

# A Propensity-based Analysis of the Use of Prothrombin Complex Concentrate (PCC) Prior to Emergent Neurosurgical Procedures

Prateek Agarwal AB; Ashwin G. Ramayya MD; Kalil G. Abdullah MD; Nikhil Nayak MD; Timothy H. Lucas MD, PhD University of Pennsylvania, Department of Neurosurgery, Philadelphia, PA



#### **Introduction**

Reversal of anticoagulation is required to mitigate the risk of intracranial bleeding prior to urgent neurosurgical procedures. New pharmacological agents, such as multifactor prothrombin complex concentrate, promise rapid efficacy but may increase the probability of thrombotic complications relative to vitamin K infusion or administration of Fresh Frozen Plasma (FFP) alone. In this study, we examined the rate of thrombotic complications in neurosurgical patients who received either PCC or FFP alone before undergoing emergent surgery.

### **Methods**

Sixty-three consecutive patients who received anticoagulation reversal for emergent neurosurgical procedures were identified between 2008-2016 at a Level I trauma center. They were divided into two cohorts based on reversal method, either PCC (n = 28) or FFP alone (n = 35). The rate of thrombotic complications within 72 hours of reversal was compared using a chi2test. To minimize selection bias, a multivariate propensity score-matching analysis was then used to identify a control group of FFP patients most similar to patients in the PCC group based on age, gender, international normalized ratio (INR) upon presentation and INR postintervention, trauma, altered mental status, and preexisting heart failure.

PCC (n = 28)		F	FFP (n = 35)		
Neurosurgical Indications	Neurosurgical Procedure	Neurosurgical Indications	Neurosurgical Procedure		
Intraparenchymal Hemorrhage (15) Subdural	Craniotomy (12)  Decompressive Craniectomy (9)	Subdural Hemorrhage (24)	Craniotomy (27)  Decompressive Craniectomy (7)		
Hemorrhage (10)	External	Hemorrhage (11)	External		
Subarachnoid Hemorrhage (3)	Ventricular Drain (5) Endovascular Embolization (2)		Ventricular Drain (1)		

#### **Results**

Thrombotic complications were uncommon but not rare in this neurosurgical population, occurring in 1.59% of treated patients (1/63). There was no difference in thrombotic complication rate between groups, 3.57% (1/28; PCC group) vs. 0% (0/35; FFP group; p = ns). Propensity matching analysis verified this finding after controlling for any selection bias.

	Prothrombin-complex (PCC; n = 28)	Fresh Frozen Plasma (FFP; n = 35)	p-value	
Age	64.3 (+/- 15.5) years	70.4 (+/- 13.3) years	0.10	
Gender	60.7% male (n = 17)	62.8% male (n =22)	> 0.5	
Trauma	21.4% (n = 6)	57.14% (n = 20)	0.0042	
Heart Failure	14.3% (n = 4)	17.1% (n = 6)	> 0.5	
Altered Mental Status	75% (n = 21)	60.0% (n = 21)	0.21	
Number of patients with thrombotic complications (within 72 hours)	3.57% (n = 1)	0 % (n = 0)	0.23	
Pulmonary Complications	39.3% (n = 11)	11.4% (n = 4)	0.009	
INR upon presentation	3.36 +/- 1.85	3.11 +/- 1.90	> 0.5	
INR post-intervention 1.36 +/31		1.37 +/- 0.22	> 0.5	

Table 2: Patient demographics for treatment group (PCC) and control group (FFP only)

	Prothrombin-complex (PCC; n = 28)	Fresh Frozen Plasma (FFP; n = 28)	p-value
Age	64.3 (+/- 15.5) years	67.7 (+/- 12.7) years	0.23
Gender	60.7% male (n = 17)	60.7% male (n = 17)	> 0.5
Trauma	21.4% (n = 6)	53.5% (n = 15)	0.013
Heart Failure	14.3% (n = 4)	10.7% (n = 3)	> 0.5
Altered Mental Status	75% (n = 21)	53.57% (n = 15)	0.09
Number of patients with thrombotic complications (within 72 hours)	3.57% (n = 1)	0 % (n = 0)	0.31
Pulmonary Complications	39.3% (n = 11)	14.2% (n = 4)	0.035
INR upon presentation	3.36 +/- 1.85	2.92 +/- 1.64	0.32
INR post-intervention	1.36 +/31	1.33 +/- 0.18	>0.5

Table 3: Patient demographics for treatment group (PCC) and control group (FFP only) after propensity matching with age, gender, INR upon presentation, INR post-intervention, and t-score (trauma, heart failure, and altered mental status)

#### **Conclusions**

Thrombotic complications in neurosurgical patients requiring rapid reversal at a Level I trauma center are uncommon but not rare. New pharmacological agents have similar rates of thrombotic complications as FFP. In this limited sample, use of PCC did not pose a significant increase in risk compared with FFP in the management of intracranial bleeding.

Thrombotic Complication	PCC or FFP	Age	Gender	Neurosurgical Indication	Neurosurgical Procedure
Saddle Pulmonary Embolism	PCC	85	Female	Subarachnoid Hemorrhage	Endovascular Embolization

Table 4: Thrombotic complications for treatment group (PCC) and control group (FFP only)

## **Learning Objectives**

- 1. Estimate the rate of thrombotic complications in patients undergoing anticoagulation reversal (PCC vs FFP alone) and subsequent neurosurgical procedure.
- 2. Understand that demographics (age/gender) and risk factors for thrombosis in neurosurgical patients (trauma, altered mental status, preexisting heart failure) may result in selection bias.
- 3. Determine if there is an elevated rate of thrombotic complications for patients who receive PCC compared with those who receive FFP alone.