Original Article :

Incidence of Venous Thromboembolism in a Paediatric Population Undergoing Neurosurgical Intervention

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Abstract

Background and Aims:

Knowledge of incidence and prevention of venous thromboembolism (VTE) in pediatric patients who undergo neurosurgical procedures is limited when compared to their adult counterparts. Risk factors for developing venous thromboembolism in pediatric patients are also less defined. Multiple systematic reviews and meta-analyses have found that chemoprophylaxis is effective in the prevention of venous thromboembolism in adult populations. However, the use of chemoprophylaxis against venous thromboembolism in children varies according to size and age. The study aims to determine the incidence of venous thromboembolism following neurosurgical intervention among pediatric population.

Methods:

This is a retrospective study that included 273 pediatric patients who underwent 396 elective or emergency neurosurgical interventions involving brain or spine between 2016 and 2019 at King Abdulaziz University Hospital. We recorded frequency of imaging ordered to diagnose VTE (e.g., computed tomography [CT] scans/ CT pulmonary angiograms [CTPA] of chest, and/or Doppler ultrasound [US] scans of the lower legs) as well incidence of VTE within 90 days post-operatively.

Results:

Only 0.5% of patients developed venous thromboembolism, all presented as pulmonary embolism, while no patients developed Deep Venous Thrombosis of legs. Only three patients underwent CT/ CTPA imaging of chest (0.8%), and no US dopplers were ordered.

Conclusion:

Given low incidence of VTE in this population, the use pharmacological agents for venous thrombo-

embolism prophylaxis in neurosurgical pediatric population requires further evaluation to determine the benefit and minimize the harm associated with such agents.

Keywords:
Venous thromboembolism, retrospective study, pediatric population, pediatric patients, neurosurgical procedures.

Introduction

Venous thromboembolism (VTE) is common in adult patients undergoing neurosurgical procedures and causes significant mortality.[1-3] Multiple systematic reviews and meta-analyses have found that chemoprophylaxis is an effective preventative of VTE in adult populations.[4-6]

Evidence of the incidence and prevention of VTE in children undergoing neurosurgical procedures is sparse. The risk of VTE in this population is low compared to that among their adult counterparts.[7,8] Risk factors for the development of VTE in pediatric patients are less clearly defined than for adults. Retrospective studies have identified several factors e.g., trauma, indwelling femoral venous lines, and malignancy.[9,10] A prospective study by Scherer et al. found that the incidence of VTE is very low in pediatric patients aged 12 or under who underwent elective neurosurgical procedures.[11] The appropriate dose for chemoprophylaxis (e.g., low molecular heparins) against VTE in children varies according to size and age.[12] Protocols and consensus on the appropriate methods for VTE prevention in children have been found to vary among UK hospitals .[13] Only one hospital had formal guidelines, while others used modified adult guidelines. The majority decided to use chemoprophylaxis against VTE in children on a case-by-case basis. Our study aims to shed further light on the incidence of VTE following neurosurgical procedures in the pediatric population.

Materials and Methods

We conducted a retrospective study at King Abdulaziz University Hospital (KAUH), which is one of the largest hospitals in the western region in Saudi Arabia and has a potential capacity of 1000 beds. We included pediatric patients (aged under 18 years) who underwent elective or emergency neurosurgical interventions between 2016 and 2019. We excluded patients whose neurosurgical interventions did involve the spine or brain. Ethical approval (reference number 517-19) was obtained from the Ethics Research Committee of King Abdulaziz University's Biomedical Unit prior to the start of the study. Informed consent was not required due to nature of study that was retrospective and only observational.

We collected data on the following baseline characteristics: age, gender, position during surgery, and the use of instrumentation, Foley catheters, drains, and blood products during surgery. We categorized the type of underlying pathology as malignant (e.g., neoplasms) or non-malignant (including benign neoplasms, trauma, infection, and congenital illnesses), and the site of surgery (spine or brain/skull). The outcomes of the study was as following 1) Threshold of ordering diagnostic imaging to detect VTE by physicians (e.g., the number of computed tomography [CT] scans/ CT pulmonary angiograms [CTPA] of chest, and Doppler ultrasound [US] scans of the lower legs ordered), as well number of post-operative VTE events (i.e. deep venous thrombosis [DVT] of legs and pulmonary embolism [PE]) within 90 days post-operatively.

Statistical analyses were performed by using the Statistical Package for the Social Sciences platform, version 18. Categorical data were presented as counts and percentages, while continuous data were expressed as means and standard deviations.

Results

We identified 273 patients who underwent 396 neurosurgical interventions between 2016 and 2019 using the KAUH database. Demographic data and details of neurosurgical interventions are presented in Table 1. The average age of patients at the time of surgery was 2 years (range: 0–18 years), of whom 48% were female (see Figure 1 and 2). Most cases were either emergency or urgent surgery (62.7%) and the majority of surgeries were performed with the patient in the supine position (72.5%). The underlying pathology in the majority of cases was malignancy (64.7%) and the most common surgical site was the brain (86.6%). Only a minority of patients received blood transfusions (21.5%) or had drainage during surgery (15.2%).

Table 1:
The characteristics for 396 neurosurgical interventions

Variable	n	(%)
Age by years [mean, SD]	[4.4, 5.1]	N/A
By months [mean, SD]	[53.2, 61.1]	N/A
Female	190 (393)	48
Emergency/Urgent (vs. routine)	248	62.7
Supine (vs. other)	287	72.5
Type Of Underlying Pathology		
Non-malignant	104	26.3
Malignant	256	64.7
Infectious	14	3.5
Congenital	22	5.5
Site		
Brain	343	86.6
Spine	53	13.4

Variable	n	(%)
Drain used during intervention	60 (392)	15.2
Foley catheter used during intervention	147	37
Instruments used during intervention	391	98.7
Blood products given during intervention	85	21.5

The postoperative VTE outcomes are presented in Table 2. In 396 surgeries, only three CTPA (0.8%) were ordered. Two episodes of PE (0.5%) were subsequently diagnosed. No Doppler US or DVT diagnoses were recorded for the entire cohort.

Table 2:
Imaging and diagnosis of Venous Thromboembolism

Variable	n	(%)
Doppler Ultrasound	0	0
Deep Vein Thrombosis	0	0
Computed Tomography Pulmonary Angiogram	3	0.8
Pulmonary Embolism	2	0.5

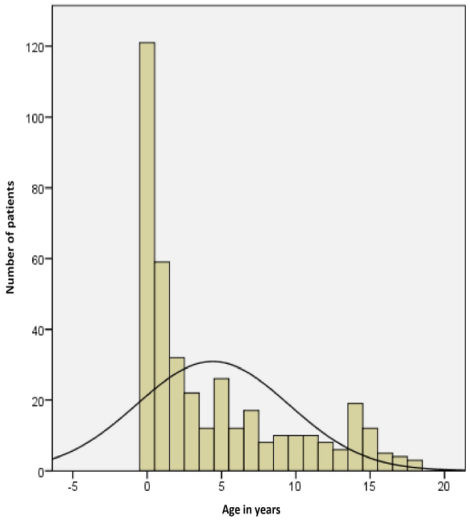


Figure 1: Number of patients in the cohort according to age (in years) at the time of surgery

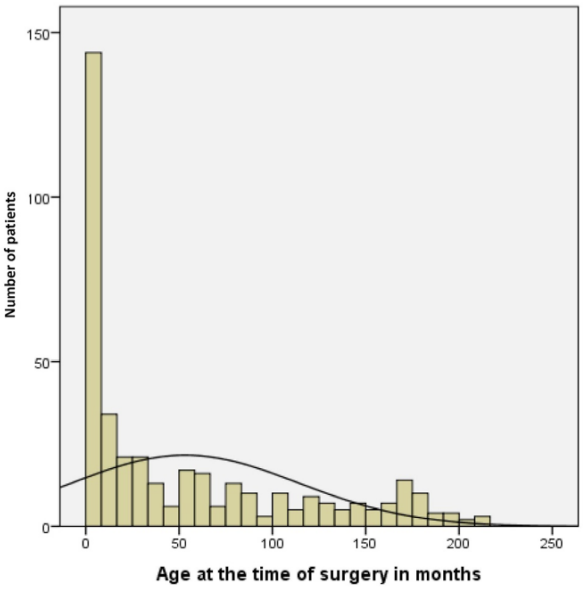


Figure 2: Number of patients in the cohort according to age (in month) at the time of surgery

Discussion

Although VTE in adult patient undergoing neurosurgical interventions is high, our study demonstrates that the risk in pediatric populations is very low.[14] Our results are consistent with the findings of similar studies .[11,15] Diagnosis of VTE is dependent on the physician recognizing the symptoms of PE or DVT followed by objective radiological confirmation of the presence of a thrombus. This may be obtained by a US Doppler of the legs or other deep veins such as the spleen, mesenteric, or cerebral veins, or through CTPA. It is known that the presentation of VTE can be unusual in the pediatric population .[16] Hence, their low rate of VTE may be due to the underdiagnosis of this condition secondary to a low index of suspicion among physicians, leading to less frequent imaging to rule out

VTE. The retrospective nature of much of the research may also miss VTE diagnosis when relying on International Classification of Diseases (ICD) coding. Our study relied on a search for postoperative imaging and medical report reviews to confirm findings of VTE. This study is one of very few that have examined the incidence of VTE in pediatric patients undergoing neurosurgical interventions. A particular strength of this study was its large sample size .[11,15]

Conclusion

This study contributes to our understanding of the risk of VTE in the pediatric population. The low rate of VTE suggests that current recommendations and protocols on the use of pharmacological VTE prevention in children warrant closer examination as the agents used are associated with increased risk of bleeding without evidence of any benefit in the reduction of VTE in this population. In this study, we categorized patients according to their underlying pathology that required surgical intervention. Other classifications with more detailed diagnoses may have provided more useful analytical information. However, because the VTE rate was extremely low in our cohort, the conclusion would have remained the same regardless of the classification used.

Conflict of Interest:

No conflict of interest to disclose.

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