

# Fibrin-glue coated collagen matrix helps prevent cerebral spinal fluid leakage after durotomy

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**INTRODUCTION:** After surgery for intradural lesions, dural reconstruction is essential to prevent cerebral spinal fluid (CSF) leakage. However, even with dural reconstruction, open CSF leakage can cause serious complications such as wound infection leading to meningitis, hypomyelination, cerebral hemorrhage, and nerve root compression syndrome.<sup>1, 2</sup> Liquid fibrin glue for dural sutures is widely and effectively used.<sup>3</sup>

Polyglycolic acid sheet (PGA sheet) and fibrin glue are effective for dural reconstruction in spinal cord surgery.<sup>4, 5</sup>

We have used PGA sheets and fibrin glue in addition to dural sutures for dural reconstruction to prevent CSF leakage.

Recently, an absorbable artificial dura mater made of a porous collagen matrix has been developed and is considered useful for dural reconstruction in patients requiring dural repair.<sup>6</sup> Although there have been reports that only porous collagen matrix placement after the dural suture is helpful for open CSF leakage, open CSF leakage has occurred even in those reports.<sup>6</sup> There are no reports comparing PGA sheets and porous collagen matrix in preventing spinal fluid leaks. We hypothesized that the hydrophilic collagen matrix would be advantageous over the hydrophobic PGA sheet in preventing CSF leakage in the wet surgical field after the dural suture. We have been using fibrin glue-coated porous collagen matrix for dural reconstruction since June 2019 in our department. The purpose of this study was to compare the efficacy of porous collagen matrix and PGA in preventing CSF leakage in the presence of fibrin glue.

**METHODS:** The study included 309 patients who underwent surgery for intradural lesions requiring dural reconstruction at our department from 2006 to 2023. The PGA sheet group (P group) and the porous collagen matrix group (C group) were compared (excluding cases of accidental dural injury). Both were placed at the site of the dural suture and coated with fibrin glue. The two groups were compared regarding age, gender, disease, and whether or not there was reoperation due to postoperative CSF leakage. Parameters were compared with the Wilcoxon test and Fisher's exact test.  $P < 0.05$  was considered statistically significant. The JMP software program (version 15; SAS Institute, Cary, NC, USA) was used for statistical analysis. The local ethics committee approved the study protocol, and all patients provided written informed consent.

**RESULT:** The median age was 60 (49-71), with 162 female patients. 309 patients (266 spinal cord tumors, 5 spinal hernias, 8 syringomyelia, and 26 membranous lesions) were in the P group (219 patients) and the C group (90 patients). Reoperations for CSF leakage occurred in 11 cases (3.6%) (Table 1), but there were significantly fewer reoperations for postoperative CSF leakage in the C group. (11 cases in group P, 0 cases in group C) ( $P < 0.05$ ) (Table 2) The sheets were placed after the dural suture; the collagen matrix sheet was hydrophilic, and the PGA sheet was hydrophobic. (Figure 1)

**DISCUSSION:** This is the first report showing that a porous collagen matrix sheet is superior to PGA sheet in preventing CSF leakage in spinal surgery under conditions where fibrin glue is used. CSF leakage occurs in 3-27% of spinal cord surgeries.<sup>7</sup> CSF leakage rate after the planned dural incision is 0-10%.<sup>8, 9</sup> Porous collagen matrix dural repair is considered valid. Still, reports of porous collagen matrix alone have shown that cerebrospinal fluid leakage and pseudo meningocele formation occurred in 4.3% of patients.<sup>6</sup> The artificial dura formed by a porous collagen matrix has an affinity for water and may be more effective against CSF leakage than hydrophobic PGA sheets.

**SIGNIFICANCE/CLINICAL RELEVANCE:** Porous collagen matrix sheets with fibrin glue are more effective than PGA sheets with fibrin glue in preventing CSF leakage during dural reconstruction.

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**Table 1 The characteristics of CSF leakage**

Factor	Total (N=309)	CSF leakage (+) (N=11)	CSF leakage (-) (N=298)	P value
Age (y.o.)	60.0 (49.0-71.0)	54.0 (35.0-63.0)	60.0 (49.0-71.0)	0.07
Female (n: %)	162 (52.4%)	7 (63.6%)	155 (52.0%)	0.55
lumbosacral (n: %)	119 (38.5%)	5 (45.5%)	114 (38.3%)	0.75
Dumbell tumor (n: %)	35 (11.4%)	3 (27.3%)	32 (10.8%)	0.12

**Table2 The comparison between the collagen matrix and the polyglycolic acid**

Factor	Total (N=309)	C group (collagen matrix: N=90)	P group (polyglycolic acid: N=219)	P value
Age (y.o.)	60.0 (49.0-71.0)	59.0 (48.5-72.0)	60.0 (49.0-70.0)	0.85
Female (n: %)	162 (52.4%)	48 (53.3%)	114 (52.1%)	0.90
Cervical (n: %)	71 (23.0%)	23 (25.6%)	48 (21.9%)	0.55
Thoracic (n: %)	128 (41.4%)	33 (36.7%)	95 (43.4%)	0.31
Lumbosacral (n: %)	119 (38.5%)	35 (38.9%)	84 (38.4%)	0.99
Dumbell (n: %)	35 (11.4%)	12 (13.3%)	23 (10.6%)	0.55
<b>cerebral spinal fluid leakage (n: %)</b>	<b>11 (3.6%)</b>	<b>0 (0%)</b>	<b>11 (5.0%)</b>	<b>0.03</b>

**Figure1 Sheet placed at the site of dural suture**

