

# Continuous low suction pressure: an innovative solution to transporting patients with Replogle tubes

Neonatal patients with trache-oesophageal fistulas are at risk of aspiration and require constant drainage of the pouch in order to clear secretions. This can be a challenge in the transport environment where low pressure suction is not always available. This article describes a solution to this problem utilising a dry seal chest drain with a built-in suction regulator.

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Oesophageal atresia (OA) with a distal trache-oesophageal fistula (TOF) is the most common variant within a spectrum of tracheal and oesophageal abnormalities<sup>1</sup>. In this condition there is an abnormal connection between the trachea and the oesophagus, and a blind ending oesophagus which is referred to as a 'pouch'. Neonatal patients with OA-TOF are at risk of aspiration and require constant drainage of the pouch in order to clear secretions. This is usually performed by connecting a low suction source to a double lumen catheter ('Replogle tube'), first described by Robert Replogle in 1963<sup>2</sup>. While this is straightforward practice in a neonatal unit, achieving continuous low suction while in an ambulance can be challenging.

## Current practice

Replogle suggested that his design of a double lumen catheter should be used with suction pressures of 25-30mmHg, which equates to 3-4kPa or 34-40cmH<sub>2</sub>O of negative pressure. There was concern that there was inconsistent practice around the country in the use of Replogle tubes and the pressures used.

A telephone survey was undertaken to compare the standard described by Replogle with current practice. Fourteen neonatal units in the UK who care for surgical newborns were contacted and asked about the suction pressure used with a Replogle Tube and whether they had a guideline for this practice.

The standard international metric unit is the Pascal (1Pa=1Newton/m<sup>2</sup>) and for ease

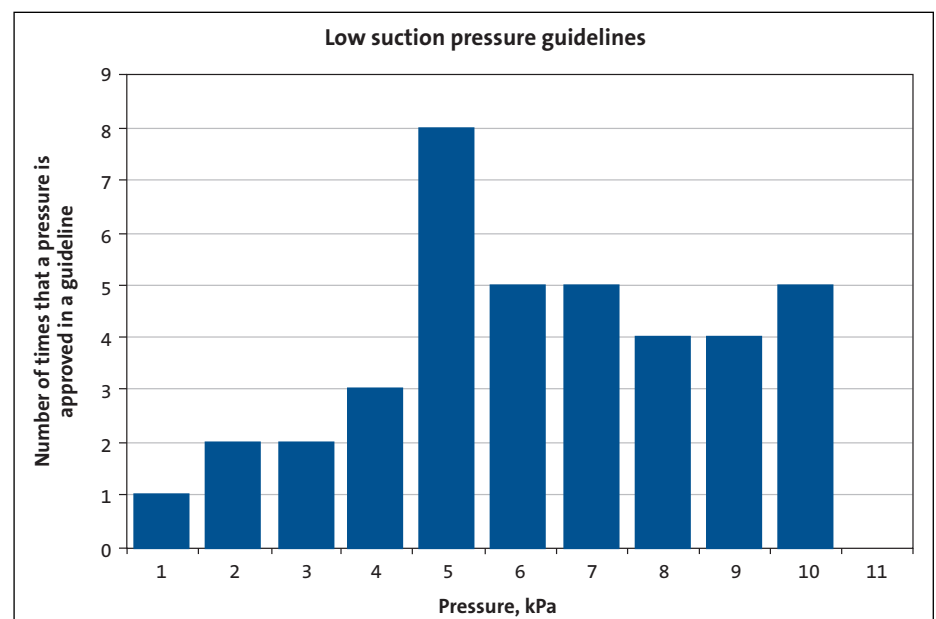
## Keywords

Replogle tube; suction; oesophageal atresia; trache-oesophageal fistula; neonatal transport

## Key points

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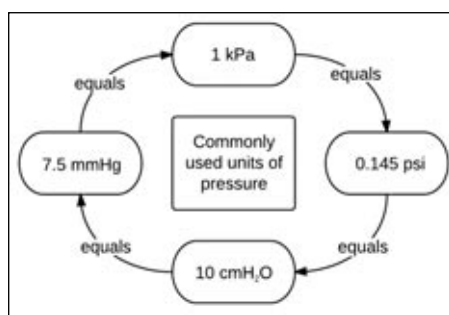
1. The provision of continuous low pressure suction in the transport environment can be a challenge.
2. The combination of a dry seal chest drain with a built-in suction regulator provides a lightweight, simple and reliable solution.
3. Information on how to convert between different units of pressure for suction is provided.



**FIGURE 1** Range of approved low suction pressures used for trache-oesophageal fistula from a sample of fourteen neonatal units.

of comparison all results shown have been converted to kPa (FIGURE 1). Some units gave a single numerical value for the pressure used (eg 5kPa) while others gave a range (eg 5 to 10kPa), in which case a mark was given to each integer in the range.

The majority of neonatal units were comfortable providing suction at 5kPa and no guideline exceeded 10kPa. High negative pressures have the potential to cause iatrogenic mucosal damage and it has been suggested that excessive levels of continuous negative pressure via a Replogle tube can impede effective respiration<sup>3</sup>. It seems appropriate therefore to use the lowest level of suction to remove secretions without compromising the patient.



**FIGURE 2** Conversion for commonly used units of pressure.

Various different scientific units of pressure measurement are referred to within the guidelines we reviewed – some use kPa, others mmHg or cmH<sub>2</sub>O (FIGURE 2). Medical equipment can also be marked with varying different scientific units (FIGURE 3). Several guidelines quoted a 4cmH<sub>2</sub>O suction pressure for infants with OA-TOF, but this equates to 0.4kPa, which is too low to be effective. It is more likely that a 10 fold error has been introduced at some point. Some neonatal units aimed to describe how to convert the different



**FIGURE 3** A low suction gauge with multiple pressure units.



**FIGURE 4** Laerdal suction unit and Express Mini 500 on transport incubator.

pressure units, but three out of fourteen units (21%) had conversion errors in their guidelines.

Practice among transport services varies between either intermittent manual aspiration using a syringe, or using the lowest level of electric suction possible, either intermittently or continuously. Infants with OA-TOF can require intermittent suction every five minutes which can make the transfer extremely difficult for both staff and patient.

Many transport services, including Embrace (Yorkshire and Humber Infant and Children Transport Service), use the portable Laerdal Suction Unit (LSU) (Laerdal, Norway). The lowest setting is marked as 80mmHg (10.7kPa)<sup>4</sup> which exceeds the pressure required for OA-TOF suction. An investigation was carried out to determine whether there was a simple way of attenuating the continuous suction pressure generated by the LSU.

## Innovation

Modern chest drainage collectors automatically attenuate the pressure and these were reviewed to see if one would be suitable for use with Replogle tubes in transport. The Express Mini 500 (Atrium, USA) is a small, lightweight disposable device that regulates suction to 20cmH<sub>2</sub>O (2kPa) (FIGURE 4). It has a high pressure release valve, a dry seal valve and a visible indicator that shows if the suction is operating<sup>5</sup>. It comes with straps that can be used to safely attach it to the frame of a transport incubator. This solution was thought to be cost effective for low purchase volumes when compared to the purchase, installation and maintenance of a low-suction regulator.

The Express Mini 500 drain and LSU combination has now been used for several infants with OA-TOF during their transfer

to a surgical centre. To set the equipment up, all the transport team was required to do was connect the Express Mini 500 drain between the Replogle tube and the LSU. The suction pressure was successfully attenuated to an appropriate level of 2kPa. The small lumen of the Replogle tube was flushed intermittently with saline and secretions were observed to flow into the collection chamber.

There were initial concerns that the LSU may overheat and cut out with continuous use, but this did not occur in the infants studied since the power saving function that switches the unit off is only active if the vacuum level exceeds 16kPa.<sup>4</sup>

## Summary

There is variation in the pressure used for Replogle suction and in the units used to measure pressure. Practitioners need to be aware of the relationship between the various units of pressure measurement with an aim to avoid future errors in calculation and application.

The authors believe that the use of the Express Mini 500 drain with the LSU is a safe and effective way to provide continuous suction in transfer for infants with OA-TOFs.

The combination is:

- lightweight and easy to secure
- simple to set up and use
- cost effective
- able to deliver an accurate, reliable and clinically appropriate level of continuous suction

Transport medicine should provide the same standard of care during the journey as in the neonatal unit. This innovation improves the quality of the transport experience for the patients with OA-TOF.

## Declaration of interest

Embrace asked for and received free samples of the Express Mini 500 from Atrium.

## References

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