

Lung ultrasound for detection of increased Extravascular Lung Water, Cardiac and Non-Cardiac patients who underwent Non-Cardiac Surgical procedures

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Abstract: Aim: Prevention of post-operative cardio-respiratory deterioration in cardiac and non-cardiac patients who have undergone non-cardiac surgical procedure due to perioperative fluid overload.

Introduction: Induction in general anaesthesia (GA) drives patients in hypotension. Vasodilation, particularly veno-dilatation, is the primary cause of relative hypovolemia produced by anaesthetic drugs. Relative hypovolemia is a consequence of increased venous compliance, decreased venous return and reduced response to vasoactive substances. Maintenance of adequate cardiac output (CO) and arterial blood pressure are vital for preserving tissue perfusion and oxygen delivery (DO₂). To preserve CO and adequate organ perfusion, anaesthesiologists may choose between liberal perioperative fluid approach and a restrictive one with small dose of vasoactive drugs. Each choice carries its own risks. In general, a liberal perioperative volume replacement strategy is more common choice. As a consequence of selected therapy, fluid overload is often seen. The clinically most significant complication of excessive volume is "Lung-Swelling" respectively pulmonary oedema. Standard monitoring that includes clinical exam, chest X ray, oxygen saturation of peripheral blood (SpO₂) and blood lactate level lacks sensitivity and specificity for pulmonary oedema diagnose. Additionally, those are late indicators of tissue and organ hypo-perfusion. Lung ultrasound provides high diagnostic sensitivities and specificities in detecting various lung pathologies: Interstitial syndrome, pneumothorax and alveolar consolidation. Interstitial syndrome represents a variety of clinical situations, including pulmonary oedema, respiratory distress syndrome, pneumonia and interstitial diseases. Due to the development of pulmonary oedema, transition of A-profile (normal lung ultrasound finding) to B-profile (that is specific for interstitial syndrome) occurs. These findings enable us to act therapeutically even before the late indicators of cardio-respiratory deterioration appear.

Increased lung water is significant pulmonary complication after surgery. This complication is observed more at the patients after neo-adjuvant chemo-radio therapy and anesthesia than after anaesthesia alone. Pulmonary complications are usually related to low arterial oxygen pressure (PaO₂) or high CO₂ pressure (PaCO₂), which can continue for several days. Surgery is additionally liable for the activation of leukocytes and inflammatory processes leading to alteration of capillary permeability also as interstitial oedema, which initiate a systemic inflammatory response that increases the entire body water and extravascular lung water (EVLW).

Lung ultrasound (LUS) can identify the foremost common pathological abnormalities of the respiratory system encountered with high diagnostic accuracy including pneumothorax, pleural effusions, consolidation, and interstitial syndrome, which significantly affect patient management. LUS also features a high diagnostic accuracy for identifying fluid overload and increased lung water and may therefore replace chest X-ray in surgical patients.

In the current research we studied the effect of surgery on postoperative EVLW using LUS and its effect on oxygenation. Aim of this study was assessment the effect of surgery and anesthesia on EVLW by using bedside LUS in patients underwent for abdominal or thoracic malignancy surgery.

Increased lung water and therefore the resultant atelectasis are significant pulmonary complications after malignancy surgery. These complications are observed more at the patients who passed neo-adjuvant chemo and radio therapy before anaesthesia than after anaesthesia alone. Unlike the well

known anesthesia-related depression of cardiac performance and arterial vasodilatation recent papers emphasis a strong impact of anesthesia on venous psychology and venous return.

Vasodilation, particularly venodilation, is the primary cause of relative hypovolemia. Relative hypovolemia is a consequence of increased venous compliance, decreased venous return, reduced response to vasoactive substances.

Maintenance of adequate cardiac output (CO) and arterial blood pressure are vital for preserving tissue perfusion and oxygen delivery (DO₂). To preserve CO and adequate organ perfusion, anaesthesiologists may choose between liberal perioperative fluid approach and a restrictive one with small dose of vasoactive drugs. Aim is to increase right ventricular end-diastolic volume (RVEDV), left ventricular end-diastolic volume (LVEDV), and depending upon the position on the Frank-Starling curve, stroke volume (SV) and cardiac output (CO). In general, a liberal perioperative volume replacement strategy is more common choice. As a consequence of selected therapy, fluid overload is often seen.

Pulmonary complications are usually related to low arterial oxygen pressure (PaO₂) or high CO₂ pressure (PaCO₂), low FiO₂/SpO₂ ratio, which can continue for several days. Surgery is additionally liable for the activation of leukocytes and inflammatory processes leading to alteration of capillary permeability also as interstitial oedema, which initiate a systemic inflammatory response that increases the entire body water and extravascular lung water (EVLW).

Lung ultrasound (LUS) can identify the foremost common pathologic abnormalities of the respiratory system encountered with high diagnostic accuracy including pneumothorax, pleural effusions, consolidation, and interstitial syndrome, which significantly affect patient management. LUS also features a high diagnostic accuracy for identifying fluid overload and increased lung water and may therefore replace chest X-ray in surgical patients. The sonographic signs of increased EVLW are the artefacts called B-lines

LUS is able to detect in real time the increase of extravascular lung water (EVLW) as well as the response to excessive fluids removal.

In the current research we studied the effect of surgery and perioperative administrated fluids on EVLW using LUS and its effect on oxygenation. LUS is safe, available, simple bedside method sensitive to detect rise in EVLW small enough to produce shunting of $\leq 20\%$ before other clinical signs of fluid overload develops

Conclusion: Lung ultrasonography is a helpful, non-invasive method for early detection and treatment of perioperative fluid overload.

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