

Does Ezrin Link Cortical Structure to Mitochondrial Function in Maturing Oocytes?

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Background

Oocyte maturation depends on precise remodelling of the actin cortex and spindle positioning. This process requires phosphorylated Ezrin, Radixin, and Moesin (pERM) proteins at the cortex. It also regulates mitochondrial activity in other cell types.

The Knowledge Gap & Clinical Importance

Whether Ezrin mechanistically links cortical organisation and mitochondrial function during oocyte maturation is unknown. This matters clinically: both cortical defects and mitochondrial dysfunction independently degrade oocyte quality, so understanding this pathway could inform fertility research and IVF outcomes.

A Cortical pERM Intensity & Band Thickness

100% → 74% → 50% of control

pERM intensity reflecting background-subtracted mean signal, shown relative to control.

1.82 → 1.56 → 1.44 μm

Cortical thickness measured by tracing the pERM-positive band at 4 points per oocyte (90° apart).

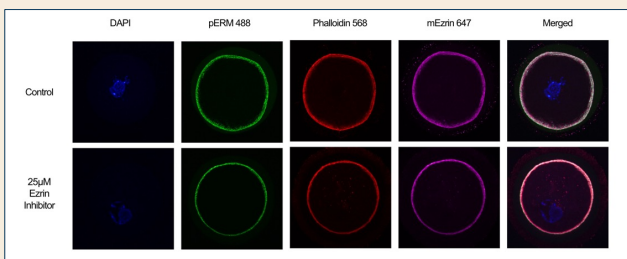
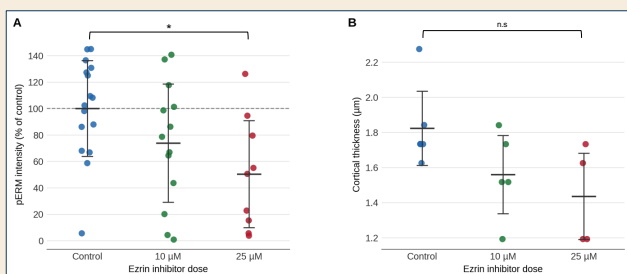


Figure 3. Representative control and 25 μM oocytes. The 25 μM cortex is visibly thinner than control; pERM ring shows some unevenness in comparison to control, consistent with quantified reductions in both cortical thickness and pERM intensity.

B Altered Mitochondrial Distribution

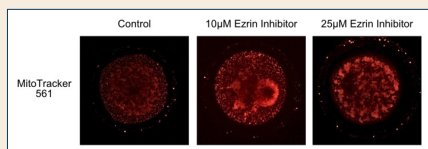


Figure 4. Representative MitoTracker staining in GV-stage oocytes across Ezrin inhibitor doses. Images are contrast-enhanced equally across all three groups and were not independently quantified.

Quantifying this puncta clustering to be explored.

MitoTracker puncta shift from fine, evenly distributed signal in controls to visible clustering with dose.

Materials & Methods

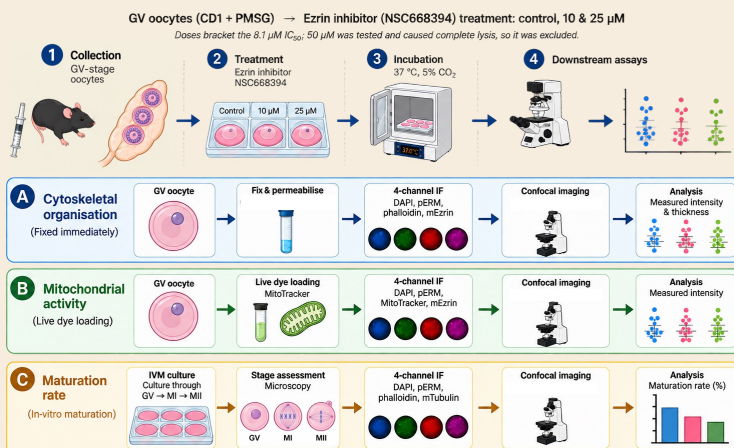


Figure 1. Experimental workflow for assessing the effects of Ezrin inhibition in mouse GV oocytes. GV (germinal vesicle) oocytes were treated with Ezrin inhibitor (0 [DMSO], 10, or 25 μM) and assessed for (A) cytoskeletal organisation, (B) mitochondrial activity, and (C) in-vitro maturation (IVM), including progression from GV to MI (metaphase I) and MII (metaphase II), using immunofluorescence, confocal imaging, and quantitative analysis.

C Maturation (IVM)

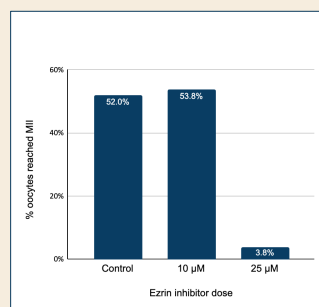


Figure 5. Percentage of oocytes reaching maturation (MII) following in vitro maturation (IVM) across Ezrin inhibitor doses pooled from two rounds of IVM; n = 25, 26, 26. Fisher's exact test, control vs. 10 μM : p = 1.0 (n.s.).

~52% → ~53.8% → ~3.8%

10 μM has no effect on MII rate (52.0% vs 53.8%, not different from control). 25 μM shows a marked reduction, driven in part by oocyte lysis at this dose.

Quantifying morphological difference between Control MII oocytes and 10 μM to be explored.

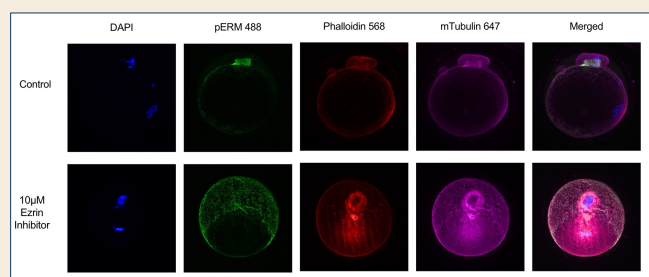


Figure 6. Representative control and 10 μM oocytes at MII, stained for DAPI, pERM, Phalloidin, and α -tubulin. The 10 μM spindle and cortical ring appear less organised than control, despite MII rate being unaffected at this dose.

Conclusions

Cortical pERM intensity and band width decline together with the increase concentration of Ezrin inhibitor, suggesting one structure failing rather than two unrelated readouts. MitoTracker distribution also shifts with dose, from fine and even to more clustered, though this is qualitative and not yet quantified. Together, ERM activity appears to support cortical organisation and mitochondrial distribution in maturing oocytes, with structural effects that scale with dose. The 25 μM collapse in MII rate may be a separate, toxicity-driven event rather than a graded extension of the same defect. MII rate is a coarse readout that may not capture disruption already visible upstream. Representative MII-stage images also show a morphological difference between control and 10 μM oocytes, suggesting cortical disruption may persist into MII even where the maturation rate itself looks unaffected.

Next Steps

Test cortex-mitochondria coupling within the same oocytes, quantify the MitoTracker clustering and MII oocyte defects as measured metrics, and expand sample sizes on underpowered readouts like cortical thickness (n = 4–6).

References

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