

# Getting Closer to Optimizing the Prevention and Detection of VTE in Hospitalized Children

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Symptomatic venous thromboembolism (VTE) in the general hospitalized pediatric population is increasing and is the second most common serious hospital-acquired condition for patients in children's hospitals, causing significant harm and expense.<sup>1-3</sup> Unlike other hospital-acquired conditions in children and adult VTE,<sup>4</sup> however, there are no broadly accepted recommendations for the implementation of a standardized process of detection, prophylaxis, and treatment of VTE in hospitalized children.<sup>5</sup> In this issue of *Hospital Pediatrics*, Shaughnessy and colleagues report both on variable quality-improvement (QI) success in decreasing variability in risk screening<sup>6</sup> and in the detection of VTE events among hospitalized pediatric patients.<sup>7</sup>

We comment below first on the improvement lessons from a comparative intervention around VTE and current algorithms and then discuss the active surveillance approach for quickly identifying VTEs in hospitalized patients. Finally, we discuss how these 2 studies, taken together, can help us develop robust, population-based pediatric algorithms for preventing and addressing healthcare-acquired pediatric VTE.

## INCREASING THE RELIABILITY OF VTE SCREENING: ARE SOME SURGICAL MICROSYSTEMS BETTER THAN OTHERS?

In their first article in this issue, Shaughnessy et al<sup>6</sup> report on their variable success in significantly improving and sustaining the reliability of a VTE prophylaxis screening process<sup>8</sup> to 86% and 46% in hospitalized pediatric surgery and orthopedic patients, respectively. The authors found that in addition to leadership and engagement, linking to a computerized provider order entry system postoperatively was the most impactful approach to ensuring high reliability for completing VTE screening.

At first glance, this tale of variable success in these 2 surgical specialties seems to be a culture or ownership issue, with general surgery outperforming orthopedics in screening reliability. Setting aside the question of different populations and risk patterns, the lack of success in the orthopedics unit is a true QI opportunity to re-evaluate through plan-do-study-act cycles and choosing to adapt, adopt, or abandon a given intervention.<sup>9</sup> Because neither initiative achieved sustainable >90% reliability, despite extensive engagement and computerized provider order entry, and some 38% of orthopedic patients were over- or undertreated, it may be worth abandoning the labor-intensive interventions and instead revisiting the workflow for orthopedics by further engaging the frontline staff,

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including trainees and perioperative teams, to develop best solutions. Shaughnessy et al's<sup>6</sup> work suggests that the increased documented screening in orthopedics was often not high quality or concordant with appropriate prophylaxis. This finding is important as a balancing measure to forcing completion of an assessment without sufficient electronic support to guide and link with prophylaxis ordering.

### **DOES THE PROPOSED VTE BUNDLE BEING IMPLEMENTED ACTUALLY REDUCE VTE?**

The small sample size and rare event risk rate reported in the study<sup>6</sup> is underpowered to suggest the correlation of appropriate risk stratification and VTE events. In a recent review, Faustino and Raffini<sup>10</sup> point out that anticoagulation has not been proven to prevent the most common cause of hospital-associated VTE in children, catheter-associated thrombosis. Do the current risk stratification and prophylaxis algorithms make a difference for most hospitalized children, or is it over- or undertreatment?<sup>11</sup> Do the Faustino and Raffini<sup>10</sup> and Meier et al<sup>8</sup> algorithms, even if adopted at >90% reliability, actually reduce VTE universally?<sup>12</sup>

For hospitalized pediatric patients, we are thus left with a need to reduce the risk of VTE, which can cause postthrombotic syndrome, a chronic condition, superior vena cava syndrome, pulmonary embolism, renal insufficiency, ischemic events, and death. At the same time, we strive to reduce overuse, including the use of possibly unnecessary compression devices or pharmacologic anticoagulation. Further work in VTE risk prevention is clearly needed to ensure confidence in and focus on increasing the reliability of a bundle that is imperfect.<sup>13</sup>

### **REAL-TIME, SENSITIVE VTE DETECTION IS CRITICAL FOR BOTH LOCAL IMPROVEMENT AND ADVANCING THE EVIDENCE BASE**

In their second article in this issue, Shaughnessy et al<sup>7</sup> demonstrate that using vascular radiology reports for VTE surveillance had the highest (98%) likelihood of detecting healthcare-

associated VTE compared with resource-intensive chart review (30%) or lag time-heavy administrative coding (85%). Using radiology reports is a logical approach that meets QI goals of rapid detection to understand events and plan for prevention in an iterative fashion.

Although this approach is intuitive, it has surprisingly not yet been rigorously studied and reported in pediatrics. Therefore, this work is significant for 2 reasons. First, these findings support the development of a standard methodology that would help effectively compare rates at a national level and thereby help us understand which interventions (exposures) work best to prevent events (outcomes). Currently, inadequate, inconsistent, and delayed local reporting to national registries contributes to variability at the aggregate level, making robust inferences about correlation challenging in large databases and in national QI collaboratives, such as Solutions for Patient Safety (solutionsforpatientsafety.org).<sup>3</sup>

Second, this study suggests that the accuracy and timeliness of vascular radiology reports in identifying most pediatric VTE may merit incorporation into a global trigger tool as part of active surveillance.<sup>14</sup> The completion of a vascular venous study, especially if linked to a real-time electronic health record, would then merit review by a content expert.

There are a few small caveats to using this vascular radiology mechanism at both reporting and sensitivity levels. First, as a standardized, national reporting approach, there is inherent local interobserver variability in pediatric vascular study interpretation and a lack of consensus around whether asymptomatic VTE merits inclusion in rates. Health centers and national quality organizations may need to consider consistent definitions or templates to promote uniformity in reporting. Second, because VTE events may be detected through nonsonographic modalities (such as computed tomography), other trigger events (such as heparin ordering) may warrant inclusion so that these rare events are not missed. The authors accordingly call

for >1 detection modality to achieve highest sensitivity.

### **OVERALL IMPLICATIONS FOR VTE PREVENTION**

Combined, the 2 VTE studies reported here<sup>6,7</sup> could hasten our understanding of how to predict and prevent postoperative pediatric VTE in hospitalized children. In comparing VTE rates by using definitions and reporting modalities and then by fidelity to and types of systems-based interventions that focus on peri- and postoperative prevention, we may begin to understand which subpopulations and risk factors should be targeted and by which interventions. Only the combined numbers of a multisite hospital-engagement network,<sup>3</sup> perhaps complemented by the deep patient-specific repository of a thrombosis registry, can answer these questions, just as a similar collaboration did for pediatric central line-associated bloodstream infection prevention in 2011.<sup>15</sup>

For readers looking to decrease VTE risk at their own institutions, both studies in this issue<sup>6,7</sup> remind us to include the use of the simplest, most easily accessible, and semiautomated tools and processes to achieve meaningful results. Involving the most appropriate team members in the screening process (such as nurses, trainees, advanced practice providers, surgeons, hospitalists, pre- and perioperative teams, venous access teams, and hematologists) may also provide innovative interventions to reduce both harm and prophylaxis over- and underuse for hospitalized children.

### **HOSPITALISTS AS EFFECTIVE LEADERS FOR MULTIDISCIPLINARY HOSPITAL-ACQUIRED CONDITIONS**

Finally, VTE prevention and management has historically involved hematologists, pharmacists, surgeons, and nursing staff. The role of the pediatric hospitalist as the leader of a multidisciplinary QI effort suggests that pediatric hospitalists are uniquely poised at the intersection of multiple specialties, with skills in systems and process improvement. As surgical comanagement and consultation grows,

hospitalists have a continued opportunity to build on their collaborative and QI skills to make their hospitals safer for children, and we commend Shaughnessy and colleagues<sup>6,7</sup> for identifying and working to bridge this gap.

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