A Comparison of Phospholipase A2 Levels- An Inflammatory Marker for Endotracheal Intubation via Direct & Video Laryngoscope in Patients Undergoing Cardiac Surgery

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Abstract: The role of inflammatory response to pathogenesis of atherosclerosis has been topic of intense research. Several markers of inflammatory response have shown predictive value for first and recurrent coronary events in patients with established Coronary Heart Disease (CHD). Among these markers, lipoprotein-associated Phospholipase A2 mass and activity appears to be associated with increased risk for CHD, in general population and in patients with pre-existing CHD. The aim of study is to measure and compare Lipoprotein associated Phospholipase A2 activity, a selective inflammatory marker of CHD in patients undergoing cardiac surgery during endotracheal intubation via direct and video laryngoscope.

Keywords: lipoprotein associated phospholipase A2, Coronary Heart Disease, Inflammatory response, direct laryngoscope, Video laryngoscope

1. Introduction

Phospholipase A2 (PLA2) is one of a family of phospholipases, enzymes that hydrolyse phospholipids. One of which, lipoprotein-associated PLA2 (LpPLA2) is also known as platelet activating factor acetyl hydrolase (PAF-AH). Lipoprotein-associated PLA2 promotes the hydrolysis of oxidized phospholipids in lipoproteins, generating lysophospholipids and proinflammatory oxidized fatty acids.

This reaction is of the utmost importance in the context of cellular signalling; since it constitutes the main pathway by which arachidonic acid (AA) is liberated from phospholipids. Free AA is a precursor of compounds known as the eicosanoids, which includes the cyclooxygenase-derived prostaglandins and the lipooxygenase-derived leukotrienes ¹.

The importance of the eicosanoids and platelet-activating factor as key mediators of inflammation as well as other pathophysiological conditions is now universally accepted [1]. Furthermore, sPLA2s promote cytokine and chemokine production from macrophages, neutrophils, eosinophils, monocytes, and endothelial cells. Hence it might play an important role in the initiation and amplification of the inflammatory reaction. ²

Inflammatory processes play a significant role in initiation, progression, and rupture of atherosclerotic plaques (3). Recent studies show lipoprotein-associated phospholipase A₂ (Lp-PLA₂) as an emerging marker of cardiovascular risk ⁴, ⁵, ⁶, ⁷, ⁸, ⁹, ¹⁰. Lp-PLA₂ is a highly specific vascular inflammatory marker ⁴, ⁵, ⁹. Lipoprotein-associated phospholipase A₂ (Lp-PLA₂) is bound predominately to low-density lipoprotein and has been implicated as a risk factor for coronary artery disease (CAD) ¹¹.

Airway management hold utmost importance during delivery of general anaesthesia. Since anaesthetised patients are unable to maintain adequate airway on their own, hence artificial devices for management of the airway is inevitable. ¹²

Endotracheal intubation is a method of airway protection that results in local inflammation and in some cases tracheal injury that may progress to subglottic stenosis. ¹³ Although these inflammatory responses carry risk for all patients who are receiving anaesthesia, it is more significant in patients who have underlying coronary artery disease.

Modification of instruments and utilization of various other intubating devices may be tried to dampen these inflammatory responses.

Direct visualisation of larynx and its structure is a prerequisite for conventional intubation with Macintosh laryngoscope which provides only a narrow field of vision and can get worsened with repeated attempts. The Video Laryngoscope provides enlarged and enhanced video image of structure of airway, facilitating better expertise.

Hence this study is aimed at comparing the alteration in inflammatory marker phospholipase A2 level during and after endotracheal intubation with conventional laryngoscope and video laryngoscope.

Inclusion Criteria
1) Age: range 20 – 80 yrs.
2) ASA physical status grade III and grade IV patients
3) Patients who gave informed written consent.
4) Elective cardiac surgery
5) Either gender

Exclusion Criteria
1) Patient refusal
2) Emergency cardiac surgery
3) MPC III and IV (difficult intubation) (anticipated difficult intubation or history of difficult intubation, and limited nuchal range of motion)
4) Failure to intubate after three attempts and duration more than 3 minutes were excluded from the study (an attempt is defined as time from introduction of laryngoscope into oral cavity until its removal)
5) Parturient and lactating women
6) Poor left ventricular function (LVEF < 35%), conduction abnormality and on permanent pacemaker
7) Less than 20 years

Source of Data
a) Study Site: MGM Medical College, Kamothe, Navi Mumbai.
c) Study design: Prospective randomized comparative study.
d) Sample size: 40 patients would be included in this study.

2. Material and Method

After obtaining informed written consent from patients, patients were randomly divided into 2 groups. Sequentially, numbered sealed opaque envelopes were used for allocation concealment.

Group ‘A’: – 20 patients: intubated by using direct laryngoscope
Group ‘B’: – 20 patients: intubated by using video laryngoscope

All intubation were performed by senior experienced anaesthesiologist who had an experience of using video laryngoscope. All patients will be kept fasting overnight. Tablet Alprazolam 0.5mg and Tablet Pantoprazole 40 mg were given to patients on day before surgery during preanaesthetic evaluation. On entering the operation theatre, one wide bore intravenous cannula along with 7 French central line and femoral line were inserted 15 min prior to induction of anaesthesia

The following monitors will be attached for continuous monitoring and baseline values recorded
1) Pulse Oximeter
2) Capnography
3) Electrocardiography (ECG)
4) Continuous arterial pressure recording through femoral arterial line
5) Continuous central venous pressure recording through central line

Patients were preoxygenated and premedicated- Inj. Midazolam 0.05mg/kg and Inj. Fentanyl 2mcg/kg and induced with IV inj. Etomidate (0.3 – 0.4 mg/kg). After confirming for check ventilation using bag and mask ventilation (i.e. visible chest rise) neuromuscular blockade was achieved using IV inj. rocuronium (0.4-0.6mg/kg). After three minutes of assisted ventilation as per the group, endotracheal tube was inserted by using conventional laryngoscope (Macintosh blade) in one group (consisting of 20 patients each) and video laryngoscope in another group.

After successful attempt cuff of the endotracheal (ET) tube was inflated and correct placement was confirmed by auscultation (i.e. air entry B/L equal) and end tidal carbon dioxide (ETCO2) values. Patient was maintained on oxygen, air and sevoflurane.

Blood samples for the determination of serum phospholipase levels were taken after discarding 5ml of blood at each time point from Central venous catheterisation.

Blood samples were taken according to the following timetable:
1) Time point 1: 5 min prior to the administration of any induction agent, for the measurement of baseline plasma levels of phospholipaseA2 [pre - induction & pre – intubation]
2) Time point 2: 15 min post tracheal intubation

All blood samples were drawn into precooled tubes (2-8°C) and immediately transferred to the laboratory and centrifuged in a refrigerated centrifuge at 0°C. The separated serum was stored at -70°C until processing. Lp-PLA2 activity was measured with Diazyme’s PLAC® Test . All assays were analysed at GENOMICS Lab, with laboratory personnel blinded to all clinical data. Lp-PLA2 index, an integrated measure of mass and activity, expressing enzymatic properties, were calculated.

Assay Principle
The PLAC Test for Lp-PLA2 Activity is an enzyme assay. Lp-PLA2, in plasma or serum, hydrolyzes the sn-2 position of the substrate, 1-myristoyl-2-(4-nitrophenyI succinyl) phosphatidylcholine, producing a colored reaction product, 4-nitrophenol. The rate of formation of 4-nitrophenol is measured spectrophotometrically and the Lp-PLA2 activity is calculated from the rate of change in absorbance. A set of five Lp-PLA2 calibrators is used to generate a standard curve fit of change in absorbance versus Lp-PLA2 activity level in nmol/min/mL. from which the sample Lp-PLA2 activity is derived

3. Observation and Results

Null Hypothesis (H0): There is variance in means (readings of Lipoprotein associated Phospholipase A2 activity, a selective inflammatory marker of CHD) between group of patients undergoing cardiac surgery during endotracheal intubation via direct and video laryngoscope.
6. Conclusion

PLA2s are emerging as a novel class of mediators of inflammation and immune responses. These molecules are found in biologic fluids in a variety of systemic inflammatory, allergic, and autoimmune disorders.

However, Null hypothesis of (H_0): There is variance in means (readings of Lipoprotein associated Phospholipase A2 activity, a selective inflammatory marker of CHD) between group of patients undergoing cardiac surgery during endotracheal intubation via direct and video laryngoscope is REJECTED.

In conclusion, it can be inferred from this study, that using Direct or Video Laryngoscopy has no effect on variation of Lipoprotein associated Phospholipase A2 activity.

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References


Figure 1: Mean values between groups (Lp-PLA2 activity level in nmol/min/mL)

Readings of Lp-PLA2 activity was compared between Group A (administered using Direct Laryngoscope) & Group B (administered using Video Laryngoscope) using two tail T test, which was used to determine if there is a significant difference between the means of two groups.

In the course of the study, it has been found that there is no statistical difference (p>0.05) in mean serum phospholipase level in Group A& Group B. However, it has been observed, that mean values of Lp-PLA2 is higher in Group A versus Group B, but no statistical inference can be drawn.

4. Discussion

In the present study, we investigated the association between PLA2 and inflammatory response to direct and video laryngoscopy in patients undergoing cardiac surgery. We report that PLA2 activity was associated with significant inflammatory response to intubation via direct and video laryngoscopy.

Because Lp-PLA2 activity levels were predictive of CAD for both groups, we performed different analysis to determine whether Lp-PLA2 activity would independently contribute to inflammatory response to endotracheal intubation beyond traditional risk factors. There was no significant statistical difference in mean serum phospholipase level in patients undergoing endotracheal intubation with both direct laryngoscopy and video laryngoscopy.

Tracheal inflammation secondary to ETT presence was previously documented in a similar study done by Carlos et al in which tracheal subglottic samples obtained from patients provided documentation that PMN recruitment and cytokine and C5a level elevation occurred during endotracheal intubation. The total number of PMNs per sample increased significantly, over the period of intubation43.

5. Limitations

Since the study was conducted in a small group of 40 patients, hence further studies with large sample size with different inflammatory markers would have given different outcome and requires further evaluation.


