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# A comparison of two different fluid resuscitation management protocols for pediatric burn patients: A retrospective study

Miao Huang [a,1], Jun-Feng Chen [b,1], Li-ying Chen [c], Li-qin Pan [c], Xiao-jian Li [c], Jie-yu Ye [c], Hui-yi Tan [a,*]

[a] Department of Nursing, Guangzhou Red Cross Hospital, Fourth Affiliated Hospital of Jinan University, Guangzhou, 510220, China
[b] Department of Infectious Diseases, Third Affiliated Hospital of Sun Yat-sen University, Ministry of Education, Guangzhou, 510630, China
[c] Department of Burns, Guangzhou Red Cross Hospital, Fourth Affiliated Hospital of Jinan University, Guangzhou, 510220, China

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ABSTRACT

*Objective:* Pediatric burn patients are more susceptible to burn shock than adults, and an effective fluid management protocol is critical to successful resuscitation. Our research aim was to investigate the safety and efficacy of two protocols for pediatric burn patients for use within the first 24 h.

*Methods:* A total of 113 pediatric burn patients were enrolled from January 2007 to October 2012. Of those patients, 57 received fluid titration regimens of alternating crystalloids and colloids once within 2 h in the first 24 h after burn (Group A), whereas the remaining patients received regimens of alternating crystalloids and colloids once within 1 h in the first 24 h after burn (Group B). The safety, fluid volume infused and urine output were recorded and compared.

*Results:* All the patients survived in the first 24 h after burn. There were no significant differences between Group A and Group B in lactic acid (LA) level and base excess (BE). The water infused in Group A were greater than that of Group B in the first 24 h ($P=0.024$). No significant differences were found in total volume intake and hourly urine output between the 2 groups in the first 24 h.

*Conclusion:* The implementation of fluid resuscitation using either protocol A or protocol B is safe and effective for pediatric burn patients in the first 24 h. The total fluid infused were similar between two protocols. But using protocol A may be more convenient and labor-saving for nurses.



*Abbreviations:* LA, lactic acid; BE, base excess; ACS, abdominal compartment syndrome; TMMU, Third Military Medical University; TBSA, total burn surface area; BW, body weight; BICU, Burn Intensive Care Unit.

* *Corresponding author at*: Department of Nursing, Guangzhou Red Cross Hospital, Fourth Affiliated Hospital of Jinan University, 396 Tongfuzhong Road, Haizhu Area, Guangzhou, 510220, China. Fax: +86 20 34403835.
E-mail address: redcrosstanhuiyi@126.com (H.-y. Tan).
[1] These authors contributed equally to this work.

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## 1. Introduction

Burn shock results from hypovolemia and edema caused by the redistribution of fluid and albumin between the circulation and the non-injured and injured interstitium [1]. Burn is one of the main causes of accidental injury in children in China [2]. Pediatric burn patients are more susceptible to burn shock than adults because of their poor tolerance to the loss of liquids [3]. Study showed that nearly 71% of pediatric burn patients suffered burn shock at the time of treatment which was related with the high incidence of complications [4]. So burn shock management is very important. Resuscitation with inadequate or excessive fluid volume in burn shock patients can increase the incidence of severe complications, such as vital organ failure due to insufficient perfusion, tissue edema, and abdominal compartment syndrome (ACS), leading to unfavorable outcomes [5,6]. Given this phenomenon, several invasive variables (e.g., central venous pressure and pulmonary arterial pressure) and non-invasive indexes (e.g., urine output, stroke volume variables, cardiac index, and systemic vascular resistance index) were used to monitor the fluid volume of burn patients, which proved to be effective and feasible [7,8]. In addition, studies have shown that both a nurse-driven resuscitation protocol and a computerized decision support system for burn patients can decrease total fluid volume, thereby avoiding complications of ACS [9,10]. However, few studies have focused on the safety and efficacy of different alternating frequencies of crystalloids and colloids in pediatric burn patients.

Our department administered fluid resuscitation to burn patients using the Third Military Medical University (TMMU) protocol, as is done in most parts of China [11]. Specifically, two different fluid titration regimens were employed. The first one involved alternating crystalloids and colloids once within 2h in the first 24h after burn, whereas the second one involved alternating crystalloids and colloids once within 1h in the first 24h after burn (Fig. 1). Studies showed that infusion of crystalloids and colloids evenly in unit time, avoiding administrating a single liquid (e.g., crystalloids, colloids) excessively in a relative long time would result in favorable outcomes in pediatric burn patients [12]. But there is not a clear definition for the "unit time". The two protocols mentioned above alternated crystalloids and colloids within different time unit (1h or 2h), and we speculated that it may have different influence on the outcomes of pediatric burn patients. Our study aimed to evaluate the safety and efficacy of these two titration regimens for pediatric burn patients in the first 24h after burn.

## 2. Patients and methods

### 2.1. Patients

Patients with a total burn surface area (TBSA) >10% who were younger than 14 years old with an administered time after burn ≤8h and burn due to hydrothermal or flame who mainly received fluid titration regimens of alternating crystalloids and colloids once within 1h or 2h in the first 24h after burn were eligible for inclusion. We excluded patients who had cardiac and pulmonary disease (e.g., all kinds of congenital heart disease and tuberculosis), suffered from a urinary system disease (e.g., glomerulonephritis and nephritic syndrome), or had incomplete clinical and biochemical data from the first 24h after burn. Patients who received fluid titration regimens of alternating crystalloids and colloids once within 2h in the first 24h after burn were in group A, whereas those who received regimens of alternating crystalloids and colloids once within 1h in the first 24h after burn were in group B.

### 2.2. Fluid resuscitation protocol

All the patients received fluid resuscitation with only one venous channel, as pediatric burn patients have poorer blood vessel condition than adult burn patients. Indwelling needle and precision infusion with a Y-connector were used. The TMMU protocol was applied to calculate the total volume of crystalloids/colloids/water. For pediatric patients, 1.0ml of lactated Ringer's solution and 1.0ml colloid (younger than 2 years) or 0.88ml of each (older than 2 years) per 1% TBSA burn area per kg body weight (BW) was administered during the first

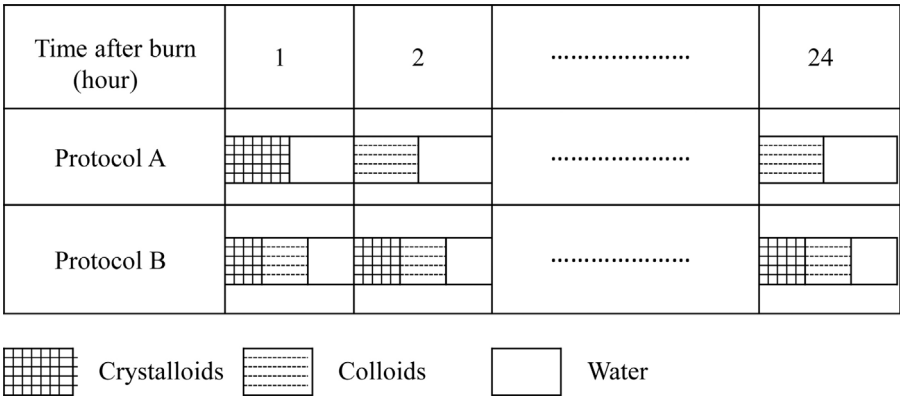


**Fig. 1 – Timeline chart of fluid resuscitation protocols for the pediatric burn patients in the first 24h. Protocol A: patients received infusion of crystalloids, colloids and water. Crystalloids and colloids alternated once within 2h. Protocol B: patients received infusion of crystalloids, colloids and water. Crystalloids and colloids alternated once within 1h.**

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