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Short communication

Autologous fibrin glue in the repair of dural defects in craniofacial resections

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Abstract
Cerebrospinal fluid leakage is a serious and well recognized complication of craniofacial resection for ethmoidal tumours in which the integrity of the dura has been breached. Autologous fibrin glue is a safe, inexpensive and simple method of improving the seal of dural repair and hence minizing CSF leakage. The principles and method of autologous fibrin glue preparation are described. The technique has proven satisfactory in 20 consecutive craniofacial resections with dural defects and is recommended as an adjunct to current techniques of dural repair.

Introduction

Any surgical procedure involving the disruption of the dura carries the potential risk of cerebrospinal fluid leakage. The defect in the dura can be repaired by the use of harvested skin, fascia, fat, muscle grafting or a combination of such measures. These various tissues do not always provide a watertight closure of the dura. We have found that the application of autologous fibrin glue (AFG) to the dural edges, fascia lata and to the overlying skin graft provides a successful seal to any potential routes of CSF leakage. AFG is non-toxic and biodegradable, and therefore leaves no foreign body behind as do commercial plastic based adhesives (Siedentop *et al.*, 1985).

Methods and materials

(1) *Preparation of AFG*

AFG is presented at surgery as two components 'A' and 'B'. Rigorous attention to sterile technique is mandatory in all steps in order to minimize the risk of introducing infection. The patient's blood is collected into citrated vacutainers (20 ml). This is centrifuged at 4000 rpm for 10 mins, the cell-free plasma is then removed and placed in a sterile vacutainer which is rapidly frozen in a −20°C freezer for approximately 1 h.

The plasma is allowed to thaw slowly after which it is centrifuged again at 4000 rpm for five mins. Next the upper portion of the serum is pipetted off, leaving 1–2 ml of serum with the cryoprecipitate rich fibrinogen and factor XIII. This is *component A* which is refrigerated until used, when it is drawn up into a 2 ml syringe.

Component B of AFG contains 100 units of topical thrombin mixed with a 40 m Molar solution of calcium chloride prepared from adding 10 ml of sterile water for injection to 0.5 ml of 10 per cent calcium chloride solution. 2 ml of this mixture is taken up into a sterile syringe.

Fibrinolysis inhibitor has been added to component B by other workers (Sierra *et al.*, 1990) but has not proved necessary in our experience.

Component A is prepared by the Haematology Department prior to surgery, while component B is made up in theatre at the time of surgery.

(2) *Application of AFG (Fig. 1)*

The edges of the dural tear are approximated and both components A and B are applied simultaneously. This is reinforced by overlaying a split skin graft and more AFG is applied to its edges. The coagulum begins to form almost immediately, but a good coagulum is formed after three mins.

The speed of bonding and the final strength of the coagulum formed is influenced by the concentration of the thrombin in component B, dryness of tissues to be glued and the warming of the components to body temperatures.

Thrombin converts fibrinogen to fibrin, and at the same time factor XIII is activated which in turn promotes the formation of a fibrin network with strong bonding power (Redle *et al.*, 1979).

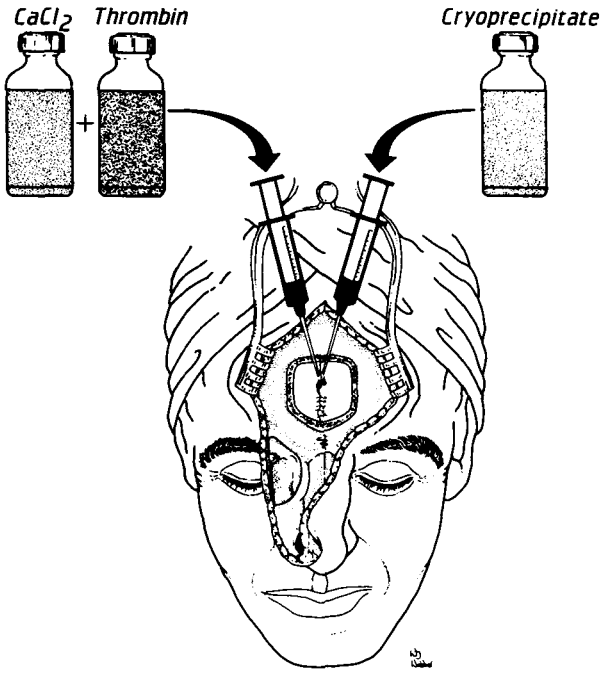

FIG. 1
Illustration showing the application of AFG to the site of dural defect.

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Seventy per cent of the final bonding power is achieved in the first two mins (Siedentop *et al.*, 1983).

(3) *Patients*

In our experience of 20 consecutive patients (11 males and nine females; average age 56.4 years) undergoing craniofacial resection for ethmoidal neoplasms between April 1990 and May 1991, all of whom had their dura disrupted, AFG has been very effective in preventing any post-operative CSF leakage. The technique has now been incorporated into our routine, which has been well described elsewhere (Cheesman, 1986).

Discussion

The increased awareness of the risks of transferring blood products between individuals, as a result of the AIDS epidemic, has led to an increased interest in autologous blood for transfusion and for the production of tissue glue. An ideal tissue glue would be cheap, reliable, safe, and possess the necessary mechanical properties appropriate to the tissues under consideration.

AFG is non-toxic and completely biodegradable and therefore does not leave a plastic foreign body behind as do cyanoacrylate adhesives. Being autologous it also avoids the potential risk of transferring hepatitis B, human immunodeficiency virus (HIV) or any other as yet unidentifiable-blood borne infective agents.

Various studies have looked at the tensile strength of AFG and compared it with that of commercially produced fibrin tissue adhesive (Tisseel) and N-butyl 2 cyanoacrylate (Histoacryl) using different methods and in a variety of conditions. All show that AFG provides adequate bonding power for the purposes for which it is used.

AFG is relatively inexpensive and simple to prepare, costing £9.00 including needles and syringes compared to Tisseel costing £164.50 and Histoacryl £43.88, for the equivalent volume.

The potential applications of AFG go beyond craniofacial resection since fibrin glue has also been used successfully in facial nerve grafting, middle ear surgery, skin grafting (Ellis and Shaikh, 1990) and many procedures in ophthalmic surgery (Bartley and McCaffrey, 1990).

Key words: Autologous fibrin tissue adhesive.

Conclusion

We recommend the use of autologous fibrin glue in craniofacial resections, and would anticipate its increasing use as an adhesive in other otorhinological procedures.

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References

Bartley, G. B., McCaffrey, T. V. (1990) Crioprecipitated fibrinogen (fibrin glue) in orbital surgery. *American Journal of Ophthalmology,* **109:** 227–228.

Cheesman, A. D. (1986) Craniofacial approach to ethmoidal tumours. In: Operative Surgery. 4th edn., (Ballantyne, J. C., Harrison, D. F. N., eds.) Nose and Throat, Butterworths, London.

Ellis, D. A. F., Shaikh, A. (1990) The ideal tissue adhesive in facial plastic and reconstructive surgery. *Journal of Otolaryngology,* **19:** 68–72.

Redl, H., Seelich, T., Guttman, J. (1979) Basic considerations and theoretical background of fibrin sealing. *European Surgical Research,* **11:** 98.

Siedentop, K. H., Harris, D. M., Loewy, A. (1983) Experimental use of fibrin tissue adhesive in middle ear surgery. *Laryngoscope,* **93:** 1310–1313.

Siedentop, K. H., Harris, D. M., Sanchez, B. (1985) Autologous fibrin tissue adhesive. *Laryngoscope,* **95:** 1074–1976.

Sierra, D. H., Nissen, A. J., Welch, J. (1990) The use of fibrin glue in intracranial procedures: preliminary results. *Laryngoscope,* **100:** 360–363.

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