

Supplemental Material 1

Temperature Change Estimate for Wallace Oocyte Collection Device: Calculations and Assumptions

Assumptions

1. Needle length plus tubing length = 1.08 m
2. Measured fluid volume = 1.15 mL
3. Fluid properties approximated as water: density = 1000 kg/m^3 , specific heat = $4180 \text{ J/kg}\cdot\text{K}$
4. Initial fluid temperature = 37°C
5. Ambient temperature = 23°C (73.4°F)
6. Convection heat-transfer coefficient $h = 12 \text{ W/m}^2\cdot\text{K}$
7. Static fluid slug completely fills the collection path
8. Lumped-capacitance model and Newton cooling applied (the difference with calculating losses due to tubing and needle separately were minimal)

Equations Used

Equivalent diameter: $d = \sqrt{(4V)/(\pi L)}$

Mass: $m = \rho V$

Thermal capacitance: mcp

Surface area: $A = \pi dL$

Time constant: $\tau = (mcp)/(hA)$

Newton cooling: $T(t) = T_\infty + (T_0 - T_\infty)e^{-t/\tau}$

Calculations

Equivalent internal diameter = 1.164 mm

Fluid mass = 0.001150 kg

Thermal capacitance = 4.807 J/K

Surface area = 0.003951 m^2

Time constant $\tau = 101.4 \text{ s}$

Temperature After 120 Seconds

$T(120) = 27.29^\circ\text{C}$

Temperature drop = 9.71°C

Citation: Rose BI, Brown SE. Best Practices for Novice Oocyte Retrieval: Minimizing Oocyte Loss and Temperature Related Injury. Arch Obstet Gynecol. 2026;7(1):59–62.

Comment: The controllable assumptions that change the calculations the most are the room temperature and the convection heat transfer coefficient which increases with air flow and positioning of the tubing to that air flow. The number 12 chosen here would be in the low range for most operating rooms, but high for office air conditioning (where 10 would be a better choice).