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DIAPHRAGMATIC HERNIA AND MESH - REVIEW AND PERSPECTIVES

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Abstract: Congenital diaphragmatic hernia is a defect that affects newborns who have had a problem in the formation of the diaphragm. Several factors may contribute to mortality, including pulmonary hypertension and pulmonary hypoplasia. Prenatal diagnosis and size estimation can contribute to adequate surgical planning, using biocompatible mesh and with fewer complications, such as recurrences. Currently there are several screens, but few are used in newborns with this pathology. The study of the biocompatibility and the large number of available biomaterials and their properties, mainly of adhesions, led to the discussion of the creation of new techniques and screens with the properties of non-toxic, non-immunogenic, biocompatible and diligent in reducing postoperative adhesions. fulfilled.
Keywords: Congenital diaphragmatic hernia, surgical meshes, healing.

INTRODUCTION

Congenital Diaphragmatic Hernia (CDH) is due to a failure during embryogenesis that occurs around 8 weeks after conception, resulting from the abnormal development of the pleuroperitoneal membranes. The diaphragm develops and separates the abdomen from the thorax and any failure can generate HDC, consequently the abnormal opening of the diaphragm, the viscera migrate to the thorax causing restriction of lung growth, later causing hypoplasia and pulmonary hypertension (GALLINDO et al, 2015; GREER, 2013; DOYLE et al, 2004; KLUTH et al, 1995).

The first description of CDH was in a necropsy of a 24-year-old young man, by Lazarus Riverius in 1679. Giovanni Batista Morgagni, in 1761, released a review on congenital and traumatic diaphragmatic hernias and described anterior CDH. Already, in 1848, Victor Bochdaleck reported patients with right and left posterolateral defects, which correspond to 80% of cases of CDH (GALLINDO et al, 2015; GREER, 2013; DOYLE et al, 2004).

CDH occurs in 8% of major congenital anomalies and occurs in between 1:2,000 to 1:4,000 live births. Males are more commonly affected, with a rate of 1.5:1 in relation to females. In breed, there is no significant difference. With regard to future pregnancies, the risk of recurrence is 2%. The left side is more commonly affected, in around 80% of cases. Despite the great medical and surgical advances in the management of CHD, mortality and morbidity remain high, in addition to the long hospital stays and the very important multidisciplinary outpatient follow-up (CHANDRASEKHARAN et al, 2017; KALAMJ et al, 2016).

The repair of diaphragm defects with meshes (biomaterials) as a priority, suggested a significant improvement in morbidity and survival of patients. Given this, if these meshes do not meet all biocompatibility criteria, they bring long-term complications and the need for new interventions (SOIDERER et al., 2004). The main biocompatibility criteria required are: adequate mechanical, physical and chemical behavior, chemical inertia and biocompatibility (CORDAS, 2006). The polypropylene mesh has some biocompatibility features (inert, non-allergenic, non-carcinogenic, easily sterilized). Due to the constant complications and impossibility of being placed in large defects of the diaphragm, as it cannot be in direct contact with the loops and the lung, the development of new membranes and new materials is necessary (RAMOS,2002).

Given the above, the objective of this work is to review the literature and demonstrate the evolution of the surgical technique and the perspectives of the prosthetic materials used.

DIAPHRAGM EMBRYOLOGY

CDH in fetuses usually appears because the pleuro-peritoneal canals do not close between the 8th and 10th week of gestation. The hypoplastic lungs of newborns with CDH have a reduced number of branches. Herniation of abdominal contents must occur before the 17th week of gestation, in the pseudoglandular stage of lung development (Harrison et al., 1990; Kluth et al., 1995).

The embryology of the diaphragm, despite its controversies, is divided into two phases: development of the primordium diaphragm and development of the pleural cavity and closure of the pleuroperitoneal canals (Kluth et al,1995; Chandrasekharan, 2017).

The pleuroperitoneal folds grow and become membranous forming the pleuroperitoneal membranes. Finally, these membranes completely separate the pleural and peritoneal cavities. Closure of the pleuroperitonal openings is completed with the growth of myoblasts into the pleuroperitoneal membranes. The right opening closes a little earlier than the left one (MOORE et al, 2016; Kluth et al, 1995)

The diaphragm has four embryonic components: Septum transversus: fuses with the ventral mesenchyme of the esophagus and with the pleuroperitoneal membranes; Pleuroperitonal membranes: fuse with the dorsal mesentery of the esophagus and the transverse septum; Dorsal esophageal mesentery: becomes the middle portion of the diaphragm and forms the crura of the diaphragm; Muscle tissue from the lateral walls of the body (MOORE et al, 2016; Kluth et al., 1995).

CONGENITAL DIAPHRAGMATIC HERNIA

HDC usually results from fusion and/or defective formation of the pleuroperitoneal membranes and other parts of the diaphragm. Prenatal diagnosis has contributed a lot to monitoring and follow-up, as well as magnetic resonance imaging (MOORE et al, 2016).

CHD occurs in live newborns (NB) and the defects are isolated in 50 – 60%, the remainder associated with other malformations. Morbidity and mortality are related to a series of factors, but hypoplasia and pulmonary hypertension contribute a lot, bearing in mind that several necropsy studies demonstrate that the side without a defect is also abnormal. The symptomatology is quite varied, in 90% of the cases the newborns have severe respiratory and circulatory symptoms at birth, 10% are diagnosed after the neonatal period. A disease that cost US$800,000 in the United States alone in 2015 (KALANJ et al., 2016; LALLY, 2016, LANSDALE et al., 2010).

Surgery in mid-1987 was considered a surgical emergency, at the time it was thought that compression of abdominal structures caused pulmonary compression. In 1990, the possibility of clinical stabilization before surgery was suggested, and very quickly it became the gold standard. Today, it is clear that stabilization becomes necessary before the surgical procedure (LALLY, 2016).

Fetal surgery evolved in the 1990s, initially with experimental models and intrauterine surgery, and no improvement in mortality was observed. In 1993, an experiment was carried out with tracheal ligation in experimental models of sheep, demonstrating improvement in lung growth. This procedure quickly began to be performed endoscopically with tracheal balloon occlusion in newborns with severe CHD (LALLY, 2016; LANSDALE, 2010).

Surgery traditionally takes place for CDH via laparotomy or thoracotomy. Which

sometimes requires a prosthesis due to the absence of the diaphragm or structures for reconstruction. In addition, there is minimally invasive surgery that reduces the trauma and disturbances of the procedure. The screens used in large defects do not exist a gold standard (LANSDALE, 2010).

The sizes of diaphragm defects and which are directly related to morbidity and mortality making it a predictor of severity. There is a classification from A to D (LALLY et al, 2013). A: small defect and surrounding muscle; B: less than 50% of the diaphragm is involved; C: defect greater than 50% and the chest wall is involved; D: diaphragm completely absent.

PULMONARY HYPOPLASIA AND PULMONARY HYPERTENSION

Some investigators believe that the lungs of newborns are primarily hypoplastic and small with decreased alveolarization, impaired gas exchange. Other authors report that the pathophysiology follows the following sequence, pulmonary hypoplasia is "secondary" and the direct consequence of a "primary" diaphragmatic defect. (Kluth et al., 1995; Kalanj, 2016). Several hypotheses are put forward, among which also that the injury occurs during the stage of organogenesis resulting in bilateral hypoplasia, consequent to the ipsilateral compression of the secondary lung causing even more injuries (CHANDRASEKHARAN et al, 2017).

In CDH, the pulmonary vascular network decreases with the decrease in the number of openings per lung unit. In addition, vascular remodeling, with hyperplasia of the medial and peripheral muscle layers in the small arterioles, is very evident. This contributes to "fixing" the pulmonary hypertension which becomes irreversible. Altered vasoreactivity due to imbalance between parasympathetic and sympathetic (CHANDRASEKHARAN et al, 2017; GALLINDO et al, 2015).

SCREENS

The polypropylene mesh, one of the most used in medicine, prevents excessive tension on the suture lines, being quite resistant, monofilament, thin and porous, which makes it compatible with the infiltration of fibroblasts, which made the procedures less recurrent. (LINCHTENSTEIN et al, 1989; STOPPA, 1989; KLINGE, 1999). However, polypropylene meshes have a large number of complications, such as intestinal fistulas, exit through the surgical scar, and recurrence of incisional hernias. Several studies have demonstrated adhesions caused by the use of these materials (Lontra et al., 2010).

The polypropylene mesh causes, in addition to an inflammatory reaction, adhesions, with the current and minimally invasive surgeries of laparoscopic herniorrhaphy, therefore, the direct contact of the polypropylene meshes can cause adhesions. Materials have been used in the meshes to prevent adhesions, with SurgiWrap® (Mast Biosurgery AG Corporate), one of the materials used as an anti-adhesive barrier of bioabsorbable film that minimizes the growth of scar tissue and prevents the formation of adhesions in adjacent tissues (Otter et al., 2010).

Therefore, the ideal mesh must have some biocompatibility characteristics: non-carcinogenic, be inert, stable in case of infection, able to develop an inflammatory response and avoid rejection, in addition to being resistant to traction (LAMBER et al, 2013).

CHALLENGES

The screens currently existing and available mainly in health care establishments of the Unified Health System (SUS) are polypropylene screens, cheaper and more accessible, requiring the development of new screens, with biocompatible materials and more accessible to the general public, mainly

in newborns affected with types C and D.

The HDC Study Group carried out follow-up work on patients correlated with the size of the defect. Patients with agenesis have a higher risk of death because they need meshes. It also relates the size of the defect with pulmonary hypertension. There are still gaps as to which screen would be ideal for these newborn children who stay in contact with the viscera. Diagnosis of large diaphragmatic defects that may require mesh can help advise and identify in the future which technique and material would benefit these patients.

CONCLUSION

Therefore, there is a constant need to incorporate new technologies with mesh material that have characteristics such as: non-toxic, non-immunogenic, biocompatible and diligent in reducing postoperative adhesions. There is for the new materials to allow the procedure of large defects, incorporating to the tissues and maintaining few adherences, imposing tissue growth, peritonizing the sites of visceral cavities, without interfering in the normal healing process.

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