RADIOFREQUENCY ABLATION WITH TWO SODIUM CHLORIDE CONCENTRATIONS COOLING SOLUTIONS AND ITS INFLUENCE ON DOG THIGH MUSCLE TISSUE DAMAGE CHARACTER AND SIZE

Gintautas Vaitiekaitis[1], Aleksandras Vitkus[2], Algis Noreika[3], Ingrida Balnytė[2], Alius Pockevičius[4], Neringa Balčiūnienė[5], Julius Liobikas[6], Danas Baniulis[7], Aldona Gružienė[8]
[1]Department of Physics Mathematics and Biophysics, Medical Academy, Lithuanian University of Health Sciences A. Mickevičiaus Str. 9, Kaunas, Lithuania, LT-44307
e-mail vaitiekaitis@vision.kmu.lt, tel. (+370 37) 327367, fax. (+370 37) 220733
[2]Department of Histology and Embryology, Lithuanian University of Health Sciences
e-mail avitkus@gmail.com, tel. (+370 37) 327315, e-mail angval@kmu.lt, tel. (+370 37) 327236
[3]Department of Noninfectious Diseases, Veterinary Academy, University of Health Sciences
Tilžės Str. 18, Kaunas, Lithuania, LT-47181, e-mail algis.noreika@lva.lt, tel. (+370 37) 409741
[4]Department of Infectious Diseases, Veterinary Academy, LUHS; e-mail palius@lva.lt, tel. (+370 37) 409740
[5]Department of Intensive Care, Neurosurgery Intensive Care Unit
Hospital of Lithuanian University of Health Sciences "Kauno Klinikos"
Eivenių Str. 2, Kaunas, Lithuania, LT-50009
e-mail xnerisx@gmail.com, tel. (+370 37) 327104
[6]Institute of Neurosciences, Laboratory of Biochemistry, Medical Academy, LUHS
Eivenių Str. 4, Kaunas, Lithuania, LT-44307; e-mail julius.liobikas@bioch.eu, tel. (+370 37) 302968
[7]Department of Genetic and Biotechnology of Orchard Plants, Institute of Horticulture, Lithuanian Center for Agriculture and Forestry
Kauno Str. 30, Babtai, Kaunas Distr., Lithuania, LT-54333; e-mail d.baniulis@lsdi.lt, tel. (+370 37) 555233
[8]Institute of Physiology and Pharmacology, Lithuanian University of Health Sciences
A. Mickevičiaus Str. 9, Kaunas, Lithuania, LT-44307; e-mail aldona.gruziene@kmu.lt, tel. (+370 37) 327256.

Abstract. During the last decades, one of the most common nondrug therapies used for patients cardiac arrhythmia treatment is a controlled thermal destruction of certain myocardial structures and tissues. However, the investigations of small microstructural changes of thermal tissue destruction are neglected. This study investigated the effect of radiofrequency ablation with active electrode cooling, on dog thigh muscle damage character and size. Three experiment sessions were performed on thirteen mongrel dogs. The first radiofrequency ablation session was done without cooling. In the second session the electrode was cooled with a 0.1% NaCl solution and during the third session, cooling was made with a 0.9% NaCl solution. In all cases the duration of ablation was 30 s and the power was 40 W. Lastly, the calculations of a theoretical model were accomplished. Our experimental results show that the strongest impact of the ablation on tissue damage was observed in the first session, medium in the second session and the lowest in the third session. The average damaged area of ablated tissue was the largest in the first session, medium in the third session and the smallest in the second session ($p<0.05$). The highest temperature on the surface of the heated tissues at the ablating electrode contact site during the ablation procedure was measured in the first session, medium in the second session and smallest in the third session. Experimental results and theoretical calculations allow making an assumption that the different concentrations of cooling solution influence the ablating tissue damage size and character, due to the redistribution of electric field strength lines. The examination of histological preparations revealed that in the tissues affected by the ablation procedure the enclosed „ring" shape stripe of damaged area is detectable.

Keywords: cardiac arrhythmia, radiofrequency ablation, cooling solution, thermal tissue damage.