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شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

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تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

Arterial and venous blood gases correlation in post cardiac surgery patients

Thesis

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By

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Mohamed Bedir Ghazi

Table Of Contents

List Of Tables

List Of Figures

List Of Abbreviations

ABG	**Arterial blood gas**
ALI	**Acute Lung Injury**
ARDS	**Acute respiratory distress syndrome**
AV	**Arteriovenous**
BE	**Base excess**
CABG	**Coronary artery bypass graft**
COPD	**Chronic obstructive pulmonary disorder**
CPAP	**Continuous positive airway pressure**
CPB	**Cardiopulmonary Bypass**
CVC	**Central venous catheter**
CVP	**Central venous pressure**
DIC	**Disseminated intravascular coagulation**
DVT	**Deep venous thrombosis**
EF	**Ejection Fraction**
FRC	**Functional residual capacity**
ICU	**Intensive Care Unit**
PCWP	**Pulmonary capillary wedge pressure**
TAPSE	**Tricuspid annular plane systolic excursion**
VAP	**Ventilator-associated pneumonia**
VBG	**Venous Blood Gas**

Introduction

Measurement of the arterial blood gases, before, during and after cardiac surgery has an extreme significance. Arterial blood gas (ABG) sampling represents the gold standard method for acquiring patients' acid base status (***Kirubakaran et al, 2003)*** However, the procedure of obtaining a blood sample for ABG analysis is invasive and painful and maybe associated with complications such as thrombosis, embolism, hematomas, aneurysm, distal limb ischemia and infections. In addition, for the medical staff, this procedure entails needle-stick injuries and subsequent exposure to infections such as HIV and hepatitis ***(O'Connor et al, 2011).***

The risks increase with repeated arterial punctures and with insertion of a catheter when performed by inexperienced individuals. Venous Blood Gas (VBG) samplings may be useful alternatives, as it is easier to obtain and a less invasive way of evaluating acid-base status, avoiding the risks of arterial punctures. ***(Rees et al, 2006)*** ABG indices such as the pH, $PaCO_2$ and HCO_3 offer a tool to evaluate the patient's perfusion status and give the physician the chance to resuscitate the patient. VBG is an alternative and safe method of estimating systemic carbon dioxide and pH ***(Walkey et al, 2010).***

Some recent studies have documented no significant difference between arterial and venous pH in some special settings; therefore, these studies recommended venous, instead of arterial, blood sample for pH analysis. Studies also revealed a significant correlation between the arterial and venous bicarbonate levels ***(Khan et al, 2010).*** Moreover, Partial Pressure of Venous Carbon Dioxide ($PvCO_2$) can be considered as a screening method in the diagnosis of arterial hypercapnia ***(Kelly et al, 2005).***

Some of these studies are not extensively generalizable due to their small sample size ***(Treger et al, 2010)*** and most of them have not examined the correlation between these blood gas indices. To date, most of the studies conducted were in patients with respiratory distress or ketoacidosis and a few studies have been done in patients in the ICU, which have shown somewhat contradicting results. A lack of evidence, in terms of the precision of VBG in the assessment of the patients in different conditions like postoperative, does exist ***(Kelly, 2014).***

Aim of the work

The aim of this study was to evaluate the reliability and to determine whether venous blood gas values can replace arterial gas values post cardiac surgery. We investigated the correlation between pH, PaCO2, HCO3 and lactate in arterial and venous blood gases.

Review of literature

(Chapter 1)

Value of Arterial blood gases in post-operative cardiac surgery ICU patients

Arterial blood gas (ABG) sampling is a relatively safe and simple procedure performed at the bedside. Once analyzed, the blood sample provides information about the patient's acid-base status, oxygenation, ventilation, and other physiologic values. Although ABG measurements remain an integral part of caring for a critically ill patient, one must acknowledge the limitations of the test, a single ABG measurement provides information about a patient at only a single point in time, and a patient's physiologic status can change quite rapidly. Furthermore, an ABG measurement must be appropriately interpreted and subsequently applied to a patient's disease process ***(Zimmerman & Dellinger, 1996).***

Indications for sampling arterial blood gases

1- Determination of pH and partial pressure of respiratory gases

- pH, PaCO2(arterial pressure of carbon dioxide), and HCO3-(bicarbonate) level are obtained to aid in the diagnosis of acid-base disorders.
- PaCO2is measured to assess ventilation in patients with respiratory diseases, such as asthma and COPD (chronic obstructive pulmonary disorder).
- PaO2(arterial pressure of oxygen) is measured to assess oxygenation of blood***.(Shrake et al, 1992)***

2- Determination of other serum blood levels

- Some laboratories require arterial blood to run certain tests. . Examples include:
    - Lactate
    - Ammonia
    - Dyshemoglobins (i.e., carboxyhemoglobin and methemoglobin)
- In some cases, these tests can be run on venous blood that is obtained in a heparinized syringe.***(Fowler & Harvey, 2003)***

3- Assessment of patient response to therapeutic interventions and progression of disease process

Examples include:

- Assessment of the effectiveness of mechanical ventilation in a critically ill patient.
- Documentation of the resolution or progression of conditions, such as diabetic ketoacidosis.

4- Sampling of blood in emergency situations when venous blood cannot be obtained.***(Shrake et al, 1992)***

Venous blood can be used instead of arterial blood for acid-base evaluation in some clinical scenarios. In the absence of low cardiac output, the venous pH is usually 0.05 pH units lower than that of arterial blood, and the venous PaCO2is 5-6 mm Hg higher than that of arterial blood. If exact values are required, an arterial sample should be obtained.***(Seifter, 2004).***

Techniques of arterial blood gases sampling

Anatomical access

- **The radial artery**

The radial artery is the preferred site for arterial puncture. The superficial location allows for easy puncture and post-procedure compression. It is relatively immobile, and the surrounding muscles (flexors of the hand and pronator quadratus) and the distal radius provide tamponade that limits hematoma formation***.(Fowler & Harvey, 2003)***

The radial artery lies medial and proximal to the radial styloid on the volar side of the wrist***.(Stroud & Rodriguez, 2004)***

Avoid puncture proximal to the radial styloid, because the artery runs deeper and is more mobile in this region, and thus may be harder to locate. ***(Kendall, 2001)***

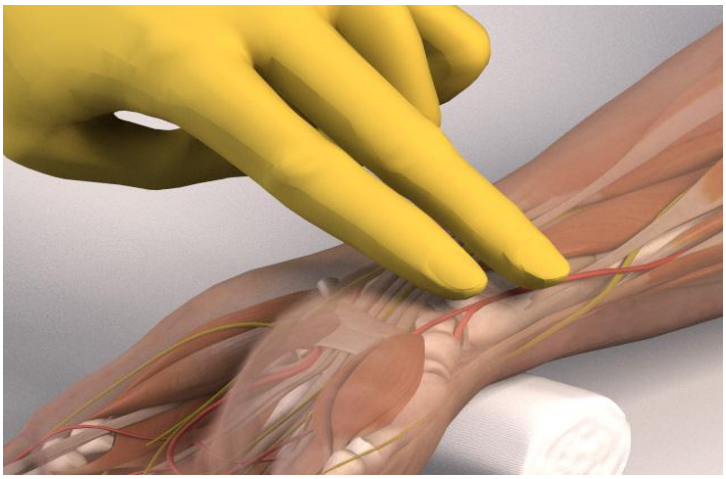

Figure 1: Radial artery.***(Murray & Todd, 2020)***

Dorsiflex the wrist and palpate the radial artery, Enter the skin at a 45-degree angle, at a point 2-3 cm proximal to the volar wrist crease. Place the bevel in the upwards position, so the lumen of the needle faces the flow of oncoming arterial blood.

The brachial artery

The brachial artery may be chosen if the radial arteries are not accessible. It is less desirable for several reasons:, The brachial artery lies deep in the antecubital fossa and may be difficult to enter. The adjacent basilic vein and median nerve may be injured during the attempt. Hematoma formation may occur because of lack of underlying anatomic support from neighboring ligaments and bones. Additionally, post-procedure compression is more difficult than with the radial artery. Collateral circulation is less robust than that of the radial artery.***(Williams, 1998)***

The brachial artery runs through the medial aspect of the antecubital fossa, lateral to the medial epicondyle and medial to the biceps brachii tendon. ***(Stroud & Rodriguez, 2004)***