

Early Cranioplasty Improves Neurologic Recovery in Syndrome of the Trephined

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Background

Traumatic brain injury (TBI) and stroke account for over one million hospitalizations annually in the United States. In severe cases, **decompressive craniectomy (DC)** is performed to relieve elevated intracranial pressure, but the resulting cranial defect may lead to **Syndrome of the Trephined (SoT)**, a delayed neurologic decline that improves after **cranioplasty (CP)**.

SoT may present with altered consciousness, motor deficits, cognitive dysfunction, and other neurologic deterioration distinct from the initial injury. Although cranioplasty is the definitive treatment, the **optimal timing of repair remains uncertain**.

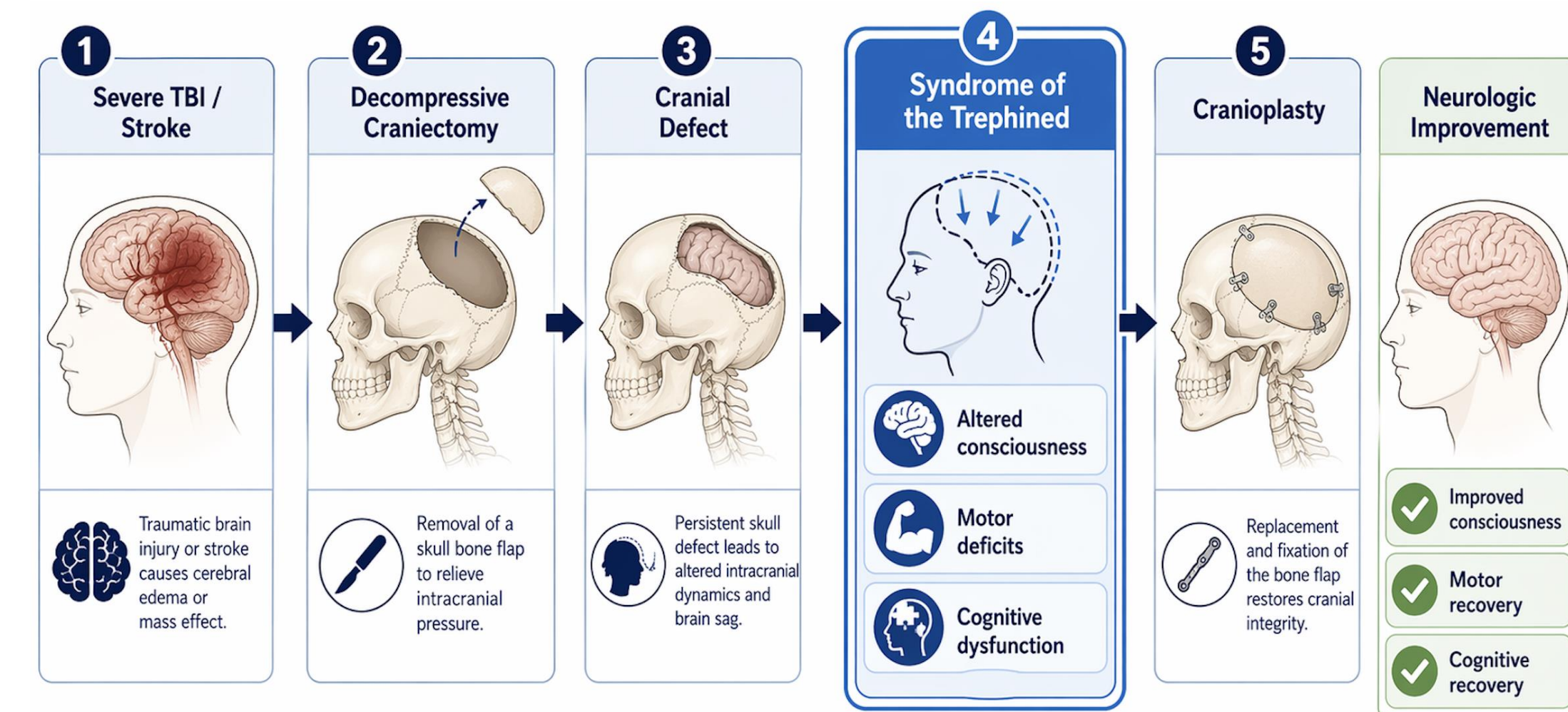


Figure 1. Clinical course of Syndrome of the Trephined after decompressive craniectomy and improvement following cranioplasty.

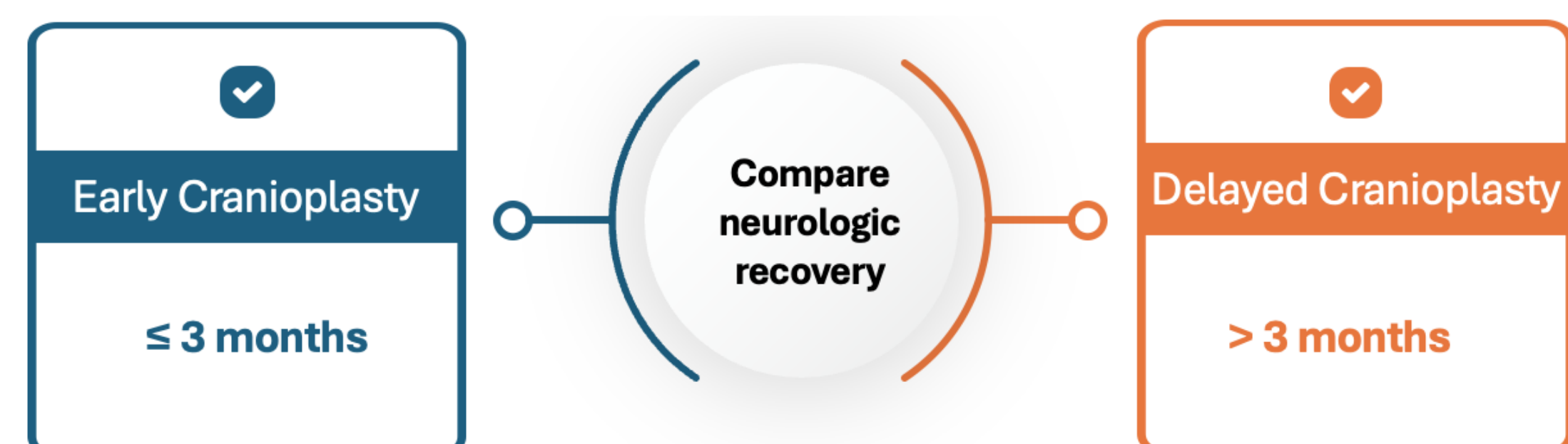


Figure 2. Objective: To compare neurologic recovery after **early cranioplasty (≤3 months)** versus **delayed cranioplasty (>3 months)** in patients with SoT.

Methods

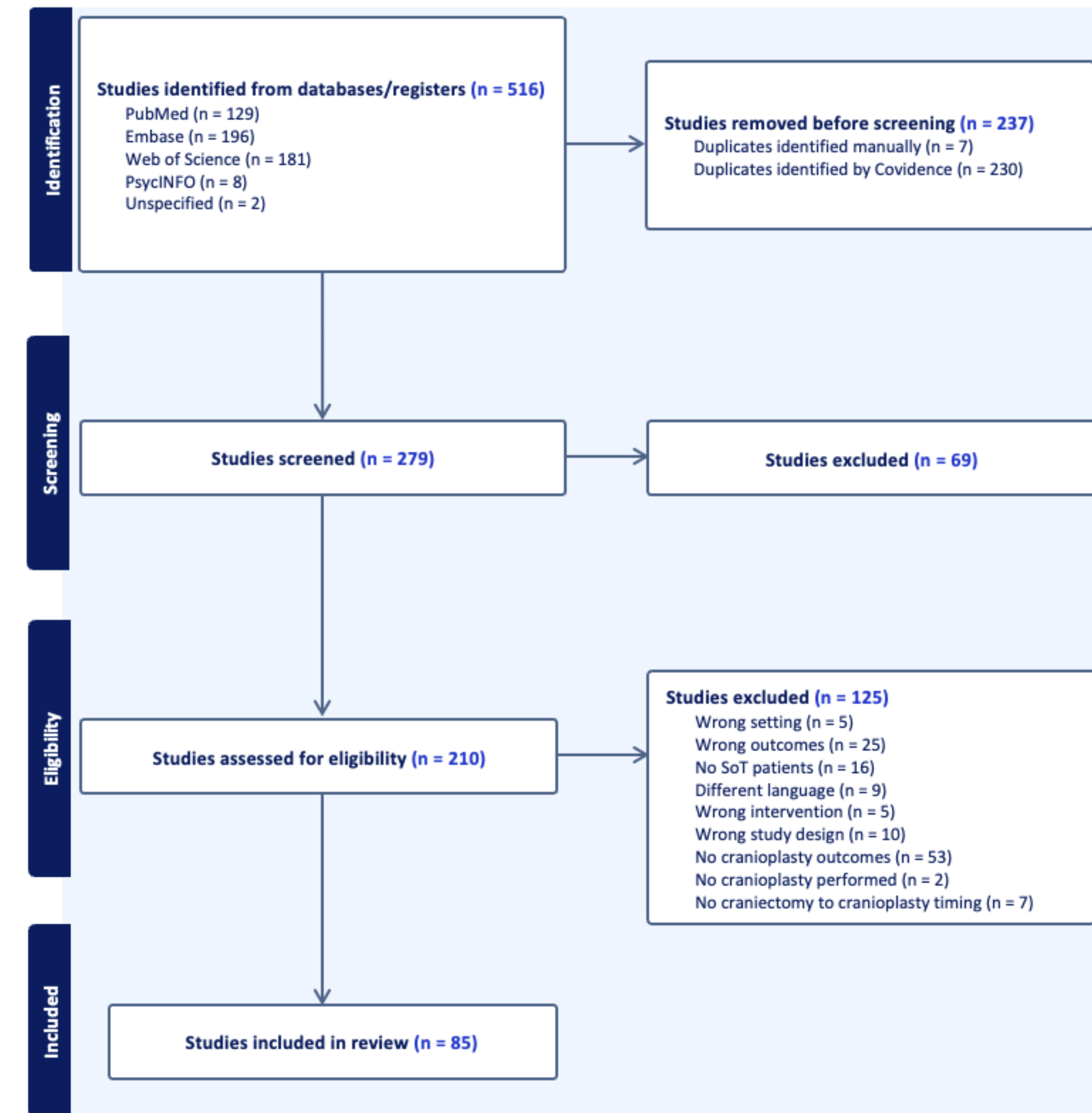


Figure 3. PRISMA flow diagram of study selection and inclusion.

A **systematic review** was performed in accordance with PRISMA guidelines:

- **Databases searched:** PubMed, Embase, Cochrane, Web of Science, PsycINFO
- **Inclusion criteria:** studies reporting cranioplasty timing and symptom resolution in SoT
- **Exclusion criteria:** non-English, review articles, animal studies, external cranioplasty, duplicates
- **Cranioplasty (CP) timing:** early CP ≤3 months vs delayed CP >3 months
- **Outcomes assessed:** consciousness, motor deficits, cognitive deficits, overall neurologic recovery
- **Final cohort:**
 - **85 studies, 548 patients (201 early CP, 347 delayed CP)**

Results

Early cranioplasty (≤3 mo)

Indications for craniectomy:

- Hemorrhage (51%)
- Trauma (33.8%)
- Stroke (16.4%)

SoT Symptoms:

- Altered Consciousness (60%)
- Motor (15%)
- Cognitive (11%)

Delayed cranioplasty (>3 mo)

Indications for craniectomy:

- Trauma (59.1%)
- Stroke (16.4%)
- Hemorrhage (13.3%)

SoT Symptoms:

- Motor (36%)
- Cognitive (17%)
- Altered Consciousness (10%)

Early CP (≤3 months) outperformed delayed CP in all neurologic recovery domains

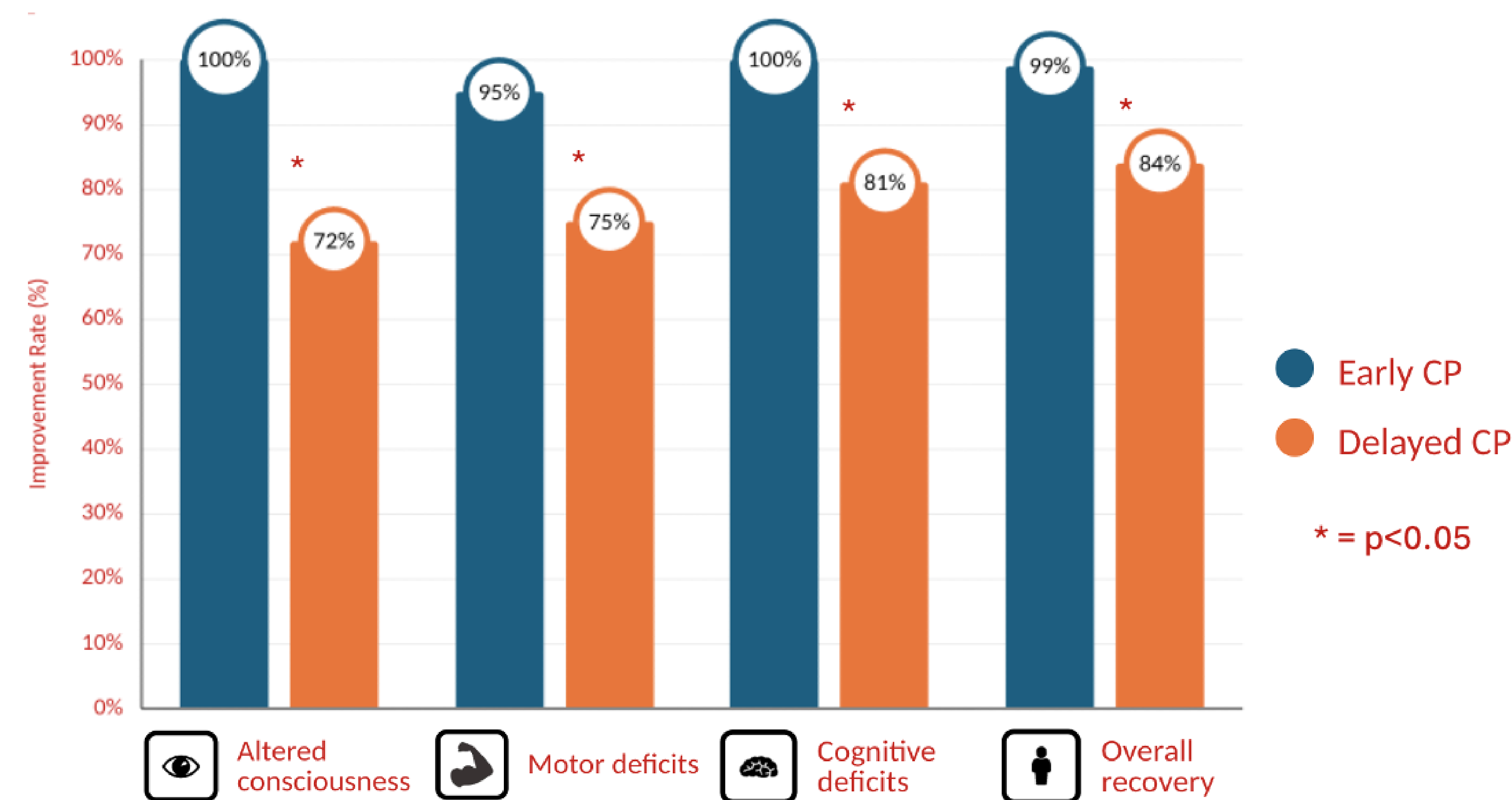


Figure 4. Recovery rates after early versus delayed cranioplasty. **Early cranioplasty** was associated with significantly greater improvement in consciousness, motor recovery, cognition, and overall neurologic recovery ($p < 0.05$).

Conclusion

- **Early cranioplasty** is associated with **significantly greater neurologic recovery** than delayed repair in patients with Syndrome of the Trephined.
- Cranioplasty ≤3 months demonstrated superior recovery of **consciousness, motor function, cognition, and overall neurologic status**.
- These findings support **earlier intervention** to improve recovery trajectory and quality of life in SoT.
- Prospective studies are needed to better define optimal timing and patient selection.

References

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