Background Effect of sagittal alignment on complications is well established. Yet, demographic and technical factors also play an important role. Survival analyses have shown that ~20% of patients having a proportioned spinopelvic shape and alignment will experience mechanical complications. Purpose The aims of the study were to detect factors affecting mechanical complications and to determine thresholds for each. Methods Patients with ≥4-levels fusion and ≥2years f-up having a postop GAP Score of 0, 1 or 2 were included. XgBoost Trees with binary logistic objective were built using 75%-25% train-test sampling. Multiplication was used to test combined effects of parameters. 5 times 3-fold repeated cross-validation was used for parameter tuning. Rough grid search was followed by feature selection using expert-guided machine learning principles. Maximum tree count was set to 6, with a maximum depth of 3 where each leaf cannot have <10 patients following cross-validation. The key metric for model selection was F-score. Performance metrics were area under the ROC curve, sensitivity, specificity and precision. Importance matrix was built to stratify the significant factors. Patients satisfying all thresholds in both ends were used to calculate their cumulative effect. Results 244 patients (200F, 44M, 44±19 yrs) with a mean f-up of 41 (24-101) months were included. 42 (17%) patients experienced a mechanical complication. 5 trees with a total of 22 leaves were built. In the test set, accuracy, sensitivity and specificity were 0.72, 0.80 and 0.71, respectively; while precision was 0.35. Five parameters, in order of importance, that drive mechanical complications in well-aligned patients were identified to have these thresholds: 1) LIV: pelvis vs sacrum and above; 2) BMI: 23; 3) age: 50 years, 4) Coronal malalignment: 2 cm and 5) pre-op ODI walking: 0-1 vs 2-5. The cumulative effect of having all 5 parameters above these thresholds was 10-folds increase in complication rates. Conclusion Approximately one fifth of sagittally well-aligned patients will suffer from mechanical complications. Technical factors such as pelvic fixation and post-op coronal malalignment, and demographic factors such as age, BMI and pre-op walking ability can stratify the complication risk within this group.