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An implantable lactate biosensor based on the co-electrodeposition of lactate oxidase and a low-potential redox polymer

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Detection of lactate levels plays a significant role in clinical analysis, sport medicine and food industry. In this work, an implantable lactate biosensor for continuously monitoring lactate levels *in vivo* was fabricated based on the co-electrodeposition of lactate oxidase (LOX) and an osmium-containing low-potential redox polymer (PVI-PAA-Os) on a carbon electrode. The PVI-PAA-Os redox polymer with a low reduction potential and LOX were able to be irreversibly deposited on the surface of the carbon electrode via simple electrochemical techniques such as potential cycling and controlled potential electrolysis. The co-electrodeposition conditions were investigated in terms of pH, PVI-PAA-Os concentration, LOX concentration and the number of deposition cycles. The characteristics of the biosensor for the detection of lactate were thoroughly investigated. It was observed that the co-deposited LOX retains its enzymatic activity and the redox polymer is able to electrochemically mediate electron-transfer between the carbon electrode and the co-deposited LOX. It was also observed that the optimized lactate biosensor exhibits a lower operating potential of +0.15 V (vs. Ag/AgCl) with a detection limit of 10 μM and a linear dynamic range up to 20 mM. In addition, stable responses were obtained over an extended period of seven days of *in vivo* testing.

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Blood needs for anemic patients admitted at ICU can be evaluated by lactate level and vital parameters at admission time

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Introduction & Objective: Evaluation of red cell transfusion effects on tissue oxygenation by measuring blood lactate levels before and after hemotransfusion. Blood lactate level is suggested as sensitive parameter to evaluate tissue oxygenation. The aim of this study was to verify the efficiency of hemotransfusions that were performed on patients in intensive care based on lactate level.

Material & Methods: In this prospective observational study on 59 patients who considered that red cell transfusion (the patients more that 25 point according to APACHE II-score were excluded). We monitor vital signs (BP, HR) at admission and also was strictly observed lactate level and hemoglobin level at admission before red cell transfusion (pre-T), two hours after transfusion (2 hours post-T) and 24 hours after (24 hours post-T with or no any another red cell transfusion). At first the patients group based at hemoglobin level, Group Ia with Hb <8 g/dl and Group IIb with Hb ≥8 g/dl. After that the patients group again based at lactate level, Group Ic lactate level ≥2.4 and Group IId lactate level <2.4.

Results: Comparison between group Ia and group IIb as belongs hemoglobin level demonstrate significance only at admission pre-T and lost significance at 2 hours post-T and 24 hours post-T, at the other hand differences between group Ic and group IId as belongs hemoglobin level stay significant at pre-T, 2 hours post-T and 24 hours post-T.

Conclusions: Statistical significant evaluation ($p<0.05$) between above mentioned groups shown that lactate level are very sensitive indicator in measuring of tissue oxygenation. Another important finding was significant high mortality and morbidity at patient group with lactate level ≥2.5.

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