Valsalva using a syringe: pressure and variation

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ABSTRACT

Background The Valsalva manoeuvre is commonly used in EDs to terminate supraventricular tachycardia by the patient blowing into a syringe.

Aim To identify whether a specific syringe size can be recommended for use in the ED.

Results 20% of syringes ‘stuck’ and required high pressures to move. In the remaining 80% of syringes, a 20 mL syringe was the most appropriate size to achieve the recommended 40 mm Hg. Once ‘released’ plunger position did not make a difference.

Conclusions Use of a syringe of any size cannot be recommended if a consistent pressure is required.

INTRODUCTION

The Valsalva manoeuvre (VM), first identified in 1704,1 is still used in EDs as a non-pharmacological method to terminate haemodynamically stable supraventricular tachycardia (SVT).2 The manoeuvre involves expiring against a closed glottis to increase intrathoracic pressure, triggering baroreceptor activity and increased vagal tone. It is believed to be safe, despite various theoretical complications.3 Blowing into a syringe is a simple method for realising VM. Other methods include blowing against the thumb in the mouth, bearing down and pushing against a hand on the abdomen.4 A standard suggested technique for the VM, based on physiological studies, requires a duration of 15 s and a pressure of 40 mm Hg in a supine posture.3 However, this is rarely followed.5 Documented success rates range from 5% to 55% using variations of the technique.7–9 A modified VM technique involving a passive leg raise (and generating pressure by blowing into a manometer) has recently been shown to move more than double success rate (43% vs 17%).9

A commonly used practical method to achieve the VM is to ask the patient to blow into the end of a syringe hard enough to move the plunger. Smith and Boyle4 found that a 10 mL syringe produced the required pressures in a single healthy volunteer (the author). We aim to test pressures required for different syringe sizes and plunger positions to identify whether a specific syringe size can be recommended.

METHODS

We compared 20 syringes each of 5 mL (BD Emerald), 10 mL (BD Emerald) and 20 mL (BD Plastipak) using an IDASS manual sphygmomanometer (lower limit: 0 mm Hg, upper limit: 300 mm Hg, 2 mm Hg increments). Each syringe was removed from its sealed packet and the manometer tubing directly attached to the syringe without altering the plunger position (figure 1). Manometer pressure was increased gradually and recorded at first sign of plunger movement (two observers). The pressure was released and the plunger was manually moved to one-fourth of the volume of the syringe (eg, 5 mL for a 20 mL syringe). The pressure required to move the plunger was recorded and the process repeated for one-half and three-fourths of the syringe volume. Finally, the plunger was moved back to the zero mark and the test was repeated.

Data were tested for normality, and the median and IQR for each syringe type were calculated.

RESULTS

All syringes required very high pressures if the plunger had not been previously moved (table 1). Once the plunger had been moved, the larger the syringe, the lower the pressure required.

Twenty per cent of syringes ‘stuck’ and required high pressure to move at all points (figure 2). Apart from these outliers, a 10 mL syringe required >70 mm Hg and a 20 mL syringe required 40–50 mm Hg (figure 3).

LIMITATIONS

Our results may not be generalisable as we tested only two models from one brand of syringes. Other departments may use different brands. For practical reasons, we were not blinded to the size of syringe and were aware of required pressures. However, the person observing plunger movement was not able to see the manometer dial. Blinding would not affect

Figure 1 Attachment of the syringe to the manometer.
the fact that some plungers could not be moved. We used a manometer bulb to create pressures. This is likely to create a different pressure pattern from a patient blowing into the syringe, so is less accurate and reliable create a pressure of 40 mm Hg, a syringe cannot be relied upon.

DISCUSSION
An important finding is that about one in five syringes ‘stick’, perhaps due to small manufacturing irregularities. This will not have an effect on the intended use of the syringe as a hand-operated device for moving fluids; however, even small irregularities may become important when syringes are used at the relatively low pressures generated by exhalation.

It is impossible to blow hard enough to move the plunger straight out of the packet, so it is important to ‘release’ the plunger before use. Once ‘released’, plunger position did not greatly affect the pressures, but we note that moving it halfway allows the patient to see the plunger moving.

The recent influential publication of the addition of leg raise to the VM used a modified manometer to reliably generate the required pressure; however, local modification of medical devices, even if apparently low risk, is discouraged.

Our results are different from the previous study, which might suggest that the specific make of syringe is important. This implies that emergency physicians should know the characteristics of their local syringe types and be aware that suppliers may change. In our department, a 20 mL syringe is most likely to provide the recommended 40 mm Hg but will not work at all 20% of the time.

CONCLUSION
There is little evidence about the optimal pressure for SVT termination. However, our results suggest that if it is important to accurately and reliably create a pressure of 40 mm Hg, a syringe cannot be relied upon.

REFERENCES