Prediction of surgical work steps in neurosurgery

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Introduction
The objective of this study was to investigate whether a surgical workflow management system (SWFMS) is able to guide a surgical intervention based on a detailed model of the surgical procedure to provide the surgeon with appropriate data and information for the current or the next work step. Furthermore, this system facilitates the control of context-sensitive user interfaces, retrieves patient data, parameterizes surgical assist systems, or provides the surgeon with decision guidance. All of these functionalities could qualitatively improve the process sequence of the surgeon.

Methods
40 patient individual surgical process models (iSPMs) from discectomy were used to select a randomized subset (L) and create a generalized surgical process model (gSPM) from it. Infrequently occurrence of work steps where filter from the gSPM. The disjoint subset (T) was selected from the iSPMs and used to simulate the surgical process against the gSPM to determine whether the gSPM is able to predict each surgical activity during the procedure. The successful guidance (s) of a surgical process represented by the gSPM was the main measurement.

Results
We showed that generalized model of the procedure consisting only 40 iSPMs are not enough to provide a proper guidance of the intervention. What we can read from the data is that a prediction rate of over 71% can be reached by increasing the total amount of iSPMs up to 160. Therefore, we were able to show that the size of the learning set L is significant to the prediction of the intervention, where else the filter level has no high influence so far.

Conclusion
Generation of gSPM from iSPMs is a promising approach to generate suitable input data for surgical workflow management engines. The recording of patient individual interventions should be advanced to generate a more robust model and thereby face the high variability of the surgical processes.