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564 - STATISTICAL POWER OF MATCHING-BASED CAUSAL INFERENCE IN COLORECTAL SURGERY: A MONTE CARLO STUDY ON PROPHYLACTIC DRAINAGE

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Resumen

Background/Objectives: Colorectal surgery is associated with a high risk of postoperative complications. In observational studies, treatment assignment is not random, which can introduce confounding bias when estimating treatment effects. Propensity score matching offers a nonparametric approach to balance treated and control groups before causal estimation. The main objective of this study was to quantify the effect of avoiding drains in colorectal surgery while accounting for confounding. A secondary objective was to assess, through Monte Carlo simulation, the statistical power and robustness of the matching-based estimation procedure under varying sample sizes.

Methods: The dataset, provided by the GERM research group, included patients undergoing colorectal surgery with and without postoperative prophylactic drainage. Patients without a drain were considered cases, and those with a drain were controls. Ten clinically relevant preoperative variables were selected to compute the propensity score. Nearest neighbor matching without replacement was applied using the MatchIt R package to achieve covariate balance. Treatment effects were estimated through logistic regression and G-computation using the marginale effects package. Monte Carlo simulations were then performed by bootstrap resampling from the matched dataset, progressively reducing the sample size to evaluate the impact on statistical power and odds ratio stability.

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Results: After matching, 15.8% of cases and 26.2% of controls experienced surgical complications. The estimated marginal odds ratio was 0.52 (95%CI 0.42-0.65; $p < 0.001$), indicating a substantial reduction in risk. Simulations showed that with the original sample size, statistical power was almost equal to 1 for $\alpha = 0.05$. Halving the sample size maintained power close to 0.99. With approximately 200 cases, power decreased to 0.86, and with around 100 cases, it dropped to 0.56, showing increased variability in the estimated effects.

Conclusions/Recommendations: Prophylactic drainage is associated with a clinically reduction in postoperative complications. Matching combined with G-computation provides robust causal estimates when sufficient sample size is available. The simulation results highlight that studies with fewer than 200 treated patients may not have adequate statistical power, emphasizing the importance of sample size planning in observational causal research.

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