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Nuss Procedure and Factor VII Deficiency: A Case Report

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Authors' contributions

This work was carried out in collaboration between all authors. Authors NG and MA wrote the initial draft of the manuscript. Author AAK read and corrected the manuscript. Authors BÖ and KD managed the literature search. Author BÖ wrote the final draft. All authors read and approved the final manuscript.

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Case Study

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ABSTRACT

A 19 year-old boy admitted with pain and discoloration on his chest wall 18 months after a Nuss procedure performed for pectus excavatum deformity. His physical examination revealed that this skin lesion was an ecchymosis. We diagnosed a very rare bleeding disorder due to Factor VII deficiency which is a recessively inherited coagulation disorder where even spontaneous bleedings may be seen. We aimed to discuss the management of the patient, if it had been diagnosed preoperatively and the preoperative preparation before the bar removal.

Keywords: Pectus excavatum; factor vii; ecchymosis; internal normalized ratio.

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1. INTRODUCTION

Pectus excavatum is the most common deformity among other chest wall deformities in children. For many years its modified open repair has been performed by the operation initially described by Ravitch [1]. Today several minimal invasive techniques, based on that described by Nuss, which involves 2 small incisions permitting the placement of a metal bar behind sternum and a stabilizator on ribs are being used in many medical centers [2,3].

Hemorrhage is the major cause of death during a surgical intervention. Management of critical hemorrhage should start from the preoperative preparation of the patient, involve the planning of the surgical procedure, transfusion practice, blood supply and anesthetic management. Prohemostatic strategies have been shown to be effective in reducing perioperative blood loss and transfusion requirements, so it decreases the incidence of clinically relevant outcomes, such as reoperation, perioperative complications and mortality [4].

Hemorrhagic complications during placement or removal of Nuss bar have been described in the literature such as cardiac perforation and liver perforation which are due to the surgical complications [5]. Here we present a very rare bleeding disorder due to Factor VII deficiency that was diagnosed after the procedure. Factor VII deficiency is a rare recessively inherited coagulation disorder where even spontaneous bleedings may be seen. The diagnosis was established after an uneventful discharge at 18th month, when the patient applied to our clinic due to an ecchymosis developed on the left anterior chest wall. We aimed to discuss the management of the patient, if it had been diagnosed preoperatively and the preoperative management before bar removal.

2. CASE REPORT

19 year-old boy admitted to our clinic with pain and discoloration on his chest wall that started 3 days previously after a stressful cough. His past history revealed that, he was operated for pectus excavatum deformity with minimal invasive technique in another center eighteen months ago. A metal bar was placed behind the sternum with an extrathoracic stabilizator placed on the left hemithorax. He was discharged 4 days later uneventfully. His dermatologic examination revealed that there was a bright red to purple colored, asymptomatic purpuric patch of 5x6 cm, located over the skin on the left side of the sternum that did not blanch with diascopy. A similar but much slighter purpuric lesion of 3x4 cm was located 6 cm below the left nipple and both were painful on palpation (Fig. 1a). There was no history of direct chest trauma, massive exercise or drug use such as acid salicylate. He didn't experience any bleeding episodes until now.

The chest x-ray was normal with an uncomplicated position of the metal bar. The laboratory studies revealed a slightly elevated INR of 1.512, prothrombin time (PT) was 15.8 second and the partial thromboplastin time (PTT) was 33.2 second and bleeding time was normal. Hematocrit was 37% and platelets were 297x 10^3/uL. Further coagulation factor studies were normal except Factor VII level which was 30%. Eventually the lesions were interpreted to be associated with a hematologic disorder rather than a traumatic course. The laboratory data was shown in Table 1.

He received 2 mg vitamin K intramuscularly and discharged on the second day. During the 2 week follow up these ecchymotic lesions has changed in colour, fading to rusty colour first and totally resorbed (Fig. 1b). He is on control for 2 years without any bleeding problems.

3. DISCUSSION

Factor VII deficiency is a rare bleeding disorder representing 3 to 5% of all inherited coagulation deficiencies. It is usually transmitted as autosomal recessive trait with a prevalence of 1 in 500000 people. A weak association is defined between coagulation Factor VII activity level and clinical bleeding severity [6]. The symptoms are variable, ranging from severe hemorrhagic forms of the disease that involve intracranial hemorrhage and hemarthrosis, to mild forms, which involve muco-cutaneous hemorrhage and post-surgical hemorrhagic complications [7]. In this case routine coagulation studies were performed before the operation. However as there was no previous bleeding history the slight elevation of INR (1.30) was underestimated.

Due to the slight elevation of INR the differential diagnosis primarily included liver diseases, fibrinogen deficiency, Vitamin K deficiency and Factor VII deficiency. Liver function tests and fibrinogen level were normal and he was not using any anticoagulants. 2 mg intramuscular

Vitamin K was administered. So we also ruled out acquired Factor VII deficiency due to vitamin K deficiency, liver diseases, or consumptive coagulopathy was ruled out where in these conditions, one would expect more extensive coagulopathy however the prolongation of the PT and INR is often the only finding in the early stages of these disorders because of the short half-life of Factor VII [8]. Similarly in the literature low dose Vitamin K use is recommended by Ortin et al as a therapeutic option where INR was brought to a safe range in excessive hypocoagulability situations [9].

The coagulation factor studies showed the Factor VII level was slightly low (30%). Factor VII deficiency is the only plasma coagulation factor deficiency in which the PT, which is expressed as the International Normalized Ratio (INR) is prolonged and a PTT is normal [8]. The most important aspect of this case report is to suspect a coagulation defect depending on the clinical presentation of the patient combined with a mildly elevated INR value which might be easily underestimated.

The dilemma pointed by Giansilly et al. [10] is the heterogeneity in clinical bleeding manifestations and poor predictability of bleeding risk by biological test for Factor VII deficiency. As symptoms are variable, it is difficult to detect those patients who are at risk of bleeding and therefore treatment strategies are difficult to establish. Clinical history usually gives the best guidance. The largest series in the literature by Benlakhal et al. [7] point on 2 major issues. The first one is; if patients with a positive bleeding history at higher risk of intra- and post-operative hemorrhage and the second one are if the absence of previous bleeding history rules out the subsequent perioperative hemorrhage. For major surgical procedures if FVII:C level is low than 10% replacement therapy is recommended. If greater than 30% no replacement is necessary. If level is between 10%-30% and patient is at pre puberty age group replacement advised. If at post puberty period and clinical bleeding history is present replacement is advised otherwise no replacement is recommended. However other than the severe clinical forms (for which treatment guidelines are well defined), consistent recommendations regarding perioperative replacement management do not exist for mild and asymptomatic Factor VII deficient patients.

In another series, Mariani et al evaluated the subjects at clear risk of bleeding and only patients with Factor VIIc levels ≤20% of normal were included. The management of patients during minor surgical interventions and invasive procedures is discussed. They concluded that, for the invasive procedures and for most of the uncomplicated minor surgery procedures,

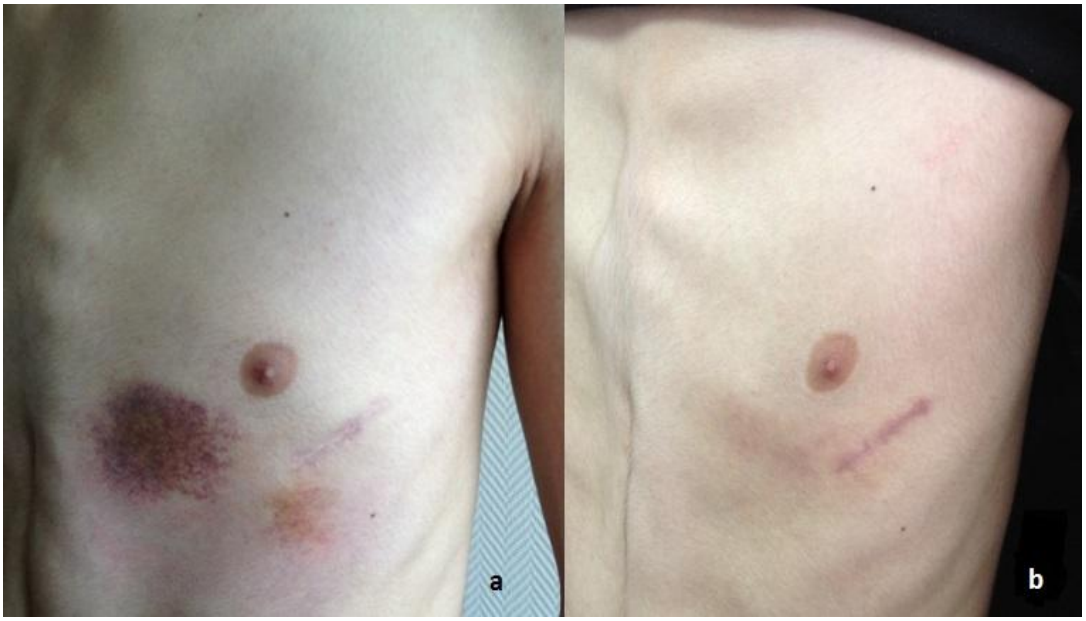

Fig. 1. a) The ecchymosis at first admission and b) the appearance of chest wall 2 weeks later

Table 1. Laboratory data of the patient at admission to our hospital

Hemoglobin	13.5 g/dl
Hematocrit	37%
Platelets	297x 103/ uL
INR	1.512
Prothrombin time (PT)	15.8 seconds
Activated partial thromboplastin time (aPTT)	33.2 seconds
Factor VII	30%
Fibrinogen level	233 mg/dL
Fibrin degradation product	9.0 mg/L
Bleeding Time	4 minutes
Glucose	86 mg/dL
Urea/Creatinine	38.3 mg/dL
Total Bilirubin/Direct Bilirubin	0.51/0.11 mg/dL
Total Protein/Serum Albumin	7.53/4.57 g/dL
AST/ALT	19/19 U/L
GGT	21 U/L
Alkaline phosphatase	88 U/L
LDH	241 U/L
TSH	1.23 uIU/mL
HBSAG/ANTİHBS/ANTİHCV/ANTİ HIV	Negative

one day replacement therapy was sufficient, with an 'average' total dose of rFVIIa of 20 µg/ kg, possibly in more than one administration [11]. However in complicated surgical interventions, longer duration and higher doses replacement therapy protocols are necessary. Gerlach et al reported an interesting case with severe difficulty in attaining intraoperative hemostasis of a recurrent hemangiopericytoma. The bleeding didn't respond to transfusion of a large number of blood products but two doses of rFVIIa during the operation. They recommended a higher dose of 120 µg/kg which was applied two hours apart [12].

3.1 Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

4. CONCLUSION

As a conclusion, we recommend to all clinicians working in university and community hospitals that even slight elevations of INR should be routinely investigated to rule out a coagulation disorder in the surgical candidates. Depending on the clinical series, in minimal invasive repair of pectus deformities with Factor VII deficiency, we advise replacement therapy one day prior to bar placement and removal to prevent life-threatening complications as bleeding symptoms are variable.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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