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Quantification of LPS Eluate from Coated Microelectrode Devices

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ABSTRACT

Penetrating microelectrode arrays have a great potential to be used as control and communication interfaces for neuroprosthetics. A persistent obstacle in the clinical implementation of microelectrode arrays is the chronic degradation of these devices, putatively due to the foreign body response. Though researchers have studied the progression of the foreign body response and the effect of anti-inflammatory drugs on the efficacy of the implant, the biological mechanisms of implant degradation are not fully understood. To more closely investigate the effect of the foreign body response on device degradation, neuroinflammation can be exacerbated by coating dummy electrodes implanted into mice brains with lipopolysaccharide (LPS) – a cell wall component of bacteria which induces inflammation. Quantifying the amount of LPS released from a coated electrode is crucial in performing such an experiment. Using a Limulus amebocyte lysate (LAL) test – a test based on the extract of the blood from horseshoe crab which reacts with LPS – the concentration of LPS can be accurately quantified, allowing for a more careful characterization of the inflammatory response. Devices coated in 1 mg/ml concentration of LPS eluted a mean mass of 4.55 ± 2.964 EU, where 1 endotoxin unit (EU) ≈ 1 ng. A linear regression of the standard concentrations resulted in an r^2 of .98, indicating a reliable model for calculating the concentration of LPS present in a sample. These results suggest that LPS elution can be accurately measured using the LAL assay.

KEYWORDS

LPS, Lipopolysaccharide, LAL, Limulus amebocyte lysate, Microelectrode, Chronic, Neuroinflammation

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