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EVALUATION OF DIAPHRAGMATIC ENGINEERING USING BIOSHEET, A COLLAGENOUS CONNECTIVE TISSUE MEMBRANE, TO REPAIR CONGENITAL DIAPHRAGMATIC HERNIA IN RABBIT

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Aim of the study: In congenital diaphragmatic hernia with large defects, prosthetic patches are used for tension-free repair. However, they can cause infection, recurrence, and thoracic deformity with growth. Although diaphragmatic engineering has been studied to avoid these complications, diaphragmatic muscular tissue regeneration has not yet been achieved. Biosheet, a collagenous connective tissue membrane, has been reported to be useful for engineering cardiovascular tissue, cornea, and airway. We evaluated the efficacy of biosheet for the regeneration and repair of diaphragm and compared it with prosthetic patches in a rabbit model.

Methods: 1.5×1.5 cm defects in the left diaphragm were created in rabbits 8 weeks after birth. In group 1, Gore-Tex® sheets (1.8×1.8 cm) were implanted into the diaphragmatic defects (n = 11). In group 2 (n = 11), SEAMDURA®, a bioabsorbable artificial dural substitute, was transplanted in the same manner. In group 3 (n = 14), biosheets were prepared by embedding silicone plates in dorsal subcutaneous pouches of 4-week-old rabbits for 4 weeks. The biosheets (1.8×1.8cm) were autologously transplanted into the diaphragmatic defects. Rabbits in all groups were sacrificed 3 months after transplantation to evaluate their graft status.

Main results: All rabbits survived 3 months after transplantation. Herniation of liver was observed in 5 rabbits (45%) in group 1, 8 (73%) in group 2, and 3 (21%) in group 3. A significant difference was noted between groups 2 and 3 (p = 0.03). Muscular tissue regeneration in implanted biosheets in group 3 was confirmed histologically (Elastica van Gieson, desmin, and Sr-1 staining).

Conclusion: Diaphragmatic engineering using biosheet is a good substitute for prosthetic patches in diaphragmatic repair. We confirmed that muscular tissue can self-regenerate onto a diaphragm patch made from biosheet.

Acknowledgment: This work was supported by JSPS KAKENHI, Grant Number 26462712.