Appraisal of time interval between separation of the placenta by cord traction and delivery of the fetus at time of caesarian section

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by

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Abstract

Background

Worldwide, caesarean section is the most common major operation performed on women. The method of removing the placenta is one such procedure that may contribute to an increase or decrease in the morbidity of caesarean section. Delivery of the placenta by cord traction at caesarean section has more advantages than manual removal. To the best of our knowledge no information has addressed the optimum time interval between the delivery of the infant and of the placenta with minimum side-effects.

Objectives

The main objective of our study is to estimate the best time needed to start the delivery of the placenta after fetal delivery in caesarian section that allow placental delivery without undue morbidity.

Patients and Methods

One hundred and twenty patients admitted for elective or emergency cesarean section after 34 weeks of gestation were recruited in a randomized, controlled clinical trial between October 2009 and May 2010 at the Gynecologic and Obstetric Department of Cairo University Hospital, Cairo, Egypt. Following study enrollment, 120 patients were randomly assigned to one of the four study groups as follows: group A, group B, group C and group D (According to the time of beginning cord traction on the placenta after fetal delivery; after 15, 30, 45, 60 seconds respectively). The time taken for the placenta to separate (seconds) was the primary outcome; while the secondary outcome was the amount of blood loss (in ml) from placental bed due to its separation.

Results

In this study, group (D) patients gives the best results in the amount of blood loss from placental bed (125.36 ± 7.96, n=30), as well as the least time interval from starting cord traction till complete delivery of the placenta(24.7 ± 4.41, n=30). Group (A) shares that it has also little amount in blood loss from placental bed (123.8 ± 16.87, n=30), but with more time interval from starting cord traction till complete delivery of the placenta (27.4 ± 5.02, n=30).

With respect to complications during delivery of the placenta as cord avulsion, incomplete removal or manual removal; those happen more frequently in group (A) (25%) than group (D) patients (16%), (n = 30).

The remaining groups, (B) and (C), give the worst results in the amount of blood loss from placental bed as well as the longest time interval from starting cord traction till complete delivery of the placenta.

Conclusion

Our study suggests that waiting enough time (at least 1 minute) after delivery of the fetus to start cord traction helps in reducing the amount of blood loss from placental bed as well as reducing the time interval needed for placental separation after starting cord traction with least morbidity.

Key words

Cesarean section; Placenta; placental delivery; spontaneous; manual; Cord traction; Time interval; Blood Loss.

Introduction:

Worldwide, caesarean section is the most common major operation performed on women. Some of the reported short-term morbidities include hemorrhage **(Chamberlain, 1999; Combs, 1991)**, need for blood transfusion **(Klapholz, 1990)**, postoperative fever and endometritis. **(Newton, 1990)**

Long-term morbidities include placenta praevia, placenta accreta and ectopic pregnancy **(Almeida, 2002; Gilliam, 2002; Hemminki, 1996)**. There are many possible ways of performing a caesarean section operation and variations in the techniques used may increase some of the complications mentioned. A series of Cochrane Reviews on this topic is currently being compiled. **(Alderdice, 2003; Anderson, 2004; Bamigboye, 2003; Dodd, 2004; Hofmeyr, 2004; Jacobs-Jokhan, 2004; Mathai, 2007)**

The method of removing the placenta is one such procedure that may contribute to an increase or decrease in the morbidity of caesarean section. The process of separation of the placenta starts immediately the baby is born when contraction and retraction of uterine muscles result in reduction in the size of the uterus. Consequently, the surface area of the uterus to which the placenta is attached (the placental bed) becomes smaller than the relatively incompressible placenta. As a result, the placenta is sheared off and the blood vessels supplying the now denuded placental bed are compressed by the continued contraction and retraction of the uterine muscles to reduce bleeding **(Anorlu et al., 2008)**.

Oxytocin is given either as an intravenous bolus dose, in an infusion or intramuscularly after the delivery of the baby to minimize blood loss. The value of routine oxytocics in the third stage of vaginal birth has been well established **(Cotter, 2001)**. Though little direct evidence exists, it seems reasonable to assume that these benefits would apply to caesarean delivery as well. **(Anorlu et al., 2008)**

Different methods for the delivery of the placenta at caesarean section have been described: placental drainage with spontaneous delivery, cord traction and manual removal. In placental drainage, the end of the umbilical cord is left unclamped and placental blood is drained and the placenta delivers spontaneously through the uterine incision, this method is not widely used. **(Sharma, 1995)**

The two methods most frequently used are cord traction and manual removal. Cord traction involves gentle traction on the umbilical cord with external uterine massage after an oxytocic has been given. Manual removal is the use of the gloved hand with a gentle sawing action to separate the placenta from its implantation site **(Anorlu et al., 2008)**. Some obstetricians commonly practice manual removal as they consider it a quicker way to deliver the placenta than awaiting spontaneous separation. The process of manual removal of the placenta may cause more bleeding **(Chamberlain, 1999)** and the introduction of a potentially contaminated hand into the uterus may increase the risk of infection. **(McCurdy, 1992)** Some studies **(Atkinson, 1996; Magann, 1993)** have found that the procedure of manual removal of the placenta increases postoperative morbidity, while others **(Cernadas, 1998)** have not.

Caesarean section is a common operation and needs to be made as safe as possible. Techniques to reduce some of the morbidities associated with this operation are very important. To the best of their knowledge no information has addressed the optimum time interval between the delivery of the infant and of the placenta with minimum side-effects. **(Anorlu et al., 2008)**

Aim of work

The main objective of our study is to estimate the best time needed to start the delivery of the placenta after fetal delivery in caesarian section that allow placental delivery without undue morbidity (decreasing blood loss from placental bed, minimizing the time needed for placental separation and to decrease morbidities during placental removal as cord avulsion, incomplete separation and manual removal).

REVIEW OF THE LITERATURE

I- Basic Considerations

A- Anatomical Considerations

Human placenta

The human placenta is discoidal, villous and hemochorial in structure. The arrangement of its maternal and fetal blood flow is in accord with the multivillous type of exchange system. These basic structural characteristics are realized by the following design: the human placenta at term is local, disk like thickening of membranous sac that is achieved by splitting the membranes into separate sheets, the chorionic plate and the basal plate. Both sheets enclose the intervillous space as cover and bottom. The intervillous space is perfused with maternal blood, after leaving the spiral arteries which circulates, directly around the trophoplastic surface of the placental villi. The maternal blood is outside the confines of the endothelium of the maternal vascular system. **(Kaufmann and Scheffen, 1992)**

The villi are complex tree like projections of the chorionic plate into the intervillous space. Inside the villi are fetal vessels that are connected to the fetal circulatory system via the chorionic plate and the umbilical cord. At the placental margin, the intervillous space is obliterated so that the chorionic plate and the basal plate fuse with each other and thus form the chorionic leave. **(Benirschke and Kaufmann, 2006)**

Assuming that there is already an intervillous circulation in the human placenta, fetal and maternal bloods come into close contact with each other as soon as an intervillous (i.e. fetal) circulation is established. The two blood streams are always separated by the placental barrier which is composed of the following layers: (1) a continuous layer of syncytiotrophoblast covering the villous surface and thus lining the intervillous space; (2) an initially (first trimester) complete, but later (second and third trimester) discontinuous layer of cytotrophoblast (Langhans' cells); (3) a trophoblastic basal lamina; (4) connective tissue; and (5) fetal endothelium which is surrounded only by an endothelial basal lamina in the last trimester. **(Kaufmann and Burton, 1994)**

A normal placenta has two portions. The maternal portion develops from the decidua basalis and the fetal portion develops from the chorion frondosum. The fetal tissue combines with the maternal decidua to form the circulation. The major functioning unit of the placental circulation is the chorionic villi, which is located in the intervillous spaces. Maternal blood enters the intervillous spaces through the spiral arterioles and pathes the chorionic villi. From there the blood enters the umbilical arteries and moves towards the fetus. **(DiGiacinto et al., 2006)**

Macroscopic features of the delivered placenta

The full-term, delivered placenta is, in more than 90% of the cases, a disk-like, flat, round to oval organ. In nearly 10%, it has abnormal shapes, such as placenta bilobata, placenta duplex, placenta succenturiata, placenta zonaria and placenta membranacea. The average diameter is 22cm, the average thickness in the center of the delivered organ is 2.5cm and the average weight is 470 g. The respective measurements show considerable interindividual variation and strongly depend on such factors as the mode of birth, timing of cord clamping and time elapsed between delivery and examination. **(Tropin, 1969)**

Fetal Surface

The fetal (chorionic or amnionic) surface, facing the amnionic cavity, has a glossy appearance because of the intact epithelial surface of the amnion. This membrane covers the chorionic plate, including the chorionic vessels. The latter branch is a star-like pattern positioned centrifugally from the cord insertion over the fetal surface. Where arteries and veins cross, the arterial branches are usually closer to the amnion; they cross the veins over their amnionic aspect. **(Wentworth, 1965)** reported that only about 3% show the opposite condition. According to **(Boyd and Hamilton, 1970)**, the superficial position of one or few venous branches at points of arteriovenous crossing is not unusual.

In the vicinity of the larger chorionic vessels, the chorionic plate normally has an opaque appearance because an increased number of collagen fibers accompany the vessels. Those areas of the chorionic plate located between the chorionic vessels are mostly transparent and are dark lilac to black because maternal blood in the intervillous space shines through. Opaque spots (bosselations) or large opaque areas independent of chorionic vessels, usually points to large subchorionic deposits of Langhans fibrinoid. **(Benirschke and Kaufmann, 2006)**

Near the placental margin, where the most peripheral branches of the chorionic vessels bend vertically towards the marginal villous trees, the transparency of the chorionic plate decreases, resulting in a largely incomplete opaque subchorial closing ring that is a result of increased amounts of cytotrophoblast and collagen fibers. It connects the placenta with the membranes. Placental shape and cord insertion are sometimes regarded as structurally impressive but functionally unimportant parameters. Both are influenced by the intrauterine position of the placenta. **(Becker, 1989)**

According to **(Benirschke and Kaufmann, 2000)** the location of the cord insertion represents the epicenter of implantation. Eccentric or marginal cord insertion thus points to an eccentric implantation on the anterior or posterior uterine wall which causes asymmetrical development of the organ for mechanical and nutritional reasons.

Maternal Surface

The uterine (maternal) surface of the placenta is opaque as it is an artificial surface originating from laminar degenerative processes within the junctional zone that led to the separation of the organ. This separation process subdivides the junctional zone between placenta and uterine wall into:

The basal plate, which is attached to the placenta and represents the maternal uterine surface of the organ.

The placental bed, which remains in utero. **(Frank and Markee, 1999)**

Definition of placental bed and basal plate

The term "placental bed" refers to part of the uterus (decidua and myometrium) lying underneath the placental insertion site. The maternal-fetal junction comprises the basal plate of the placenta, which is composed of tissues normally detached with the placenta and the placental bed, which is what is left in the uterus. **(Frank and Markee, 1999)** The term "placental bed" should not be confused with the "basal plate of the placenta", which is the floor of the intervillous space. Its surface is visible with the naked eye on the maternal surface of the placenta, and is composed of the part of the maternal-fetal junction adhering to the delivered placenta. **(Benirschke and Kaufmann, 1999)**

An incomplete system of grooves subdivides the basal surface of the placenta into 10 to 40 slightly elevated areas called maternal cotyledons (lobes or lobules). Internally, these grooves correspond to the placental septa, folds of basal plate, which project into the intervillous space. In histologic sections they can often be seen to be indented at their basal surfaces. It is likely that these grooves and the respective basal indentations of the septa are the postpartal results of tearing at sites of minor mechanical resistance, as the basal central parts of the septa are often characterized by necrotic zones, clefts and local pseudocysts. Despite their possibly artifactual genesis, the grooves delineate the lobes and mark the position of the septa. **(Boyd and Hamilton, 1970)**

The septa must not be understood as separating structures that subdivide the intervillous space into chambers; rather, they are irregular pillars or short sails that only trace the lobular borders. The lobes show fairly good harmony with the position of the **fetal cotyledons**. From the chorionic plate at term 60 to 70 villous stems arise, each branching into one villous tree (or fetal cotyledon). Thus, according to **(Kaufmann, 1985)**, each lobe is occupied by one or several villous trees. Small marginal lobes are likely to be occupied by only a single villous tree and thus correspond to what **Schuhmann and his group (1981)** described as representing a ***placentone***.

Wigglesworth (1967) studied corrosion casts of fetal vessels and suggested that most villous trees are arranged as hollow-centered bud-like structures around a central cavity. This finding is in agreement with most descriptions of the maternal arterial inlets as being located near the centers of the villous **(Schuhmann and Wehler, 1971; Schuhmann, 1981)**, which direct the bloodstreams into these centers. **(Panigel and Pascaud, 1968)**

The 20 to 200 maternal venous outlets of each placenta are thought to be arranged around the periphery of the villous trees. Thus, each fetomaternal circulatory unit is composed of one villous tree with a corresponding, centrifugally perfused portion of the intervillous space. This unit was called a "placentone" by **(Schuhmann and Wehler, 1971; Schuhmann, 1982)**

Most placentologists agree that, under in vivo conditions most of the 40 to 60 placentones are in contact with each other and that they overlap more or less broadly. This supposition is highly probable, as structural borderline such as placental septa, are absent. **(Becker and Jipp, 1963)**

According to **Benirschke and Kaufmann (2006)**, the peripheral placentones are more clearly separated from each other and thus exhibit typical structural differences between their central and peripheral zones. In the thicker, more central regions of the placenta, most villous trees overlap causing less distinct differences between maternal inflow and outflow areas of the placentone.

According to **Schuhmann and Wehler (1971)**, the centers of typical placentones exhibit loosely arranged villi, mostly of the immature intermediate type, and provide a large intervillous space for the maternal arterial inflow and the central arterial inflow area. It is still uncertain if these large loosely arranged villi regularly delineate a central cavity as described by **Wilkin (1965)**. **Schuhmann (1981)** suggests that these cavities are pressure-dependent in vivo structures that rapidly collapse after delivery and this suggestion is borne out by ultrasonographic findings.

According to considerations of **Moll (1981)**, the existence of such a central cavity guarantees the rapid and homogenous distribution of blood into the surrounding mantle of small densely packed villi with little loss of pressure. The surrounding mantle is composed mostly of small villi of the mature intermediate and terminal types and provides the peripheral exchange area. The villi are densely packed. **Schmid-Schonbein (1988)** described the intervillous space in this zone as a system of randomly shaped and oriented interconnected clefts or "connected voids".

The most peripheral zone of a placentone, the venous outflow area, is the loosely arranged area that separates neighboring villous trees and that subchorially is connected to the Subchorial Lake. It collects the maternal venous blood that has left the high impedance area of the fetomaternal exchange zone of the densely packed terminal villi. **(Benirschke and Kaufmann, 2006)**

This is called the perilobular zone, which is functionally comparable to wide venules of other vascular beds. It allows venous backflow under conditions of low blood flow resistance. The zonal differences become evident only after the development of mature intermediate villi at the end of the second trimester. Up to that time, the villous trees are largely homogenous. In most placentas, the immature placentone centers are present until term, at least in the more peripheral areas of the placenta. Only in cases of preterm maturation of the placenta (hypermaturity maturitas paraecox) mature placentone centers are regularly found resulting in a virtually homogenous structure of the placentones. Thus, such a placenta has lost its capacity to grow, as only the immature intermediate villi and their intermediate mesenchymal branches are able to sprout and act as growth zones. **(Moll, 1981)**