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Using random forest to explore risk factors for early revision after total hip arthroplasty

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Introduction

The individuation of risk factors for early revision after total hip arthroplasty is a topic of crucial importance for registries. Benchmark tools are Logistic Regression, Cox Proportional Hazard Models and Competitive Risks Analysis. Often, in real world, the hypotheses these models rely on, such as the absence of multicollinearity or the proportional risks assumption, do not hold and these approaches lead to erroneously identify risk factors.

Aim of this study is to show the use of Random Forest (RF) to identify risk factors in early revision, as this class of models requires less strict theoretical conditions.

Materials and Methods

We tested the proposed approach on 13,428 primary interventions collected by the regional registries of Autonomous Provinces of Trento and Bolzano, 236 of them leading to an implant failure within two years, and compared the result with the logistic regression output.

The covariates were: age, sex, hospital, cause of first implant, access, comorbidities.

Kaplan-Meier model and log-rank test were used to give evidence to the results.

Results

The logistic regression identified hospitals as factors increasing the probability of observing an early revision ($p < 0.05$).

The RF identified both hospital and cause of first implant as risk factors for the early revision.

The analysis carried out via Kaplan-Meier model and log-rank test confirmed the results obtained by using RF.

Discussion/Conclusion

As it relies on a relaxed theoretical framework, RF results to be a more effective and flexible tool to identify risk factors for early revision after total hip arthroplasty.