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Tranexamic Acid Use:

Development of a Pediatric Protocol for the Operating Room

Jennifer Aumann BSN, RN

Introduction of the Problem

According to the National Quality Forum (2017), there were 51.4 million inpatient procedures, including adult and pediatric, in nonfederal hospitals within the United States performed in the year 2010, and this rate continues to increase. Bleeding is a risk associated with every surgery. The goal is to limit blood loss and maintain hemodynamic stability. A systematic literature review completed by Ker, Kiriya, Perel, Edwards, Shakur, and Roberts (2012) estimated 400,000 worldwide, in-hospital deaths due to bleeding each year. Historically, blood transfusions were the treatment for excessive surgical blood loss. Transfusion of blood products have associated risks: infection, volume overload, and immunological reactions (Fraser, Porte, Kouides, & Lukes, 2008; Porte & Leebeek, 2002; Yuan, Zhao, & Xu, 2016). Tranexamic acid (TXA) use decreases the number of required blood transfusions thereby reducing transfusion-related morbidity (Lei, Xie, Xu, Xie, Huang, & Pei, 2017; Li, Sun, Luo, & Zhang, 2016; Porte & Leebeek, 2002; Sui, Ye, & Yang, 2016; Yuan, Zhao, & Xu, 2017).

In 2018, a tertiary care center in central Illinois performed 2,041 pediatric surgical cases. These cases included neonates to twelve years of age. The risk of excessive surgical bleeding and complications from required blood transfusions can be limited with TXA use. Therefore, the purpose of this project was to improve pediatric outcomes undergoing non-cardiac surgery in this tertiary care center in central Illinois through the development of a TXA infusion protocol. TXA was being under-utilized and only administered when the surgeon requested administration.

There was not an infusion protocol in place to follow, thus, providing clinical relevance for this project.

Literature Review

The pediatric population represents unique challenges during surgery due to differences in anatomy and physiology when compared to the adult population. Pediatric cardiac, spinal, orthopedic, and craniofacial surgeries are associated with large volumes of perioperative blood loss (Basta, Stricker, & Taylor, 2012; Goobie et al., 2013; Goobie et al., 2017; Junejo et al., 2018; Majid et al., 2015; Ng et al., 2015; Phi et al., 2014; Rakic et al., 2015; Sui et al., 2016). Interventions to decrease blood loss are essential to improve surgical outcomes.

TXA is an antifibrinolytic used for prophylaxis prevention and treatment of bleeding caused by local or generalized hyperfibrinolysis (Majid, Alshryda, Somanchi, Morakis, & Foster, 2015; Pabinger, Fries, Schochl, Streif, & Toller, 2017; Rakic et al., 2016). TXA has been studied in the adult population with proven advantages for hemorrhagic trauma, which has led to its prophylactic use in major surgical procedures (Fraser et al., 2008; Ker et al., 2012; Nishijima et al., 2016). Although there are fewer studies regarding the pediatric population, prophylactic use of TXA in pediatric cardiac, craniofacial, and orthopedic surgeries is gaining popularity related to the results in the adult population (Goobie et al., 2013; Goobie et al., 2017; Majid et al., 2015; Nishijima et al., 2016; Ng, Chau, Hung, Hui, Lam, & Cheng, 2015). Surgical trauma triggers the release of tPA from the endothelium, resulting in activation of plasmin and, thus, the potential for significant bleeding (Nishijima et al., 2018; Roberts et al., 2017). The antifibrinolytic effects of TXA administration have improved outcomes in patients with bleeding, or at risk of bleeding, with minimum side effects (Dunn & Goa, 1999; Fraser et al., 2008; Henry et al., 2011; Ker et al., 2012; Nishijima et al., 2016; Pabinger et al., 2017; Robert et al., 2017).). Decreased hemorrhage

leads to improved hemodynamic stability, fewer transfusion requirements, and overall improved surgical outcomes in both adult and pediatric surgical procedures.

Project Methods

The development of this intraoperative TXA protocol utilized a nonexperimental design to create and introduce an evidence-based protocol for adoption by a tertiary care center in central Illinois. This project incorporated evidence-based findings related to pediatric treatment with TXA for major non-cardiac surgeries. The evidence within the extensive literature review was used to develop a TXA protocol. The protocol serves as a guide for anesthesia providers responsible for treating pediatric patients, age 18 or younger, undergoing surgery to decrease intraoperative blood loss and the need for a blood transfusion by the administration of TXA.

Following approval from the project committee, the evidence-based TXA infusion protocol was presented as a PowerPoint presentation in this tertiary care center in central Illinois. Those in attendance included staff from the anesthesiology and pharmacy departments. After the presentation, those in attendance evaluated the presentation and protocol using a short questionnaire. The survey included demographic information, yes/no questions, and a section for optional comments regarding areas for improvement and any anticipated barriers for implementation of the protocol. The completion of the survey was voluntary and anonymous. The PowerPoint was also provided to anesthesia staff unable to attend, although no questionnaire was provided. The results of surveys completed without attendance at the presentation might hinder the full understanding of the entirety of the information supplied at the oral presentation.

This project was declared exempt from the Southern Illinois University Edwardsville Institutional Review Board and was approved by the Research Review Committee at the tertiary

care center. The project was a quality improvement design and did not include patient information or patient interaction. Also, this project posed minimal risks, such as time inconvenience, to those who attended the presentation and completed the post-presentation survey.

Evaluation

There were ten staff members present for the presentation. The staff that attended included an MDA, several CRNAs, and a few pharmacists. The years of professional experience varied from three to twenty plus years, with the average staff experience falling within the category of 11 to 15 years. All staff in attendance had some basic knowledge of TXA before the presentation. All the participants found the protocol easy to follow and agreed that the protocol provided enough knowledge to administer TXA appropriately to the pediatric population undergoing major non-cardiac surgery. Ninety percent of participants plan to administer TXA according to the protocol based on the presentation. The one participant that did not intend to administer TXA was a pharmacist, and they considered themselves as nonapplicable since they do not administer medications.

There were a few barriers provided by the pharmacist group, that could be addressed with policy change in the facility. Another limitation is the small sample size. There were six anesthesia staff members present for the presentation, which is approximately 11% of the anesthesia staff that provides care at the facility. From the survey results reported by the anesthesia providers that attended the presentation, who are the professionals administering TXA, there seems to be no barrier to implementation of the protocol.

Impact on Practice

Hospital costs continue to increase, and facilities are challenged to provide excellent patient care within a budget. The inclusion of a TXA protocol for pediatric surgeries with the possibility of significant blood loss can help provide excellent patient care while decreasing costs. This central Illinois facility is the only pediatric hospital in the area and is a level II pediatric trauma facility with neonatal and pediatric intensive care units. This facility provided surgical care to over two thousand neonatal/pediatric patients in 2018. Implementation of a TXA protocol at this facility will have an immediate impact on decreasing surgical blood loss, reducing the need for blood transfusions, reduce the length of hospital stay, and overall improve patient outcomes. According to the survey results, anesthesia and pharmacy staff members supported the implementation of the TXA protocol. Anesthesia staff has implemented the protocol for pediatric cases at risk for estimated blood loss >5ml/kg or significant blood loss. These surgeries include major spine, major abdominal, and craniotomies for tumor resection at this facility.

Conclusion

TXA is available for pediatric surgical use at this tertiary care center. Although before the presentation, there was not a protocol for use. With the development of an evidence-based protocol, there will be less surgical bleeding and improved outcomes in pediatric patients undergoing surgery at this central Illinois facility. This project helped to educate the healthcare providers on current evidence concerning the role of TXA and dosing for pediatric surgical patients. The protocol has been implemented for pediatric cases at risk of major blood loss. The staff are administering TXA for major spine, abdominal, and craniotomies for tumor resection. The inclusion of this protocol should have a positive impact on the care provided to pediatric surgical patients at this center. Recommendations for follow up could include a survey to

anesthesia staff regarding protocol use and chart review of major non-cardiac pediatric surgeries to enhance long-term change in practice.

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