Imaging biomarkers

Imaging biomarkers, also referred to as imaging markers or radiological biomarkers, are measurable characteristics or features extracted from medical imaging data that provide quantitative or qualitative information about a biological process, disease state, or treatment response. These biomarkers are derived from various imaging modalities such as magnetic resonance imaging (MRI), computed tomography (CT), positron emission tomography (PET), single-photon emission computed tomography (SPECT), or ultrasound.

Imaging biomarkers can be used to:

Diagnosis: They can aid in the detection and differentiation of specific diseases or conditions. For example, in neurology, imaging biomarkers can help diagnose Alzheimer's disease by detecting characteristic brain changes associated with the condition.

Prognosis: They can provide information about the likely outcome or progression of a disease. For instance, in oncology, imaging biomarkers can predict tumor aggressiveness or patient survival rates based on features such as tumor size, shape, or metabolic activity.

Treatment response assessment: They can help monitor the response to therapy and evaluate treatment efficacy. Changes in imaging biomarkers over time can indicate whether a treatment is effective or if adjustments are needed.

Patient stratification: They can aid in categorizing patients into subgroups based on disease characteristics, which can inform personalized treatment approaches. Imaging biomarkers can identify specific subtypes of a disease or predict treatment response based on individual patient characteristics.

Advancements in image analysis algorithms, machine learning, and artificial intelligence have greatly facilitated the extraction and interpretation of imaging biomarkers. These techniques enable the detection of subtle patterns, quantification of imaging features, and the development of predictive models to improve diagnostic accuracy, patient stratification, and treatment planning.

It's worth noting that imaging biomarkers are not standalone diagnostic tools, but are used in conjunction with clinical information and other diagnostic tests to guide medical decision-making. Additionally, validation and standardization of imaging biomarkers are crucial to ensure their reliability and reproducibility across different imaging platforms and clinical settings.

Hirai et al. aimed to investigate the impact of baseline infarct area and collateral status (CS), which are imaging predictors of clinical stroke outcome, after endovascular treatment (EVT) in MRI-selected patients with acute basilar artery occlusion (BAO).

Patients with acute BAO who underwent EVT within 24 h after stroke from December 2013 to February 2021 were included in this retrospective, multicenter, observational study. The baseline infarct area was evaluated by the posterior circulation of Acute Stroke Prognosis Early Computed Tomography Score (pc-ASPECTS) using diffuse-weighted imaging (DWI), and CS was assessed by measuring the computed tomography angiography of the basilar artery (BATMAN) score and the posterior circulation collateral score (PC-CS) using magnetic resonance angiography (MRA). A Good

outcome was defined as a modified Rankin scale score ≤ 3 at 3 months. For each imaging predictor, a multivariate logistic regression analysis was performed to evaluate its impact on good outcomes.

A total of 86 patients were analyzed, and 37 (43.0%) had a good outcome. The latter showed significantly higher pc-ASPECTS than those without good outcomes. In multivariate analyses, a pc-ASPECTS ≥ 7 was significantly associated with good outcomes (OR, 2.98 [95% CI, 1.10-8.13], P = 0.032), while PC-CS ≥ 4 (OR, 2.49 [95% CI, 0.92-6.74], P = 0.073) and BATMAN score ≥ 5 (OR, 1.51 [95% CI, 0.58-3.98], P = 0.401) were not.

In MRI-selected patients with acute BAO, pc-ASPECTS on DWI was an independent predictor of clinical outcomes after EVT, while the MRA-based CS assessments were not [1].

1)
Hirai S, Hirakawa A, Fujita K, Ishiwada T, Sasaki M, Yoshimura M, Shigeta K, Sato Y, Yamada K, Ishikawa M, Sagawa H, Aoyama J, Fujii S, Ishii Y, Sawada K, Obata Y, Karakama J, Hara M, Kawano Y, Nemoto S, Sumita K. Imaging predictors of clinical outcomes after endovascular treatment in MRI-selected patients with acute basilar artery occlusion. Clin Neurol Neurosurg. 2023 Jun 7;231:107824. doi: 10.1016/j.clineuro.2023.107824. Epub ahead of print. PMID: 37320887.