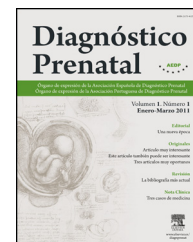


Diagnóstico Prenatal

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Original article

Monochorionic twin placentas: Injection technique and analysis

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ARTICLE INFO

Article history:

Received 28 August 2013

Accepted 12 September 2013

Available online 22 October 2013

Keywords:

Monochorionic placentas

Injection technique

Vascular anastomoses

Palabras clave:

Placentas monocoriónicas

Técnica de inyección

Anastomosis vasculares

ABSTRACT

Careful placenta examination and injection studies are crucial to understand the differences between the various complications in monochorionic (MC) pregnancies. In this review, we will first describe an accurate and simple method of placental injection and then discuss the placental characteristics of normal MC, twin-twin transfusion syndrome (TTTS), twin anemia-polycythemia sequence (TAPS), selective intrauterine growth restriction (sIUGR), monoamniotic (MA) and other special cases.

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Placentas monocoriónicas: técnicas de inyección y análisis

RESUMEN

El examen cuidadoso de la placenta y los estudios de inyección son cruciales para comprender las diferencias existentes entre las diversas complicaciones de los embarazos MC. En esta revisión, vamos a describir primero un método preciso y simple de inyección placentaria y, posteriormente, abordaremos las características de una placenta normal en MC, el síndrome de transfusión fetal-fetal (STFF), la secuencia anemia-policitemia (SAP), la restricción del crecimiento intrauterino selectivo (CIRS), la placenta monoamniótica (MA) y otros casos especiales.

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Introduction

Twin pregnancies can be classified into two different groups: monochorionic (MC) and dichorionic. MC twins have a 3–6-fold

increased risk of adverse perinatal outcome.^{1,2} Adverse outcome in MC twinning is due to complications associated with the presence of placental vascular anastomoses. Vascular anastomoses connecting the circulation of the twins are ubiquitous in MC placentas but are extremely

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rare in dichorionic placentas. These placental vascular anastomoses may lead to several complications including twin-twin transfusion syndrome (TTTS), spontaneous twin anemia-polycythemia sequence (TAPS), selective intrauterine growth restriction (sIUGR) and twin reversed arterial perfusion (TRAP).²⁻⁶ Imbalance of volume of blood flow through the vascular anastomoses may cause hypovolemia and/or anemia in one twin (donor) and hypervolemia and/or polycythemia in the co-twin (recipient). In addition, MC twins may also be monoamniotic (MA) which may lead to complications such as cord entanglement and double fetal demise.⁷

In this review, the methodology for injecting placentas is extensively described.

Dye-colored injection of MC placentas

All MC placentas should be routinely examined and injected after birth in order to understand the pathogenesis of the various complications. In addition, in TTTS placentas treated with fetoscopic laser coagulation, injection studies are of paramount importance to evaluate the accuracy and completeness of laser surgery, an important tool for laser therapy specialists. A detailed protocol for placental injection used at our center is reported here below and can be viewed using the following links: <http://www.youtube.com/watch?v=Qm4bdLk19BE>.⁸

Preparation of the placenta after delivery

Use clamps to label the umbilical cords of the twins with one for the first-born or two for the second-born. Then, inspect the maternal and fetal surface of the placenta for completeness or disruption and record the following data: type of cord insertion (central, eccentric, marginal or velamentous), number of blood vessels in the umbilical cord (usually one vein and two arteries, sometimes only one artery) and color difference between both placental shares. A section of the dividing membranes can be sent to Pathology to confirm the type of chorionicity. The placenta can then be placed in a plastic bowl and refrigerated until the final examination (best within one week) and color dye injection. The placenta must not be frozen or fixed (do not use formalin).

Catheterization of the umbilical vessels

Wash the placenta with warm water or saline, trim the peripheral membrane, remove the inter-twin dividing membrane and peel off the amnions (for better visualization of the vascular anastomoses and better quality of the placental pictures). Transect each umbilical cord at approximately 5 cm distance from the cord insertion and gently squeeze out blood clots from the umbilical vessels and placental vessels. Then, cannulate the umbilical cord vessels. Cannulate the umbilical vein with an appropriately sized catheter, avoiding false passages. Cannulate one of the two umbilical arteries with a smaller catheter using tweezers to widen the lumen of the artery. Only one of the 2 umbilical arteries needs to be catheterized since

an anastomosis (of Hyrtl) connects the 2 arteries near the cord insertion. Cannulation of the vessels of the other cord is same. Placement of the catheter can be facilitated by gentle back and forth massaging of the umbilical vessels. Any type of catheter can be used for this procedure. We choose to use (and recycle) the catheters used at our neonatology ward for umbilical catheterization in neonates. Tie a piece of tape around both cords to avoid back flow of the colored dye during dye injection.

Injection with colored dye

Connect a 20 ml syringe filled with colored dye to each catheter. Any viscous colored dye can be used to visualize the placental angio-architecture. Use contrasting colors to allow good visualization of the anastomoses (dark colors for the arteries, bright colors for the veins). Gently inject (with low pressure) the colored dye in the vein while an assistant gently pushes the dye to allow the colored dye to fill all placental vessels, also the smallest ones. Pay particular attention to the small vessels near the vascular equator (the vascular equator is the place where the anastomoses from either twin connect with each other). Repeat the previous steps to inject colored dye into the artery. Of note: arteries may be more difficult to inject and require more patience. Repeat above steps for the other umbilical cord.

Evaluation and documentation of the placenta after colored dye injection

Carefully examine the vascular equator and record the number and types of anastomoses. Place a measuring tape on the placenta to measure the diameters and placental shares on the digital picture. Use a high-resolution digital camera and take pictures of the injected placenta. Make sure that the pictures are taken perpendicular to the placenta.

Vascular anastomoses include 3 types: arterioarterial (AA), venovenous (VV) and arteriovenous (AV) or venoarterial (VA) anastomoses. The first two types are superficial with bidirectional blood flow and directly linking the arteries and veins of two umbilical cords, while AV anastomoses form at a deep capillary level within shared cotyledons and allow only unidirectional blood flow. Of note, color dye injected in AA and VV anastomoses mixes and crosses the vascular equator, whereas color dye in AV or VA anastomoses does not mix and does not cross over the vascular equator.

Differences between the various types of MC placentas

Between June 2002 and January 2013 a total of 654 MC placentas were examined at our center. We were not able to inject 46 placentas due to damage caused by maceration or destruction ($n = 41$) or formaline ($n = 5$). The results of the 608 injected placentas are summarized in [Table 1](#) shows the differences in angio-architecture between the various subtypes. A detailed description of the differences between each subtype of MC placentas is reported here below.

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