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### Scientific and Technological Research

## Identification of a thromboelastographic pattern in children undergoing cardiac surgery with prolonged exposure to cardiopulmonary bypass<sup>☆</sup>

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#### ABSTRACT

**Background:** Point-of-care thromboelastography is used for guiding peri-operative haemostatic therapy.

**Objective:** To identify a thromboelastographic pattern in children with prolonged cardiopulmonary bypass exposure.

**Material and methods:** A cohort study of 62 patients undergoing prolonged cardiopulmonary bypass was performed. Patients with preexisting coagulopathy, use of drugs known to interfere with clotting, hematocrit >60%, weight <3 kg, or hepatic disease were excluded. The thromboelastography study was conducted at the point of care.

**Results:** Baseline and rewarming reaction time values were  $8.24 \pm 6.35$  and  $7.66 \pm 2.15$  min, respectively ( $p = 0.102$ ). Baseline and rewarming angle values were  $64.88 \pm 13.08$  and  $54.67 \pm 8.98$  degrees, respectively ( $p < 0.001$ ). Baseline and rewarming maximum amplitude values were  $64.54 \pm 12.31$  and  $43.14 \pm 12.47$  mm, respectively ( $p = 0.001$ ). The same trend was observed when the cohort was divided into patients under and over 3 years of age, and patients under and over 10 kg of body weight.

**Discussion:** This study suggests the existence of a thromboelastographic pattern independent of age or weight in patients undergoing paediatric cardiac surgery with prolonged cardiopulmonary bypass exposure, characterised by a reduction of angle and maximum amplitude values, with no change in reaction time.

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## Identificación de un patrón tromboelastográfico en niños sometidos a cirugía cardíaca con exposición prolongada a circulación extracorpórea

### R E S U M E N

#### Palabras clave:

Tromboelastografía  
Cirugía torácica  
Hemorragia  
Niño  
Coagulación sanguínea

**Introducción:** La tromboelastografía se emplea para la orientación en el manejo de la coagulación perioperatoria en el sitio de atención.

**Objetivo:** Identificar un patrón de coagulación en niños sometidos a tiempos prolongados en circulación extracorpórea así como su asociación con edad y peso.

**Material y Métodos:** Realizamos un estudio de cohorte en 62 pacientes sometidos a circulación extracorpórea prolongada. Excluimos pacientes con coagulopatía pre - existente, empleo de medicamentos interfiriendo con la coagulación, hematocrito >60%, peso <3 Kg o con enfermedad hepática. El estudio de tromboelastografía fue realizado en el sitio de atención. **Resultados:** Los valores para el tiempo de Reacción basales y durante recalentamiento fueron: 8,24 +/- 6,35 y 7,66 +/- 2,15 minutos respectivamente (p= 0,102). Los valores para el Ángulo basales y durante recalentamiento fueron: 64,89 +/- 13,08 y 54,67 +/- 8,98 grados (p < 0,001). Los valores para Amplitud Máxima basales y durante recalentamiento fueron: 64,54 +/- 12,31 y 43,14 +/- 12,47 mm respectivamente (p=0,001). Dividiendo la cohorte en pacientes menores o mayores a 3 años o bien en menores o mayores a 10 Kg se observó el mismo comportamiento.

**Discusión:** Este estudio sugiere la existencia de un patrón tromboelastográfico independiente de la edad o peso en pacientes sometidos cirugía cardíaca pediátrica con permanencia prolongada en circulación extracorpórea caracterizado por reducción en los valores de ángulo y amplitud máxima, sin modificación en el tiempo de reacción.

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## Introduction

Peri-operative bleeding is perhaps the most common complication in paediatric cardiac surgery (PCS). This event is often associated with an increase in hospital length of stay or the need for surgical reintervention during the postoperative period.

One of the main factors associated with increased bleeding is prolonged exposure to cardiopulmonary by-pass circulation (CPB), which is also related to the complexity of the surgery required to address the cardiac condition. Likewise, other factors associated with a higher risk of bleeding include age under 1 year, level and duration of the hypothermia, and a low pre-operative platelet count.<sup>1</sup>

Several strategies have been proposed for reducing peri-operative bleeding in different situations, including CPB, but no consensus has been reached so far<sup>2</sup>; however, a group of experts from the European Society of Anaesthesia under the coordination of Sibylle A. Kozek-Langenecker have published management guidelines for the control of massive bleeding.<sup>3</sup>

These guidelines include the following recommendations:

We recommend the use of transfusion algorithms incorporating pre-defined intervention triggers to guide interventions designed to achieve control of intra-operative bleeding (Level 1B Recommendation).

We recommend the application of transfusion algorithms incorporating pre-defined triggers based on point-of-care (POC) coagulation monitoring studies to guide corrective

manoeuvres during cardiovascular surgery (Level 1C Recommendation).

More recently, the American Society of Anaesthesiologists (ASA)<sup>4</sup> has published guidelines for the peri-operative management of blood products, reaching the same conclusion as those published by the European Society in the sense that the use of viscoelastic tests to build algorithms or protocols for peri-operative management reduces the need for using blood products during the peri-operative period.

At the Instituto Nacional de Pediatría (National Paediatrics Institute) in Mexico we use the concept of point-of-care (POC) diagnosis, and as far as clotting is concerned, we use thromboelastography (TEG) for monitoring haemostasis abnormalities. This study was designed to determine whether there is a coagulation pattern in children undergoing prolonged exposure to CPB, and to analyse the effects of weight and age on the outcomes for these variables.<sup>1,5</sup>

## Materials and methods

Both the Ethics as well as the Research Committee of Instituto Nacional de Pediatría granted registration number 060/2012 on June 17 and July 20, 2012, respectively. The informed consent for anaesthetic and surgical procedures, and for transfusion if needed, was obtained from the parents or guardians.

This prospective, descriptive and observational cohort study included all patients undergoing PCS with the potential of remaining under CPB for more than 90 min between

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