Lamb

The surgical model that is most similar to simulating the human disease is the fetal lamb model of myelomeningocele (MMC) introduced by Meuli and Adzick in 1994. The MMC-like defect was surgically created at 75 days of gestation (term 145 to 150 days) by a lumbo-sacral laminectomy. Approximately 3 weeks after creation of the defect a reversed latissimus dorsi flap was used to cover the exposed neural placode and the animals were delivered by cesarean section just prior term. Human MMC-like lesions with similar neurological deficit were found in the control newborn lambs. In contrast, animals that underwent closure had near-normal neurological function and well-preserved cytoarchitecture of the covered spinal cord on histopathological examination. Despite mild paraparesis, they were able to stand, walk, perform demanding motor test and demonstrated no signs of incontinence. Furthermore, sensory function of the hind limbs was present clinically and confirmed electrophysiologically. Further studies.showed that this model when combined with a lumbar spinal cord myelotomy leads to the hindbrain herniation characteristic of the Chiari II malformation and that in utero surgery restores normal hindbrain anatomy.

Eighteen fetuses underwent surgical creation of a MMC defect at day 75. Fetuses were then randomized into 3 groups. Four fetuses remained untreated (control group). In the other 14 fetuses, a prenatal repair was performed at day 90: 7 fetuses had an open repair (oMMC), and 7 fetuses had a fetoscopic repair (fMMC) using a single-layer running suture through a 2-port access. Lambs were sacrificed at term, and histological examinations were performed. RESULTS:

Hindbrain herniation was observed in all live lambs in the control group. A complete closure of the defect was achieved in all the lambs of the fMMC group. A complete healing of the defect and no hindbrain herniation were observed in all live lambs of the oMMC and fMMC groups. The durations of surgeries were not statistically different between the oMMC and the fMMC groups (60 vs. 53 min, p = 0.40), as was the risk of fetal loss (fMMC: 1/7, oMMC: 3/7, p = 0.56). DISCUSSION:

Fetoscopic repair of MMC can be performed using a single-layer running suture through a 2-port access and may be promising to reduce the risk of premature rupture of membranes [1)].

1)
Guilbaud L, Garabedian C, Roux N, Friszer S, Dhombres F, Vialle R, Shah Z, Bessières B, Di Rocco F, Zerah M, Jouannic JM. Two-Port Fetoscopic Repair of Myelomeningocele in Fetal Lambs. Fetal Diagn Ther. 2018 Feb 21. doi: 10.1159/000485655. [Epub ahead of print] PubMed PMID: 29466789.