

NANO-PRECISION IN ENDOMETRIOSIS THERAPY

**Delivering Fulvestrant
Where It's Needed Most**

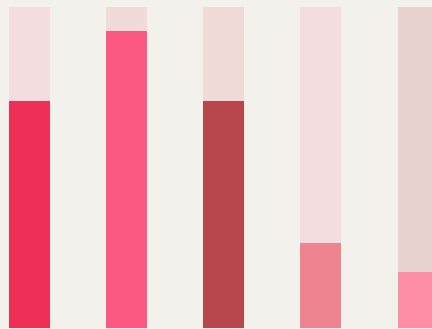


ENDURING PAIN, EMERGING HOPE



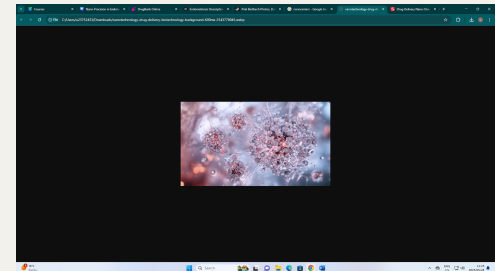
demographics

1 in 10 women may have endometriosis.
Any woman of any age undergoing menstruation
can be affected



Living with Endometriosis

Dysmenorrhoea, dyspareunia, menorrhagia,
Infertility



Types of Nanocarriers

polymeric nanoparticles, lipid-based carriers, gold
nanoparticles, dendrimers, carbon tubes

UNDERSTANDING THE PROBLEM:

BACKGROUND AND RESEARCH DIRECTION

CURRENT CHALLENGES

Current Endometriosis Treatments involves systemic hormonal therapies that work by lowering oestrogen levels. While these assist in managing the endometrial symptoms, they are often accompanied by significant adverse effects.(1)

PRECISION GAPS

Nanocarrier-based drug delivery has emerged as a promising alternative. However, most of the approaches developed so far target receptors like CD44 or the folate receptor. These receptors aren't unique to endometriotic lesions.(2)

THERAPEUTIC OPPORTUNITY

Recent studies have identified some promising molecular markers, such as Rab37, Rho-GDI α , and SM-22 α . These markers are found in high amounts in ectopic lesions but are barely present in healthy endometrial or peritoneal tissue (3).



AIM & OBJECTIV

E Aim

To develop a targeted nanocarrier system using lesion-specific markers for the delivery of fulvestrant in endometriosis, enhancing drug stability, precision, and reducing systemic side effects.

Objectives

- Identify and validate biomarkers that are uniquely expressed in ectopic endometrial tissue.
- Design and optimise nanocarriers functionalised with ligands targeting these biomarkers.
- Assess the ability of fulvestrant-loaded nanocarriers to selectively inhibit endometriotic cell activity with minimal impact on healthy cells.
- Compare the side effect profiles of conventional therapy versus nanocarrier-mediated delivery.



Methods



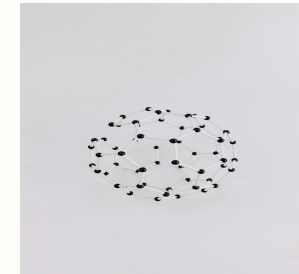
Experiment 1: Biomarker Identification

Gene expression analysis (GEO) was used to identify differentially expressed biomarkers in ectopic endometrial tissue. Key markers include CD10, integrin $\alpha v \beta 3$, VEGF-R2, MMP-2, and MMP-9.



Experiment 2: Targeted Nanocarrier System

A nanocarrier was selected and functionalised with ligands targeting overexpressed biomarkers in ectopic tissue. Upon binding, the system delivers the drug directly to lesions, with enzyme-responsive release triggered by local inflammation.



Experiment 3: Fulvestrant-Loaded Nanoparticles

Fulvestrant-loaded nanoparticles were prepared using biodegradable polymers via emulsification. The resulting particles were purified, freeze-dried, and characterised for size, charge, drug loading, and release profile. Drug release was tested in buffer to simulate physiological conditions.



Methods continue...

Experiment 4: Comparing Side Effects of Traditional vs Nanocarrier Therapy

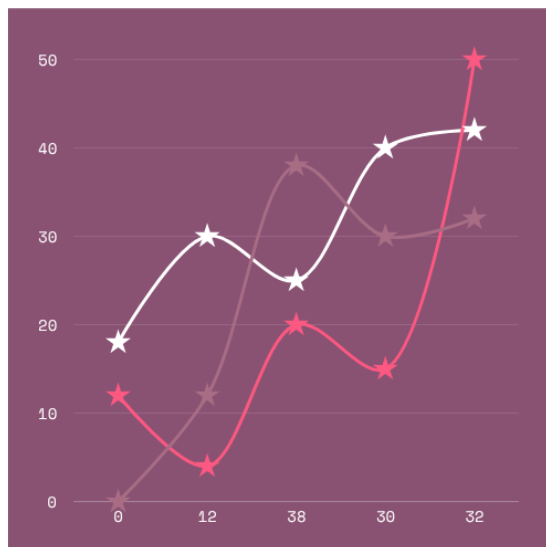
This experiment evaluates and compares the side effect profiles of conventional hormone-based therapy and fulvestrant delivered via nanocarriers in endometriosis patients. Three groups (n=10 per group) will be monitored over one month, with specific focus during the premenstrual and menstrual phases.

- Group 1 will receive standard systemic hormonal therapy.
- Group 2 will be treated with fulvestrant-loaded nanocarriers.
- Group 3 will serve as the placebo control.

Clinical side effects—such as gastrointestinal discomfort, fatigue, mood disturbances, and systemic symptoms—will be recorded.

- The aim is to assess whether targeted nanocarrier delivery reduces off-target effects and improves patient tolerability compared to conventional methods.





EXPECTED OUTCOMES

HIGH BINDING SPECIFICITY

High binding specificity of nanocarriers to ectopic endometrial lesions

ENHANCED DELIVERY

Enhanced delivery of fulvestrant directly at lesion sites

MARKED INHIBITION

Marked inhibition of ectopic cell proliferation

MINIMAL UPTAKE

Minimal uptake by healthy endometrial tissue

REDUCED SYSTEMIC EXPOSURE

Reduced systemic exposure and off-target effects

