Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/burns

TRALI following fresh frozen plasma resuscitation from burn shock

Larry M. Jones [a,*], Nicholas Deluga [b], Puneet Bhatti [c], Scott R. Scrape [d], John K. Bailey [a], Rebecca A. Coffey [a]

[a] Department of Surgery, The Ohio State University Wexner Medical Center, Columbus, OH 43210, USA
[b] College of Medicine, The Ohio State University, Columbus, OH 43210, USA
[c] The Ohio State University, Columbus, OH 43210, USA
[d] Department of Pathology, The Ohio State University Wexner Medical Center, Columbus, OH 43210, USA

ARTICLE INFO

Article history:
Accepted 22 August 2016

Keywords:
Fresh frozen plasma
TRALI
Burn shock resuscitation

ABSTRACT

Introduction: Resuscitation from burn shock using fresh frozen plasma (FFP) has been described. Critics of FFP resuscitation cite the development of transfusion related acute lung injury (TRALI) as a deterrent to its use. This study examines the occurrence of TRALI with FFP resuscitation of critically ill burned patients.

Methods: A retrospective chart review was conducted of severely burned patients who received FFP resuscitation. Data points included age, TBSA, TBSA full thickness, presence of alternate etiologies of acute lung injury, total FFP administered, and signs and symptoms of TRALI as defined per the Canadian Blood Services Consensus Conference.

Results: Eighty-three patients met the definition of severe burn and received FFP resuscitation. Of those, 65 met exclusion criteria. Eighteen patients were left for analysis with only one found to have signs and symptoms of TRALI. That patient suffered a 53.5% TBSA burn, received a total of 6228 ml FFP, had no competing etiologies of ALI, and was diagnosed with TRALI within 6 h of completing the FFP transfusion.

Conclusion: The possible occurrence of TRALI in burn patients receiving FFP resuscitation should be weighed against the reported benefits of such a resuscitation strategy.

1. Introduction

Since its introduction in 1968, the Parkland Formula has become the most widely used guide for the resuscitation of patients from burn shock [1–3]. Recent criticisms of the Parkland Formula have prompted burn surgeons to look for alternative estimates to guide burn resuscitation and to consider the role of colloid in burn resuscitation.

The use of fresh frozen plasma (FFP) was first described by Du et al. [4]. A follow-up report by O'Mara et al. defined what has become known as the West Penn Formula (also known as the Slater Formula) to be FFP initiated at 75 cc/kg body weight over 24 h plus lactated Ringer's solution at 2 l/24 h [5]. The FFP is titrated to achieve a urine output of 0.5–1.0 cc/kg/h. The crystalloid rate is not titrated. This infusion is continued for up to 48 h post burn or until the patient is fully resuscitated.

* *Corresponding author at*: The Ohio State University Wexner Medical Center, N744 Doan Hall, 410 W. 10th Avenue, Columbus, OH 43210, USA. Fax: +1 614 293 3425.
E-mail addresses: Larry.jones@osumc.edu (L.M. Jones), Nicholas.Deluga@osumc.edu (N. Deluga), bhatti.16@buckeyemail.osu.edu (P. Bhatti), Scott.scrape@osumc.edu (S.R. Scrape), john.bailey@osumc.edu (J.K. Bailey), Rebecca.coffey@osumc.edu (R.A. Coffey).
http://dx.doi.org/10.1016/j.burns.2016.08.016
0305-4179/

This regimen has the reported advantage of avoiding excessive fluid administration and the complications of weight gain and development of abdominal compartment syndrome that often accompanies massive crystalloid resuscitations [4,5].

One criticism of FFP resuscitation is the potential for Transfusion Related Acute Lung Injury (TRALI). Described in 1983 by Popovsky, TRALI is a syndrome presenting as acute respiratory distress typically within 6 h of transfusion of blood products and has been reported following transfusion of all blood components [6]. Clinical presentation varies with rapid onset of dyspnea, tachypnea and respiratory distress with non-cardiogenic pulmonary edema progressing to Adult Respiratory Distress Syndrome on X-ray [7].

Since February 1, 2006, severely burned patients (defined as greater than 40% TBSA or greater than 30% TBSA accompanied by inhalation injury) admitted to our verified burn center have received resuscitation with FFP following the formula described by O'Mara et al. [5]. This is a review of our experience with the incidence of TRALI occurring in those patients.

Table 1 – Criteria for TRALI.

1	ALI a. Acute onset b. Hypoxemia $PaO_2/FiO_2 \leq 300$ or $SpO_2 < 90\%$ on room air or other clinical evidence of hypoxemia c. Bilateral infiltrates on frontal chest radiograph d. No evidence of left atrial hypertension
2	No pre-existing ALI before transfusion
3	Occurrence during or within 6 h of transfusion
4	No temporal relationship to an alternative risk factor for ALI

From: Kleinman S., et al. Transfusion 2004; 44: page 1775.

2. Methods

Following IRB approval, a retrospective chart review was performed of patients admitted between February 1, 2006 and June 30, 2011, with a burn covering ≥40% TBSA or ≥30% TBSA with an associated inhalation injury (IHI) and having received FFP resuscitation. TRALI was defined per the Canadian Blood Services Consensus Conference definition as "a new episode of Acute Lung Injury (ALI) that occurs during or within 6 h of a completed transfusion, which is not temporally related to a competing etiology for ALI" [8]. Patients were excluded if they had competing etiologies of Acute Lung Injury (ALI) which included aspiration, pneumonia, toxic inhalation including smoke, lung contusion or near drowning. Patient data points collected were age, sex, TBSA, TBSA full thickness, presence of competing etiologies of ALI, total FFP administered, signs and symptoms of ALI as listed in Table 1.

3. Results

Eighty-three patients met the definition of severe burn and received FFP resuscitation. Of those, 65 met exclusion criteria leaving eighteen patients for analysis (Table 2). Of those, only one patient was found to have signs and symptoms of TRALI consistent with the definition (Fig. 1). That patient, a 52 year old man, suffered a 53.5% TBSA burn from a gasoline tank explosion. This occurred out of doors and there was no inhalation component. Afterwards the patient jumped into a

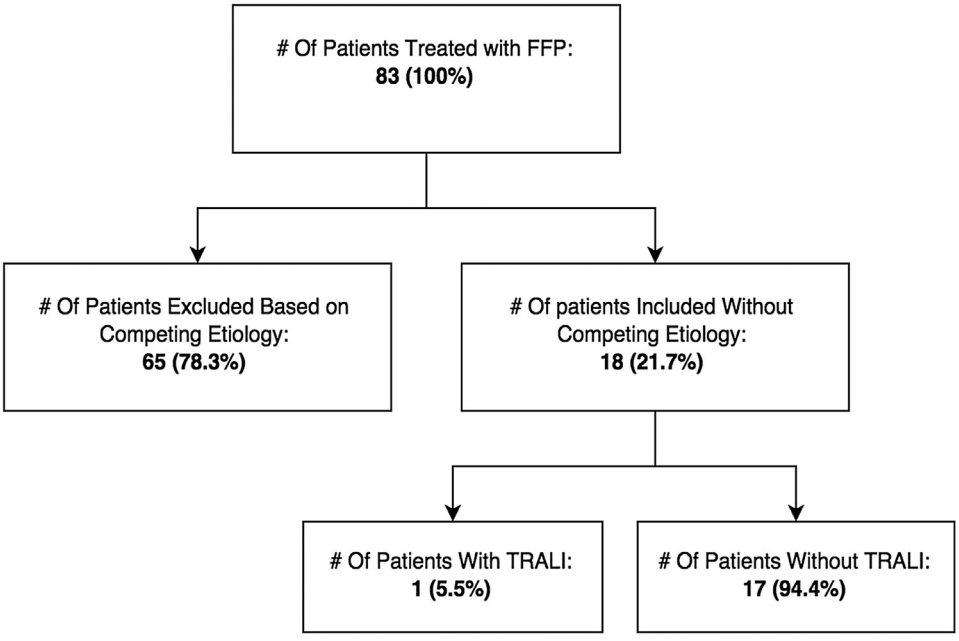

Fig. 1 – Flow diagram for sample size.