

Development of Non-Invasive Evaluation of Spermatogenesis Using Cr-CEST MRI

Advanced Imaging in
Assisted Reproductive Technologies (ART)

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Prevalence of Male Infertility

Male infertility accounts for about half of all infertility cases and affects 10% of married couples globally.

Azoospermia Impact

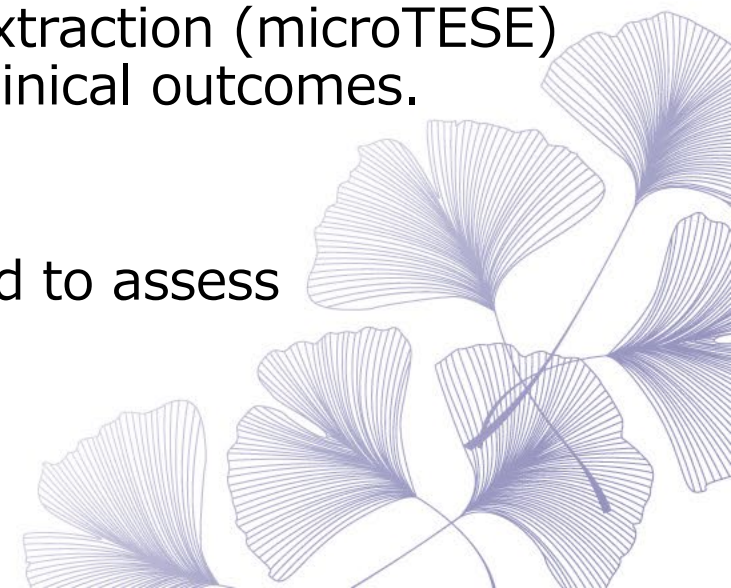
Azoospermia, the absence of sperm, impacts 3% of reproductive age men, posing a significant clinical challenge.

Limitations of Current Diagnostics

Current invasive methods like microsurgical testicular sperm extraction (microTESE) have low sperm retrieval success rates around 34%, limiting clinical outcomes.

Need for Non-invasive Imaging

Accurate, non-invasive imaging techniques are urgently needed to assess spermatogenesis and improve infertility treatments.



Molecular Imaging Technique

Cr-CEST MRI visualizes creatine distribution non-invasively, enabling repeatable metabolic evaluations in tissues.

Energy Metabolism Indicator

Creatine levels measured by Cr-CEST MRI reflect tissue energy metabolism and metabolic changes.

Application in Ischemic Limbs

Cr-CEST MRI detects increased creatine levels in ischemic limbs, aiding clinical assessments.

(Takahashi, Kioka et al, J Magn Reson Imaging. 2020-1)

Higher Signal in Testes

Testes show higher Cr-CEST signals compared to skeletal muscle, indicating imaging suitability.

(Takahashi, Kioka et al, J Magn Reson Imaging. 2020-2)



Creatine and Male Infertility

Reduced creatine levels are observed in male infertility, highlighting its importance in reproductive health.

Creatine Imaging with CrCEST-MRI

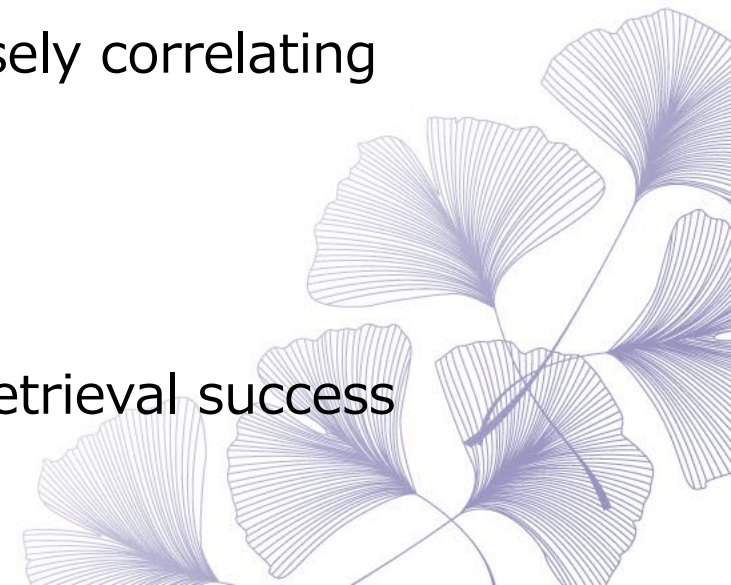
CrCEST-MRI reveals creatine concentration and spatial distribution in the testis, aiding intraoperative navigation for microTESE operation.

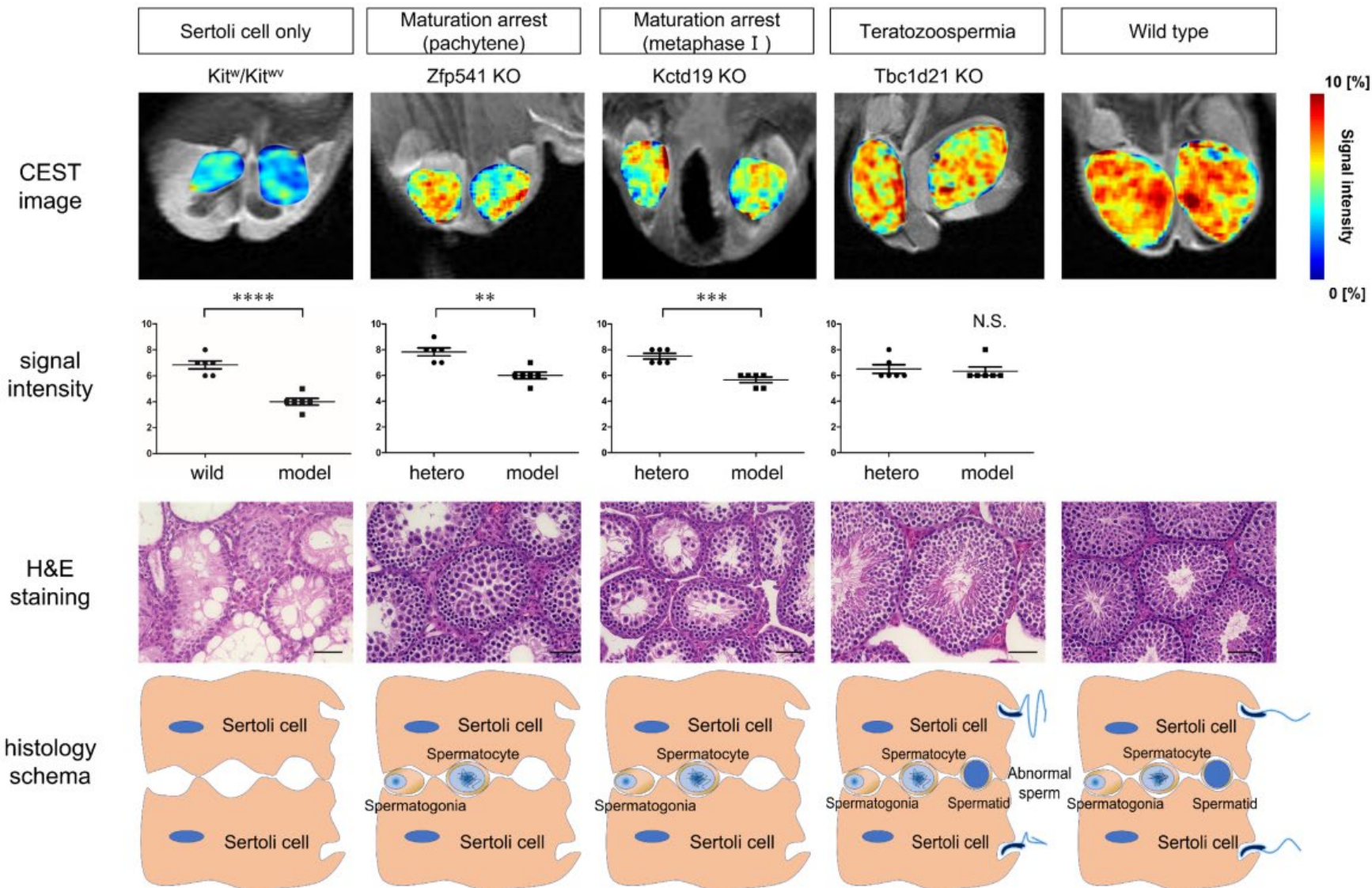
Role in Spermatogenesis

Creatine produced by Sertoli cells is taken up by germ cells, closely correlating with sperm production.

Possible Clinical Utility of Cr-CEST MRI

1. Non-invasive assessment of testicular function.
2. Image-guided navigation for microTESE to improve sperm retrieval success rate.





Validation Using Mouse Models

Multiple mouse models with impaired spermatogenesis were used to validate the Cr-CEST MRI technique effectively.

Correlation with Spermatogenesis

Cr-CEST signal intensity increased with spermatogenesis progression, confirmed by histopathological analysis.

First in human

Conducted the first-in-human trial of testicular Cr-CEST MRI as part of the AMED-BIRTHDAY project (2020-2023).

(Manuscript in preparation)

Next generation Cr-CEST MRI

Currently developing a second-generation, high-resolution testicular Cr-CEST MRI system using a dedicated testicular MRI coil.

