Tackling prostate epithelial cells proliferation with HAAO-binding Ferroferric oxide nanomissiles

Jie Wang[1,#], Yi Wang[1,#], Chenxi Ye[1,#], Guorong Yang[1], Xiaowei Hao[1], Yin Lu[1], Fan Gao[1], Yue Teng[2,*], Bin Zheng[3,*], Qing Yuan[1,*]

1 Department of Urology,The Chinese People's Liberation Army(PLA) General Hospital,Beijing,China

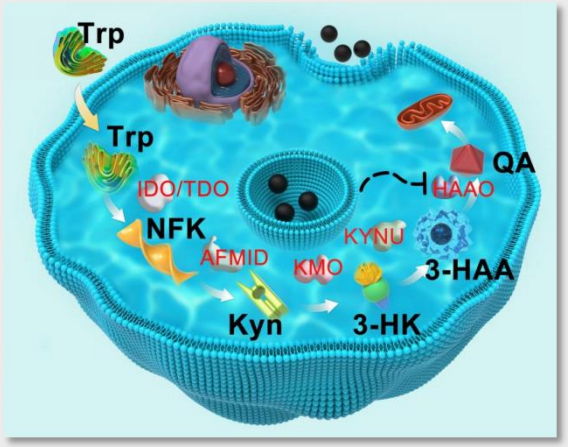
2 State Key Laboratory of Pathogen and Biosecurity, Academy of Military Medical Sciences, Beijing,China

3 School of Biomedical Engineering and Technology, Tianjin Medical University, Tianjin, China

www.ics-eus.org/2025/abstract/ 408

Background

Benign prostatic hyperplasia (BPH) is a prevalent urinary disorder in aging men, and 3-hydroxyanthranilate 3,4-dioxygenase(HAAO)—traditionally associated with neuroinflammatory pathways via quinolinic acid (QA) production—is newly identified as a driver of prostate epithelial proliferation. This study elucidates how HAAO upregulation reprograms tryptophan metabolism in BPH tissues and demonstrates that ferroferric oxide nanoparticles selectively inhibit this enzyme to suppress disease progression.

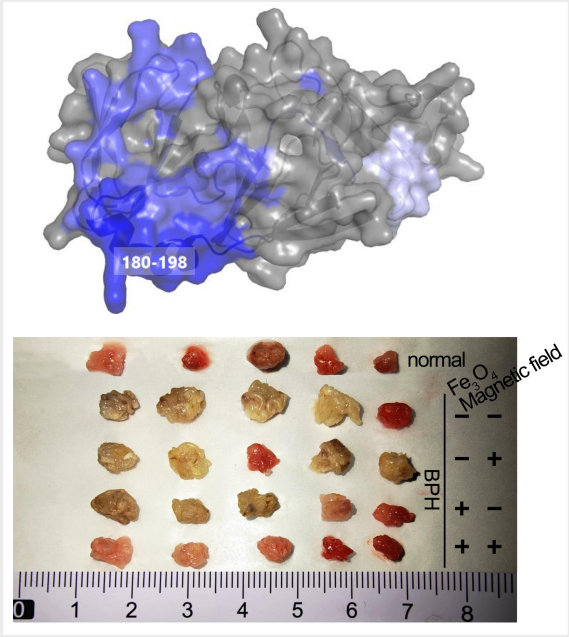


Methods

Researchers analyzed prostate tissue samples from 18 BPH patients and 3 healthy donors using Data-Independent Acquisition (DIA) mass spectrometry-based proteomics to detect HAAO enzyme upregulation. This approach enabled comprehensive identification of both significantly dysregulated metabolic pathways (e.g., tryptophan metabolism) and novel protein targets implicated in prostate epithelial proliferation.

Results

Studies have shown that in patients with benign prostatic hyperplasia (BPH), the expression level of HAAO is significantly upregulated compared to that in normal individuals, reaching approximately more than twice that of the latter. Further mechanistic studies suggest that HAAO may promote the DNA replication process, thereby accelerating cell proliferation. It is noteworthy that ferroferric oxide can specifically bind to HAAO, inhibiting its biological function and ultimately slowing down the hyperplastic progression of prostate cells.



Implications

The findings support routine HAAO pathway screening in BPH diagnosis and risk stratification. Identifying HAAO upregulation can guide precision therapeutic decisions, such as using ferroferric oxide nanoparticle-based therapies to inhibit QA-driven proliferation, and help tailor patient-specific interventions for halting disease progression while minimizing systemic toxicity.