MRI evaluation of fetal spine anomalies

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Introduction

Fetal MRI provides detailed anatomy of the fetal spine and is a powerful tool in the assessment of suspected spinal abnormalities. MRI is complimentary to ultrasound and together they allow for more accurate prenatal diagnosis and postnatal patient care planning. Spinal malformations often present with other CNS and non-CNS anomalies which may be better characterized by MRI. This pictorial review will present various fetal spine anomalies and discuss their MRI findings.

Methods

Anomalies to be reviewed include caudal regression syndrome, sacroccygial teratoma, body stalk anomaly, akinetic sequence, myelomeningocele, and vertebral segmentation anomaly. Fetuses with these anomalies were diagnosed with MRI during the second or third trimester. Their clinical information was retrieved and MRIs reviewed.

Fetal MRI Protocol

• Multislice T2 HASTE, T1 weighted, and TrueFISP images centered on the fetal head, chest, abdomen, chest/abdomen, and fetal head. Additional focused images of the maternal uterus, fetal chest/abdomen, and fetal head. Multiplanar T2 HASTE, T1, and post gadolinium T1 weighted images can help identify T1 hypointense fat in cases of intradural lipomas, lipomeningomyeloceles, or sacrococcygeal teratomas.

• MRI is obtained at a minimum gestational age of 16 weeks. Preferred gestational age is greater than 22 weeks for adequate anatomical evaluation, particularly of the fetal brain and spine.

• MRI performed on a 1.5 tesla scanner.

• No gadolinium or other contrast agent/medication is used.

• Fetal MRI is used to demonstrate normal anatomy.

Caudal regression syndrome

• Abnormalities related to lack of fetal movement in uterus. Caused by multiple different etiologies.

• Varying degrees of omphaloceles.

• Abnormal posture of limbs with lack of extremity motion despite fetal stimulation. Lack of facial movement with polyhydramnios from decreased fetal swallowing. Micrognathia

• Fetal MRI is useful to evaluate for a CNS cause.

Body stalk anomaly

• Abnormal anterior line of septation of the vertebral column.

• Open neural tube defect. Ossous dysraphism with extension of meninges and neural tissue through the defect.

• Almost always associated with Chiari 2 malformation. Fetal MRI may aid in utero surgical planning.

• In utero surgical repair decreases the features of Chiari 2 malformation and improves motor outcomes.

• Open neural tube defects. Ossous dysraphism with extension of meninges and neural elements through the defect.

Myelomeningocele

• Abnormal position of the fetal spine is commonly due to normal fetal stretching movement. This should be considered if there is motion in the extremities, normal amniotic fluid volume, and change in position on follow-up scans.

• May be due to fetal crowding with multiple gestations or late in pregnancy. Can be seen with oligohydramnios, uterine synchiae, Mullerian duct anomalies.

Positional variation in spine contour

• Partial or complete failure of vertebral formation.

• Varying degrees of associated scoliosis.

• Abnormal vertebralae may be supernumerary or replace normal vertebral body.

• Consider syndrome with other neural or visceral anomalies.

Vertebral segmentation anomaly

• Abnormalities related to lack of fetal movement in uterus. Caused by multiple different etiologies.

• Varying degrees of omphaloceles.

• Abnormal posture of limbs with lack of extremity motion despite fetal stimulation. Lack of facial movement with polyhydramnios from decreased fetal swallowing. Micrognathia

• Fetal MRI is useful to evaluate for a CNS cause.

Akinetic sequence

• Cystic/solid mass extending from the sacrum. May extend into the pelvis and abdominal extent of tumor.

• Extent of solid component is most important prognostic factor. Solid tumors may have AV shunting which can lead to hydrocephalus. The more cystic the tumor, the better the outcome.

• Fetal MRI is superior to ultrasound for evaluation of the intra-abdominal extent of tumor. MRI is also useful to assess for possible involvement of the spinal canal, the extent of intraluminal hemorhage, and to differentiate between solid tumor and multicystic types.

Sacrococcygeal teratoma

• Abnormal anterior line of septation of the vertebral column.


• Sagittal TrueFISP image demonstrates marked scoliosis. The malformation was lethal.

• Long T2 HASTE image demonstrates marked scoliosis. The abnormality is lethal.

• Coronal T1 weighted images demonstrate marked scoliosis. The abnormality is lethal.

• Postmortem radiograph demonstrates complete absence of the sacrum with flattening and ossification of the filum medullaris which terminates high at T11-T12. The bumb is thickened. Sacral agenesis is again noted.

Conclusion

Early prenatal diagnosis of fetal spine anomalies can significantly impact pre- and postnatal management and subsequent outcomes. Fetal MRI plays an ever increasing role in the prenatal diagnosis of fetal spine anomalies. This pictorial review presented several such spinal anomalies and their associated MRI findings.

References


