Repurposed Cephalexin Causes Multifaceted Pro-Cancer Effects by Way of Wnt Signaling Pathway

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Existing drugs are being researched for novel repurposed usages to supplant the traditional, inefficient process of new drug discovery. Cephalexin is a cephalosporin antibiotic purported to have anticancer effects by interfering with DNA transcription, but its actual results are not well studied. This study sought to investigate cephalexin as a potential anticancer drug. After conducting MTT, attachment, and caspase assays, however, cephalexin was found to act as a potent tumor promoter by increasing cancer viability, proliferation, and attachment, while decreasing apoptosis. In order to elucidate the mechanism by which cephalexin unexpectedly caused this result, cephalexin was tested for interaction with 21 proteins involved in oncogenesis using in silico molecular docking. Cephalexin was found to most strongly bind with protein kinase C (PKC), a molecule integral to tumorigenesis through the Wnt signaling pathway. Cephalexin was further tested for interaction with tetradecanoylphorbol acetate (TPA) and lipopolysaccharide (LPS), and cephalexin specifically enhanced TPA, a Wnt-dependent tumor promoter. The effects of cephalexin were then found to be differential depending on Wnt/PKC involvement in oncogenesis of cancer type; increased proliferation was observed in PKC-implicated colon adenocarcinoma, but not neuroblastoma, after conducting MTT assays. These results demonstrate that cephalexin acts by positively modulating Wnt signaling via PKC binding. Greater caution is therefore warranted regarding drug repurposing, given the potential for adverse treatment effects. This research highlights the heretofore undocumented pro-cancer interactions between antibiotics and tumorigenic pathways, and urges consideration by researchers while repurposing drugs to novel targets.

Awards Won:
Second Award of $2,000