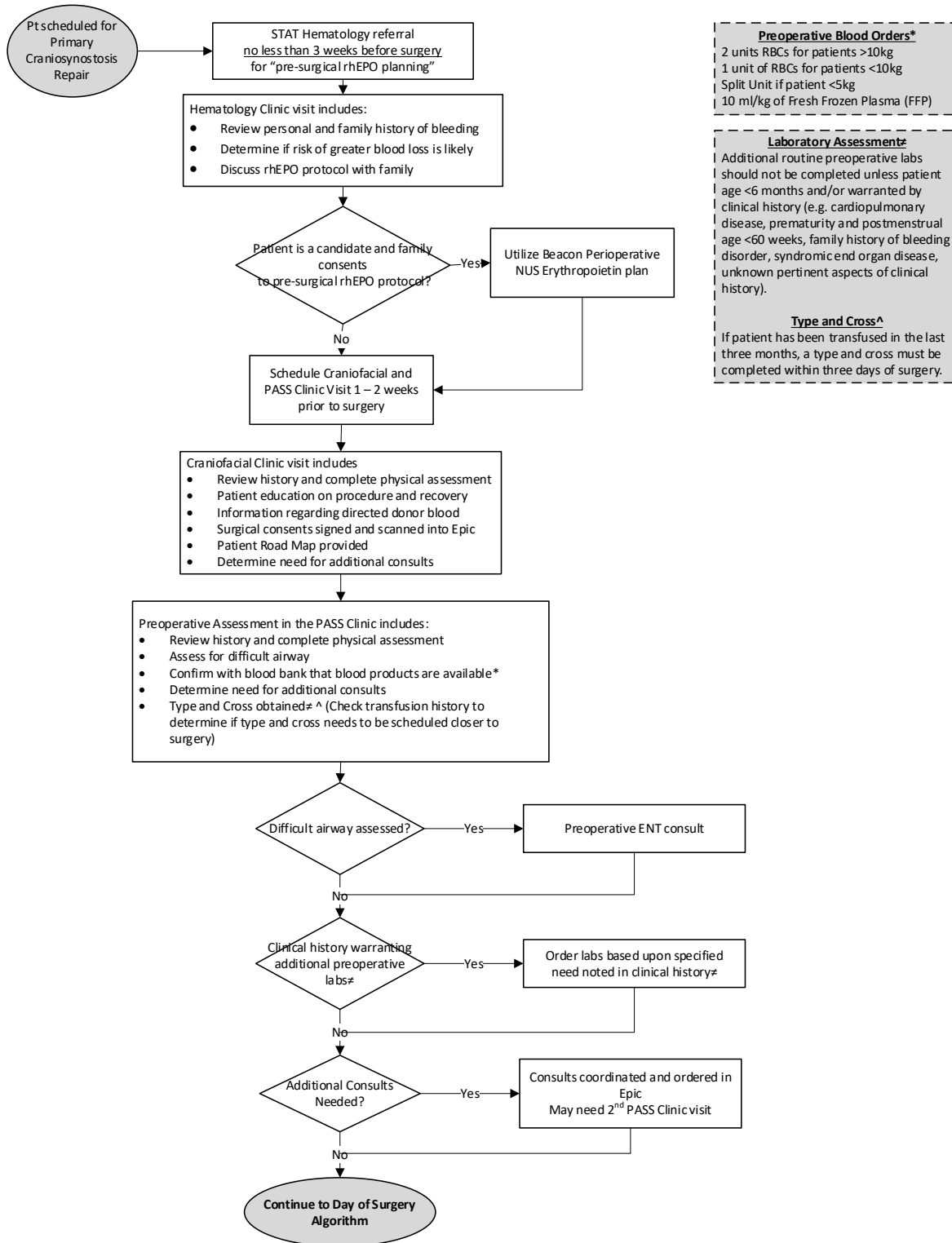


**TEXAS CHILDREN'S HOSPITAL
EVIDENCE-BASED OUTCOMES CENTER**

**Preoperative Management of Patients Receiving Primary Craniosynostosis Repair
Evidence-Informed Pathway**



Preoperative Blood Orders*
2 units RBCs for patients >10kg
1 unit of RBCs for patients <10kg
Split Unit if patient <5kg
10 ml/kg of Fresh Frozen Plasma (FFP)

Laboratory Assessment
Additional routine preoperative labs should not be completed unless patient age <6 months and/or warranted by clinical history (e.g. cardiopulmonary disease, prematurity and postmenstrual age <60 weeks, family history of bleeding disorder, syndromic and organ disease, unknown pertinent aspects of clinical history).

Type and Cross^
If patient has been transfused in the last three months, a type and cross must be completed within three days of surgery.

TEXAS CHILDREN'S HOSPITAL
EVIDENCE-BASED OUTCOMES CENTER

Day of Surgery Management of Patients Receiving Primary Craniosynostosis Repair
 Evidence-Informed Pathway

Tranexamic Acid
 - Tranexamic acid or aminocaproic acid should be used in patients who are undergoing procedures with high levels of anticipated blood loss such as craniofacial procedures.
 - Dose tranexamic acid at a loading dose of 10 mg/kg IV over 15 minutes prior to incision, followed by 1 - 2 mg/kg/hr until skin closure.
 - See Blood Transfusions Guideline for additional evidence of this topic.

Blood Product Administration‡
 Blood products should be administered in the following situations:
 (1) Once **two** lab values are out of range **OR** one abnormal lab value **and** active bleeding.
 (2) Hemodynamic instability as determined by the operative team

Directed Donor Blood‡
 For patients with directed donor blood, give whole blood at 20 ml/kg then administer platelets at 5 ml/kg

Day of Surgery Assessment completed by Admitting Nurse
 Notify Anesthesia of any abnormalities*

Verify blood product availability
 Retrieve Blood Bank Lab STAT Pack

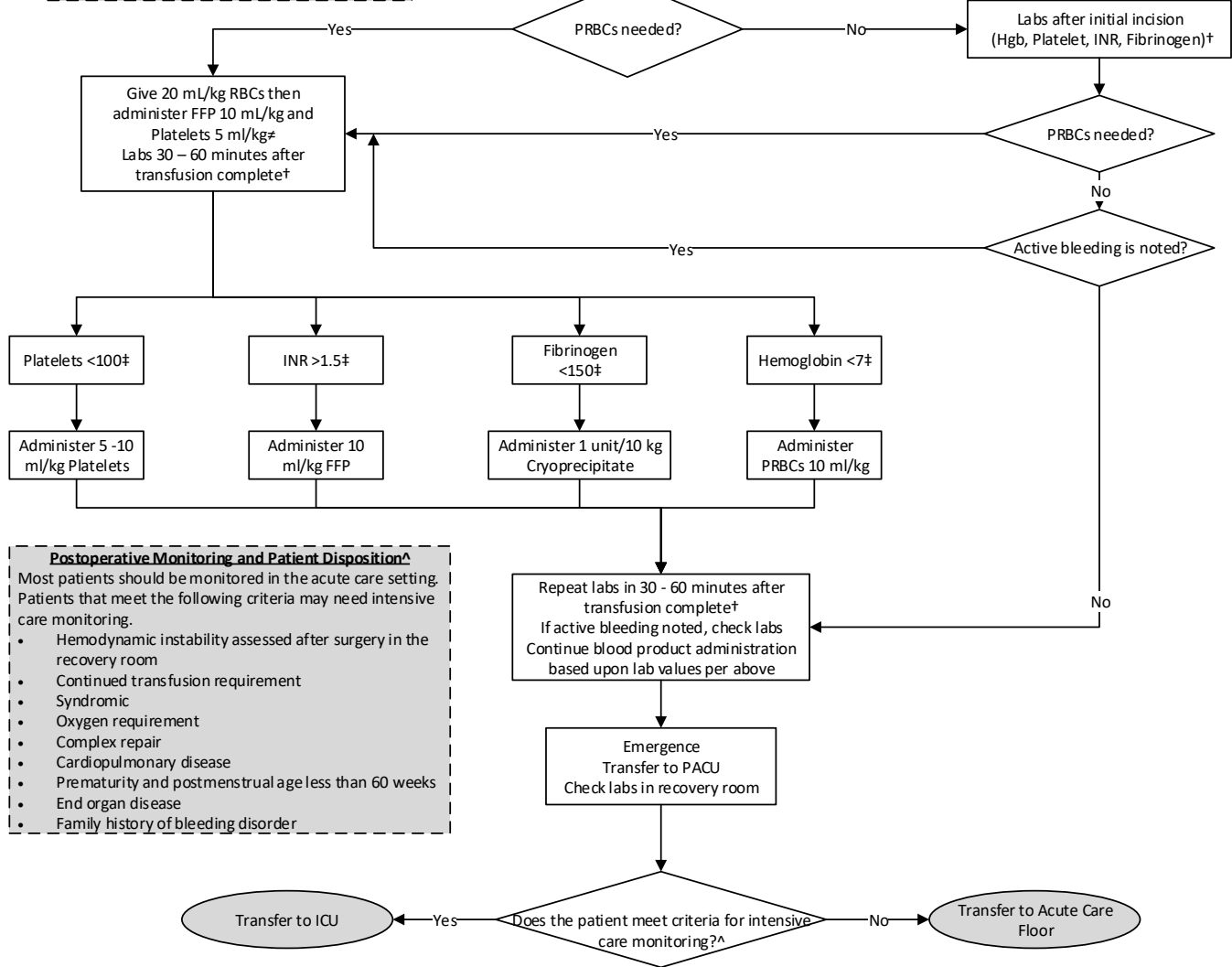
Preoperative Huddle
 Topics of discussion
 • Positioning
 • Postoperative disposition (Request PICU bed if needed)
 • Challenges Anticipated

Anesthesia induction
 Surgical Antibiotic Prophylaxis
 Baseline labs (Hgb, Platelet, INR, Fibrinogen)†

Surgery Cancellation Criteria*
 Active upper respiratory infection
 NPO violations
 Active infections
 Fever within the last 24 hours
 Emesis within the last 24 hours

Intraoperative Fluid Replacement
 - Lactated Ringer's or Plasmalyte should be used for intraoperative fluid replacement.
 - Albumin should be considered for patients with hypotension, hypovolemia and/or hemodynamic instability (e.g. pulse pressure variation of 10-12% on arterial line.)

Notify pathologist that labs are being sent for craniosynostosis patient†



Critical Points of Evidence

Evidence Supports

- Post-operative monitoring for patients <2 years of age receiving a primary repair for non-syndromic craniosynostosis should be provided in the acute care setting and include continuous cardiac and pulse oximetry monitoring, hematocrit level within 12-24 hours of postoperative care based on procedure type, and monitoring of drain output every four hours. Patients meeting the requirements below should be monitored in the intensive care unit postoperatively.⁽¹⁻⁶⁾ – Strong recommendation, Low quality evidence
 - Hemodynamic instability assessed after surgery in the recovery room
 - Continued transfusion requirement
 - Syndromic
 - Oxygen requirement
 - Complex repair
 - Cardiopulmonary disease
 - Prematurity and postmenstrual age less than 60 weeks
 - End organ disease
 - Family history of bleeding disorder
- Lactated ringer's or Plasmalyte should be used for intraoperative fluid replacement. Albumin should be considered for patients with hypotension, hypovolemia and/or hemodynamic instability (e.g. pulse pressure variation 10-12% on arterial line)⁽⁷⁻¹³⁾ – Strong recommendation, moderate quality evidence
- The use of a Goal Directed Transfusion Pathway should be employed to decrease blood product transfusion in patients with craniosynostosis repair.⁽¹³⁻²²⁾ – Strong recommendation, low quality evidence
- A type and cross should be obtained on patients scheduled for craniosynostosis repair. Additional routine preoperative labs should not be completed unless patient age <6 months and/or warranted by clinical history (e.g. cardiopulmonary disease, prematurity and postmenstrual age less than 60 weeks, family history of bleeding disorder, syndromic, end organ disease, unknown pertinent aspects of clinical history).^(4,23-31) – Strong recommendation, very low quality evidence
- An alternative transfusion strategy of 2:1 ratio of red blood cells (RBCs) and fresh frozen plasma (FFP) should be administered to perioperative craniosynostosis patients requiring blood products. (For every 20 mL/kg of RBCs, a dose of 10 ml/kg of FFP and 5 ml/kg of platelets should be given. For patients with directed donor blood, whole blood should be administered and once a transfusion amount of 20 ml/kg is reached give 5 ml/kg of platelets.)⁽³²⁻³⁷⁾ – Strong recommendation, low quality evidence

Evidence Lacking/Inconclusive

- Transfusions of FFP, Platelets, Cryoprecipitate and/or Fibrinogen should be based upon abnormal lab values and active bleeding. Blood product administration should be administered as noted below once two laboratory values are abnormal or there is active bleeding with one abnormal lab value.⁽³⁶⁻³⁸⁾ – Consensus recommendation
 - Platelets <100 then give 5 – 10 ml/kg Platelets
 - INR >1.5 give 10 ml/kg FFP
 - Fibrinogen < 150 give 1 unit/10 kg Cryoprecipitate**Remarks:** Laboratory values should be rechecked after blood product administration to evaluate if additional blood product is necessary.
- The use of cell saver to decrease the rate of transfusion.^(36,37,39-43) – Unable to make a recommendation.
Remarks: More information is needed to determine if cell saver is an appropriate intervention for use in this population as some hemostatic agents used during surgery may be incompatible with the use of this equipment.
- Recombinant human erythropoietin (rhEPO) has been used to reduce the need for blood transfusion in pediatric open heart surgery, spinal surgery and craniofacial surgeries. Studies of children undergoing craniosynostosis surgery have successfully demonstrated that it reduces the rate of transfusion in these patients.⁽⁴³⁻⁴⁹⁾
Remarks: See [S-20210039 Perioperative Erythropoietin & Iron Supplementation for Craniosynostosis Repair](#)
[TXCH Best Current Practice Standard](#)

Evidence Against

- Preoperative vitamin K should not be used to decrease the rate of transfusion in perioperative craniosynostosis patients.⁽⁵⁰⁾ – Strong recommendation, low quality evidence
- Controlled hypotension should not be used to decrease the rate of transfusion in perioperative patients receiving craniosynostosis patients.^(36,51) – Strong recommendation, moderate quality evidence
- Acute normovolemic hemodilution should not be routinely used to decrease the rate of transfusion in patients receiving perioperative craniosynostosis patients.^(36,52) – Strong recommendation, low quality evidence

References

1. Goobie, S., Zurakowski, D., Proctor, M., Meara, J., Meier, P., et al. (2015). Predictors of clinically significant postoperative events after open craniostylosis surgery. *Anesthesiology*, 122, 1021-1032.
2. McIntyre, J., Gosman, A., Meltzer, H., Levy, M., & Cohen, S. (2015). Clinical protocol and 15 year experience of caring for postoperative craniostylosis patients on the ward. *Plastic and Reconstructive Surgery*, 136(4 Suppl), 42.
3. Seruya, M., Sauerhammer, T., Basci, D., Rogers, G., Boyajian, M., et al. (2013). Analysis of routine intensive care unit admission following fronto-orbital advancement for craniostylosis. *Plastic and Reconstructive Surgery*, 131(4), 582e-588e.
4. Seattle Children's Hospital. (2014). Craniostylosis. Accessed August 30, 2016 from <http://www.seattlechildrens.org/healthcare-professionals/gateway/pathways/>.
5. McCarthy, J., Warren, S., Bernstein, J., Burnett, W., Cunningham, M., et al. (2012). Parameters of Care for Craniostylosis. *The Cleft Palate – Craniofacial Journal*, 49 Suppl: 1S-24S.
6. Working Group on Craniostylosis. (2015). Guidelines for Care for Patients With a Diagnosis of Craniostylosis. Accessed August 30, 2016 from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4568904/pdf/jcrsu-26-1735.pdf>.
7. Song, J., Shim, J., Kim, N., Jang, J., & Kwak, Y. (2015). The effect of 0.9% saline versus plasmalyte on coagulation in patients undergoing lumbar spinal surgery: A randomized controlled trial. *International Journal of Surgery*, 20, 128-134.
8. Waters, J., Gottlieb, A., Schoenwald, P., Popovich, M., Sprung, J., et al. Normal saline versus lactated ringer's solution for intraoperative fluid management in patients undergoing abdominal aortic aneurysm repair: An outcome study. *Anesthesia & Analgesia*, 93, 817-822.
9. Shaw, A., Bagshaw, S., Goldstein, S., Scherer, L., Duan, M., et al. (2012). Major complications, mortality, and resource utilization after open abdominal surgery. *Annals of Surgery*, 255(5), 821-829.
10. Allison, E., Evans, R., Wall, S., Johnson, D., & Das, S. (2015). Postoperative hypoalbuminemia following surgery related to craniostylosis. *Pediatric Anesthesia*, 25, 924-928.
11. Hadimioglu, N., Saadawy, I., Saglam, T., Ertug, Z., & Dinckan, A. (2008). The effect of different crystalloid solutions on acid-base balance and early kidney function after kidney transplantation. *Anesthesia & Analgesia*, 107, 264-269.
12. Hosking, J., Dowling, K., & Costi, D. (2012). Intraoperative and postoperative hyponatremia with craniostylosis surgery. *Pediatric Anesthesia*, 22, 654-660.
13. Zunini, G., Rando, K., & Cox, R. (2011). Fluid replacement in craniofacial pediatric surgery: Normal saline or Ringer's lactate? *The Journal of Craniofacial Surgery*, 22(4), 1370-1374.
14. Cui, Y., Hei, F., Long, C., Feng, Z., Zhao, J., et al. (2010). Perioperative monitoring of thromboelastograph on blood protection and recovery for severely cyanotic patients undergoing complex cardiac surgery. *Artificial Organs*, 34(11), 955-960.
15. Faraoni, D., Willems, A., Romlin, B., Belisle, S., & Linden, P. (2015). Development of a specific algorithm to guide haemostatic therapy in children undergoing cardiac surgery. *European Journal of Anaesthesiology*, 32, 320-329.
16. Haas, T., Goobie, S., Spielmann, N., Weiss, M., & Schmutge, M. (2014). Improvements in patient blood management for pediatric craniostylosis surgery using a ROTEM – assisted strategy – feasibility and costs. *Pediatric Anesthesia*, 24, 774-780.
17. Kane, L., Woodward, C., Husain, S., & Frei-Jones, M. (2016). Thromboelastography – does it impact blood component transfusion in pediatric heart surgery? *Journal of Surgical Research*, 200, 21-27.
18. Nakayama, Y., Nakajima, Y., Tanaka, K., Sessler, D., Maeda, S. (2015). Thromboelastometry-guided intraoperative haemostatic management reduces bleeding and red cell transfusion after pediatric cardiac surgery. *British Journal of Anaesthesia*, 114(1), 91-102.
19. Nguyen, T., Hill, S., Austin, T., Whitney, G., Wellons, J., et al. (2015). Use of blood-sparing surgical techniques and transfusion algorithms: Association with decreased blood administration in children undergoing primary open craniostylosis repair. *Journal of Neurosurgery: Pediatrics*, 16, 556-563.
20. Romlin, B., Wahlander, H., Berggren, H., et al. (2011). Intraoperative thromboelastometry is associated with reduced transfusion prevalence in pediatric cardiac surgery. *Anesthesia & Analgesia*, 112, 30-36.
21. Whitney, G., Daves, S., Hughes, A., et al. (2013). Implementation of a transfusion algorithm to reduce blood product utilization in pediatric cardiac surgery. *Pediatric Anesthesia*, 23, 639-646.
22. Wikkelso, A., Wetterslev, J., Moller, A., & Afshari, A. Thromboelastography (TEG) or thromboelastometry (ROTEM) to monitor haemostatic treatment versus usual care in adults or children with bleeding. *Cochrane Database of Systematic Reviews* 2016, Issue 8. Art. No.: CD007871.
23. Adenekan, A., Faponle, A., & Oginni, F. (2012). Pre-operative haematological investigations in paediatric orofacial cleft repair: Any relevance to management outcome? *African Journal of Paediatric Surgery*, 9(1), 52-56.
24. Almesbah, F., Mandiwanza, T., Kaliaperumal, C., Kaliaperumal, C., Caird, J., et al. (2013). Routine preoperative blood testing in pediatric neurosurgery. *J Neurosurg Pediatrics*, 12, 615-621.
25. Eley, K., & Goodacre, T. (2010). Are routine pre-operative blood tests required in children undergoing primary cleft lip and/or palate repair? *Journal of Plastic, Reconstructive & Aesthetic Surgery*, 63, 926-929.
26. Fernandez, A., Cronin, J., Greenberg, R., Heitmiller, E. (2014). Pediatric preoperative blood ordering: when is a type and screen or crossmatch really needed? *Pediatric Anesthesia*, 24, 146-150.
27. Samkova, A., Blatny, J., Fiamoli, V., Dulicek, P., & Parizkova, E. (2012). Significance and causes of abnormal preoperative coagulation test results in children. *Haemophilia*, 18, e297-e301.
28. Yang, M., Singhal, A., Au, N., & Hengel, R. (2015). Impact of preoperative laboratory investigation and blood cross-match on clinical management of pediatric neurosurgical patients. *Childs Nerv Syst*, 31, 533-539.
29. American Society of Anesthesiology. (2012). Practice Advisory for Preanesthesia Evaluation. Accessed March 29, 2017 from <http://anesthesiology.pubs.asahq.org/article.aspx?articleid=2443414>.
30. National Institute for Health and Care Excellence. (2016). Routine preoperative tests for elective surgery. Accessed March 29, 2017 from <https://www.nice.org.uk/guidance/ng45/evidence>.

31. Agency of Healthcare Research and Quality. (2014) Benefits and harms of routine perioperative testing: Comparative effectiveness. Accessed March 29, 2017 from https://www.ncbi.nlm.nih.gov/books/NBK184821/pdf/Bookshelf_NBK184821.pdf.
32. Cortellazzi, P., Caldiroli, D., Lamperti, M., Bricchi, M., Valentini, L. (2009). Early transfusion and crystalloid infusion strategy in infants undergoing cranioplasty surgery. *Pediatric Anesthesia*, 19, 1251.
33. Pieters, B., Conley, L., Weiford, J., Hamilton, M., Wicklund, B., et al. (2015). Prophylactic versus reactive transfusion of thawed plasma in patients undergoing surgical repair of craniosynostosis: A randomized clinical trial. *Pediatric Anesthesia*, 25, 279-287.
34. Stricker, P., Fiadjo, J., Davis, A., Sussman, E., Burgess, B., et al. (2011). Reconstituted blood reduces blood donor exposures in children undergoing craniofacial reconstruction surgery, *Pediatric Anesthesia*, 21, 54-61.
35. Thottathil, P., Sesok-Pizzini, D., Taylor, J., Fiadjo, J., Vincent, A., et al. (2017). Whole blood in pediatric craniofacial reconstruction surgery. *The Journal of Craniofacial Surgery*, 28(5), 1175-1178.
36. National Blood Authority of Australia. (2015). Patient Blood Management Guidelines: Neonatal and pediatrics. Accessed June 27, 2017 from https://www.blood.gov.au/system/files/14523_NBA%20Module%206%20Neonat_Paediatrics_internals_5_FA_updated_15Feb2017.pdf.
37. National Institute of Clinical Excellence. (2015). Blood Transfusions. Accessed June 27, 2017 from <https://www.nice.org.uk/guidance/ng24/evidence>.
38. American Association of Blood Banks. (2015). Platelet transfusions: A clinical guideline from the AABB. Accessed June 27, 2017 from <http://annals.org/aim/article/1930861/platelet-transfusion-clinical-practice-guideline-from-aabb>.
39. Dahmani, S., Orliaguet, G., Meyer, P., Blanot, S., Renier, D., et al. (2000). Perioperative blood salvage during surgical correction of craniosynostosis in infants. *British Journal of Anaesthesia*, 85(4), 550-505.
40. Deva, A., Hopper, R., Landecker, A., Flores, R., Weiner, H., et al. (2002). The use of intraoperative autotransfusion during cranial vault remodeling for craniosynostosis. *Plastic and Reconstructive Surgery*, 109(1), 58-63.
41. Duncan, C., Richardson, D., Thiruchelvam, J., Shong, D., & Grogan, J. (2008). Reducing blood loss in synostosis surgery: The Liverpool experience. *The Journal of Craniofacial Surgery*, 19(5), 1424-1430.
42. Fearon, J. (2004). Reducing allogeneic blood transfusions during pediatric cranial vault surgical procedures: A prospective analysis of blood recycling. *Plastic and Reconstructive Surgery*, 113(4), 1126-1130.
43. Krajewski, K., Ashley, R., Pung, N., Wald, S., Lazareff, J., et al. (2008). Successful blood conservation during craniosynostosis correction with dual therapy using Procrit and cell saver. *The Journal of Craniofacial Surgery*, 19(1), 101-105.
44. Fearon, J., & Weinthal, J. (2002). The use of recombinant erythropoietin in the reduction of blood transfusion rates in craniosynostosis repair in infants and children. *Plast Reconstr Surg*, 109, 2190-2196.
45. Meara, J., Smith, E., Harshbarger, R., Farlo, J., Matar, M., et al. (2005). Blood-conservation techniques in craniofacial surgery. *Annals of Plastic Surgery*, 54(5), 525-529.
46. Meneghini, L., Zadra, N., Aneloni, V., Metrangolo, S., Faggini, R., et al. (2003). Erythropoietin therapy and acute preoperative normovolemic haemodilution in infants undergoing craniosynostosis surgery. *Paediatric Anaesthesia*, 13, 392-396.
47. Vega, R., Lyon, C., Kierce, J., Tye, G., Ritter, A., et al. (2014). Minimizing transfusion requirements for children undergoing craniosynostosis repair: The CHoR protocol. *J Neurosurg Pediatrics*, 14, 190-195.3.
48. Velardi F, Di Chirico A, Di Rocco C, et al. "No allogeneic blood transfusion" protocol for the surgical correction of craniosynostoses. II. Clinical application. *Child's nervous system : ChNS : official journal of the International Society for Pediatric Neurosurgery*. Dec 1998;14(12):732-739; discussion 740-731.
49. Krajewski K, Ashley RK, Pung N, et al. Successful blood conservation during craniosynostotic correction with dual therapy using procrit and cell saver. *The Journal of craniofacial surgery*. Jan 2008;19(1):101-105.
50. Kicker, J., Wilson, D., Kelly, R., Jane, J., Roberts, S., et al. (2014). Impact of supplemental vitamin K administration on postoperative blood component requirements after craniosynostosis repair: A prospective, placebo-controlled, randomized, blinded study. *The Journal of Craniofacial Surgery*, 25(1), 154-159.
51. Fearon, J., Cook, T., & Herbert, M. (2014). Effects of hypotensive anesthesia on blood transfusion rates in craniosynostosis corrections. *Plastic and Reconstructive Surgery*, 133, 1133-1136.
52. Hans, P., Collin, V., Bonhomme, V., Damas, F., Born, J., et al. (2000). Evaluation of acute normovolemic hemodilution for surgical repair of craniosynostosis. *Journal of Neurosurgical Anesthesiology*, 12(1), 33-36.

Clinical Standards Preparation

This clinical standard was prepared by the Evidence-Based Outcomes Center (EBOC) team in collaboration with content experts at Texas Children's Hospital. Development of this clinical standard supports the TCH Quality and Patient Safety Program initiative to promote clinical standards and outcomes that build a culture of quality and safety within the organization.

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No relevant financial or intellectual conflicts to report.

Development Process

This clinical standard was developed using the process outlined in the EBOC Manual. The literature appraisal documents the following steps:

1. Review Preparation
 - PICO questions established
 - Evidence search confirmed with content experts
2. Review of Existing Internal and External Guidelines
 - Parameters of Care for Craniosynostosis, National Foundation of Facial Reconstruction; Guideline for Care of Patients with the Diagnosis of Craniosynostosis, Working Group of Craniosynostosis; Craniosynostosis, Seattle Children's Hospital; An Updated Report by the American Society of Anesthesiologists Task Force on Preanesthesia Evaluation, Practice Advisory for Preanesthesia Evaluation; Preoperative tests (update) – Routine preoperative tests for elective surgery, National Institute for Health and Care Excellence; Benefits and Harms of Routine Preoperative Testing: Comparative Effectiveness, Agency of Healthcare Research and Quality; Blood Transfusions, National Institute of Clinical Excellence; Patient Blood Management Guidelines: Neonatal & Pediatrics, National Blood Authority of Australia; Platelet Transfusion: A Clinical Guideline from the AABB, AABB
3. Literature Review of Relevant Evidence
 - Searched: PubMed, Cochrane Collaboration, CINAHL, Google Scholar
4. Critically Analyze the Evidence
 - 10 randomized **controlled** trials, and 22 nonrandomized studies, as applicable
5. Summarize the Evidence
 - Materials used in the development of the guideline, evidence summary, and order sets are maintained in a craniosynostosis repair evidence-based review manual within EBOC.

Evaluating the Quality of the Evidence

Published clinical guidelines were evaluated for this review using the **AGREE II** criteria. The summary of these guidelines are included in the literature appraisal. AGREE II criteria evaluate Guideline Scope and Purpose, Stakeholder Involvement, Rigor of Development, Clarity and Presentation, Applicability, and Editorial Independence using a 4-point Likert scale. The higher the score, the more comprehensive the guideline.

This clinical standard specifically summarizes the evidence *in support of* or *against* specific interventions and identifies where evidence is *lacking/inconclusive*. The following categories describe how research findings provide support for treatment interventions. "**Evidence Supports**" provides clear evidence that the benefits of the intervention exceed harm.

"**Evidence Against**" provides clear evidence that the intervention is likely to be ineffective or that it is harmful.

"**Evidence Lacking/Inconclusive**" indicates there is currently insufficient data or inadequate data to support or refute a specific intervention.

The **GRADE** criteria were utilized to evaluate the body of evidence used to make practice recommendations. The table below defines how the quality of the evidence is rated and how a strong versus weak recommendation is established. The literature appraisal reflects the critical points of evidence.

Recommendation	
STRONG	Desirable effects clearly outweigh undesirable effects or vice versa
WEAK	Desirable effects closely balanced with undesirable effects
Quality	Type of Evidence
High	Consistent evidence from well-performed RCTs or exceptionally strong evidence from unbiased observational studies
Moderate	Evidence from RCTs with important limitations (e.g., inconsistent results, methodological flaws, indirect evidence, or imprecise results) or unusually strong evidence from unbiased observational studies
Low	Evidence for at least 1 critical outcome from observational studies, RCTs with serious flaws or indirect evidence
Very Low	Evidence for at least 1 critical outcome from unsystematic clinical observations or very indirect evidence

Recommendations

Practice recommendations were directed by the existing evidence and consensus amongst the content experts. Patient and family preferences were included when possible. The Content Expert Team and EBOC team remain aware of the controversies craniosynostosis repair for children. When evidence is lacking, options in care are provided in the clinical standard and the accompanying order sets (if applicable).

Approval Process

Clinical standards are reviewed and approved by hospital committees as deemed appropriate for its intended use. Clinical standards are reviewed as necessary within EBOC at Texas Children's Hospital. Content Expert Teams are involved with every review and update.

Disclaimer

Practice recommendations are based upon the evidence available at the time the clinical standard was developed. Clinical standards (guidelines, summaries, or pathways) do not set out the standard of care and are not intended to be used to dictate a course of care. Each physician/practitioner should use his or her independent judgment in the management of any specific patient and is responsible, in consultation with the patient and/or the patient's family, to make the ultimate judgment regarding care.

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Version History

Date	Action	Comments
Dec 2017	Pathway Development	
Feb 2018	Revision	TXA Dosing Change
Mar 2022	Update	Pre-op algorithm change and rhEPO update

Related Documents

[Craniosynostosis Literature Appraisal Document](#)