Physical–chemical properties of antibiotic drugs: What we miss in our research

We have read with great interest the article titled “Effects of the local administration of antibiotics on bone formation on implant surface in animal models: A systematic review and meta-analysis” by Ali Alenezi and Bruno Chrčanovic and published on November 2020 on Japanese Dental Science Review [1]. Based on the analysis of the scientific literature, the authors evaluated the effect of local delivery of antibiotics included in the implant surface on some quantitative parameters of bone formation. The influence of antibiotics when applied to the implant surface was mainly considered. Antibiotics such as bacitracin, doxycycline, enoxacin, gentamicin, minocycline, tobramycin, and vancomycin were considered.

Based on the relevant publications devoted to the study of this problem in animal models, the authors suggest that the local administration of antibiotics around the implants did not negatively affect the process of direct contact with the bone around the implants. At the same time, the authors point out the risk of bias in these studies, which allows us to question the reliability of these results to some extent. Therefore, the authors express doubt that these results will be confirmed in a clinical setting in the future.

We support the authors’ doubts and believe that additional laboratory and experimental data are needed to accurately understand the role of local action of antibiotics in the clinic. The fact is that clinical improvement may result from pleiotropic actions of an antibiotic [2]. In particular, the local type of action of drugs (including antibiotics) on human tissue very much depends on the exact dosage form of the drug (powder, suspension, emulsion, ointment, cream, paste, glue, solution, etc.), in what concentration it provides local interaction and what physical and chemical factors of local interaction are involved in the local action (meaning the values of disintegration, solubility, osmotic and acid (alkaline) activity, etc.) [3].

In this regard, to assess the local effect of antibiotics, it is very important to take into account not only the name of the main active substance (the name of the antibiotic), but also the type of its salt (this is a sodium or potassium salt), the dosage form in which the antibiotic is used, the manufacturer who produced the drug, the entire list of ingredients that are part of the finished drug, the concentration of the antibiotic and specific values of osmotic and acid (alkaline) activity of drug.

We believe that information about the specific physicochemical properties of the antibiotic drugs that cover the implants can be useful for accurately determining their role in the formation of bone around the implants. The fact is that the physical and chemical factors of local interaction can have a great influence on the processes of local inflammation, blood circulation and regeneration with the local use of antibiotics [4].

Therefore, we agree with the precocious judgments about the specific mechanisms of local action of antibiotics on the formation of bone tissue and draw the attention of researchers to the importance of the physico-chemical properties of the antibiotics used. It is especially important to take into account their concentration, osmotic and acidic activity. In our opinion, this will improve the quality of research, provide new information about the non-specific local action of antibiotics, reveal the previously unknown side of their local action and help optimize the medical support of surgical implantation.

Ethical approval and consent to participate

The study was approved by the Ethics Committee of the Institute of Thermology (№ 2 dated 1.01.2016, Izhevsk).

Consent for publication

Yes.

Availability of data and materials

Yes.

Authors’ contributions (authorship contributions)

Participated in research design: Urakov and Urakova.
Performed data analysis: Urakov and Reshetnikov.
Wrote or contributed to the writing of the manuscript: Urakov, Urakova and Reshetnikov.

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Competing interests

The authors declare no competing interests.

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