

可描述横向电场中外周神经兴奋的电缆方程

王毅、沈强、于辉、蒋大宗
西安交通大学生物医学工程研究所

传统的电缆方程只能用于描述纵向电场中外周神经的兴奋,无法描述外周神经在横向电场作用下的兴奋。基于两阶段过程模型,提出一种改进的电缆方程,可以描述外周神经在横向电场中的兴奋,其结果和Struijk的离体实验数据相吻合。此改进的电缆方程可用于描述任意电场中外周神经的兴奋。

A MODIFYING CABLE FUNCTION FOR REPRESENTING THE EXCITATION OF PERIPHERAL NERVES BY TRANSVERSE FIELD

The classical cable equation has been only used to represent the response of peripheral nerve to external electrical field in the direction of the nerve, and can not describe the excitation of peripheral nerve to the transverse field induced by pulse magnetic field. In this paper, a modified cable equation is obtained to represent the response of peripheral nerve to a transverse field. The simulation results demonstrate that the excitation results from net inward current along radial direction. It is in agreement with the empirical results of Struijk of the magnetic stimulation of myelinated nerve in vitro. This modified cable equation can be used to represent the response of peripheral nerve to arbitrary electric field and to improve the stimulation coil in magnetic stimulation.

关键词

横向电场(Transverse field); 兴奋(Excitation); 外周神经(Peripheral nerve); 电缆方程(Magnetic stimulation)