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Advancing Infected Bone Defect Treatment: Integrating Natural Products into Hydrogel Drug Delivery Systems [Letter]

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Dear editor

We found Sun et al's article[1] on vancomycin-loaded PEG/ODEX hydrogels for the treatment of infected bone defects highly intriguing. The authors describe a novel drug delivery system using PEG/ODEX hydrogels loaded with vancomycin to treat infected bone defects. While we commend the authors for their innovative approach, we would like to offer some comments and suggest potential avenues for future research, drawing upon our own ongoing work in the field.

Firstly, the study highlights the importance of developing effective local antibiotic delivery systems to address the challenges posed by infected bone defects. The use of hydrogels as a drug delivery vehicle is particularly appealing due to their ability to mimic the extracellular matrix, providing a conducive environment for cell growth and differentiation. The PEG/ODEX hydrogels utilized in this study exhibit good gelling properties, biodegradability, and a sustained release profile of vancomycin, which is crucial for maintaining therapeutic antibiotic concentrations at the infection site.

However, we believe that there is still room for improvement in the design of such drug delivery systems. For instance, while vancomycin is widely used as an antibiotic for bone infections, it is not devoid of limitations. A recent case report,[2] which reviewed pertinent cases in the literature, highlights the crucial importance of recognizing this rare adverse reaction. However, natural products hold significant promise in the realm of therapeutic agents, particularly those possessing osteogenic properties. Among these, artemisinin stands out as a notable example, showcasing impressive results in preclinical studies. Specifically, artesunate exhibits anti-inflammatory and osteogenic effects, positioning it as a potential candidate for bone tissue engineering applications.[3,4] Recent review[5] suggest that artemisinin may down-regulate RANKL expression in osteoblasts, thus promoting osteogenesis and reducing bone resorption. This mechanism offers an additional therapeutic advantage over traditional antibiotic-based systems by targeting both the infection and the bone healing process. In light of these considerations, we suggest that future research could explore the integration of artemisinin or other bioactive molecules with hydrogel-based drug delivery systems to enhance their therapeutic efficacy. By combining antibiotics with agents that promote bone regeneration and modulate bone turnover, it may be possible to develop more comprehensive treatment strategies for infected bone defects.[6]

Finally, while the rat model used in this study provides valuable insights, the translation of these findings to human patients will require further validation in larger animal models and eventually clinical trials. Additionally, the long-term effects of the hydrogel-based delivery system on bone quality and function should be thoroughly evaluated to ensure the safety and efficacy of this approach.

In conclusion, we commend the authors for their innovative work in the field of bone tissue engineering and antibacterial drug delivery. We believe that by continuing to explore alternative therapeutic agents and combining them with advanced biomaterial systems, it may be achieve even greater improvements in the treatment of infected bone defects.

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Disclosure

The authors declare no conflicts of interest in this communication.

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