

Background

MMC is associated with hindbrain herniation (HBH). Prenatal surgery can reverse HBH but its impact on brainstem microstructure is unclear. We used DWI to assess changes before and after fetal surgery.

Objective

To evaluate brainstem and cerebellar microstructure in fetuses with MMC before and after repair, according to HBH reversal using DWI.

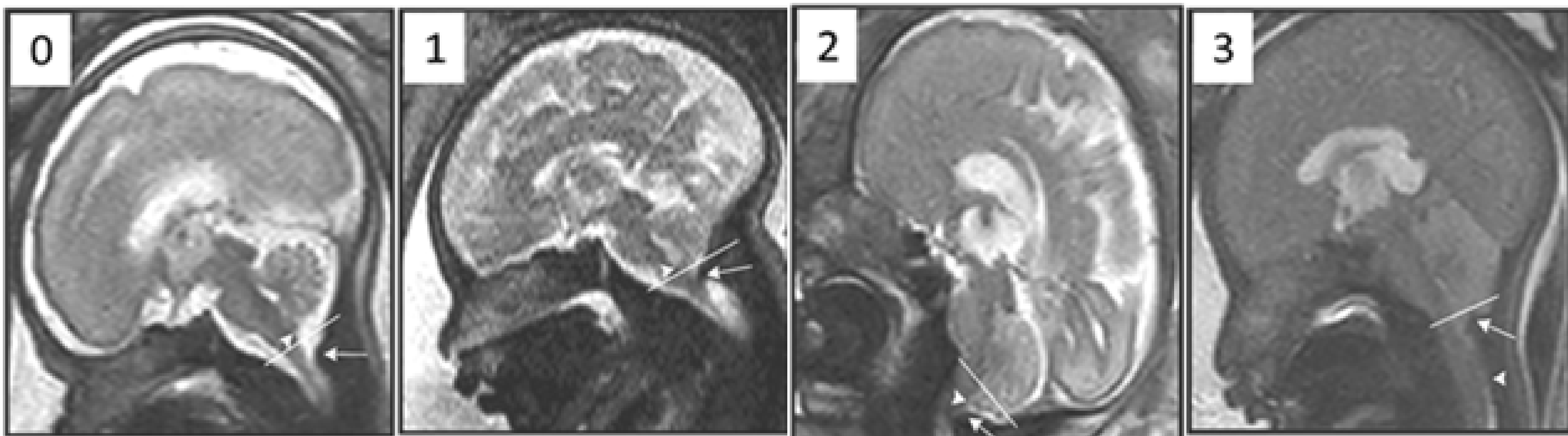
Methods

Retrospective study of 59 fetuses who underwent prenatal MMC repair at Texas Children's Hospital, Houston, Texas, USA.

MRI scans were performed at referral (22.9 [19.0–25.4] weeks) and 6 weeks post-op (31.1 [27.3–33.3] weeks), and included DWI sequences.

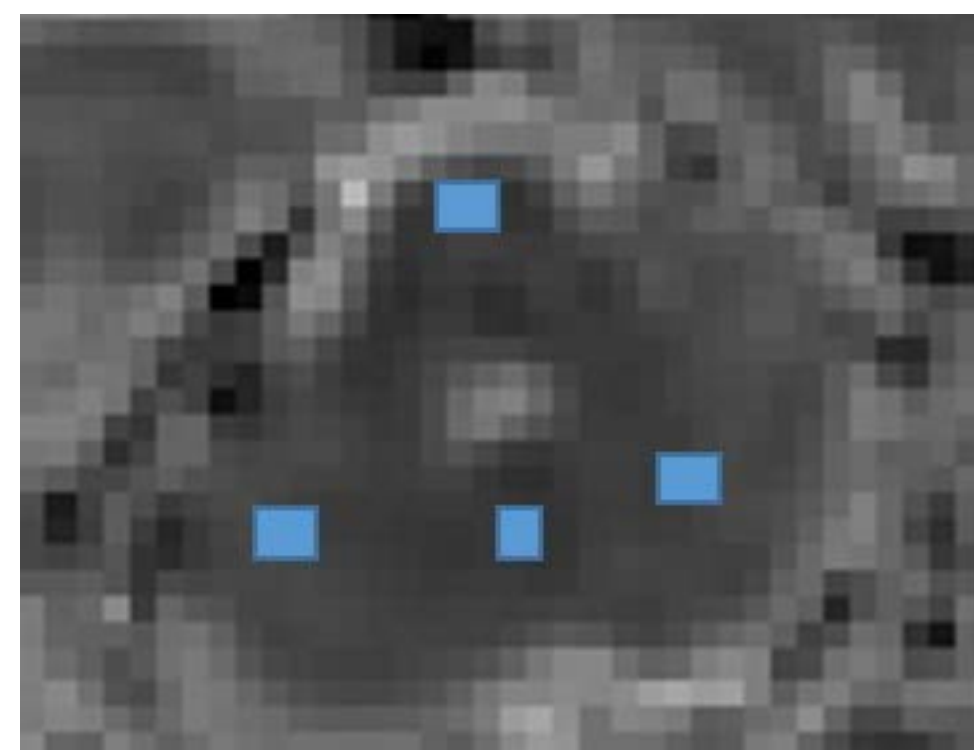
HBH grading:

Grade 0: cerebellar tonsils were seen above the level of the foramen magnum; **grade 1:** effacement of the 4th ventricle and/or cisterna magna without HBH; **grade 2:** HBH above the Cervical one (C1) posterior arch; and **grade 3** as HBH bellow C1 posterior arch.



At 6 post-op weeks, reversal was categorized as **complete** (grade 0), **partial** (improvement but not complete resolution), or **none** (unchanged).

ADC values ($\times 10^{-6}$ mm²/s) were measured at the pons, vermis and cerebellar hemispheres.



Results

At referral, HBH was grade 2 in 17% and grade 3 in 83%. No ADC differences were found between HBH grade 2 vs 3.

At 6 post-op weeks, ADC values were significantly higher in HBH grade 3 vs. the remaining fetuses with grades 0–2 in the brainstem and cerebellum.

	MRI scans at referral			MRI scans at 6 post-operative weeks			MRI scans at 6 post-operative weeks			
	HBH grade 2 (n=10)	HBH grade 3 (n=49)	p	HBH grade 0-1-2 (n=52)	HBH grade 3 (n=6)	p	No HBH reversal (n=6)	Partial HBH reversal (n=7)	Complete HBH reversal (n=45)	p
Gestational age at the time of MRI (weeks)	22.3[20.4-24.9]	22.9[19.0-25.4]	0.72	30.8[30.0-33.3]	31.0[30.7-31.4]	0.63	31.0[30.7-31.4]	30.9[30.0-33.3]	31.1[27.3-32.7]	0.88
Pons (ADC)	2.41[1.13-3.62]	2.41[1.23-4.41]	0.59	1.90[1.03-3.39]	4.06[3.00-6.44]	0.01	4.06[3.00-6.44]	2.01[1.03-3.39]	2.33[0.80-6.81]	0.01
Cerebellar right hemisphere (ADC)	2.51[0.75-4.24]	3.01[1.93-5.71]	0.23	2.35[1.25-4.48]	3.46[2.47-6.37]	0.04	3.46[2.47-6.37]	2.61[1.24-4.48]	2.90[0.86-9.32]	0.01
Cerebellar left hemisphere (ADC)	2.51[0.88-3.63]	3.06[1.95-4.79]	0.20	2.39[1.29-4.57]	3.90[2.68-6.17]	0.04	3.90[2.68-6.18]	2.41[1.29-4.57]	2.65[0.62-7.51]	0.04
Vermis (ADC)	2.29[1.74-3.39]	2.87[1.61-6.12]	0.22	1.93[1.07-4.11]	3.81[2.41-6.39]	0.02	3.81[2.41-6.39]	1.93[1.08-4.11]	2.66[1.00-7.96]	0.04

At 6 post-op weeks, HBH reversal was complete in 78%, partial in 12%, and absent in 10%.

Fetuses without HBH reversal had higher ADC values at brainstem and cerebellum.

Conclusion

Fetuses with **severe HBH after prenatal MMC repair** showed **higher ADC values** in brainstem and cerebellum, suggesting **microstructural alterations**.