Short report

Endaural extracranial repair for cerebrospinal otorrhoea with human fibrin glue: technical note

LUIGI FERRANTE, EMANUEL PALATINSKY, MICHELE ACQUI, LUCIANO MASTRONARDI

From the Department of Neurological Sciences, Section of Neurosurgery, University "La Sapienza" of Rome, Italy

SUMMARY A simple surgical procedure for the repair of cerebrospinal otorrhoea using human fibrin glue has proved safe and successful in two patients with post-surgical fistula. The procedure, which requires only mild sedation, is recommended for open or closed cerebrospinal otorrhoea accompanied by severe neurosensory hearing loss, as long as the fistula has not been caused by chronic inflammatory processes or given rise to intracranial infectious complications.

Cerebrospinal otorrhoea is a rare but potentially fatal condition in which there is a communication between the subarachnoid space and the cavity of the middle ear. It may be open or closed, according to whether the tympanic membrane is ruptured or intact.¹ The fistula may occur through a breach in one of the walls of the tympanic cavity:² in the roof (tegmen tympani), the posterior wall or the medial wall through a break at the oval or round window or promontory. The aetiology may be traumatic,^{3,1} tumoural,¹ congenital,^{1,4} following otitis,^{5,1} or surgery.^{1,6}

The treatment of cerebrospinal otorrhoea as a rule is by operation; the only exception is in the post-traumatic variety, which clears conservatively in about 60% of cases.¹ The surgical approach may be otological (endaural or retroauricular), neurosurgical or otoneurosurgical.²

Materials and methods

We recently operated on two patients: one with a left glomus jugulare chemodectoma and the other with a giant left eighth cranial nerve neurinoma. Both had cerebrospinal otorrhoea after operation, which did not subside despite continuous lumbar drainage for 10 days and diuretics. CT head scan

showed no hydrocephalus in either patient therefore we did not insert a peritoneal shunt. For this reason we treated the patients as follows.

The patients were positioned on the operating table on his unaffected side without anaesthesia or intubation and requiring only mild sedation (diazepam 10 mg IV): cerebrospinal fluid was drawn off through a lumbar tap to make the middle ear as dry as possible. The external auditory meatus (fig 1), the tympanic perforation and the portion of the medial wall of the tympanic cavity visible through it were examined with a sterilised speculum controlled microscopically. When the surgical field was completely dry, human fibrin glue (ca. 1 ml of compound) was injected

Fig 1 Position of the speculum in the external auditory meatus and canal and break in the eardrum through which the glue was injected.

Address for reprint requests: Luigi Ferrante, MD, Department of Neurological Sciences, Section of Neurosurgery, Viale dell'Università, 30/A, 00185, Rome, Italy.

Received 19 November 1987 and in revised form 16 February 1988.
Accepted 12 March 1988

Fig 2 Final aspect of the operating field after obliteration of the tympanic cavity and apposition of human fibrin glue on the eardrum. The glue injector is also shown.

through the breach until the tympanic cavity had been filled. After 3 minutes, (the time needed for initial adhesion of the compound) another 0.5 ml of the substance was dropped into the external auditory meatus against the tympanic membrane. The patient was kept immobile for about 10 minutes (fig 2).

The human fibrin glue used (Tissucol R obtained from Immuno AG-Oesterreichisches Institut für Haemoderivate Ges. M.H.B., Vienna, Austria) is a biological adhesive consisting of two components; the first is CaCl₂-regenerated lyophilised thrombin. The second is a lyophilised mixture (derived from pooled human plasma by cryoprecipitation) of fibrinogen, coagulation factor XIII and fibronectin regenerated with a solution of aprotinin. Once the two components are mixed in equal quantities, the thrombin solution catalyses the conversion of fibrinogen to a fibrin monomer, thus gradually producing an adhesive.⁷⁻⁹

This substance causes rapid adhesion and, through monocyte and fibroblast chemotaxis induced specifically by fibronectin,^{10,11} induces local inflammation, which in turn leads to collagen formation. This action ensures firm and durable bonding by the compound, which is completely replaced by newly formed collagen within about 20 days.

After completion of the procedure, continuous CSF drainage was maintained for a week as a precaution.

Both patients are currently free from otorrhoea; one 2 years and the other 20 months after the operation and in view of the biochemical properties of the compound used, we do not anticipate relapse.

Discussion

To summarise: this simple surgical procedure appears non traumatic, safe and can, if necessary, be repeated or replaced by another surgical procedure; the method can be recommended for both open or closed cerebrospinal otorrhoea (in the latter case after tympanotomy) in patients already affected by severe neurosensory hearing loss.

On the other hand, it is contraindicated in all instances in which the middle ear is exposed to

infection or contamination, especially in cerebrospinal otorrhoea owing to chronic inflammation or when the fistula results in intracranial complications.

With regard to possible transfusion related complications, adverse immune or toxic reactions caused by human fibrin glue, none has yet been reported. Nevertheless, we are aware of the potential risk of exposure to viral infections such as hepatitis B, hepatitis non A-non B and acquired immune deficiency syndrome (AIDS). Though this risk is considered real by American literature,¹² each single plasma unit used in the manufacture of the kits we used was tested for HIV-antibody by means of a FDA approved test system (ELISA) and found HIV-antibody negative.

Since the fibrinogen and factor XIII components are not approved for human use in the United States, Epstein *et al*¹² have proposed a state-of-the-art procedure for creating an autologous fibrinogen-based adhesive for otologic surgery. In our opinion their experience is of great value in contributing to an increased clinical relevance of this promising tissue bonding and sealing system.

In conclusion: we believe that the method we describe represents a valuable adjunct to conventional methods (either surgical or conservative), but, wider clinical experience with longer follow-up is needed to determine the long term efficacy of this procedure.

References

- 1 Norris DA, Clark RAF, Swigart LM, Huff JC, Weston WL, Howell SE. Fibronectin fragment(s) are chemotactic for human peripheral blood monocytes. *J Immunol* 1982;129:1612-8.
- 2 Griffin JE, *et al*. Bilateral longitudinal temporal bone fractures: a retrospective review of 70 cases. *Laryngoscope* 1970;89:1432-5.
- 3 Corona C, *et al*. Esperienze di utilizzazione clinica del Tissucol in Neurochirurgia. *Ortopedia e Traumatologia Oggi* 1982;11:130-6.
- 4 Cawthorne T. The surgery of the ear in the management of intracranial complications of chronic suppurative otitis media. *J Laryngol Otol* 1955;69:579-87.
- 5 Bousquet C, Vanecloo FM, Julliot JP, Piquet JJ, Christiansen JL, Laine E. Les otoliquorhées traumatiques. A propos de 50 malades opérés. *Neurochirurgie* 1980;26:369-75.
- 6 Hasegawa H, Bitoh B, Obashi J, Maruno M. Closure of carotid-cavernous fistulae by use of a fibrin adhesive system. *Surg Neurosurg* 1985;24:23-26.
- 7 Hicks GW, Wright JW Jr, Wright WJ. Cerebrospinal fluid otorrhea. *Laryngoscope* 1980;90 (2nd part):1-25.
- 8 Blatt IM. Surgical repair for cerebrospinal otorrhoea due to middle ear and mastoid disease. *Laryngoscope*

- 1963;73:446–60.
- 9 Haase J. Use of Tisseel in Neurosurgery. *J Neurosurg* 1984;61:801.
 - 10 Staindl O. Tissue adhesion with highly human fibrinogen in otolaryngology. *Ann Otol Rhinol Laryngol* 1979;88:413–8.
 - 11 Epstein GH, Weisman RA, Zwillenberg S, Schreiber A. A new autologous fibrinogen-based adhesive for otologic surgery. *Ann Otol Rhinol Laryngol* 1986;95:40–45.
 - 12 Armenise B, Montinaro A. The prevention of nasal liquorrea caused by transphenoidal surgery for pituitary adenomas. Technical note. *J Neurosurg Sci* 1985;29:57–59.
 - 13 Rice WJ, Waggoner LG. Congenital cerebrospinal fluid otorrhea via defect in the stapes footplate. *Laryngoscope* 1967;77:341–9.
 - 14 Czop JK, Austen KF. Augmentation of phagocytosis by a specific fibronectin fragment that links particulate activators to the fibronectin adherence receptor of human monocytes. *J Immunol* 1982;129:2678–81.
 - 15 Sugita K, Kobayashi S. Technical and instrumental improvements in the surgical treatment of acoustic neurinomas. *J Neurosurg* 1982;57:747–52.

Ferrante, Palatinsky, Acqui, Mastronardi