

# Cryoprecipitate Transfusion in On-Pump Cardiac Surgery

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## Background:

Severe post-operative bleeding is a serious complication after cardiac surgery resulting in increased morbidity and mortality. Bleeding is influenced by both surgical factors and impaired hemostasis associated with cardiopulmonary bypass (CPB) use. The exposure of blood to foreign surfaces causes platelet dysfunction, enhanced fibrinolysis, and coagulopathy which can increase hemorrhagic complications.

In the past, thrombocytopenia was the first hemostatic abnormality observed during blood loss when whole-blood transfusion predominated. With current approaches including modern IV fluids and red blood cell concentrates, fibrinogen deficiency is the first observed defect. Pre-operative fibrinogen concentration, even within the normal range, has been suggested as a limiting factor for postoperative hemostasis.

Cryoprecipitate (CRYO) is derived from plasma and is a concentrated source of fibrinogen, FVIII, FXIII, vWF and other proteins. Transfusion during cardiac surgery is currently the most common indication for CRYO use in Canada, representing 45% of all CRYO transfusions. However, no clinical studies have been performed to support its use in this context.

Several scores exist for predicting need for transfusion in cardiac surgery. The TRUST score is a validated risk scoring tool that predicts allogeneic blood transfusion developed on a large patient cohort in Toronto. It is based on 8 preoperative variables that stratifies patients' perioperative risk of transfusion of blood products in general.

TRUST	Score	Risk of Transfusion
1 Preoperative Hemoglobin <135 g/L	0	Baseline (0-19%)
2 Weight <77 kg	1	Low (20-39%)
3 Female sex	2	Intermediate (40-59%)
4 Age >65 years	3	High (60-79%)
5 Non-elective procedure	4-8	Very High (80-100%)
6 Preoperative Creatinine >120 umol/L		
7 Previous cardiac surgical procedure		
8 Non-isolated procedure		

## Research Questions:

What are demographic and surgical variables associated with increased risk of post-CPB transfusion of CRYO in adult cardiac surgical patients?

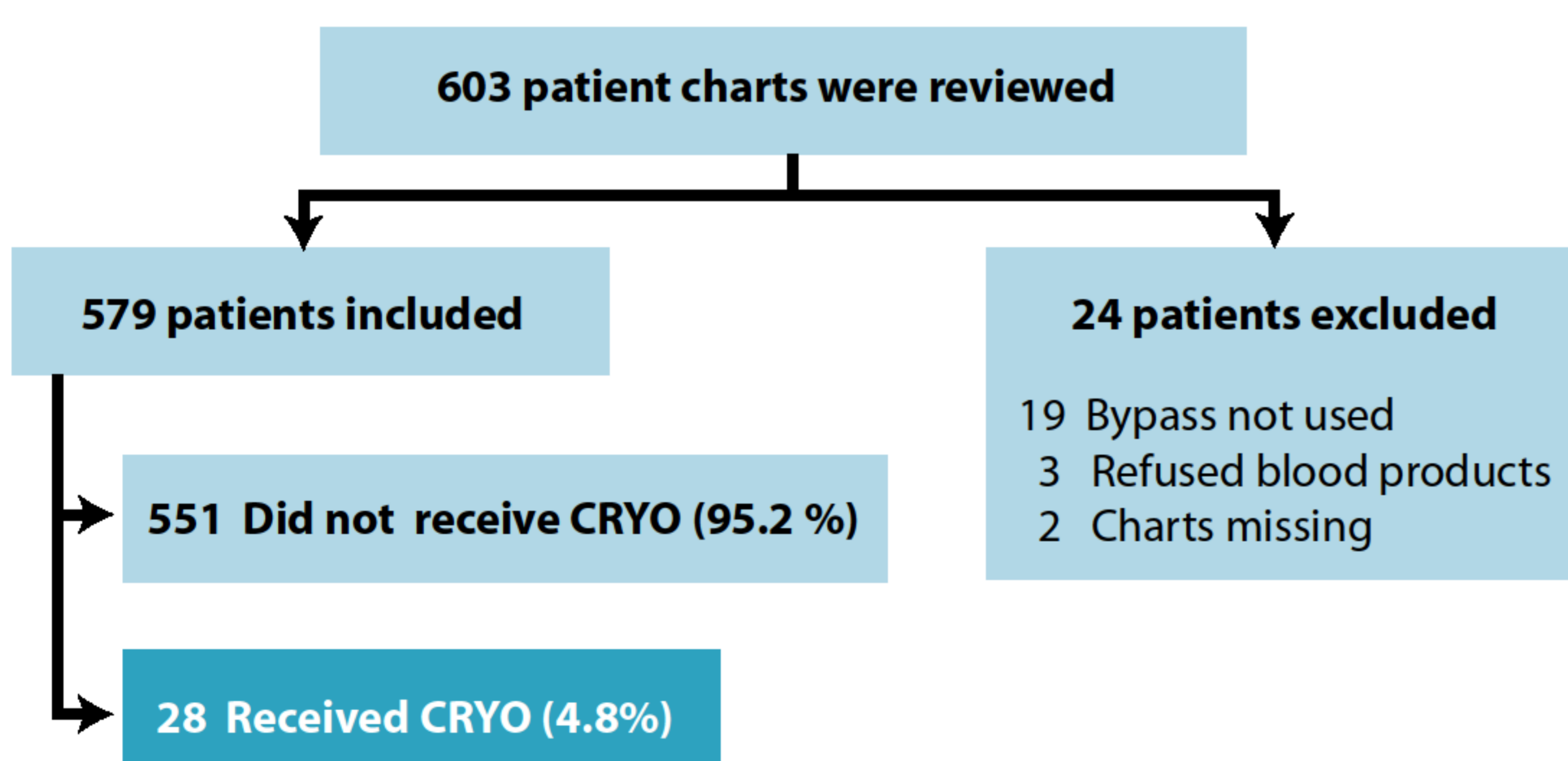
Does TRUST score predict risk of CRYO transfusion?

## Methods:

We conducted a retrospective chart review at an academic teaching hospital and included consecutive adult patients (>18 years old) who underwent cardiac surgery over a 6 months period (January to June 2010). We excluded patients who underwent off-pump surgery, did not consent to use of blood products, or had missing/incomplete charts.

Variables were abstracted from operative and ward electronic medical records, and from a cardiac anesthesia database.

## Results:



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344 units of CRYO were transfused to 28 patients within 24 hrs of OR. . Approximately half (53%) of patients received CRYO in the OR, with the remaining being transfused in the post-operative period in the cardiovascular intensive care unit (CVICU).

In all cases, CRYO was given in the setting of active bleeding. Among patients who received CRYO transfusion, only 17 of 28 (61%) had fibrinogen measured pre-transfusion, and this value ranged from 0.10 to 3.03 g/L. For this study, we considered transfusions appropriate for levels less than 1.5 g/L. Applying this threshold, 46% of the CRYO transfusions were likely appropriate.

**Table 1 Baseline Characteristics**

	Total Cohort n (%)	CRYO Group n (%)	No CRYO Group n (%)	P-value
Patients	579 (100)	28 (4.8)	551 (95.2)	
Female	159 (27.5)	6 (21.4)	153 (27.8)	0.46
Mean age	65.3 ± 11.9	60.8 ± 14.5	65.5 ± 11.7	0.04
Mean weight, kg	79.9 ± 17.4	76.9 ± 14.3	80.0 ± 17.6	0.35
Mean BSA, m <sup>2</sup>	1.9 ± 0.2	1.9 ± 0.2	1.9 ± 0.2	0.85
Mean pre-op Hgb, g/L	130.4 ± 18.2	133.6 ± 20.8	130.2 ± 18.1	0.34
Baseline creatinine, umol/L	93.6 ± 43.2	93.3 ± 24.0	93.7 ± 44.0	0.40
Pre-op renal disease	58 (10.0)	5 (17.9)	53 (9.62)	0.19
Pre-op liver disease	4 (0.7)	0 (0.0)	4 (0.7)	1.00

**Table 2 Baseline TRUST Variables**

TRUST Score Variables	Total Cohort n (%)	CRYO Group n (%)	No CRYO Group n (%)	P-value
Female	159 (27.5)	6 (21.4)	153 (27.8)	0.46
Age >65	308 (53.2)	11 (39.3)	297 (53.9)	0.13
Weight <77 kg	275 (47.5)	16 (57.1)	259 (47.0)	0.29
Hemoglobin <135g/L	318 (55.2)	14 (50.0)	304 (55.5)	0.57
Creatinine >120 umol/L	61 (10.8)	2 (7.1)	59 (10.8)	0.76
Previous cardiac surgery	26 (4.5)	5 (17.9)	21 (3.8)	0.0059
Non-isolated CABG	165 (28.5)	22 (78.6)	143 (26.0)	<.0001
Non-elective surgery	247 (42.7)	10 (35.7)	237 (43.0)	0.45
Mean TRUST score	2.7 ± 1.6	3.1 ± 1.4	2.7 ± 1.6	0.19

Patients who received CRYO also received other blood products (100% received RBC, 78.6% platelets, and 82.1% frozen plasma).

Patients in the CRYO group had higher mortality rate (10.7% vs. 1.3%, p=0.0097), higher re-operation for bleeding (32% vs. 2.7%, p<0.0001), longer ICU stay (5.0 vs. 1.8 days, p<0.0001), more frequent prolonged ventilation (25% vs. 3.6%, p<0.0001), more liver dysfunction (7.1% vs. 0%, p=0.0023) and more renal dysfunction (32.1% vs. 12%, p=0.0056).

## Conclusions:

This study reveals that many general predictors of transfusion (gender, BSA, non-elective surgery, TRUST score) were not associated with CRYO transfusion. CRYO transfusion on the other hand was associated with previous cardiac surgery, non-isolated procedure and somewhat surprisingly younger age. One possible explanation is that higher risk procedures (combined procedures with longer bypass time), are being attempted on younger patients on an elective basis. CRYO use was associated with a number of adverse clinical outcomes, suggesting that it is a marker of morbidity in this patient population.

## Limitations:

This was a single-center study that represents one hospital's population and practices, and this may affect generalizability of our conclusions. Although we included a large number of patients, only a small subset received CRYO, limiting our ability to reliably compare the groups.

## Funding:

The study was supported by a grant from CSL Behring Canada Inc.

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