

Investigating the Association between Escherichia Coli Infection and Breast Cancer Incidence: A Retrospective Analysis and Literature Review

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Abstract : Breast cancer is the most common cancer among women, with a lifetime risk of one in eight of all women in the United States. Although breast cancer is prevalent throughout the world, the uneven distribution in incidence and mortality rates is shaped by the variation in population structure, environment, genetics and known lifestyle risk factors. Furthermore, the bacterial profile in healthy and cancerous breast tissue differs with a higher relative abundance of bacteria capable of causing DNA damage in breast cancer patients. Previous bacterial infections may change the composition of the microbiome and partially account for the environmental factors promoting breast cancer. One study found that higher amounts of Staphylococcus, Bacillus, and Enterobacteriaceae, of which Escherichia coli (E. coli) is a part, were present in breast tumor tissue. Based on E. coli's ability to damage DNA, it is hypothesized that there is an increased risk of breast cancer associated with previous E. coli infection. Therefore, the purpose of this study was to evaluate the correlation between E. coli infection and the incidence of breast cancer. Holy Cross Health, Fort Lauderdale, provided access to the Health Insurance Portability and Accountability (HIPAA) compliant national database for the purpose of academic research. International Classification of Disease 9th and 10th Codes (ICD-9, ICD-10) was then used to conduct a retrospective analysis using data from January 2010 to December 2019. All breast cancer diagnoses and all patients infected versus not infected with E. coli that underwent typical E. coli treatment were investigated. The obtained data were matched for age, Charlson Comorbidity Score (CCI score), and antibiotic treatment. Standard statistical methods were applied to determine statistical significance and an odds ratio was used to estimate the relative risk. A total of 81286 patients were identified and analyzed from the initial query and then reduced to 31894 antibiotic-specific treated patients in both the infected and control group, respectively. The incidence of breast cancer was 2.51% and present in 2043 patients in the E. coli group compared to 5.996% and present in 4874 patients in the control group. The incidence of breast cancer was 3.84% and present in 1223 patients in the treated E. coli group compared to 6.38% and present in 2034 patients in the treated control group. The decreased incidence of breast cancer in the E. coli and treated E. coli groups was statistically significant with a p-value of 2.2×10^{-16} and 2.264×10^{-16} , respectively. The odds ratio in the E. coli and treated E. coli groups was 0.784 and 0.787 with a 95% confidence interval, respectively (0.756-0.813; 0.743-0.833). The current study shows a statistically significant decrease in breast cancer incidence in association with previous Escherichia coli infection. Researching the relationship between single bacterial species is important as only up to 10% of breast cancer risk is attributable to genetics, while the contribution of environmental factors including previous infections potentially accounts for a majority of the preventable risk. Further evaluation is recommended to assess the potential and mechanism of E. coli in decreasing the risk of breast cancer.

Keywords : breast cancer, escherichia coli, incidence, infection, microbiome, risk

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