60TH ERA CONGRESS MILAN & VIRTUAL JUNE 15-18, 2023

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

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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**.

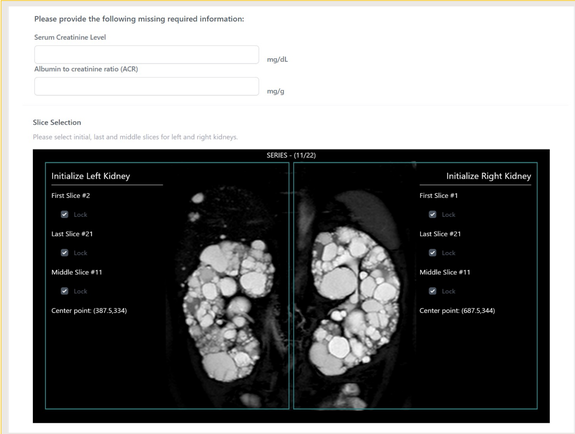

Figure 1: ADPKD Predictor – Input page: User uploads MRI data, scrolls through images and selects one point inside kidney's parenchyma in the central slice.

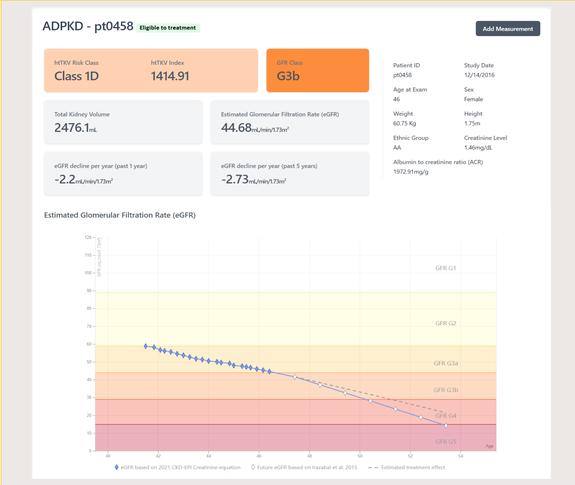

Figure 2: ADPKD Predictor – Output page: showing TKV and ADPKD Imaging Classification, eGFR history and future eGFR, estimated treatment effect, and GFR Category.

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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