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Optimal proportions of gelatin resorcin formalin components in aortic surgery

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Abstract:

Background: Gelatin–resorcin–formalin (**GRF**) glue, a haemostatic agent often employed for aortic surgery, has beneficial effects on early results in surgery for acute aortic dissection but may have late adverse effects, probably due to excess use of the activators such as formaldehyde and glutaraldehyde. The purpose of this study was to determine the optimal proportions of **GRF** components that minimise toxicity to human aortic smooth muscle cells and elastin with acceptable adhesive strength.

Methods: (1) The degree of polymerisation was examined at various proportions (activator/gelatin + resorcinol = 0%, 2%, 4%, 6%, 8% and 10%) to estimate adhesive strength. (2) (i) The toxicity of the activator was confirmed 24 h after its supplementation to human aortic smooth muscle cells in various proportions (activator/human aortic smooth muscle cell = 0%, 0.5%, 1%, 1.5%, 2% and 2.5%). (ii) The toxicity of **GRF** glue to human aortic smooth muscle cells was evaluated 1 h and 60 h after its supplementation (activator/gelatin + resorcinol = 0%, 2%, 4%, 6%, 8% and 10%). Another set of experiments in the same study was also performed. The only difference was that **GRF** glues were washed after polymerisation to exclude non-polymerised constituents. (3) Effects of 8%-**GRF** glue on toxicity to elastin derived from human aortic wall cells were investigated using an immunoblotting method.

Results: (1) The polymerisation area increased dose dependently and that of the 10% activator/gelatin + resorcinol mixture was significantly wider than those of 6%, 4%, 2% and 0%, but had no significant difference from that of 8%. (2) (i) Human aortic smooth muscle cell death occurred in all dishes except activator-free dishes. (ii) Sixty hours after exposure to **GRF** glue, human aortic smooth muscle cell death occurred only in the 10% dish. In a washed **GRF** glue study, no human aortic smooth muscle cell death occurred in any dishes. (3) Toxicity to elastin was not significantly different between 8%-**GRF** glue and the control, whereas toxicity of elastase to elastin was significantly higher than for both the glue and the control.

Conclusions: An 8%-**GRF** glue provides lower toxicity to human aortic smooth muscle cells and elastin with an acceptable degree of polymerisation, and thus seems to be an optimal proportion for **GRF** glue.