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## The foetal distress decreases the number of stem cells in umbilical cord blood

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## The foetal distress decreases the number of stem cells in umbilical cord blood

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### Abstract:

The authors evaluated the blood volume of foetal blood remaining in the placenta after giving birth with the foetal distress and after a physiological delivery. While the amount of blood collected did not differ between groups, the number of CD34 cells was greater in the physiological group. Foetal distress during labour leads to a shift of blood from the placenta to the foetal circulation compartment.

**Key words:** Distress, Foetal stem cells, Umbilical Cord Blood

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### Introduction

A lot of research has been performed all over the world on umbilical cord blood (UCB), and many UCB banks have been instituted in the U.S.A. and Europe, since Gabutti, for the first time, collected and isolated several foetal haematopoietic progenitor cells from the residual placental blood, after delivery and ligation of the umbilical cord. In Italy, also, UCB banks belonging to the GRACE group [1,2] of Milan connected to the European Netcord have been established. Recently, a new UCB bank has been instituted in Sicily, particularly in Sciacca. It is currently waiting for the official affiliation to the GRACE group (ISO 9002 certification).

Considered as an alternative source of haematopoietic stem cells to bone marrow, UCB is becoming more common in the treatment of malignant and non-malignant haematologic and immunologic diseases [3-6]. Rubinstein argues that UCB confers some additional advantages when compared to hematopoietic stem cells

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taken from bone marrow. For example, there is a lower risk of graft-versus-host disease despite HLA mismatch in transplantation with UCB, and there is no risk or pain for the donor. However, some disadvantages have been noted, like a relatively lower amount of stem cells acquired.

### Our experience

Since the beginning of its activity, the Obstetrics and Gynaecology Department of the University

of Catania has been involved in the collection of UCB samples. From December 2009 to February 2010, 263 UCB units had been collected and sent to Sciacca's bank. Among them, 134 were collected from newborns delivered vaginally, without foetal distress while the remaining were collected from caesarean sections in order to foetal distress.

All vaginal deliveries were done under epidural or local infiltration anaesthesia and no uterotonic drugs were given before cord clamping. No significant obstetric complications were recorded. All infants were in the 38<sup>th</sup>-41<sup>st</sup> week of gestation, with an Apgar score of 7 or more at the 1<sup>st</sup> and 5<sup>th</sup> minute, and remained healthy in the newborn nursery [7]. We measured the time elapsed between birth of the buttocks and the moment when the umbilical cord was clamped. At delivery, infants were held above of the level of the surgical table and below the height of maternal abdomen. This level was similar to the level at which vaginally delivered infants were held. The cord was handled carefully so as to stretch it as little as possible, but it was often necessary to unwind it from the infant's neck or legs. We measured the time elapsed from the birth of the buttocks in a vertex, cephalic presentation when the breech was first delivered through the uterine incision to the first cry and the time when the umbilical cord was clamped. We evaluated the volume of blood collected [6,8] and the number of CD34+ cells [9,10] contained in the foetal cord blood according to the birth route: caesarean section (for foetal distress) or vaginal delivery (not foetal distress). The method of blood collection consisted of puncturing, with an 18-gauge needle, the umbilical cord vein and withdrawing the blood into a sterile bag immediately after clamping and newborn assistance (Figure 1). The blood was collected when the placenta was still in uterus. In fact, as shown by Dunn [11], after vaginal delivery of an infant, the compression of the placenta due to uterine contractions forces

blood from the placenta to the infant and hastens placenta transfusion [12].



**Figure 1. Collection of umbilical cord blood in vaginal delivery**

The blood contained in the in situ placenta flowed by gravity from the umbilical cord to the sterile collection bag. Collection was approved by the local ethical committee and an informed consent was obtained from the mother before each collection. The indications for a caesarean delivery were independent from the study. UCB clamping times, independently from the research, were obviously different in the two groups, owing to the technical reasons based on the type of delivery. Clamping times were particularly shorter in caesarean sections with respect to vaginal deliveries. This is particularly important because the time allowed between delivery of an infant and clamping of his/her umbilical cord is the principal determinant of the distribution of blood between the infant and the placenta. In addition foetal distress during labour leads to a shift of blood from the placenta to the foetal circulation compartment.

The results showed that cord blood volume were similar between the 2 groups (Table 1). The higher median volume of blood collected from infant delivered through a caesarean section seems mainly due to the different clamping time rather than the kind of delivery.

**Table 1. Cord Blood in foetal and no-foetal distress**

	No-foetal distress (n=134)	Foetal distress (n=129)	p-value
Cord Blood Volume (ml)	59±27	55±23	0.11†
Cord Blood CD34+ (x10 <sup>5</sup> )	30±6	17.4±2.4	0.04*

\*Mann-Whitney U Test. † Not statistically significant. \*Statistically significant

In conclusion, according to what was previously reported, there was no statistically significant difference between the quantity of blood collected during caesarean sections for foetal distress or vaginal deliveries. This has an important implication in the selection of the kind of delivery for the crucial collections performed when a pregnant woman has a child affected by a disease treatable with stem cells transplantation. These cells can be obtained from either the newborn foetal cord blood or his bone marrow, if he is HLA compatible. In such cases it is not necessary to perform a caesarean delivery in the attempt to collect a higher blood volume and consequently a higher number of transplantable foetal haematopoietic stem cells.

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