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Brief Reports

THE EFFECT OF FRESH FROZEN PLASMA TRANSFUSION ON INTERNATIONAL NORMALIZED RATIO IN EMERGENCY DEPARTMENT PATIENTS

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☐ **Abstract—Background: There are few studies researching the effect of fresh frozen plasma (FFP) transfusion on international normalized ratio (INR) in patients with coagulation abnormality. Objective: This study's aim was to determine the effect of FFP transfusion on INR as calculated pretransfusion. In addition, patients were grouped according to pretransfusion INR to determine the improvement in INR per unit of FFP. Methods: Adult patients who had been admitted to our Emergency Department (ED) with coagulation abnormality and received an FFP transfusion, and had pre- and posttransfusion coagulation tests performed, were included in the study. Patients were categorized into five groups according to their pretransfusion INR levels. Improvement in INR per unit of FFP-transfused values (Δ INR $_{1\ \text{unit FFP}}$) was determined for each group. Results: Eighty-seven patients were entered into the study, and were administered a total of 199 units of FFP. Δ INR $_{1\ \text{unit FFP}}$ value was 0.03 ± 0.13 for patients whose pretransfusion INR level was under 2; 0.77 ± 0.47 for those between 2 and 5; 2.14 ± 0.63 for those between 5 and 9; 3.34 ± 0.89 for those between 9 and 12; and 4.63 ± 1.99 for those over 12. A very strong positive correlation was found between pretransfusion INR and Δ INR $_{1\ \text{unit FFP}}$ ($p < 0.001$, $r = 0.957$). Conclusion: A significant improvement in INR was observed in patients with higher pretransfusion INR. While determining FFP dose for patients admitted to the ED due to coagulation defect, pretransfusion INR value should be taken into account.** © **2014 Elsevier Inc.**

☐ **Keywords—international normalized ratio; INR; fresh frozen plasma; transfusion; blood transfusion; emergency department**

INTRODUCTION

The use of fresh frozen plasma (FFP) transfusion is gradually increasing worldwide (1–4). FFP is widely used in patients admitted to emergency departments (EDs) with coagulation abnormality. However, there are no widely accepted standardized doses of FFP to be administered to patients according to the severity of their coagulation abnormality. The number of studies investigating the improvement in international normalized ratio (INR) achieved per unit of FFP transfused is limited (5,6). In our study, we investigated how much improvement was achieved, per unit of FFP that was transfused, over pretransfusion INR values.

METHODS

In this cross-sectional retrospective study, we conducted a review of the records of patients, presenting over a period of 34 months (January 2010–October 2012), who were older than 14 years of age, admitted to our ED, transfused with FFP, and who also had pre- and posttransfusion coagulation tests. The study was carried out in a tertiary ED that serves approximately 200,000 patients annually.

Patients who received FFP transfusions were identified from the hospital automated record system, and their records were scanned. The first and third authors of the study abstracted the data. Patient charts, nurse observation charts, and the hospital database were reviewed for data

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collection. Patient demographics, chief complaints on admission, reasons for coagulation abnormality, pre- and posttransfusion INR, prothrombin time, activated partial thromboplastin time, number of units per patient of transfused FFP, duration of FFP application, time the blood samples were taken to check for INR value, warfarin use, and final diagnosis were recorded. Patients who had a coagulopathy secondary to warfarin overdose or hemorrhage from any site were categorized by the site of hemorrhage (e.g., "gastrointestinal hemorrhage"). The final diagnosis of "warfarin overdose" meant that the patient was asymptomatic. The records indicating the time of FFP transfusion were taken from the nurse observation charts. A unit of FFP was 250 mL. Neither factor VIIa nor prothrombin complex concentrates were used in our setting.

Patients whose posttransfusion coagulation tests were not studied within the first 6 h after transfusion were excluded from the study. Patients who had their FFP transfusion begun in the ED but completed and INR calculated in one of the other hospital services were also excluded from the study. Patients were categorized into five groups according to their pretransfusion INR as 1–2, 2.01–5, 5.01–9, 9.01–12, and 12.01 and over. For each group of patients, improvement in INR per unit of FFP values for one transfused unit of FFP (Δ INR for 1 unit of fresh frozen plasma = Δ INR $_{1\ \text{unit FFP}}$) was determined. Δ INR $_{1}$ unit FFP value for each patient was obtained with the following calculation: (PretransfusionINR value − Posttransfusion INR value)/number of transfused FFP units.

Data Analysis

Data were analyzed with IBM SPSS Statistics 20.0 for Windows (IBM, Armonk, NY). Normal distribution of the data was evaluated with Shapiro-Wilk test, and nonparametric tests were used for variables that were not normally distributed. Qualitative data are reported as number of observations and percentage (%), where as quantitative data are reported as mean ± SD. Pearson analysis was used for calculating the correlation between parametric variables. A $p < 0.05$ was considered significant.

RESULTS

There were 148 patients given FFP transfusion during the study period. Sixty-one patients whose coagulation tests were not performed in the first 6 h after transfusion for various reasons (e.g., left the ED prematurely or posttransfusion INR test was not requested) were excluded from the study; a total of 87 patients were enrolled in the study. One patient's INR value was not included in the calculations because his pretransfusion INR level was too high to be measured.

Table 1. Patient Chief Complaints at Admission and Final Diagnosis

	n (%)
Symptoms	
Subcutaneous ecchymosis	13 (14.9)
Impaired general condition	11 (12.6)
Hematuria	10 (11.5)
Epistaxis	7 (8)
Gingival bleeding	7 (8)
Hematemesis	7 (8)
Chest pain	7 (8)
Rectal bleeding	6 (6.9)
Abdominal pain	5 (5.7)
Other*	14 (16)
Final diagnosis	
Warfarin overdose	63 (72.4)
Gastrointestinal bleeding	8 (9.2)
Multiple organ dysfunction syndrome	4 (4.6)
Acute liver failure	3 (3.4)
FFP practice prior to intervention	3 (3.4)
Disseminated intravascular coagulation	2 (2,3)
Hemarthrosis	2 (2,3)
Multiple trauma	1 (1,1)
Intracranial bleeding	1 (1,1)

FFP = fresh frozen plasma.
* Other: Bleeding in catheter place, minor trauma, vaginal bleeding, hemarthrosis, extremity ulcer bleeding, bleeding in external auditory canal, asymptomatic patient.

Fifty (57.5%) of the patients were women; the mean age was 63.6 ± 13.9 years. The chief complaints of patients and their final diagnoses are shown in Table 1. Sixty-seven patients (77%) were using warfarin. Sixty-six patients (75.9%) were discharged from the ED, 9 (10.3%) were hospitalized, 7 (8%) were transferred to another hospital, 4 (4.6%) died, and 1 (1.1%) refused treatment and left the ED.

The 87 patients included in the study were given a total of 199 units of FFP, one unit to 8 patients, two units to 58 patients, three units to 11 patients, four units to 9 patients, and six units to 1 patient. The median of the second INR draw times for post-FFP transfusion was 121 min (minimum 33, maximum 347 min). Pretransfusion and posttransfusion coagulation parameters of the patients are shown in Table 2. A scatterplot of delta INR vs. pretransfusion INR values is shown in Figure 1. Δ INR $_{1\ \text{unit FFP}}$

Table 2. Patients' Pre- and Posttransfusion Coagulation Test Results

	INR Mean (SD)	PT Mean (SD)	aPTT Mean (SD)
Pretransfusion	6.4 (4.3)	69.2 (47.6)	53.6 (22.7)
Post transfusion	2.2 (0.6)	25.6 (6.7)	38.2 (11)
Improvement	4.2 (4.0)	43.6 (45)	15.3 (18.5)

INR = international normalized ratio; PT = prothrombin time; aPTT = activated partial thromboplastin time.