femoral artery access to avoid accidental small bowel perforation. As seen in this case, a careful examination should be done in cases of femoral...
2. Reducing the risk of fatal and disabling hypoglycaemia: A comparison of arterial blood sampling systems

Author(s): Brennan K.A., Eapen G., Turnbull D.
Citation: British Journal of Anaesthesia, April 2010, vol./is. 104/4(446-451), 0007-0912;1471-6771 (April 2010)
PUBLICATION DATE: April 2010
Abstract: Background. In 2008, the National Patient Safety Agency (NPSA) published a report after 42 incidents and two deaths where glucose-containing flush solutions were attached to the arterial line. The molar concentration of 5% glucose is 277 mmol litre⁻¹. Only a tiny amount of sample contamination will lead to an artificially high glucose. As the NPSA sought a solution, a bench model was constructed to compare the performance of three open and three closed arterial line systems in limiting sample contamination.

Methods. All arterial line systems were set up in a standard manner and pressurized to 300 mm Hg with 5% glucose used as the flush solution. This was connected to the 'radial artery' using an 18 G needle representing the radial cannula. The radial artery was simulated using a wide-bore extension set with 'blood' flow at 60 ml min⁻¹. Blood was simulated by the addition of red dye to Hartmann's solution. Increasing multiples of arterial line dead space were aspirated and discarded. Blood samples were then obtained and glucose concentration was measured. Results. Significant glucose contamination (3 mmol litre⁻¹ +/- 3.4) was detected in all open arterial line systems up to an aspiration volume of five times the dead space. No samples from the closed systems recorded glucose concentration >1 mmol litre⁻¹. Conclusions. Recommended minimal discard volumes are inadequate in the presence of glucose as the flush solution and can lead to high blood glucose readings, inappropriate insulin use, and iatrogenic neuroglycopenia. Our study demonstrates that the closed-loop arterial sampling system could be the universal solution sought by the NPSA. The Author [2010]. Published by Oxford University Press on behalf of the British Journal of Anaesthesia. All rights reserved.

Source: EMBASE
Full Text: Available in print at Lincoln County Hospital Professional Library

3. Radial artery pseudoaneurysm after a single arterial puncture for blood-gas analysis: A case report

Author(s): Leone V., Misuri D., Console N.
Citation: Cases Journal, 2009, vol./is. 2/7, 1757-1626 (2009)
PUBLICATION DATE: 2009
Abstract: We report a case of a radial artery pseudoaneurysm complicating a single arterial puncture for blood-gas analysis that was treated with excision of pseudoaneurysm and suture of the defect of wall of radial artery. The puncture for continuous blood pressure monitoring and serial blood gas analysis have been reported in critically ill patients, but, to the best of our knowledge, there are no cases reported of pseudoaneurysm after a single arterial puncture for blood-gas analysis. In the reported case we think that the main cause of the pseudoaneurysm onset was an incorrect compression and/or a too much short time of compression of the radial artery after the puncture. Minor sequelae and rare complications may be minimized by careful attention to detail in the performance of such procedures and care of the patient also after a single arterial puncture. 2009 Leone et al; licensee Cases Network Ltd.

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Full Text: Available in fulltext at National Library of Medicine

4. Late haemodynamic and functional consequences of radial artery removal on the forearm circulation

Citation: International Journal of Cardiology, September 2008, vol./is. 129/2(255-258), 0167-5273 (26 Sep 2008)
PUBLICATION DATE: September 2008
Abstract: Background: We aimed at evaluating the late haemodynamic and functional consequences on the forearm circulation of radial artery removal for coronary artery bypass
grafting. Methods: Ten years after surgery we performed basal and stress echo-Doppler evaluation of the forearm circulation, baseline and stress transcutaneous oxymetry and determination of reactive oxygen metabolites in the operated and control arm in 20 asymptomatic patients submitted to radial artery removal. Results: The peak systolic velocity of the ulnar artery of the operated side was significantly higher than the control site. Transcutaneous oxymetry revealed asymptomatic hand ischemia at moderate level of muscular effort in the operated arm, but reactive oxygen metabolites measurement did not differ between the two arms. Conclusions: Even in patients with good ulnar compensation, radial artery removal leads to subtle degree of hand ischemia in conditions of sustained muscular effort. Although the clinical significance of this observation remains to be determined, this finding can have important implications for conduit selection in patients involved in manual activities. 2007 Elsevier Ireland Ltd. All rights reserved.

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5. How often should we perform arterial blood gas analysis during thoracoscopic surgery?
Author(s): Ganter M.T., Schneider U., Heinzelmann M., Zaugg M., Lucchinetti E., Zollinger A., Hofer C.K.
Citation: Journal of Clinical Anesthesia, December 2007, vol./is. 19/8(569-575), 0952-8180 (Dec 2007)
PUBLICATION DATE: December 2007
Abstract: Study Objectives: To continuously measure arterial blood gases (ABGs), to calculate the percentage of anticipated changes over time, and to develop recommendations for sampling frequencies of arterial blood gases in patients undergoing thoracoscopic surgery. Design: Prospective, observational clinical trial. Setting: University hospital. Patients: 43 consecutive elective patients undergoing thoracoscopic surgery with one-lung ventilation. Interventions and Measurements: A Paratrend 7 probe for continuous arterial partial pressure of oxygen and arterial partial pressure of carbon dioxide measurement was introduced through a radial artery cannula in the awake patient before surgery. Data were collected throughout the procedure until patients left the operating room. Afterward, time courses of arterial blood gas values were transformed into frequency space by fast Fourier transform analysis, and the expected deviations in arterial blood gases were calculated over time. Main Results: Forty-three consecutive patients undergoing thoracoscopic surgery were included, and arterial blood gas values were measured during a total of 141.5 h. Critical arterial partial pressure of oxygen values <=60 mmHg were recorded in 16 patients for a total of 4.5 hours. Fourier amplitude spectra showed comparable characteristics of arterial partial pressure of oxygen and arterial partial pressure of carbon dioxide time courses in all patients. It takes only 5, 10, or 20 minutes for the arterial partial pressure of oxygen to change 10%, 20%, or 40%, respectively (95% confidence). Conclusions: Current standards to monitor arterial blood gases are not sufficient to detect and prevent hypoxemic events during thoracoscopic surgery with one-lung ventilation. Intermittent arterial blood gas analyses must be performed more frequently, up to every 10 minutes, to detect changes of 20% in arterial partial pressure of oxygen. 2007 Elsevier Inc. All rights reserved.
Source: EMBASE

6. Iatrogenic brachial and femoral artery complications following venipuncture in children
Author(s): Dogan O.F., Demircin M., Ucar I., Duman U., Yilmaz M., Boke E.
Citation: The heart surgery forum, 2006, vol./is. 9/4(E675-680), 1522-6662 (2006)
Publication Date: 2006
Abstract: INTRODUCTION: Catheter- or noncatheter-related peripheral arterial complications such as arterial pseudoaneurysm, embolus, or arteriovenous fistula may be seen in the pediatric age group. The most common etiologies defined for arterial complications are peripheral arterial puncture performed for a routine arterial blood gas analysis, arterial catheters placed for invasive monitorization of children, or catheterization performed for diagnostic purposes through the peripheral arterial system, most commonly the femoral artery. MATERIALS AND METHODS: Nine children with peripheral arterial complications, whose ages varied between 2 months and 2.5 years, were enrolled in this study. All patients were treated surgically. Following physical examination, Doppler ultrasonography, computed tomography angiography, magnetic resonance angiography, or digital subtraction angiography were used as diagnostic tools. We studied thrombophilic panels preoperatively. Six patients had brachial artery pseudoaneurysms that developed...
accidentally during venipuncture, I had a brachial arteriovenous fistula that developed after an accidental brachial artery puncture during routine peripheral blood analysis. In the remaining 2 patients, peripheral arterial embolic events were detected. One had a left brachial arterial embolus and the other had a sudden onset right femoral artery embolus that was detected via diagnostic interventions. RESULTS: No morbidity such as amputation, extremity loss, or mortality occurred due to the arterial events or surgery. All patients were discharged from the hospital in good clinical condition. In all patients, follow-up at 3 or 6 months revealed palpable peripheral artery pulsations of the ulnar and radial arteries at wrist level. CONCLUSION: Because the incidence of peripheral arterial complications is relatively low in children compared to adults, the diagnostic and therapeutic approaches are extrapolated from the adult guidelines. We proposed that early diagnosis and surgical approach prevented the complications from further developing in the affected extremity in these particular cases.

Source: EMBASE

7. Radial artery pseudoaneurysm: A maneuver to decrease the risk of thrombin therapy

Author(s): Pozniak M.A., Mitchell C., Ledwidge M.
Citation: Journal of Ultrasound in Medicine, January 2005, vol./is. 24/1(119-122), 0278-4297 (Jan 2005)
Publication Date: January 2005
Abstract: A pseudoaneurysm is an infrequent complication of arterial intervention. It is most frequently seen in the groin after coronary catheterization but can be seen in any vessel as a sequela of trauma. Pseudoaneurysms can also occur peripherally as the sequela of arteriovenous shunting for dialysis or placement of indwelling catheters or after traumatic drawing of arterial blood gas. Treatment of pseudoaneurysms has evolved through the years. Initially it was the domain of surgical intervention. Subsequently, most cases have been treated with ultrasound-guided compression. Recently thrombin (Jones Pharmacy Inc, St Louis, MO) injection has become the preferred treatment method. However, direct injection of thrombin into a pseudoaneurysm is not without risk. If thrombin should escape the pseudoaneurysm, a clot can propagate into the affected artery and result in embolization or thrombosis of peripheral branch vessels. The severity of the iatrogenic insult is amplified when the blood supply is to more critical areas, such as the head or hand. In this report, a new technique to help minimize the chance of unwanted propagation of the thrombus into the peripheral vasculature during thrombin treatment of a radial artery pseudoaneurysm is described.

Source: EMBASE

8. Iatrogenic pseudoaneurysm resulting in transection of the radial artery

Author(s): Henney S.E., Bhattacharya V., Sarker B.A.
Citation: Journal of Ultrasound in Medicine, August 2004, vol./is. 23/8(1091-1093), 0278-4297 (Aug 2004)
Publication Date: August 2004
Abstract: Radial artery catheters are routinely used for continuous hemodynamic monitoring in critically ill patients. Arterial cannulation is a safe procedure allowing repeated arterial blood gas monitoring. As with all invasive devices, complications have been reported, including thrombosis, embolization, infection, sepsis, and, rarely, pseudoaneurysm. A case of pseudoaneurysm resulting in complete transection of the radial artery is presented.

Source: EMBASE

9. A large radial artery false aneurysm after repeated arterial punctures, causing compartment syndrome of the forearm [5]

Author(s): Matsagas M.I., Mitsis M., Rigopoulos C., Theodossiou V., Koulouras V., Polyzoidis K., Kappas A.M.
Citation: Intensive Care Medicine, June 2003, vol./is. 29/6(1032), 0342-4642 (01 Jun 2003)
Publication Date: June 2003
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10. MRSA infected pseudoaneurysms of the radial artery
Abstract: The use of radial artery catheters for real-time blood pressure monitoring and arterial blood gas sampling has become commonplace in both intensive care and high dependency units. Although this procedure is relatively safe, it can be complicated by local infection leading to pseudoaneurysm formation. In this report we describe three cases of pseudoaneurysm formation following prolonged radial catheter placement, with evidence of local methicillin resistant staphylococcus aureus (MRSA) infection. With the growing problem of in-hospital MRSA colonisation, the report aims to emphasize the need for vigilance for this complication and reinforce the importance of careful asepsis. In all cases the pseudoaneurysms were successfully treated with local ligation of the radial artery, without subsequent ischaemic complications. Allen's test was performed to ensure sufficient collateral circulation prior to surgery.

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11. Accuracy and utility of a continuous intra-arterial blood gas monitoring system in pediatric patients
Author(s): Coule L.W., Truemper E.J., Steinhart C.M., Lutin W.A.
Citation: Critical Care Medicine, 2001, vol./is. 29/2(420-426), 0090-3493 (2001)
Publication Date: 2001
Abstract: Objectives: To determine the accuracy of the Paratrend 7 continuous intra-arterial blood gas monitor (CI-ABGM) in radial and femoral artery catheters placed in children compared with simultaneous measurements of pH, Paco2, and Pao2 performed by intermittent blood gas analysis. To determine sensor longevity in pediatric patients at different arterial sites. To determine the utility of CI-ABGM for tracking unanticipated events related to blood gas deterioration. Setting: A pediatric intensive care unit of a university hospital. Design: A prospective clinical investigation. Patients: Fifty critically ill pediatric patients, ranging in age from 1 wk to 18 yrs of age, who required either radial or femoral artery catheters for intermittent arterial blood gas monitoring. Interventions: None. Measurements and Main Results: A Paratrend 7 intra-arterial sensor was placed through either an 18- or 20-gauge catheter previously inserted into the radial or femoral artery. At clinically predetermined intervals ranging from every 1 to 8 hrs, the CI-ABGM measurements of pH, Pco2, and Po2 were compared with the values determined by standard intermittent blood gas analysis. The Paratrend 7 system values were individually adjusted to match ABG results when the Paratrend 7 pH differed by greater than +/-0.05 units, Pco2 was greater than +/-15% of the ABG value. Significant aberrations in gas exchange defined as unanticipated events were categorized as isolated metabolic acidosis (pH <7.20), hypercapnia (Pco2, >70 torr; 9.3 kPa), and hypoxemia (Po2, <50 torr; 6.7 kPa). All unanticipated events were earmarked from consecutive monitoring epochs ranging from 4 to 24 hrs duration from the time of Paratrend 7 sensor insertion to the time of sensor removal. Fifteen sensors were placed into the radial artery, 34 sensors were placed into the femoral artery, and one sensor was initially placed in the radial and moved to a femoral artery location. Mean radial artery insertion duration was 35 hrs. Mean femoral artery duration was 137.2 hrs. A total of 1445 pairs of ABG results were available for comparison. After removal of individual values, which did not meet inclusion criteria, 1411 pH data pairs, 1408 Pco2 data pairs, and 1326 Po2 data pairs were analyzed. The bias and precision for the pH data were 0.00 and 0.04 units, respectively; for the Pco2 data were -0.4 and 4.8 torr (-0.05 and 0.64 kPa), respectively; and for the Po2 data 1.0 and 25 torr (0.1 and 3.3 kPa), respectively. Detection of unanticipated events was evenly spread across the three categories and was most commonly related to iatrogenic causes or cardiac failure. Persistent waveform dampening necessitating sensor removal was more frequently encountered in radial placement compared to femoral placement. Conclusions: The Paratrend 7 CI-ABGM is accurate within the extremes of physiologic gas exchange typically encountered in the pediatric intensive care setting. The device is capable of tracking extreme fluctuations in gas exchange with a response rate suitable for making real-time therapeutic decisions. The sensor can be recommended for insertion into a femoral artery cannula. There is a high incidence of blood pressure waveform dampening encountered in radial artery use.
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[CITATION] Two Different Ways of Collecting Samples From Radial Artery for Blood-gas Analysis
F Xiuyun... - 2004 - en.cnki.com.cn
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