

[01-001]

Ultrasound-guided intrauterine embolization of a large Vein of Galen malformation

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Vein of Galen malformation (VOGM) is a rare and complex congenital vascular anomaly that is still associated with severe morbidity and mortality because of cardiac failure and brain lesions. A fetus with extremely large VOGM was referred to our Fetal Center at 36 weeks' gestation. In our center, fetal cardiac evaluation showed fetal cardiomegaly with early signs of fetal cardiac distress, but no fetal hydrops and no fetal brain lesions. After multidisciplinary evaluation and approval from the Fetal Ethical Boards, an intrauterine embolization of fetal VOGM was offered and performed successfully under ultrasound-guidance at 37 weeks' gestation. The VOGM was coiled in approximately 70% immediately after the procedure and approximately 80% before birth. A male infant weighing 3710 g, Apgars 8/9/9 was delivered by elective cesarean section at 39 weeks' gestation. The newborn demonstrated normal cardiac function and respiratory function and was discharged home without needing any procedure. The baby had a complete embolization of the remnant of the VOGM at 12 months of age.

Keywords: Aneurysmal malformations; Coil; Congenital abnormalities; Embolization; Intrauterine procedures; Transuterine; VGOM; Vein of Galen.

[01-002]

Spectrum of Fetal Imaging Findings Pre- and Post- In Utero Embolization for Vein of Galen Malformation

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Background: Vein of Galen Malformations (VOGMs) produce arteriovenous shunting which can lead to high-output cardiac failure and cerebral injury. Fetuses with falcine sinus diameters $\geq 7\text{mm}$ were considered high-risk and eligible for enrollment in a clinical trial of in utero embolization.

Objective: To describe the fetal imaging findings pre- and post- in utero VOGM embolization.

Methods: Following IRB- and FDA-approved protocols, seven eligible patients were enrolled. Pre- and post-intervention imaging included US, MRI, and echocardiography. Investigated parameters included VOGM volume, greatest falcine sinus diameter, measurements of cardiomegaly, combined cardiac output (CCO), umbilical artery (UA), middle cerebral artery (MCA), and ductus venosus (DV) Doppler indices, and additional intracranial abnormalities.

Results: Five subjects underwent successful VOGM embolization. All fetuses demonstrated smaller falcine sinuses, decreased cardiomegaly and CCO, improved UA Doppler indices, and increased cerebroplacental ratios following embolization. There were otherwise no appreciable trends in VOGM volume or MCA/DV Doppler parameters. Three patients demonstrated new intracranial findings. Particular post-embolization MRI sequences resulted in artifactual projection of coil loops beyond the confines of the venous varix.

Conclusion: Critical imaging parameters improved immediately after in utero VOGM embolization. Understanding pre- and post-intervention imaging findings helps assess procedure eligibility, treatment effects, and coil artifact pitfalls.

[01-003]

Fetal aqueductal stenosis: in utero progression and criteria for fetal intervention**Yada Kunpalin**

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Objective: To characterize the natural history of fetal aqueductal stenosis (AS) and identify optimal candidates and timing for potential fetal intervention.

Methods: This retrospective cohort study included 60 fetuses with prenatally diagnosed AS, including 27 isolated AS and 33 AS associated with intraventricular hemorrhage (IVH). Serial ultrasound and fetal MRI were reviewed. Longitudinal ventricular growth was assessed using linear mixed-effects models, and ROC analysis evaluated ventricular size thresholds associated with ventricular rupture.

Results: Fetuses with isolated AS were diagnosed earlier than those with IVH-associated AS (21.9vs30.6weeks, $p=0.006$). Ventricular size increased progressively in both groups. Ventricular rupture occurred in 18.8% of cases and was strongly associated with ventricular size (OR1.19/mm, $p=0.002$), with ROC analysis showing good predictive performance (AUC0.87) and high specificity at thresholds of 35.0–36.7 mm. Fetuses requiring early cerebrospinal fluid diversion or termination of pregnancy showed significantly faster ventricular growth than those without severe outcomes. Divergence in growth trajectories occurred earlier in isolated AS (from 20weeks, ≥ 15 mm) than IVH-associated AS (from 33 weeks, > 26 mm).

Conclusion: Fetal AS demonstrates progressive ventricular enlargement, with accelerated growth associated with severe outcomes. A gestational age- and size-dependent therapeutic window may exist prior to extreme ventricular dilation, providing a framework for future prenatal intervention studies.

[01-004]**North American Fetal Therapy Network: Neurodevelopmental outcomes at ages 1 and 2 in children diagnosed prenatally with isolated aqueductal stenosis****Stephen Paul Emery**

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Background:

To describe neurodevelopmental outcomes at ages 1 and 2 in children with prenatally diagnosed isolated aqueductal stenosis (AS) confirmed by neonatal neuroimaging within a prospective NAFTNet cohort.

Methods:

NAFTNet Protocol 01-14, "Prenatal Diagnosis of Aqueductal Stenosis," is a prospective observational cohort study of fetuses with isolated AS identified prenatally and confirmed postnatally by neuroimaging. Subjects underwent contemporary management and were followed through 2 years of age. Prespecified neurodevelopmental outcomes were assessed at 1 and 2 years, recorded in a REDCap database, and analyzed.

Results:

Twenty-four subjects had complete neurodevelopmental data at 1 year, and 20 at 2 years. At 1 year, 92% were alive, 83% had undergone cerebrospinal fluid (CSF) shunting, 26% had a seizure disorder, 27% had focal motor deficits, and 70% demonstrated developmental delay. At 2 years, 90% were alive, 72% were shunted, 44% had a seizure disorder, 35% had focal motor deficits, and 77% demonstrated developmental delay.

Conclusion:

Isolated fetal AS is associated with high rates of adverse neurodevelopmental outcomes despite contemporary care. This well-characterized cohort excludes other etiologies of hydrocephalus thereby reducing outcome heterogeneity. These data provide an important benchmark and may serve as a control group for future trials of in-utero CSF diversion.

[01-005]

Prenatal Findings and Postnatal Outcomes in Closed Spinal Dysraphisms

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Objective - To correlate prenatal US findings in fetuses with closed spinal dysraphism (CSD) and their postnatal management and outcomes at 36 months.

Methods - We included fetuses with a prenatal diagnosis of CSD between 2014 and 2024 in 2 tertiary centers. Lesions were reassessed and classified according to the ORPHANET classification. Prenatal imaging findings, pregnancy outcome, postnatal diagnostic concordance, neurosurgical management, and functional outcomes were analyzed.

Results - 70 with CSD were included. Saccular forms accounted for 86% (n=60) of cases: LDM (47%, n=33), meningocele (26%, n=18), and conus lipoma (13%, n=9). Lesions were predominantly located at the lumbar or sacral level (84%). Associated structural cerebral anomalies were identified prenatally in 19% (n=12). There were 59 live births (84%), 11 were terminated (16%) including 8 cases for major cerebral anomalies. Among live-born infants, postnatal surgery was performed in 90%. Prenatal diagnosis was adjusted postnatally in 10% of cases. At 36 months, independent ambulation was achieved in 94% of children. In contrast, urinary dysfunction was present in 43% at 18 months, while gastrointestinal disorders were less frequent (13%).

Conclusion - Prenatal US allows reliable characterization of CSD. Motor outcomes are favorable, whereas early urological morbidity is observed in half of the cases.

[01-006]

Saccular Limited Dorsal Myeloschisis: A New Indication for Prenatal Surgery? Case Series and Scoping Review**JOSE MIGUEL MULLER**

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Introduction: Limited dorsal myeloschisis (LDM) is a rare closed spinal dysraphism characterized by a fibroneural stalk connecting a midline skin defect to the spinal cord. Its saccular form can resemble open spina bifida (OSB), such as myelomeningocele (MMC), in prenatal imaging, increasing the risk of misdiagnosis and inappropriate management. Case Presentation: We retrospectively analyzed eight LDM cases diagnosed at Dr. Franco Ravera Zunino Hospital in 2024. Clinical, imaging, surgical, and histopathological data were reviewed. Three cases were prenatally misdiagnosed as MMC and underwent fetal surgery; four were diagnosed and treated postnatally; one showed sac rupture during gestation and was presumed LDM without histological confirmation. The seven confirmed cases met Pang's criteria: a midline cutaneous lesion and a fibroneural stalk with GFAP-immunopositive neuroglial tissue. Five patients had Chiari II malformation, three presented ventriculomegaly, and one required shunting. Motor deficits were observed in four patients, involving levels from L2 to L4. One initially excluded from fetal surgery later developed sac rupture and progression of Chiari II malformation. Conclusion: LDM should be considered in the differential diagnosis of OSB during prenatal assessment. Distinguishing LDM from MMC, particularly in saccular cases, remains challenging, highlighting the need for improved prenatal imaging and diagnostic accuracy.

[01-007]

Atlanto-occipital membrane bulging as an early sign of evolving hindbrain herniation in open spinal dysraphism

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Introduction: Hindbrain herniation (HBH) is a feature of Chiari II malformation in fetuses with open spinal dysraphism (OSD) and constitutes an eligibility criterion for prenatal repair. Protrusion of the atlanto-occipital membrane (AOM) is frequently observed in association with vermian descent; however, its significance in the absence of HBH remains unclear.

We report two fetuses with OSD who initially showed no HBH on fetal MRI but presented with isolated CSF-filled AOM bulging. In both cases, repeat MRI within the time window for fetal surgery demonstrated interval development of HBH below the foramen magnum. Case 1 presented at 22.3 weeks with L4 myelomeningocele, normal ventricles, and preserved motor function. Repeat MRI at 24.1 weeks confirmed HBH. Prenatal repair was performed at 26.0 weeks. Case 2 presented at 20.3 weeks with L5 myelomeningocele, normal ventricles, and intact motor function. Repeat MRT at 25 weeks confirmed HBH. Prenatal repair was performed at 25.3 weeks. In both fetuses, postoperative MRI demonstrated reversal of HBH. Postnatal outcome was favourable, with preserved motor function and no requirement for CSF diversion at follow-up. **Conclusion:** AOM bulging may represent an early imaging sign of evolving HBH. Repeat MRI may identify fetuses who develop HBH within the time window for fetal surgery.

[01-008]

Outcomes Following Fetal Open Spina Bifida Repair May Differ Depending on Level of Lesion

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Background: Sacral open spina bifidas (OSB) are presumed favorable for post-fetal repair outcomes versus higher lesions. When ventricles are normal-sized (NSV) or mildly enlarged, the benefit of fetal OSB (fOSB) repair is uncertain. We compared shunt and motor outcomes after fOSB repair for sacral versus lumbar lesions with NSV and mild ventriculomegaly (MVM).

Methods: NAFTNet OSB registry for fOSB repairs (2011–2025) was reviewed. Definitions include: sacral (S1/S2) or lumbar (L1–L5) lesions, NSV: bilateral ventricles <10 mm; MVM: 10.0–12.9 mm. Patients lacking follow-up/shunt status were excluded. Primary outcome was shunt-ever. Fisher's exact test and Firth multivariable logistic regression adjusted for lesion level and myeloschisis vs myelomeningocele (MMC).

Results: 800/2,049 patients met inclusion. Among NSV and MVM+NSV, shunting was higher with sacral lesions: 11/17 (64.7%) vs 68/236 (28.8%) for NSV ($p=0.0047$); 17/29 (58.6%) vs 174/510 (34.1%) for NSV+MVM ($p=0.0094$). Adjusted OR for shunting in all sacral vs lumbar lesions was 2.99 (95% CI 1.36–6.57; $p=0.0065$). Myeloschisis was independently associated with shunting (OR 3.36, 95% CI 2.24–5.06; $p<0.0001$). Motor outcomes did not differ between groups.

Conclusions: After fOSB repair, sacral lesions and myeloschisis confer higher shunt-risk despite NSV/MVM, with similar motor outcomes between groups. These findings may impact counseling but require further study.

[01-009]

Ultrasound Estimation of Fetal Calf Muscle Volume in Spina Bifida and Association with Postnatal Motor Outcomes

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Objectives: Prenatal estimation of motor prognosis in MMC traditionally relies on determining lesion level and qualitative assessment of fetal movement, which can be inaccurate. We evaluated whether fetal calf muscle volume measured by prenatal ultrasound predicts postnatal motor outcomes.

Methods: This was a retrospective cohort study of fetuses with isolated MMC evaluated between 2021 and 2025 diagnosed between 19+0 and 25+6 weeks with ultrasound images and documented postnatal outcomes. Calf volume was calculated using Simpson's method based on tibial length and anterior-posterior and medio-lateral calf measurements at three levels. Primary outcome was lower extremity motor function at 12 months.

Results: Of 71 identified cases, 36 had complete follow-up. At 12 months, plantar flexion was present in 58% of infants. In multivariable logistic regression adjusting for gestational age at first volume measurement, greater calf volume was associated with plantar flexion bilaterally (right OR 4.91, 95% CI 1.74–13.83, $p=0.003$; left OR 3.03, 95% CI 1.10–8.36, $p=0.032$).

Conclusion: Larger fetal calf volumes were significantly associated with preserved plantar flexion at 12 months, suggesting fetal calf muscle volume may help predict postnatal motor outcomes in MMC.

[01-010]

Brain oedema as an imaging marker of surgical success and postnatal shunt requirement in fetuses with open spinal dysraphism undergoing prenatal repair**Ivonne Bedei^{1,2}**¹ Justus-Liebig-University, Giessen, Germany Prenatal Diagnosis and Fetal Therapy² Aarhus University, Aarhus, Denmark. Department of Molecular Medicine

Objective: To evaluate the prevalence and clinical relevance of brain oedema (BOE) in fetuses with open spinal dysraphism (OSD) undergoing prenatal repair, and to assess its association with postoperative imaging findings, surgical success, and postnatal shunt rate.

Methods: Retrospective single-centre cohort study including fetuses with OSD undergoing laparotomy-assisted three-port fetoscopic repair between 2021 and 2025. Fetal MRI was performed before and after surgery. The BOE was assessed by two independent investigators, blinded to the outcome.

Results: Among 41 fetuses, preoperative BOE was present in 26/40 (65.0%), whereas postoperative oedema persisted in 4/41 (9.6%). Preoperative oedema was associated with increased postoperative ventricular width ($p=0.014$) and postnatal shunt placement within the neonatal period (OR, 5.73, $p=0.036$) and 12 months (OR, 5.80, $p=0.029$). Postoperative oedema was associated with larger lesion size ($p=0.001$), increased postoperative ventricular width ($p=0.008$), cavum septi pellucidi perforation ($p=0.007$), and neonatal shunt placement (OR, 36.60, $p=0.002$). Watertight closure and reversal of HBH were associated with reduced odds of postoperative oedema.

Conclusion: Fetal BOE is common in OSD and resolves after successful prenatal surgery. Persistent postoperative oedema is strongly associated with residual HBH, non-watertight repair, and increased shunt requirement. Prenatal evaluation of BOE may provide relevant prognostic information for counselling and outcome prediction.

[01-011]

Spina Bifida Lesion Types with Associated Clinical Outcomes at 12 months in Children after Fetoscopic Spina Bifida Repair

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Objectives. Open spina bifida (SB) is morphologically heterogeneous, yet prognostic frameworks still treat it as a single entity or myelomeningocele–myeloschisis dichotomy. We previously defined five intraoperative lesion types correlating with preoperative anatomy and perinatal outcomes. This study tested whether lesion type predicts 12-month outcomes after fetoscopic repair.

Methods. Prospective cohort of 116 fetuses undergoing laparotomy-assisted fetoscopic repair with a cryopreserved umbilical cord patch. Lesions were classified intraoperatively (Types 1–5: n=9, 47, 21, 22, 17). Baseline ultrasound/MRI assessed ventricular diameter, tonsillar herniation, lesion level and volume. Twelve-month outcomes (shunt, secondary spinal surgery, seizures, motor milestones) were ascertained in 92 children; postnatal MRI (n=46) assessed herniation reversal, syringohydromyelia, tethering index and Evans' index.

Results. Tonsillar herniation and lesion volume differed by type (both $P<0.001$); NICU outcomes did not. At 12 months, shunt placement differed (46% overall; 0% Type 1, 59% Type 2, 38–47% Types 3–5; $P=0.032$), as did herniation reversal (100% Type 3 vs 25–29% Types 4–5; $P=0.018$) and tethering index (3.9 vs 41.6, Type 1 vs 5; $P=0.021$); Evans' index did not ($P=0.233$).

Conclusions. Lesion type predicts herniation reversal, cord tethering and shunt dependence at 12 months despite comparable perinatal courses, supporting its use in counseling and selection, pending multicenter validation.

[01-012]

Limited utility of bedside observation to predict sleep-disordered breathing in neonates with myelomeningocele

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Background: Neonates with myelomeningocele are at high risk for sleep-disordered breathing (SDB). We aimed to evaluate how bedside nursing assessments in the Neonatal ICU (NICU) might inform risk stratification for SDB, in a prospective multicenter study.

Methods: NICU nurses filled out a questionnaire prior to a gold-standard PSG. A generalized estimating equation (GEE) logistic regression model was fit to examine the association between nurse questionnaire responses and any SDB diagnoses, clustering observations by site. Model discrimination was assessed using the area under the receiver operating characteristic curve (AUC).

Results: Among 119 neonates (EGA 36.4 ± 2.2 weeks) with available questionnaire responses, 56 had postnatal MMC closure, 42 open fetal surgery, and 21 fetoscopic surgery. Nurse reports of desaturations were associated with SDB (OR 3.16; 95% CI 1.40, 7.15, $p=0.006$) but other questionnaire variables were not predictive. A GEE logistic regression with desaturations as the predictor and SDB as the outcome showed AUC=0.62 and predicted 70% probability of SDB (sensitivity 0.43, specificity 0.81).

Conclusions: Neonates with myelomeningocele who have observed oxygen desaturations are at particularly high risk for SDB, although other standard bedside observations are insufficient to identify most infants with SDB.