

Letter to Editor

Side effects of increased lactate concentrations in the blood in various clinical situations

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Introduction

To the best of our knowledge, the study results recently published in your journal by Wu & Pan [1] show the link between the daily events experienced by the practitioners and multidisciplinary, translational research results concerning hypoxia and oxidative stress consequences in the human body. As the product of hypoxia, lactic acid exists in our bodies with dynamical fluctuations depending on impaired or optimal lung ventilation function. The study demonstrated the possibility of using serum lactic acid and 4-Hydroxynonenal as diagnostic and prognostic biomarkers of severe pneumonia [1]. The authors well designed and showed correlations of the serum concentrations of these two biomarkers with mortality and disease status, and finally, their predictive efficacy concerning severe pneumonia [1].

Discussion

We want to extend the discussion of this topic since we have clinical background and experience with measuring blood gas and acid-base changes, including lactate concentrations in patients undergoing laparoscopic surgeries in our previous studies and literature concerning lactic acid evaluation in other conditions. It is well-known that the surgical manipulation space in laparoscopy is created by intra-abdominal carbon dioxide insufflation (CO₂ pneumoperitoneum) under a pressure of up to 25 mm of Hg. Subsequently, this intervention induces blood

gas changes with the increased partial pressure of carbon dioxide (pCO₂) in the human body and decreased pH with other respiratory-hemodynamic and cardiac functioning disturbances [2].

The impact of CO₂-pneumoperitoneum is widely discussed in the literature and generally accepted as the most physiological, well-tolerated by patients, and safe gas for laparoscopy. However, many risk factors could increase the side effects of CO₂-pneumoperitoneum, such as the age of patients (children and elderly people), respiratory or cardiovascular comorbidities, obesity, and other intraoperative conditions; Trendelenburg positioning, bleeding, high insufflation pressure, as well as long-lasting surgery, and cold with low humidity gas, etc. In experimental studies, we demonstrated that raised pCO₂ and decreased pH were correlated with increased lactic acid concentrations in a rabbit model [2]. These changes were confirmed in our clinical studies in the pediatric population [3].

Analogously, in another study [4] the correlated dynamics of decreased pH and increased lactic acid in elderly patients undergoing laparoscopic colorectal surgery was studied when cold and dry gas was insufflated compared to warm and humidified gas. These intraoperative disturbances were accompanied by faster hemodynamic stabilization, a shorter recovery time in the post-anesthesia care unit, and a significantly decreased incidence of acute gastro-

intestinal injury-related symptoms (both the times to the first flatus/defecation and the first bowel movement) in patients insufflated with a cold and dry gas [4]. In another study, persistent perioperative lactate elevation was associated with obesity as an independent risk factor before surgery, prolonged time during surgery, and an extended length of hospital stay [5].

Finally, based on a retrospective analysis of 239 surgical patients with severe hyperlactatemia treated in the intensive care unit, the same conclusions were drawn as in the current study [6]: hyperlactatemia remains a life-threatening emergency status with a high mortality rate and the lactate clearance predicts mortality [7].

Conclusion

These observations of lactic acid elevations are the small part of the functioning of this acidic molecule in the human body homeostasis. The role of lactic acid in many other pathologic conditions especially in the microenvironment and metabolism of cancer cells has been widely discussing in the current literature [8]. Therefore studies on this topic are the important for researchers in the field of translational medicine and physiology.

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References

- [1] Wu H and Pan J. Correlation between serum 4-HNE and lactic acid levels and disease status in patients with severe pneumonia and its diagnostic value and prognostic evaluation. *Am J Transl Res* 2023; 15: 1913-1920.
- [2] Mynbaev OA, Molinas CR, Adamyan LV, Vanaeker B and Koninckx PR. Pathogenesis of CO(2) pneumoperitoneum-induced metabolic hypoxemia in a rabbit model. *J Am Assoc Gynecol Laparosc* 2002; 9: 306-14.
- [3] Ormantayev AK, Sepbayeva AD, Kosmas IP, Baimaganbetov AK, Issakov VY and Mynbaev OA. Comment on "evidence for negative effects of elevated intra-abdominal pressure on pulmonary mechanics and oxidative stress". *ScientificWorldJournal* 2015; 2015: 746937.
- [4] Liu L, Lv N and Hou C. Effects of a multifaceted individualized pneumoperitoneum strategy in elderly patients undergoing laparoscopic colorectal surgery: a retrospective study. *Medicine (Baltimore)* 2019; 98: e15112.
- [5] Gulmez S, Senger AS, Uzun O, Keklikkiran ZZ, Bozkurt H, Omeroglu S, Polat E and Duman M. The risk factors of intraoperative hyperlactatemia in patients undergoing laparoscopic colorectal surgery. *Ann Ital Chir* 2021; 92: 277-282.
- [6] Vincent JL, Quintairos E Silva A, Couto L Jr and Taccone FS. The value of blood lactate kinetics in critically ill patients: a systematic review. *Crit Care* 2016; 20: 257.
- [7] Spiegelberg J, Lederer AK, Claus S, Runkel M, Utzolino S, Fichtner-Feigl S and Kousoulas L. Severe hyperlactatemia in unselected surgical patients: retrospective analysis of prognostic outcome factors. *BMC Surg* 2022; 22: 312.
- [8] Gao Y, Zhou H, Liu G, Wu J, Yuan Y and Shang A. Tumor microenvironment: lactic acid promotes tumor development. *J Immunol Res* 2022; 2022: 3119375.