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Aggressive imaging in young children on antithrombotic therapy with minor traumatic head injury

Clinical decision rules have been developed to guide clinicians to perform or to omit a CT scan in children with minor traumatic head injury (MTHI) [1-3]. These guidelines do not define the use of antithrombotic therapy as a major risk factor for intracranial pathology in young children, in contrast to children of six years and older and adults, where this is an indication to perform a CT scan.

A two-year-old boy on antithrombotic treatment fell on the back of his head from a one-meter high slide. There was no loss of consciousness, he cried immediately, and after 30 min he vomited once. At the emergency department, 60 min after the incident, his Glasgow Coma Scale was fifteen. At physical and neurological examination, no abnormalities were observed, except an occipital bump. He used low dose antiplatelet therapy (Carbasalate Calcium, 19 mg once daily) as thrombosis prophylaxis after a liver transplantation. According to Dutch guidelines, vomiting is a criterion to perform a head CT-scan in children two years and older. The CT scan revealed a right frontoparietal subdural hematoma with mild mass effect and midline shift without concomitant skull fractures. The patient did not undergo neurosurgery and was discharged after 48 h. At follow up neurological examination was normal.

This case shows that antithrombotic therapy should be regarded as a major risk factor for intracranial pathology also in children after MTHI and there should be a low threshold to perform a CT scan. All three clinical decision rules (PECARN, CATCH, CHALICE) do not mention anything about the use of antithrombotic therapy in children [1-3]. One reason could be lack of awareness. Only one prospective multicenter study compared CT use and intracranial hemorrhage after MTHI in children with and without congenital and acquired bleeding disorders, including the use of antithrombotic therapy [4]. Only 16 of all 43,904 (0.04%) included children received antithrombotic therapy. Of these 16 patients, one six-year old child with a congenital heart disorder receiving warfarin showed traumatic intracranial hemorrhage on the CT scan.

Antithrombotic therapy is given for the prevention or treatment of venous and/or arterial thrombosis. The use of antithrombotic drugs in pediatric patients has increased over last decades because of an increased incidence of venous thromboembolism (VTE) [5,6]. The placement of central venous devices is an important contributor in the development of VTE in pediatric patients [7-9]. Other medical conditions associated with VTE in children include malignancies, inflammatory bowel disease, neuromuscular disease, trauma, surgery and/or vascular malformations [5,6,10,11]. Therefore, with a growing number of children surviving with chronic medical conditions requiring antithrombotic therapy, we expect more children on antithrombotic therapy that may present at the emergency departments with MTHIs.

Low molecular weight heparin (LMWH) is the most commonly used drug for acute VTE in pediatric patients [12,13]. A review reported of 308 children receiving therapeutic doses LMWH for the treated of VTE, nine (2.9%) had a major bleeding, and 72 (23.4%) a minor bleeding [14]. In 133 children receiving prophylactic doses of LMWH, one (0.8%) had a major bleeding, and four (3.0%) a minor bleeding. These bleedings occurred all spontaneously without a traumatic cause. Vitamin K antagonists (VKA) include warfarin, acenocoumarol and phenprocoumon. The most common VKA used in the pediatric setting is warfarin [13]. Risk of major bleeding varies including 0.5% per patient year reported in a large cohort study versus 12.2% in a randomized controlled trial of 41 children [15]. Aspirin is the most commonly used antiplatelet agent for the prevention of arterial thrombotic events in children [16]. It is commonly used for the prevention of stroke recurrence and prophylactically after interventional cardiac catheterization (ICC) and cardiac surgery. In older children, aspirin rarely causes important hemorrhage, except in the presence of an underlying hemostatic defect or in children also treated with anticoagulants or thrombolytic therapy [13].

In the pediatric population, little is known on the risk of intracranial hemorrhage after a MTHI when using a form of antithrombotic therapy. Intracranial pathology after a MTHI in patients on antithrombotic therapy has mostly been described in adults, with inconsistent conclusions about the associated risk of intracranial pathology. Direct oral anticoagulants (DOACs) are considered lower-risk medication compared to warfarin for intracranial pathology after MTHI in the adult population [17]. However, currently there is a lack of information about their efficacy and safety in children, and therefore they are seldom used in children. In adults and the elderly, no consensus exists on which antithrombotic has the highest risk on intracranial pathology after MTHI. A recent meta-analysis showed that antiplatelet therapy is associated with an increased risk of intracranial pathology after MTHI [18]. Generally, aspirin as monotherapy is considered a safe option in regard to intracranial pathology after MTHI.

In conclusion, children using antithrombotic therapy constitute a high-risk patient group for intracranial bleeding after MTHI. Current guidelines need to be adapted.

Conflicts of interest and sources of funding

None to declare.

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A novel chain-based sponge dressing for management of junctional hemorrhage

Dear Editor

Bleeding is the leading cause of death on the battlefield. With the widespread use of extremity tourniquet, junctional hemorrhage becomes the most common cause to lead death [1]. Currently, there is no perfect hemostatic product available for junctional hemorrhage [2]. We have made a new type of hemostatic device based on chain structure that can be used in the junctional hemorrhage.

The Chain Sponge Dressing (CSD) is made of polyvinyl alcohol expansion sponge (Network Medical Products Ltd.). Each one contains 20 triangles which are strung together with surgical suture (VICRYL, Johnson& Johnson). Every triangle is $1 * 1.5 * 0.45$ cm and packed in a 20 ml syringe. Each device can expand 10–12 times in 20s.

Using 5 female Bama miniature pigs, accepted the femoral artery injury model (6-mm arteriotomy) [3]. Exposure and isolation of at least 6 cm of the femoral artery was performed. A 0.6 cm wound on the femoral artery with a drill. After 30 s of free bleeding, blood loss was collected by gauze, the device was applied into the wound. Hemostasis was judged by if there was no oozing with visual observation. Pressure was not allowed after packing. After observation for 180 min, the dressings were removed. Resuscitation was continued for the entire observation period. In the end, all 5 completed hemostasis within 45 s and the survival rate reached 100%. The average time to remove the device was 38.8 s (Table 1) (Fig. 1).

This study was demonstrated that the device has the potential to stop bleeding without additional compression. It could permit quick application with syringe applicator. The chain structure reduced the time of removing dressings. The hemostasis unit adopted triangular structure which increases the contact area with the blood and increases the expansion speed.

This study was a first step to introduce and demonstrate this device was effective in junctional hemorrhage. In the follow-up study, we will continue to improve this device such as adding radiopaque. To compare the effect of the device with standard gauze would be important.

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Competing interests

There are no conflicts of interest.

Disclosure

The product is still investigational.

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