ESCAPE from ESKAPE: Effect of Natural Substances on Penetration of Biofilms Formed by the ESKAPE Bacteria

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The formation of biofilms on biomedical devices has become a major issue all over the world. People with biomedical implants often require several surgeries for replacement of their biomedical devices damaged by biofilms, or for removal of biofilms from implants. The ESKAPE bacteria are six of the most dangerous bacteria due to their resistance to many drugs and their ability to create biofilms that are impenetrable by most antibiotics. The purpose of this experiment was to find a natural substance that could penetrate through biofilms successfully and kill a significant amount of the bacteria keeping the side effects to a minimum. This would result in fewer implant-related surgeries. In Part 1 of this experiment, extracts of Curcuma longa, Cinnamomum verum, Allium sativum, and Brassica nigra were made and Minimum Inhibitory Concentration (MIC) tests were conducted using concentrations of 100, 200, 300 and 400µg/ml against each of the ESKAPE bacteria. The results indicated that Curcuma longa performed the best in killing Enterococcus faecium, Staphylococcus aureus, and Pseudomonas aeruginosa. Having identified the natural substance that worked best, Part 2 of the experiment was performed. The extract of Curcuma longa was tested on the biofilms created by Enterococcus faecium, Staphylococcus aureus, and Pseudomonas aeruginosa. The Optical Density test showed that the percent of recovery reduced as the concentration of the extract increased. The Colony Forming Units test showed that Curcuma longa penetrated through the biofilm; the percent of recovery for Pseudomonas aeruginosa was 3.48%, 21.59% for Enterococcus faecium, and 72.62% for Staphylococcus aureus.

Awards Won: