**Arterial hyperoxemia and acute kidney injury in trauma patients: a retrospective observational study**

**Background:**

Oxygen (O2) is essential for humans and the consequences associated with hypoxemia can be devastating. While O2 has been widely prescribed for therapy in medicine (1), there is an emerging concern that hyperoxemia (increased PaO2) could also embrace potential detrimental systemic effects (2).

It was reported, that hyperoxemia can induce cellular damage caused by excess reactive oxygen species and have negative hemodynamic effects (3) (4). Recently, the potentially harmful impact of oxygen has been studied in clinical trials and advocated in various patient populations: cardiopulmonary resuscitation (5) (6), stroke (7), myocardial infarction (8), traumatic brain injury (9) and medical-surgical intensive care (10).

Considering the suggested injurious mechanisms, kidney function could be one of the targets for hyperoxemia toxicity. Animal studies have shown the detrimental effect of hyperoxemia on renal tissue through protein expression associated with inflammation and imbalance of renal oxygen delivery and demand (11) (12). In humans, a strong association between acute kidney injury and mortality (13) was shown and the potential impact of hyperoxemia on kidney function could be a major concern.

O2 might be the most commonly administered drug in a trauma setting. Since significant hypoxemia after trauma can quickly lead to a fatal event, liberal oxygen therapy is provided either in response to or for prevention of hypoxic organ damage. However, the impact of keeping supranormal arterial blood oxygen tensions during the ICU stay on the development of acute kidney injury (AKI) in the critically injured patients is unclear.

**Research Hypotheses:**

We hypothesize that hyperoxemia will increase renal dysfunction in traumatic patients between 48 hours and up to 7 days of the ICU stay.

**Research Question / Objective:**

The aim of this study is to survey the prevalence and the degree of hyperoxemia among trauma patients in an intensive care unit and to investigate the association between PaO2 and the development of AKI. Our research question is how the maximum and/or time-weighted average PaO2 during the first 24 hours of the ICU stay is associated with the development of AKI.Development of AKI is defined as the primary outcome using Kidney Disease Improving Global Outcomes (KDIGO) consensus criteria {Kellum:2008gn}.The secondary outcomes are all-cause mortality, length of stay in the ICU and hospital length of stay, and duration of mechanical ventilation and renal replacement therapy.

**Study Population:**

Inclusion criteria:

* 18 years old and older
* Trauma patients who are defined by using International Classification of Disease, 9th Revision and 10th Revision, Clinical Modification codes: 800 – 956 for ICD9 and S00 - S99, T07, T14 - T28, T30 - T34, T36 - T79 for ICD10
* Patients who, directly or through the operation room, admitted to the ICU
* Patients who stayed in the ICU at least 48 hours

Exclusion criteria:

* Preexisting chronic kidney dysfunction and hemodialysis
* Patients without ABG measurements, creatinine and/or urine output
* Patients after cardiopulmonary resuscitation

**Covariate(s) of Interest (Exposure):**

All of the included patients are divided into one of the three groups (normal, moderate and severe hyperoxemia) based on the average PaO2 during the first 24 hours of the ICU stay. Patients with an average PaO2 ≤ 100 mmHg will be assigned to the “normal” group. An average PaO2 ≥ 101 and ≤ 200 mmHg will result in an assinment to a “moderate” group. If the average PaO2 is ≥ 201 mmHg, the patient will be assigned to a “severe” group. After the group assignment we aim to perform an intention-to-treat analysis.

**Confounders:**

We will adjust for the following confounders: age, gender, disease severity (APACHE IV), amount of transfused blood products (blood loss), preexisting kidney disease, preexisting heart disease, diabetes mellitus, chronic lung disease, nephrotoxic medication (NSARS, nephrotoxic antibiotics).

**Acknowledgements:**

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