DEGRADABLE BIOSENSOR FOR THE EARLY DETECTION OF ABDOMINAL SEPSIS

Introduction: Postoperative abdominal sepsis is often a catastrophic event with huge clinical, organizational and economic impact. Clinical evaluation, blood count, serum biomarkers and imaging are the tools available during the first few postoperative days. However, these often fail to identify early signs of an anastomotic leak. Prior to systemic clinical manifestations of abdominal sepsis, localized processes result in pH change, oxidative damage and release of inflammatory mediators that change the electrical properties of the GI tract as well as surrounding tissues. We hypothesized that those changes will generate a measurable change when recorded by an electrode adjacent to an anastomotic site. These changes further affect the degradation properties of a biodegradable electrode therefore enabling more sensitive detection. Here we present a leak detection system based on measuring the electrical parameters of a biodegradable electrode implanted near a staple line. **Methods:** A biodegradable Mg alloy was used to construct a thin implantable electrode**.** . The impedance of the biodegradable electrode was measured in different conditions in-vitro and compared to a similar sized biocompatible stainless steel electrode. The electrodes were then implanted abdominally in mice induced with iatrogenic large bowel and gastric injuries. Impedance over time was recorded. Finally, the electrodes were implanted in a swine model with a refined leak model induced by a 20mm laceration in the descending colon.. **Results:** In-vitro biodegradable electrode impedance evaluation showed good sensitivity to different media. The impedance of acidic environment ($1.22\pm0.02k\Omega$ for citric acid) was two fold higher than the impedance of phosphate buffered saline (PBS) ($0.64\pm0.003k\Omega$). Remarkably, the measurement enabled classification of Saline ($0.42\pm0.007k\Omega$) vs. PBS, in contrast to the detection performance of the control stainless steel electrodes (**Fig. 1**) The results translated to a mouse model, where the impedance prior to leak induction increased, exhibiting significant difference 120 minutes post leak (99.7% increase vs 9.6% increase in the control group, $p<0.05$, n=4/group, **Fig. 2A).** A similar increase was observed when a refined leak model was implemented in a swine: baseline impedance ($2.3\pm0.03k\Omega$ in the leak model vs. $2.5\pm0.1k\Omega$ in the control) rapidly increased following induction of the leak to a value of $3.8\pm0.2k\Omega$ where the impedance in the control animal kept relatively stable ($2.7\pm0.1k\Omega$, **Fig. 2B**). **Conclusion:** Electrophysiological parameters appear to be sensitive to the effects of leaks and may contribute to early detection of postoperative abdominal sepsis. The utilization of biodegradable electrode not only contributes to detection sensitivity but also present a compelling clinical approach towards biodegradable tissue monitoring sensors.