

1137-92-39

Leonid Hanin* (hanin@isu.edu), Department of Mathematics and Statistics, Idaho State University, 921 S. 8th Avenue, Stop 8085, Pocatello, ID. *A Mathematical Model of the Metastatic Cascade with Application to Breast Cancer Recurrence.*

We seek to uncover clinically important aspects of post-surgery metastatic relapse of breast cancer and quantify effects of surgery on metastatic progression. We classified metastases into three categories: (1) solitary cancer cells formed before or during surgery; (2) dormant avascular metastases; and (3) vascular secondary tumors. We developed a general mathematical model of post-surgery dynamics of these metastatic states and its parametric versions assuming exponentially or Erlang distributed state sojourn times. Model parameters were estimated from metastatic relapse or censoring times for 673 breast cancer patients treated with surgery. We estimated the expected number of metastases and mean sojourn times for the three states and found that they decrease with state number. We also computed the probability that metastatic relapse resulted from a metastasis in a given state at surgery.

CONCLUSIONS. (1) Metastasis may occur before surgery; (2) Metastatic dormancy is significant; (3) Surgery may stimulate escape from dormancy, promote angiogenesis and accelerate metastatic growth in some breast cancer patients. These findings call into question the widely held belief that primary tumor resection is universally beneficial to patients with invasive breast cancer. (Received January 17, 2018)