

How well are We Teaching the Physiology of Transition at Birth?

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Abstract

A true physiological transition of the circulation at birth does not include any intervention. Teaching texts were searched and we found that nearly all included the intervention of cord clamping either overtly or covertly. The implications of this distortion of physiology are discussed.

Introduction

Human physiology is primarily about understanding how our bodies function, and armed with this knowledge we should be able to understand how the body responds and adapts to external events. There can be a dispute or uncertainty about the precise way a physiological function works. There can be no dispute that a true physiological description cannot include any outside intervention. Transition at birth from placental respiration (via the umbilical cord circulation) into pulmonary respiration is a complex change which has to occur with relative speed. Recent practice has been to “assist” this transition by clamping the umbilical cord at birth. However no matter how beneficial or otherwise this may be, this outside intervention cannot be included in a true physiological description.

Method

A range of well-known physiology and medical textbooks stocked in the hospital library were searched for a description of transition of the neonate at birth. The description of transition of the circulation was checked to determine how the closure of the placental circulation was achieved and whether or not an umbilical cord clamp was included in this description. Eight textbooks were found to contain the description of physiological transition at birth.

Results and Discussion

This is the description in the recent publication of Ganong’s Review of Medical Physiology [1]. The description was checked to determine whether or not it met with the physiological criteria? *“Because of the patent ductus arteriosus and foramen ovale, the left heart and right heart pump in parallel in the fetus rather than in series as they do in the adult. At birth, the placental circulation is cut off and the peripheral resistance suddenly rises. The pressure in the aorta rises until it exceeds that in the pulmonary artery. Meanwhile, because the placental circulation has been cut off, the infant becomes increasingly asphyxial. Finally, the infant gasps several times, and the lungs expand. The markedly negative intrapleural pressure (-30 to -50 mm Hg) during the gasps contributes to the expansion of the lungs, but other factors are likely also involved. The sucking action of the first breath plus constriction of the umbilical vein squeezes as much as 100mL of blood from the placenta (The placental transfusion)”*

Firstly this description does not provide any explanation for the statement that “At birth, the placental circulation is cut off . . .” which is clearly a sudden event as it results in “the peripheral resistance suddenly rising.” The passive tense suggests an outside influence has led to the placental circulation being cut off. In a normal physiological transition there is no sudden “cut off” of the placental circulation which usually continues for at least 120 seconds [2]. Ganong’s description states that the infant is becoming increasingly asphyxiated however this recent investigation showed a steady rise in the cord arterial pO₂ and a similar rise in venous pO₂ up to 45 seconds after birth [2]. The sequence of events may not be fully explained in the Ganong description but there is the implication that the sequence is in the same order as they are described. The description therefore is at the very least, quite confusing by stating that “constriction of the umbilical vein squeezes as much as 100mls of blood from the placenta.” when earlier on we are told that the placental circulation has been cut off. How has it opened up again? Even if it was open how can constriction of the umbilical vein squeeze blood from the placenta into the baby?

The use of a cord clamp is not specified in this description but it is difficult to find an alternative explanation for the events described. The obvious explanation for the placental circulation being “suddenly cut off” after birth, is the cord clamp. The first invention of the cord clamp “A midwifery surgical clamp” was published in The Lancet 111 years ago by Edward Magennis who specifically advised that his clamp should be placed on the cord “when it has ceased to pulsate” [3]. The implication is that any functional circulation within the cord has ceased naturally before the clamp is applied.

Two other textbooks of physiology were available and the descriptions of transition was equally distorted by including an umbilical cord clamp [4,5]. Gray’s Anatomy provides a satisfactory description [6] providing a biochemical and physiological explanation for the construction of the umbilical vessels. Two textbooks of paediatrics [7-9], and one of cardiology [10] describes the cord clamp as part of the physiological process.

At best these descriptions are confusing to a student. Physiology is a subject taught at the start of the medical education course at a time when subtle influences may not be apparent. Could this partly explain the reluctance of the medical establishment to consider that applying a cord clamp is a medical intervention, while not clamping the cord [or at least delaying clamping for several minutes until its function has

appeared to cease], is close to the normal physiological event. Many clinicians fail to appreciate that early cord clamping is an intervention. Current research in preterm neonates should regard the physiological norm to be delayed cord clamping [11] and the clinical practice of early cord clamping permitted only if a benefit for the neonates is eventually shown in the research.

Physiological descriptions of transition must reflect a true physiological process. If cord clamping is considered to be important, a description of the physiological adaption to the intervention should be clearly explained. 25th edition of Ganong published January 2016 provides a true physiological description.

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