ADPKD Predictor: A cloud-based prognostic tool for Autosomal Dominant Polycystic Kidney Disease

INTRODUCTION
Total Kidney Volume (TKV) is accepted by FDA and EMA as a prognostic enrichment biomarker to identify ADPKD patients at high risk for a progressive decline in renal function for eligibility in drug treatment. TKV calculation by manual segmentation of medical images (MRI, CT) is labor-intensive. Better accuracy requires contrast medium, with important limitations in patients with impaired renal function.

AIM
ADPKD Predictor is a cloud-based tool for fast and accurate estimation of disease classification and progression, based on advanced image processing techniques. This easy-to-use tool requires no specific computational expertise, numerical software or dedicated hardware, since all computations are run remotely in the cloud.

METHOD
The tool was designed on the InSilicoTrials cloud-based platform leveraging Microsoft Azure to automatize the set-up and running of a MATLAB algorithm to automatically detect kidneys contours from MRI data [1].

RESULTS
Through the web interface, the user inserts few clinical information, uploads MRI data and selects one point inside kidney's parenchyma in the central slice (Figure 1). TKV is automatically calculated and eGFR based on CKD-EPI equation, ADPKD Imaging Classification and future eGFR [2], estimated Tolvaptan treatment effect [3], and GFR Category based on KDIGO CKD staging system are obtained (Figure 2). The tool is very fast and precise compared to manual segmentation of medical images (absolute mean error 2.4% ± 2.7%) [1]. The tool is faster and more accurate than ellipsoid-based method, resulting in a reduction of misclassification error (2.5%) [1] hence limiting potential therapeutic consequences. The MRI dataset is anonymized before upload to the cloud; data and results are stored in a secure and reliable environment controlled by the user. The tool can be seamlessly scaled to thousand of patients and effortlessly integrated with various data sources (nonclinical, -omics, clinical, …) and additional modeling solutions, such as drug-related mechanism of actions.

CONCLUSIONS
ADPKD Predictor provides fast and reproducible assessment of risk classification and disease progression, based on automatic image segmentation. It represents an extremely useful tool for researchers and clinicians potentially helping in correct stratification of patients and monitoring disease progression, hence supporting effective therapy administration. Also, it represents a great benefit for the patient, since the tool analyzes medical images obtained without the use of contrast medium.

REFERENCES

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