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Comparison of the hemostatic efficacy of low-volume lyophilized plasma reconstituted using sterile water, lactated Ringer's, normal saline, and Hextend solutions.

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BACKGROUND: Low-volume ascorbic acid-buffered reconstituted lyophilized plasma (LP) provides logistic advantages, reduces the risks for large-volume resuscitation, modulates inflammation, and is equally effective for hemostatic resuscitation as full-volume LP. We compared the physiologic effects of resuscitation using LP reconstituted with sterile water (LP-SW), lactated Ringer's solution (LP-LR), normal saline (LP-NS), and Hextend (LP-Hx).

METHODS: Plasma was collected from swine, lyophilized, and then reconstituted into four test solutions: LP-SW, LP-LR, LP-NS, or LP-Hx. Forty swine were anesthetized and subjected to a validated model of polytrauma and hemorrhagic shock (including a Grade V liver injury), then randomized to receive one of the four test solutions. Physiologic parameters, blood loss, lactate, and hematocrit were followed up. Coagulation status was evaluated using thrombelastography. Inflammatory mediator expression was evaluated by multiplex serum assay.

RESULTS: Forty animals were included in the study (10 animals per group). One animal died following LP-Hx resuscitation. There was less blood loss in the LP-SW and LP-LR groups compared with the LP-NS and LP-Hx groups ($p < 0.05$). The LP-SW group exhibited less early coagulopathic changes by thrombelastography, and the LP-Hx group had persistently elevated international normalized ratios at the end of the study period ($p < 0.05$). Serum interleukin 6 was lower after 4 hours in the LP-SW group compared with LP-NS ($p < 0.05$).

CONCLUSION: Resuscitation using low-volume LP-SW and LP-LR buffered with ascorbic acid confers an anti-inflammatory benefit and results in less blood loss. Sterile water is a safe, cost-effective, and universally available fluid for creating a low-volume hemostatic LP resuscitation solution.