

Xenograft Bone-Derived Collagen Scaffold for Myelomeningocele Management

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ABSTRACT

Background and Hypothesis: Spina bifida is a neural tube defect resulting from an incomplete closure of the caudal neuropore. The most debilitating form of spina bifida, myelomeningocele (MMC), can present with Chiari II malformation with concomitant hydrocephalus, bowel and bladder abnormalities, and impaired motor function of the lower limbs. The incidence rate of spina bifida is 3.4 per 10,000 live births reported within the US. On average, the US spends \$1,176,000,000 annually on patient management and treatment. Advancements in existing treatment options, namely fetal surgery, can greatly decrease neurological injury and related costs, but at the risk of fetal and maternal complications. Various tissue engineering methods have been proposed including biodegradable and synthetic scaffolds, seeded with or without bioactive proteins and stem cells, sutured or glued to the defect, and administered fetoscopically or through open fetal surgery. However, no combination of these methods is fully biointegratable, watertight, provides complete coverage with adequate mechanical strength, and is able to be administered fetoscopically.

Experimental Design: This study utilizes bovine and porcine bone to create an organic, flexible collagen scaffold that can be seeded with bioactive proteins and attached with adhesive for successful coverage of MMC defects.

Conclusion and Potential Impact: The natural matrix may allow for quicker host cell integration and greater mechanical strength compared to existing models. This study will characterize the mechanical strength, permeability, and biointegration of the proposed management of spina bifida.

KEYWORDS

Spina Bifida, Myelomeningocele, Fetal Surgery, Meningomyelocele, Spina Bifida Aperta, Open Spina Bifida, Tissue Engineering, Tissue Scaffold, Tissue Adhesive, Tissue Adhesive Testing, Collagen, Neural Tube Defect, Peel Test, Permeability Test, MMC, T-Peel Test