Supplementary Figure S1: Cerebral lesions assessed by $^{18}$F-FDG and $^{68}$Ga-FAPI-04 PET/CT. The same patient as in figure 2b additionally presented with an occipital meningeal lesion (arrowhead) due to the high target to background ratio clearly visible on $^{68}$Ga-FAPI-04 PET/CT but hardly detectable on $^{18}$F-FDG PET/CT or contrast enhanced CT. The respective lesion was confirmed on contrast enhanced cerebral MRI (arrowhead).
Supplementary Figure S2

(a) Histological analysis of IgG4-RD patients with proliferative (lymph node), mixed (thoracic aorta) and fibrotic (retroperitoneal mass) phenotypes. (a) Upper row: hematoxylin/eosin (H.E.) stain; lower row: immunofluorescence (IF.); CD45 indicates leukocyte infiltration, vimentin indicates fibroblast infiltration. DAPI is a nuclear stain and depicts all cells. (b) Higher magnification of ROIs depicted in (a).

Supplementary Figure S2: Histological analysis of IgG4-RD patients with proliferative (lymph node), mixed (thoracic aorta) and fibrotic (retroperitoneal mass) phenotypes. (a) Upper row: hematoxylin/eosin (H.E.) stain; lower row: immunofluorescence (IF.); CD45 indicates leukocyte infiltration, vimentin indicates fibroblast infiltration. DAPI is a nuclear stain and depicts all cells. (b) Higher magnification of ROIs depicted in (a).
Supplementary Figure S3

a

FDG PET/CT

FAPI PET/CT

b

before anti-inflammatory treatment

after anti-inflammatory treatment

FDG PET/CT

FAPI PET/CT

c

before anti-inflammatory treatment

after anti-inflammatory treatment

FDG PET/CT

FAPI PET/CT

d

before anti-inflammatory treatment

after anti-inflammatory treatment

FDG PET/CT

FAPI PET/CT
Supplementary Figure S3: Disease activity assessment of IgG4-RD by ¹⁸F-FDG and ⁶⁸Ga-FAPI-04 PET/CT before and after anti-inflammatory treatment.

(a) 58-year old male patient with histologically confirmed IgG4-RD of the thyroid gland after hemithyroidectomy of the right thyroid lobe (surgical clips in situ). ¹⁸F-FDG PET/CT demonstrates tracer uptake in the apical left thyroid lobe with no significant uptake by the middle and inferior left lobe (arrowheads). The slightly increased uptake in the right thyroid bed was interpreted as reactive to surgery. In contrast, ⁶⁸Ga-FAPI-04 PET/CT disclosed no tracer uptake in the apical left thyroid lobe, but markedly increased tracer uptake in the middle and inferior left lobe (arrowheads).

(b-d) 59-year old female patient with histologically confirmed IgG4-RD intraorbital tissue mass assessed by ¹⁸F-FDG PET/CT and ⁶⁸Ga-FAPI-04 PET/CT (b, arrowheads) demonstrates a decrease of metabolic activity on ¹⁸F-FDG PET/CT following treatment with rituximab, while there was an increase in ⁶⁸Ga-FAPI-04 tracer uptake. The patient reported of progressive visual impairment with double images due to ocular muscle infiltration. The same patient also had a slightly increased ¹⁸F-FDG uptake and an markedly increased ⁶⁸Ga-FAPI-04 uptake of the submandibular glands declining on follow-up imaging after rituximab therapy (c, arrowheads). Furthermore, the patient also had ⁶⁸Ga-FAPI-04 uptake in the pancreas, declining after rituximab treatment on follow-up imaging (d, arrowheads) while no significant tracer uptake could be demonstrated on the respective ¹⁸F-FDG PET/CT examination.