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# Blood Transfusion and Opioid Requirements: Open vs. Minimally Invasive Repair of Single Suture Craniosynostosis

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## Introduction

Advances in surgical techniques in recent decades have allowed for the development of minimally-invasive approaches.

Popularity of minimally invasive repair for the treatment of craniosynostosis has increased as an alternative to the established open procedures.

This study aims to compare the outcomes and assess the morbidity of the open versus minimally-invasive approach for the treatment of craniosynostosis.

## Methods

A retrospective chart review of patients that presented with a diagnosis of craniosynostosis and underwent surgical repair at our institution from January 2007 through December 2022 was performed.

Patients with multi-suture synostosis, syndromic association, and >24 months of age at repair were excluded.

Information regarding to blood product administration was limited to packed red blood cells (pRBCs) and whole blood.

Intraoperative and postoperative opioid medication administration were calculated and converted to total milligrams of oral morphine equivalent (OME) for standardized comparison (Table 1).

**Table 1. Opioid Equivalence Factors** [1]

| Opioids | Route | Unit | Conversion Factor | OME |
|---|---|---|---|---|
| **Fentanyl** | IV | mcg | 300 | 300 mcg / 0.3 mg |
| **Hydromorphone** | IV | mg | 18 | 18 mg |
| **Hydrocodone** | PO | mg | 1 | 1 mg |
| **Oxycodone** | PO | mg | 1.5 | 1.5 mg |
| **Codeine** | PO | mg | 0.15 | 0.15 mg |

Pearson's chi-squared tests were used to compare the complication rates between techniques. Two-tailed t-tests were used to assess for differences in average blood product transfusion volumes and opioid medication administration.

## Results

**Figure 1. Distribution of suture involvement among patients who underwent open repair versus minimally invasive craniosynostosis repair**

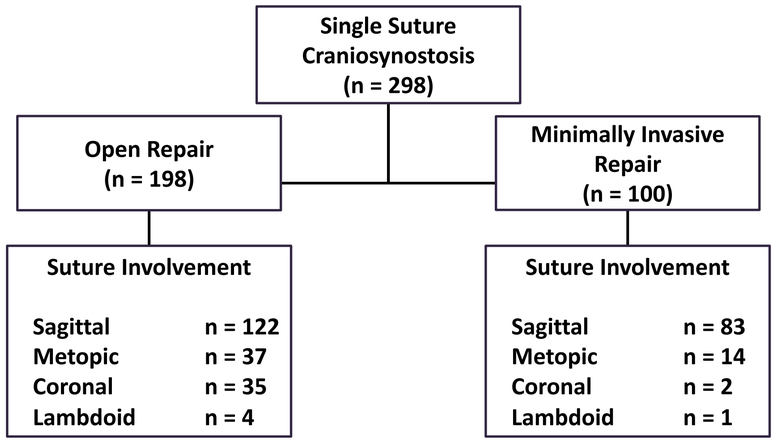


**Table 2. Clinical variables and in-hospital complications in open versus minimally invasive repair**

| Variable | Open Repair | Minimally Invasive Repair | P-value |
|---|---|---|---|
| **Age (months)** | 7.7 | 3.6 | **< 0.001** |
| **Weight (kg)** | 8.0 | 6.3 | **< 0.001** |
| **Operative time (minutes)** | 304 | 186 | **< 0.001** |
| **Anesthesia time (minutes)** | 327 | 194 | **< 0.001** |
| **Length of stay (days)** | 3.5 | 1.9 | **< 0.001** |
| Complications | | | |
| Hematoma | 2 | 1 | 1 |
| Hemorrhage | 2 | 1 | 1 |
| Infection | 4 | 0 | 0.15 |
| Wound dehiscence | 7 | 0 | 0.05 |
| **CSF leak** | 8 | 0 | **0.04** |
| Increased ICP | 0 | 0 | 1 |
| Dural tear | 18 | 4 | 0.11 |
| Return to OR | 10 | 1 | 0.08 |

**Table 3. Average blood transfusion volume and postoperative opioid administration in open versus minimally invasive repair from 2007-2022 and 2019-2022**

| Variable | 2007-2022 Open Repair | 2007-2022 Minimally Invasive Repair | P-value |
|---|---|---|---|
| Blood transfusion (mL/kg) | 27.6 | 24 | 0.16 |
| **Opioid administration (mg/kg)** | 1.22 | 0.73 | **< 0.001** |

| Variable | 2019-2022 Open Repair | 2019-2022 Minimally Invasive Repair | P-value |
|---|---|---|---|
| **Blood transfusion (mL/kg)** | 19.0 | 7.3 | **< 0.001** |
| **Opioid administration (mg/kg)** | 1.39 | 0.37 | **< 0.001** |

## Conclusions

The average operative time, anesthesia time, and length of stay was longer in open repairs. Complications were similar between groups.

Opioid requirements were less in minimally invasive repairs in recent years.

While the threshold for blood transfusion is highly variable, blood transfusion volume was less in minimally invasive repairs in recent years.

As early screening and diagnosis of craniofacial abnormalities is becoming more common, physicians have increasing opportunities to intervene with a less morbid surgical technique.

## References

1. Pain Management Education at UCSF. Calculation of Oral Morphine Equivalents (OME). Available at: https://pain.ucsf.edu/opioid-analgesics/calculation-oral-morphine-equivalents-ome. Accessed January 1, 2024.