5P: Application of Novel Machine Learning Model in Predicting Survival in Adrenocortical Cancer

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BACKGROUND

- Machine learning has the potential to revolutionize cancer care, however, its application is lacking in rare diseases such as adrenocortical cancer (ACC).
- ACC has a dismal prognosis and in need of effective therapies and prognostic tools
- Here we applied a retrospective novel AI-assisted technology utilizing ^{18}F-FDG PET scans using a scoring system to characterize metabolic signatures that correlates with survival

METHODS

- 69 patients with at least two ^{18}F-FDG PET scans were analyzed.
- Regions of interest (ROIs) were quantified and matched across baseline and follow-up scans using TRAQinform IQ (AIQ Solutions).
- Features within and across imaging timepoints were used to predict prognosis.
- Univariate predictive power of overall survival prediction of each feature was determined using Cox regression models.
- TRAQinform Profile (AIQ Solutions) was calculated to predict overall survival using 3-fold cross-validation of a random survival forest.

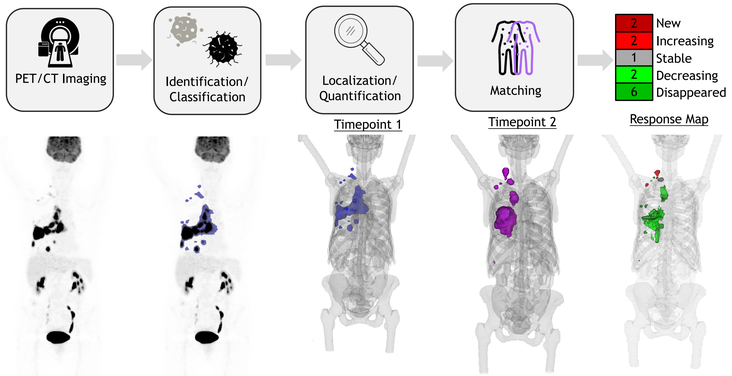


Fig.1 Image processing workflow of TRAQinform IQ: across multiple timepoints, PET/CT images are taken, ROIs are identified and classified, ROIs are localized and quantified; then change in each ROI is quantified across timepoints.

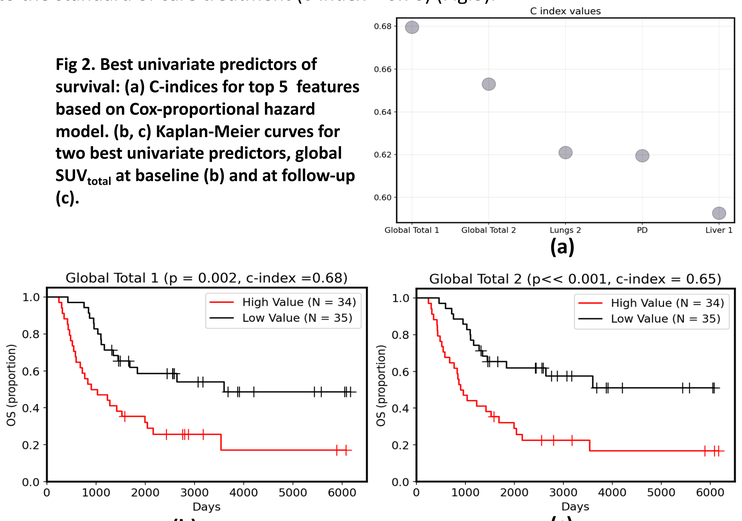
PATIENT CHARACTERISTIC

Sex, n (%)	Male - 23 (33) Female - 46 (67)
Age, Median (years)	50
Disease Status, (%)	Metastatic - 80 Localized - 16 No Imaging (PET) Evidence of Disease – 4

RESULTS

- The overall disease burden at the baseline (Global Total 1) was the strongest univariate predictor of overall survival (c-index = 0.68).
- This was followed by disease burden at follow-up (Global Total 2, c-index = 0.65), number of ROIs in the lungs at follow-up (Lungs 2, 0.62), and number of increasing regions of interest (PD, 0.62).
- TRAQinform Profile was able to predict the responder's vs suboptimal responders to the standard of care treatment (c-index = 0.76) (Fig.3).

Fig 2. Best univariate predictors of survival: (a) C-indices for top 5 features based on Cox-proportional hazard model. (b, c) Kaplan-Meier curves for two best univariate predictors, global SUV_{total} at baseline (b) and at follow-up (c).



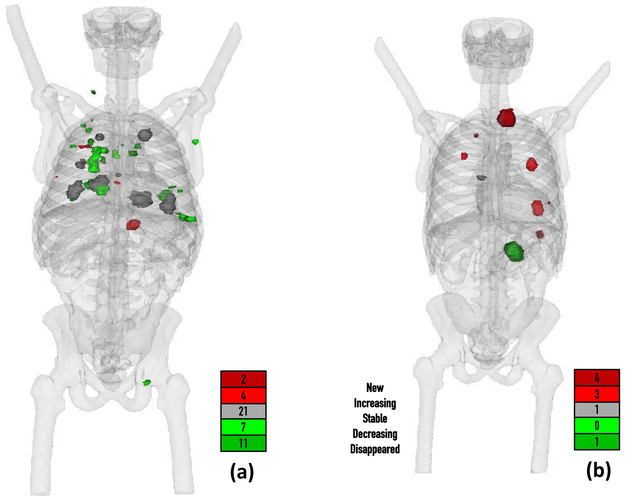
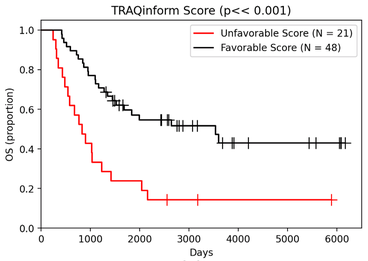


Fig.3 TRAQinform IQ analysis of representative TRAQinform Profile predicted (a) responder and (b) non-responder; and (c) full Kaplan-Meier curves for all 69 patients analyzed (p<<0.001, c-index = 0.76).



CONCLUSION

- This quantitative analysis can be translated to tailoring the treatment options to a more personalized approach.
- Machine learning algorithms are rapidly evolving and new tools using AI are being added to the repertoire of cancer management.
- Here we present an AI-assisted technology that can help predict the prognosis of ACC patients' disease based on the analysis of the ^{18}F-FDG-PET/CT images.

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CONFLICT OF INTEREST: OL, RMG, and TP are employed by AIQ Solutions (Madison, WI, USA).

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