

# Radiation Therapy Does Not Significantly Increase The Risk Of Postoperative Complications In Cancer Patients Undergoing Posterior Spinal Arthrodesis

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**INTRODUCTION:** Prior studies suggest that cancer and radiation therapy (RT) may increase postoperative complications, but their independent and combined effects on posterior spinal arthrodesis outcomes remain underexplored. The purpose of this study was to evaluate medical and surgical complications following posterior spinal arthrodesis in patients with a history of RT and/or cancer.

**METHODS:** A retrospective cohort analysis was conducted using the TriNetX database. Adult patients who underwent posterior spinal arthrodesis from 2000-2019 were stratified into three cohorts after 1:1 propensity score matching: (1) with and without prior RT; (2) with and without prior cancer; and (3) cancer patients with and without prior RT. For the analysis comparing cancer patients with and without RT, cohorts were matched for cancer type and treatment modalities including chemotherapy, surgical resection, and immunotherapy. Medical complications were assessed at 30 and 90 days; surgical complications were analyzed at 30 days, 90 days, 1 year, and 2 years postoperatively. Continuous variables were compared using independent samples t-tests, and categorical variables were analyzed using Chi-square or Fisher's exact tests, as appropriate. Comparative analyses between matched cohorts were performed to estimate odds ratios (OR) with 95% confidence intervals (CIs) for each outcome. Statistical significance was determined using a threshold of  $p < 0.05$ .

**RESULTS SECTION:** A total of 19,576 propensity-matched patients (11,701 males and 7,875 females) were analyzed, including 2,582 in the RT versus no RT cohort pair, 4,760 in the cancer versus no cancer cohort pair, and 8,090 in the cancer with RT versus cancer without RT cohort pair. An RT or cancer history alone was associated with increased rates of anemia, pneumonia, sepsis, deep vein thrombosis, respiratory failure, emergency readmission, and mortality within 30 and 90 days (all  $p < 0.05$ ). RT alone conferred a greater risk of wound dehiscence (90d, 1yr, 2yr) and implant loosening within all intervals (90d: OR 2.4, 95% CI: 1.4-3.9,  $p < 0.001$ ) (all  $p < 0.05$ ). In contrast, cancer alone was associated with increased odds of surgical site infection (90d, 1yr, 2yr), wound dehiscence (30d, 90d, 1yr, 2yr), cerebrospinal fluid leak (2yr), back pain (30d, 90d), revision surgery (90d), and implant loosening (90d, 1yr, 2yr) (all  $p < 0.05$ ). Patients with both cancer and RT were not at increased risk for any complications compared to those with cancer alone.

**DISCUSSION:** Both an independent history of RT and a history of cancer increase the odds of multiple postoperative medical and surgical complications following posterior spinal arthrodesis. RT alone was associated with wound dehiscence and implant loosening. In contrast, cancer alone conferred an elevated risk for surgical site infection, wound dehiscence, cerebrospinal fluid leak, back pain, revision surgery, and implant loosening. Notably, the combination of cancer and RT did not result in additive risk, suggesting that the systemic effects of cancer may be the dominant driver of adverse outcomes in this surgical population. These findings differ from prior work in arthroplasty and other spine procedures, where additive effects of RT and cancer have been observed, highlighting the need for procedure-specific risk stratification. Tailored preoperative counseling and optimization strategies for patients with a radiation and/or cancer history undergoing posterior spinal arthrodesis are indicated. Limitations included retrospective design, potential coding inaccuracies, and a lack of data regarding RT dose, location, and timing.

**SIGNIFICANCE/CLINICAL RELEVANCE:** While an independent history of cancer or RT increases the odds of postoperative complications following posterior spinal arthrodesis, their combination does not confer an additive risk. The baseline risk of cancer alone may outweigh additional contributions from preoperative radiation exposure and may help guide surgical counseling and perioperative risk optimization.

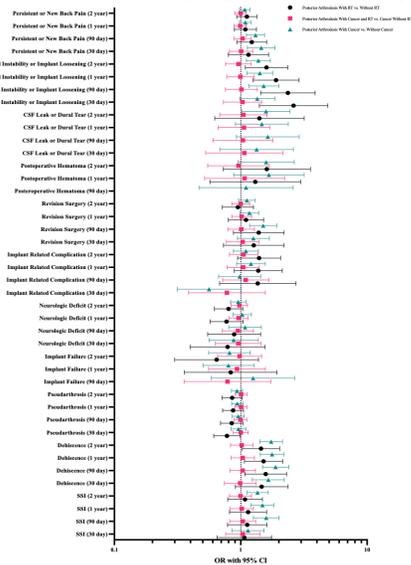


Figure 1. Forest plot demonstrating odds ratios (OR) with 95% confidence intervals (CI) for postoperative surgical complications following posterior spinal arthrodesis across cancer and radiation therapy (RT) cohorts.

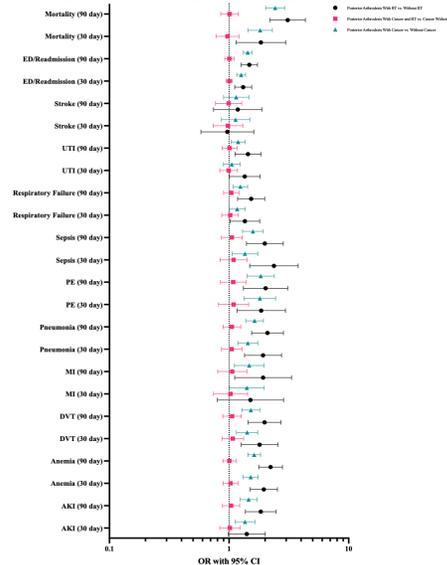


Figure 2. Forest plot demonstrating odds ratios (OR) with 95% confidence intervals (CI) for postoperative medical complications following posterior spinal arthrodesis across cancer and radiation therapy (RT) cohorts.