

Assessment of Fetal Calf Muscle Volume on Prenatal Ultrasound to Improve Prediction of Motor Outcomes in Spina Bifida

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Background

Prenatal estimation of motor prognosis for patients with myelomeningocele (MMC) has traditionally relied on determining the anatomical level of the lesion on imaging and on qualitative observation of fetal lower limb movement, which can be inaccurate.

Objective

To assess whether fetal calf muscle volumes measured by prenatal ultrasound were useful in predicting postnatal motor function outcomes.

Methods

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 (Figure 1). Primary outcome was lower extremity motor function at 12 months.

Results

Details of patients enrolled (n=36) are listed in Table 1. In multivariable logistic regression adjusting for GA at measurement, **greater calf volume was associated with plantar flexion at 12 months** (OR 3.33, 95% CI 1.19 – 12.00, p=0.036). Subjective ankle movement on initial ultrasound and a model including fetal calf volume with gestational age demonstrated modest discrimination for plantar flexion at 12 months (AUC = 0.67 and 0.77). **A combined model including both predictors improved discrimination (AUC = 0.84) and was significantly better than the subjective ankle movement model alone by DeLong’s test (p = 0.0109).**

Conclusions

Larger calf volumes were significantly associated with preserved plantar flexion at 12 months. Combining calf volumes and subjective assessment of ankle movement improved prediction of postnatal motor outcomes in spina bifida.

Characteristic	Results
Prenatal findings	
Gestational age first ultrasound (weeks), mean +/- SD	23.44 +/- 1.14
Level of Lesion	
Thoracic (T7—T12)	3 (8.3%)
Upper lumbar (L1-L2)	3 (8.3%)
Lower lumbar / sacral	30 (83.3%)
Subjective ankle movement on first ultrasound	31 (86.11%)
Calculated initial leg volume (cm³), mean +/- SD	3.83 +/- 0.89
Repair type	
Prenatal repair	26 (72.2%)
Postnatal repair	10 (27.8%)
Delivery and Neonatal Outcomes	
Gestational age at delivery (weeks), mean +/- SD	36.42 +/- 2.77
Birthweight (grams), mean +/- SD	2835.64 +/- 715.26
Postnatal Outcomes	
Age at motor assessment (months), mean +/- SD	12.56 +/- 1.86
Lower extremity motor function at 12 months	
Hip flexion – Right and Left	33 (91.67%)
Knee extension – Right and Left	32 (88.89%)
Dorsiflexion – Right	27 (75%)
Dorsiflexion – Left	28 (77.78%)
Plantar flexion – Right and Left	21 (58.33%)
Hydrocephalus requiring treatment	13 (36.11%)
Clubfoot at 12 months	4 (11.11%)

Table 1. Maternal and prenatal characteristics of cohort

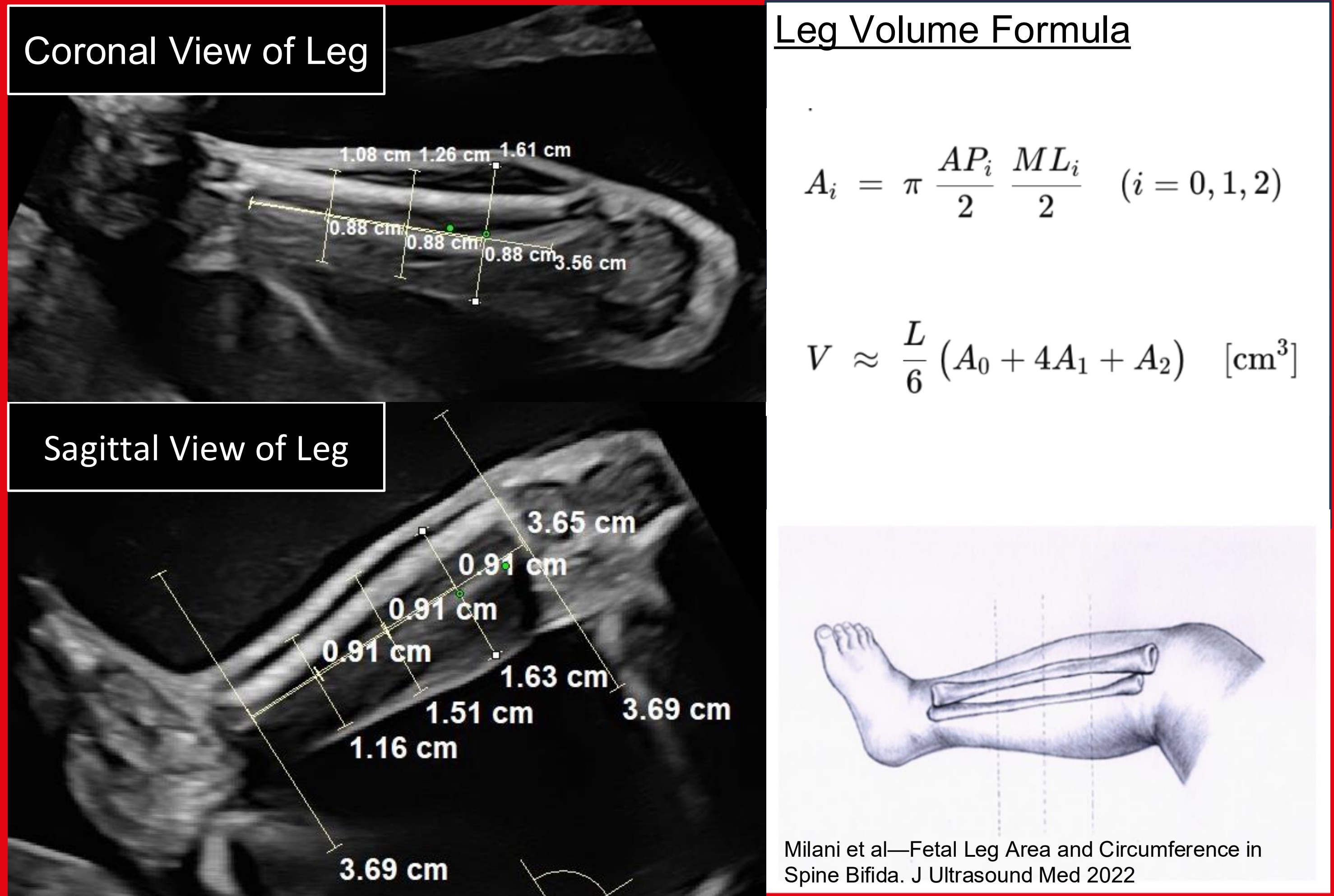


Figure 1. Retrospective Leg Volume Measurement