**BRIEF REPORT**

**Recombinant Factor VIIa Is Effective for Bleeding and Surgery in Patients With Glanzmann Thrombasthenia**

By Man-Chiu Poon, Christine Demers, François Jobin, and John W.Y. Wu

Recombinant activated factor VII (rFVIIa) was found to be effective and safe in treating 24 bleeding episodes and to prevent bleeding during one bilateral herniorrhaphy in four children with Glanzmann thrombasthenia. One of the patients had alloantibodies to platelet membrane glycoprotein (GP) IIb/IIIa and was refractory to platelet transfusion. rFVIIa was administered at 89 to 116 µg/kg per injection every 2 hours, in association with antifibrinolytic drugs. Bleeding stopped in all cases, but platelet transfusion was required in one. Two bleeding episodes recurred 36 and 63 hours after discontinuation of rFVIIa, but were successfully treated with additional doses. No adverse effects of rFVIIa were observed. Although the number of patients is small, our study suggests that rFVIIa may be an alternative to platelet transfusions in patients with a severe congenital thrombocytopenia.

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**RESULTS**

Twenty-four bleeding episodes were treated with rFVIIa after failure of local measures, including 13 nosebleeds, 7 oropharyngeal bleeds, 3 GI bleeds, and a posttraumatic facial hematoma (Table 1). Red blood cell transfusions were needed in 7 episodes (3 GI bleeds and 4 nosebleeds). Bleeding stopped within 6 hours of starting rFVIIa in 16 (67%) episodes, and between 6 and 24 hours in 7 (29%) episodes. The remaining GI bleed (patient 3) did not stop despite 24 rFVIIa injections over 2 days, but stopped promptly after one platelet transfusion. Two of the bleeds (GI, lip/frenulum cuts), which each initially stopped after 3 rFVIIa doses at 4 and 5 hours, respectively, recurred 36 and 63 hours later; in both cases, bleeding stopped after additional rFVIIa injections without reblooding (Tables 1 and 2). The number of rFVIIa injections required to stop bleeding is shown in Table 2. Additional rFVIIa doses for maintenance were given after severe bleeds because of concern for recurrence (Table 2). The bilateral herniorrhaphy was performed without platelet transfusion, and no abnormal peri- or postoperative bleeding was observed. The child was discharged home 36 hours after the surgery with e-aminocaproic acid. No patient developed adverse effects with the use of rFVIIa.

**GLANZMANN THROMBASTHENIA** is a congenital, hereditary hemorrhagic disorder caused by qualitative or quantitative abnormalities of platelet glycoprotein (GP) IIb/IIIa leading to excessive bleeding. Platelet transfusion is the standard treatment for severe bleeding and for surgical support. However, repeated platelet transfusions in such patients may result in alloimmunization to human leukocyte antigens (HLA) and/or platelet membrane GPIIb/IIIa, rendering future transfusions ineffective. Furthermore, platelet transfusions have risk for adverse reactions including virus transmission, and may not be readily available to patients in remote areas.

In 1996, Tengborn and Petruson first reported the successful use of recombinant factor VIIa (rFVIIa, NovoSeven [Novo Nordisk, Bagsvaerd, Denmark]) for a severe epistaxis in a boy with Glanzmann thrombasthenia. Additional case reports suggest the usefulness of this agent for bleeding and for surgical prophylaxis in other patients with congenital functional platelet disorders including Glanzmann thrombasthenia, Bernard-Soulier syndrome, and platelet type (pseudo) von Willebrand disease and acquired thrombocytopenias related to uremia or myelodysplastic syndrome. We report here the experience with the use of rFVIIa in 4 patients with Glanzmann thrombasthenia.

**PATIENTS, MATERIALS, AND METHODS**

Four children with type 1 Glanzmann thrombasthenia (Table 1) received treatment, after informed consent, with rFVIIa for bleeding episodes or for surgical prophylaxis in this open-label study. Patient 2 had alloantibodies to platelet GPIIb/IIIa, and was refractory to platelet transfusions. Patients 3 and 4 lived in remote areas with limited access to platelet transfusions. The study protocol was approved by the institutional ethics board and rFVIIa was supplied at no cost by Novo Nordisk Canada Inc (Mississauga, Ontario, Canada). Patients undergoing surgical procedures, or having bleeding episodes not controlled by conservative measures such as the use of local pressure, nasal packing, or topical thrombin, were administered rFVIIa at a standard dose of 0.075 mg/kg (patient 1) or 0.1 mg/kg (patients 2 through 4) every 2 hours until bleeding stopped. Gastrointestinal (GI) bleeding was considered to have stopped when the patient continued to be hemodynamically stable and the hemoglobin values remained stable. Bleeding episodes were considered severe when there was a decrease in the hemoglobin concentration by 20 g/L or more within 4 days preceding the start of rFVIIa or when there was compression of a vital organ. Follow-up maintenance doses of rFVIIa were at the discretion of the investigators. Antifibrinolytic agents such as e-aminocaproic acid (Amicar; Wyeth-Ayerst, Caroline, Puerto Rico) (300 to 400 mg/kg/d) or tranexamic acid (Cyclokapron; Pharma-

cia & Upjohn, Stockholm, Sweden) (75 mg/kg/d) were used during and for 7 to 9 days after rFVIIa therapy for all but 2 bleeding episodes (1 mild oropharyngeal bleed and 1 facial hematoma) and for surgery. Platelet transfusions were allowed when in the judgment of the treating physician rFVIIa was not effective.

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DISCUSSION

rFVIIa has been used extensively for patients with inhibitors to factor VIII or IX (congenital or acquired hemophilia) and in a limited number of patients with a variety of congenital and acquired platelet functional disorders. Our study, though limited in the number of patients, represents the largest experience in the use of rFVIIa in patients with Glanzmann thrombasthenia. rFVIIa was effective in treating 23 of the 24 bleeding episodes and in 1 surgical procedure in these patients with or without anti-IIb/IIIa antibodies. Bleeding stopped promptly in many cases.

Maintenance doses of rFVIIa after the cessation of bleeding were used early in our study according to previous reports. As we gained experience, we observed that many of the bleeding episodes did not rebleed in the absence of maintenance doses. It is possible that in patients with normal plasma coagulation systems, once a primary platelet plug has formed to stop bleeding, a permanent clot is readily formed by the fibrin deposition and stabilization. In this respect, antifibrinolytic agents to prevent clot lysis seem to be an important adjunct to rFVIIa therapy. However, maintenance doses may be needed for severe bleeds, posttraumatic bleeds, GI bleeds, and after surgery.

The experience so far suggests the use of rFVIIa in patients with Glanzmann thrombasthenia and other platelet defects is safe. Only one serious side effect has been reported so far: a bilateral deep vein thrombosis and pulmonary embolism observed 6 days after discontinuation of high-dose rFVIIa administered by continuous infusion for 15 days to cover a bowel resection in a 72-year-old woman with Glanzmann thrombasthenia.

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rFVIIa has been used extensively for patients with inhibitors to factor VIII or IX (congenital or acquired hemophilia) and in a limited number of patients with a variety of congenital and acquired platelet functional disorders.1-3 Our study, though limited in the number of patients, represents the largest experience in the use of rFVIIa in patients with Glanzmann thrombasthenia. rFVIIa was effective in treating 23 of the 24 bleeding episodes and in 1 surgical procedure in these patients with or without anti-IIb/IIIa antibodies. Bleeding stopped promptly in many cases.

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In summary, rFVIIa is an attractive alternative to platelet transfusions for the treatment of dysfunctional platelet-related bleeding. However, this needs to be confirmed on a larger population. We need additional studies to define the minimal effective dose, the ideal way to administer rFVIIa, the relative role of rFVIIa and antifibrinolytic agents in these patients, as well as the cost and benefit of using rFVIIa over platelet transfusion, especially in patients without platelet or HLA antibodies. To gather more data on clinical experience with the use of rFVIIa in patients with Glanzmann disease and other congenital platelet disorders, an "International Registry on
Recombinant Factor VIIa and Congenital Platelet Disorders” has recently been established (forms available from the first author). We hope that the data collected will allow assessment of the role of rFVIIa in these platelet disorders, and assist in the design of formal studies to address specific issues associated with the treatment of these patients. Finally, studies to define the mechanism by which rFVIIa affects hemostasis in these patients are also needed.

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REFERENCES


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