HAEMOSTATIC MECHANISMS IN MATERNAL, UMBILICAL VEIN AND UMBILICAL ARTERY BLOOD AT THE TIME OF DELIVERY IN NORMAL PREGNANCY

by

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Introduction

As pregnancy is a physiological process, certain physiological adjustments regularly takes place to meet the increased metabolic demand consequent on or conditioned by pregnancy. These adjustment include important circulating biochemical and haematological changes which affects haemostatic mechanism.

Though obvious clinical disturbances in coagulation and fibrinolysis are rare to occur in normal pregnancy, significant biochemical detectable elevation do occur. The haemostatic mechanism appears to be altered towards an enhanced capacity to form fibrin and a diminished capacity to lyse fibrin.

Bonnar *et al* (191) reported a decrease in clotting factors, clotting activity and an increase in fibrinolytic activity in umbilical vein blood immediately after delivery. Umbilical vein platelets have been shown to have decreased function when compared with maternal platelets. Umbilical artery blood is more likely than umbilical vein blood to reflect the haemostatic state of baby in utero during labour and in early neonatal period, as umbilical artery blood is influenced by placental separation.

Foley *et al* (1977) while studying the haemostatic mechanism on paired samples from umbilical vein and artery and from maternal peripheral venous blood immediately following delivery in patients with uncomplicated pregnancy demonstrated that neonatal blood shows a significant decrease in clotting activity, platelet function and significant increase in fibrinolytic activity. The umbilical vein in comparison to artery showed increase clotting activity, increased platelet function and decreased fibrinolytic activity. Their study showed that placenta has an influence on neonatal haemostasis. An increase in clotting activity platelet function with decreased fibrinolytic activity was demonstrated in maternal blood following placental separation. They found neonatal haemostatic mechanism to be significantly less active than maternal mechanism which is hyperactive at the time of delivery.

It is reasonable to assume that the decrease potential haemostatic activity has a beneficial effect on the well being of foetus in uterus and therefore any altera-

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Accepted for publication on 4-11-80.

tion might have an effect on foetal growth and development. The maintainance of a patent arterial and venous system is clearly essential for placental perfusion and it is attractive to speculate that increased fibrinolytic activity in the foetus may be an important contributory factor.

Material and Method

Eighty-one healthy patients with uncomplicated pregnancy were studied.

5 cc. of blood was drawn from antecubital vein from maternal side within 30 minutes of delivery and mixed with anticoagulant in a sterilised test tube. The umbilical cord was doubly clamped and the samples were collected from the arteries and veins between clamps. The tests were carried out within 30 minutes of sample collection.

After taking the blood for total platelets count, the rest of the blood was centrifuged without delay at 1200-1500 for 5 minutes. The supernatant plasma was then removed in a clear glass test-tube and kept at 40°C till the rest of the tests were performed.

Method of Estimating Haemostatic Components

Total Platelets count: By basic methods using formal citrate red cells diluent.

Clotting time: By capillary tube method

Plasma recalcification time:

By Calcium time method

Plasma Fibrinogen:

By Turbidimetric Method modified by Ellis and Stransky

Plasma Fibrinolytic activity:

By Euglobin Clotlysis time

Table shows mean value range and standard deviation of all the components estimated in present series of work.

While the mean umbilical vein platelet count (2,27,400/cum of blood) were found to be greater than the mean maternal vein platelet count (1,55,2.40 cum of blood) and the mean umbilical artery platelet count (2,04,200/cumm blood) which were also greater than mean maternal platelet count, our results show cord blood platelet count to be higher than that of maternal blood and umbilical vein platelets showing greater rise than umbilical artery platelets.

The clotting time in umbilical vein and artery was found to be higher than that of maternal blood, although the difference was not so marked.

The mean maternal vein clotting time is about 3' 38".12 while umbilical vein 4' 37".5 and mean umbilical artery clotting time is 4' 05".7.

In the present study, maternal vein blood shows recalcification time to be almost within normal range (92-120 seconds) but much prolonged in umbilical cord blood. Recalcification time in maternal vein ranged from 70-108 seconds, while umbilical vein shows an average of 182.46 seconds and mean umbilical artery 275.68 seconds.

Plasma fibrinogen concentration in cord blood is remarkably lower than well elevated level in maternal blood. The difference between the umbilical vein and artery is not so marked but greater on venous side. The maternal vein blood shows average plasma fibrinogen level of 533.68 mg./100 ml of blood. The mean maternal vein fibrinogen is found to be much greater than mean umbilical vein 320.96 mg. and the mean umbilical artery fibrinogen 294.04 mg. The umbilical vein fibrinogen level is though not so marked

TABLE I

Components of Haemostatic Mechanism at Birth in Normal Pregnancy in Maternal, Umbilical Vein and Umbilical Artery

Components	Maternal Vein N = 50			Umbilical Vein N = 50			Umbilical Artery N = 50		
	Mean	Range	S.D.	Mean	Range	S.D.	Mean	Range	S.D.
Total Platelet Count (Per cum of blood)	1,55240	142-1,73,000	7514.14	2,27,400	211-23,9,000	5546.16	1,04,200	197-2,17,00	5520.13
Clotting time (in minutes & Seconds)	338″.12	3′-4′20″	19″.44	4′37″.5	3′55″ 5′15″	17″.06	4′05″.77	3′33″-4′33″	13″.20
Recalcification time (in Second)	91″.44	70″-108″	11″.09	182″.46	155″-203″	14″.74	275″.68	233″-299	17″.01
Plasma Fibrinogen (mg/100 mg of blood)	533.68	498-565	15.96	320.96	295-348	15.507	294.04	275-320	12.76
Euglobin lysis time (in minutes)	122′.82	97′-150′	11.37	219′.62	190′-256	17′.74	299′.48	270′-325	11′.68

but still greater than umbilical artery plasma fibrinogen level.

Our observation shows that fibrinolytic activity in Euglobin lysis test is increased in cord blood than in maternal blood.

Mean Euglobin lysis time 122.88 minutes in maternal vein. 219.62 minutes in umbilical vein and 299.48 in umbilical artery.

Discussion

The haemostatic mechanism in pregnancy appears to be altered towards enhanced capacity to form fibrin and diminished ability to lyse fibrin. These changes may be physiological development to ensure the integrity of the foetal and maternal circulation producing rapid and effective haemostasis in uterus during and after placental separation.

The principle objective of present work was to study the haemostatic mechanism in maternal, umbilical vein and umbilical artery blood at the time of delivery in normal pregnancy with a view to study the possible adverse influence of placenta on haemostasis in the foetus and the new born.

Our results show cord blood platelet count to be higher than that of maternal blood and at the same time umbilical vein blood platelets are increased more than the umbilical artery platelets.

Foley *et al* (1977) while studying the haemostatic mechanism at birth reported decreased maternal platelet count in comparison to umbilical vein and umbilical artery blood. They also reported slight but significantly greater platelet count in umbilical vein blood than artery. This increased platelet count is explained by them that it may be due to release in venous circulation at the time of placental separation from placenta which stores small number of platelets.

The clotting time in umbilical vein and artery was found to be higher than that of maternal blood, although a difference was not so marked. Bonnar *et al* (1971) also made similar observation.

Re-calcification time was found to be significantly increased when compared to maternal vein ($P < 0.005$), the difference is much greater when umbilical artery is compared with maternal vein ($P < 0.05$) the difference between umbilical vein and artery is also significantly being greater on arterial side.

Plasma fibrinogen concentration in cord blood is remarkably lower than well elevated level in maternal blood. The difference between the umbilical vein and artery is not so marked but greater on venous side. Foley *et al* (1977) observed that the level of fibrinogen in cord blood was significantly lower than well elevated level in maternal vein. The low level of plasma fibrinogen is explained as due to increased fibrinolytic activity in shed blood, which presumably reflect a healthy vascular compartment with no fibrin deposition and no fibrinolysis. High level of fibrinogen in maternal blood was explained as an associated reduced level of fibrinolytic activity, a finding which was explained in past by high levels of maternal antiplasmin and low levels of circulations plasminogen activators in normal pregnancy (Bonnar *et al*, 1969).

Fibrinolytic activity in Euglobin lysis test is increased in cord blood than in maternal vein. Lysis time and blood fibrinolytic activity are inversely related hence a long lysis time means a high fibrinolytic activity and vice versa (Nilsson and Olow, 1962).

Conclusions

Our study shows that placenta has an influence on neonatal haemostatic mecha-

nism. Neonatal blood showed a significant decrease in clotting activity and platelet function and decreased fibrinolytic activity.

The study confirms that cord blood is influenced by placental separation, it is possible that placenta influences foetal haemostasis in the uterus.

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