Electrically generated silver ions as a bacteriocidal agent in acute and chronic Enterobacter cloacae osteomyelitis in rabbits

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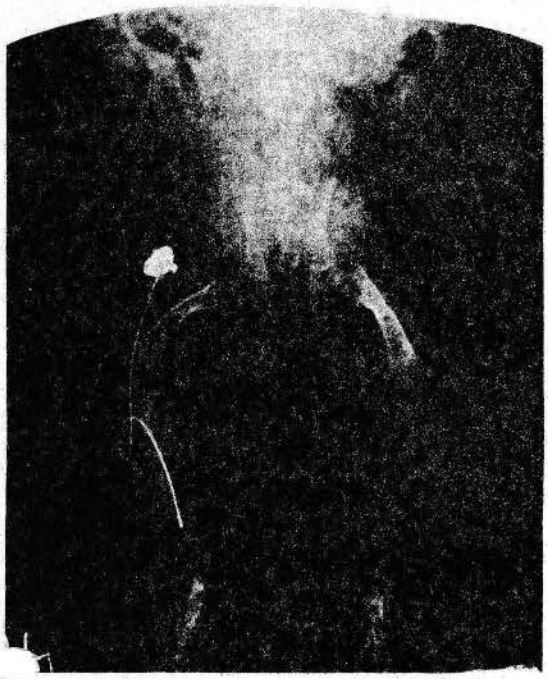

An animal model for osteomyelitis which can be evaluated by radiologic changes and microbiologic techniques was accomplished with the use of Enterobacter cloacae in rabbits. The authors then attempt to demonstrate the bacteriocidal effect of electrically induced silver ions in both acute and chronically established infections.

We have established that approximately 10^{10}/cc of Enterobactero cloacae injected in precise quantities of .2 cc into the medullary cavity of the tibia for ordinary white Australian rabbits weighing approximately 1000 grams in three weeks will show definite radiologic changes compatible with osteomyelitis and microbilogically can be cultured to be positive.

Method and Discussion - Rabbits weighing approximately 1000 grams anesthetized with Nembutal and Ketamine, the right tibia being the experimental one and the left as a control. With an anterior lateral longitudinal incision the proximal tibia is isolated employing an electric dental a 2 mm. diameter hole is made in the anterior lateral border of the tibia and further reamed out so the medullary canal contents can be aspirated with an 18 gauge needle and flushed with sterile saline. .2 cc of 10^{10}/cc Enterobacter cloacae was then injected into the medullary canal and the hole sealed with bone wax. X-rays were sequentially performed on both tibias on a weekly basis. Usually by three weeks we can see definite radiologic changes compatible with osteomyelitis.

At three weeks we approached the knee through the same incision after the usual prep and the same anesthesia. The medullary canal is similarly reamed out. The medullary contents are not aspirated at this point but merely a swab culture is taken from the intermedullary reamer and this has consistently grew out moderate to heavy population of Enterobacter cloacae. A 1.35 volt Malloy Duracell Mercury Battery wired in simple series circuit with a current limited circuit generating approximately 2.7 micro-amperes. This is a self contained silicone coated unit with battery pack implanted subcutaneously in the flank region of the rabbit.

The lead wire is teflon coated silver and the ground site is in the flank of the rabbit. The silver electrode is implanted through the hole burred in the proximal tibia and directed distalwards. The rabbit is then x-rayed on a weekly basis for two weeks at which time the animal is sacrificed and under sterile conditions the right tibia is open, the silver electrode is cultured and the medullary cavities to be sterile, others have been reduced from heavy growth to rare colonies

We have also implanted similar battery packs at the time of first introduction of the bacteria and have found that no radiologic changes can be determined at three weeks and that the cultures are completely sterile at three weeks.

Summary - Enterobacter cloacae in ordinary white laboratory rabbits has been established as a good model for osteomyelitis. We have also found that electrically generated silver ions can significantly, it not totally, sterilize a localized area in both acute and chronically infected medullary canals in rabbits.

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