The feasibility of creating optimum wound lavage pressure

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INTRODUCTION

Lavage removes superficial foreign material and microbes from wounds. Low pressures may be insufficient to dislodge debris and contamination. Conversely, high pressures may risk tissue damage and drive contamination deeper. Current surgical texts recommend using an optimum pressure of 8psi (reported values of 4psi-15psi). There is no clear guidance on how to accurately recreate this pressure.

The aim of this study was to establish whether 8psi could be consistently achieved using equipment commonly found in small animal practice and develop clear guidelines to accurately create optimal lavage pressure. This is important practical information for the treatment of most wounds.

METHODS AND MATERIALS

Optimal flow rates for a range of standard needle diameters (16G, 19G, 21G, 23G, 25G) to achieve a pressure of 8psi were calculated using a modified Bernoulli equation. Experimental testing was performed to determine the achievable lavage pressure, using a pressure cuff and 500ml or 1000ml saline fluid bags with an extension set attached to a three way tap and a range of needle diameters (19G, 21G, 23G, 25G). The

effect of removing the cannulated shaft of the needle from the hub was also investigated.

RESULTS

Optimal flow rates for a range of standard gauge needles are shown in the table below. Any syringe volume with graduations to allow estimation of flow rate can be used.

Needle size (G)	16	19	21	23	25
Advisable flow rate (ml/s)	12	4	2	1	0.5

Flow rates achieved using a fluid bag within a pressure cuff were consistent and reproducible. However, the maximum cuff pressure using standard equipment (300mmHg) did not achieve sufficient flow rate to create 8psi. A pressure cuff at 300mmHg and either a 500ml or 1000ml saline bag achieved a lavage pressure of 4psi when using 23G and 25G needles with the cannulated metal shaft removed. Removal of the cannulated needle from the hub achieved higher flow ($p=0.025$). Pressures created using a syringe and needle were more variable compared with a fluid bag and pressure cuff.

CONCLUSION

A syringe and needle can be used to effectively lavage traumatic wounds. Guidelines for flow rates dependent on needle diameter are described. Pressure cuffs and fluid bags can achieve consistent and reproducible lavage pressure. However, higher cuff pressures than are currently achievable are required to generate the recommended 8psi of lavage pressure.