MIND study

The **MIND study involving the ARTEMIS Penumbra System**.

Minimally Invasive Neuro Evacuation Device (MIND): A clinical study evaluating the **safety and efficacy of the ARTEMIS™ neuro evacuation device** in the treatment of **intracerebral hemorrhage (ICH)**.

Critical Summary

Objective: To evaluate whether **minimally invasive aspiration using ARTEMIS** can safely reduce **hematoma volume** and potentially improve **clinical outcomes** in patients with spontaneous ICH.

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Study Design: - **Prospective, multicenter**, single-arm observational study. - Sponsored by **Penumbra Inc.** - Involved patients with **deep ICH** (e.g., basal ganglia, thalamus) eligible for **minimally invasive evacuation**. - Primary endpoints:

1. **Safety** (mortality, procedure-related complications).
2. **Efficacy** (volume reduction, midline shift, functional outcomes like mRS).

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Key Strengths:

- **Real-world data** from multiple centers. - Use of **modern, targeted aspiration technique** (ARTEMIS catheter). - Focused on **deep hematomas**, often harder to access surgically. - Early results show **significant hematoma volume reduction** in most patients. - Procedure generally well tolerated, with **low perioperative complication rates**.

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⚠ **Limitations and Critique:**

1. **Lack of control group**:

    1. Being a **single-arm study**, it lacks a comparison against **conservative treatment** or **other surgical approaches** (e.g., craniotomy, MISTIE-style catheter+lysis).

2. **Functional outcomes unclear**:

    1. Volume reduction was achieved, but **meaningful clinical recovery** (e.g., return to independence) varies widely by center and patient selection.
    2. Small sample size so far makes it hard to generalize.

3. **Timing of intervention**:

    1. There's variability in **when** patients were treated (early vs. delayed aspiration), which affects

the results.
2. No clear guidelines yet on optimal **time window** for ARTEMIS use.

4. **No long-term follow-up** published yet:

1. Cognitive and neurological outcomes beyond 90 days are not well documented.

5. **Commercial interest**:

1. As it's **industry-sponsored**, results must be interpreted carefully with independent validation.

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Conclusion:

The **MIND study** confirms that the **ARTEMIS™ system** is: - **Technically feasible**, - **Safe for aspiration** of deep ICH, - Effective in reducing **hematoma volume**.

But it stops short of proving that this translates into **better functional outcomes**, especially compared to **medical management**.

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What's Needed Next:

- A **randomized controlled trial (RCT)** comparing ARTEMIS vs. standard care or vs. other minimally invasive techniques. - Stratified analysis of **ICH volume, location, and timing**. - Cost-effectiveness evaluations. - Long-term outcome tracking.