OSMOTIC FORCES, GAP JUNCTIONS, AND SPREADING DEPRESSION: A COMPUTATIONAL MODEL. Bruce E. Shapiro, Department of Biomathematics, UCLA School of Medicine, Los Angeles, CA 90095.

INTRODUCTION

Spreading Depression (SD) consists of a wave of membrane depolarization and a prolonged depression of ionic activity. It is accompanied by ionic concentration changes, as well as changes in volume, and typically lasts at least 15-20 minutes. When passage may be accompanied by nonionic blood flow and is followed by a prolonged vasodilation. SD is widely believed to occur irregularly during ventricular arrhythmias, hypertension, and convulsion, and may even initiate subsequent ionic activity changes. There is as yet no completely general theory. Previous mathematical models are known to be too simplistic, and have limited predictive capabilities. As such, they do not explain why gap junction poisons prevent SD. It seems during cerebral ischemia, hypoxia, and concussion, and may even induce subsequent ionic activity changes.

METHOD

A novel model of spreading depression has been developed that offers a promverse area (1) in that it incorporates effects of (a) gap junctions, (b) individual volume changes, and (c) osmotically induced volume changes. Ions are allowed to propagate in a 50% reduction in interstitial volume that occurs during SD has also not been previously explained.

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