Comparative study of fibrin and chemical synthetic sealant on dural regeneration and brain damage.

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Abstract:

OBJECT: Several materials, such as polyethylene glycol (PEG) hydrogel and fibrin glue, have been used to seal dural incisions after brain and spinal surgeries. Although the use of PEG sealant is gaining popularity, it can be associated with postoperative cerebrospinal fluid leakage and infection. However, the reasons for this association are currently unknown. The present study aimed to investigate the effects of PEG sealant and fibrin glue on wound healing and brain damage in vivo.

METHODS: Oval-shaped bone defects and dural defects were created bilaterally over the parietal lobes of 22 Japanese white rabbits. The dural defects were covered with 0.5 ml of fibrin glue on one side and 0.5 ml of PEG sealant on the other side. Dural regeneration and brain damage were investigated in each harvested brain and dura mater using light microscopy.

RESULTS: Dural regeneration was more effective in the presence of fibrin glue than it was with PEG sealant ($p = 0.014$). Of the 22 rabbits, 11 showed thick (Grades ++ and +++) dural regeneration by 28 days postsurgery in the hemisphere where fibrin glue was used, whereas Grade +++ dural regeneration was not observed in the PEG hydrogel hemisphere, and only 4 rabbits showed Grade ++ regeneration. Abscess and granulation formation also tended to be more severe when PEG hydrogel sealant was used. No Grade ++ granulation/abscess formation was observed with fibrin glue, and Grade + was only observed in 13 of 22 rabbits. Conversely, with PEG hydrogel sealant, only 2 rabbits did not show granulation/abscess formation, and Grade +, ++, and +++

granulation/abscess formation was observed in 8, 7, and 5 rabbits, respectively. The extent of cortical damage was significantly greater in rabbits with abscesses and granulations, compared with rabbits without these lesions ($p = 0.007$).

CONCLUSIONS: Dural regeneration tended to occur more rapidly with fibrin glue, whereas granulation was more likely with PEG hydrogel sealant, which led to postoperative complications. Histological analysis indicated that PEG hydrogel sealant inhibited the normal tissue healing process and that outcomes were improved by the use of fibrin glue.