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Histopathological evaluation of fibrous tissue surrounding bioceramic delivery systems in sheep and rodent models

The major challenges face the vast majority of orthopedic and dental implants are: (i) biocompatibility, (ii) resorbability and (iii) maintenance of mechanical strength. Several studies conducted in our laboratories have documented the effectiveness of various ceramic drug delivery systems (CDDS) in regulating fertility in females as well as males. It was observed that the mode of sustained delivery of reproductive hormones from CDDS was governed and regulated by the development of capsular tissue surrounding the implantable CDDS. This research was mainly designed to correlate fibrous capsule thickness and various histopathological components that was being seen in the fibrous capsule surrounding ALCAP, HA, and TCP ceramics at the S/C and I/P implantation sites in small (rats) and large (sheep) animals. Male albino rats and castrated adult rams were utilized for these studies. All animals selected for experimental results were implanted either S/C or I/P with ALCAP, HA, and TCP ceramics delivery devices loaded with 40 mg testosterone. After 90 days of post-implantation, the implanted animals in all groups were euthanized and the fibrous tissue surrounding the ceramic devices and internal organs were harvested. After routine histological processing, sections of tissue were stained with hematoxylin and eosin as well as special stains and evaluated using light microscopy. Analysis of the data revealed the followings: (1) development of fibrous tissue around the implants did not show any significant difference in small or large animals, (2) capsular tissues retrieved from S/C site induced less fibrous tissue formation compared to I/P site in both models, (3) the presence of proinflammatory cells such as macrophages, neutrophils, fibroblasts, and vascularity, was found to be statistically different among the S/C implanted CDDS groups ($p<0.01$) compared to I/P implantation site, and (4) regardless of animal model, the ease of fibrous capsule thickness were ALCAP>HA>TCP, respectively. Results from these studies provided very important outcomes which can be utilized to predict the longevity of the physical strength of CDDS and the duration of delivery profiles. The clinical impact of this investigation stems in the ability to develop biocompatible and effective delivery systems that ultimately will lead to fertility regulation.

Biography

Benghuzzi is a Professor at the University of MS Medical Center. He is known nationally and internationally as a pioneer in Ceramic Drug Delivery Systems. He has published over 250 PubMed indexed articles and over 700 abstracts detailing the release characteristics of various biologicals from the bioceramic carriers. He has trained more than 40 PhD students who are actively involved in academic careers. He has been in research leadership roles in many organizations such as President of the Academy of Surgical Research, Vice President of the Rocky Mountain Bioengineering Society, President of MAS, Academy's Executive Director, and also organized and chaired several regional, national and international society programs. He has also served on numerous NIH special emphasis panels including R-25, K01, KO8, T-35, and P-60 center grants. In addition, he has received numerous awards from various organizations during his career. A few of his awards includes: Presidential Award from the RMBS, Presidential Award from SEM International, Endocrine's Society Outstanding Investigator Award, MAS Contribution to Science Award, MAS Dudley Peeler Award, and HEADWAE Award, C.Hall Award, Outstanding Contribution to Biomedical Engineering, and ISCM Excellence Award from the International Society for Ceramics in Medicine.

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