Low-Pressure Wound Irrigation

Establishing a Method to Compare Available Techniques and Products

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Abstract

Low-pressure wound irrigation is common clinical practice to prepare wound beds for debridement. However, the performance of different wound wash products and techniques could help by comparing their performance to common practice of low-pressure irrigation. Our study revealed considerable heterogeneity amongst tested products. This simple method may be used for irrigation technique characterization and better understanding of clinical outcomes.

Introduction

Wound cleansing is considered an important step in the treatment of acute and chronic wounds. The goals of wound cleansing range from removal of debris and dead tissue to mere reduction of debris and bacterial load. Consequently there is a range of techniques including high-pressure irrigation,谤low-pressure irrigation, soaking, bathing, washing the affected area under a running solution, and even immersion in a whirlpool bath (also known as hydrotherapy). Low-pressure wound irrigation is common clinical practice to prepare wound beds for further intervention and care. In acute settings it is the only available intervention before covering an open wound. Low-pressure wound irrigation aims to reduce debris and bacterial load, while avoiding further tissue damage or bacterial transfer into lower wound areas.

According to literature, syringes of at least 35 ml connected to a 19-gauge angiocath are widely used for low-pressure wound irrigation. At manual actuation, pressure levels (4-15 PSI) of the irrigation stream are correlated with the impact force on a simulated wound surface.

Results

Needle and Syringe Instillation

The measurement equipment was set up by modifying a procedure published earlier, connecting needle, syringe and manometer as shown in Figure 1.

Materials and Methods

For assessment of syringes and needle procedure performance, a 50 ml syringe (Osmolite, B.Braun Melsungen AG, Germany) was connected to a 19-gauge needle (Integria IG3197, B.Braun Melsungen AG, Germany), and a manometer (Kistler Germany, Type 501A) by using commercially available plastic tubes and a three-way connection.

BOV-based saline wound wash products (Walgreens Saline Wound Wash, Angiocath Saline Wound Wash, Nurse Assist Medical Drain Flush, Amerigel Saline Wound Wash, NeildMed micCleanse Wound Wash) were pre-filled 6 units from the U.S. market and shipped to Aptar Radolfzell for further analysis. Individual cans with obvious damage from shipping (e.g., broken actuator, empty can) were excluded. All products were characterized regarding initial valve pressure and system pressure. For each product, three individual cans were assessed and results were averaged.

The Aptar Anastasia JET actuator was mounted to a commercially available can, assembled with an Aptar bag-on-valve system and filled with 0.9% saline. Impact forces resulting from irrigation streams were assessed through a plastic disk (diameter 7 cm) coupled to a force sensor (Type KAP-TC, Zwick Roell, Germany) at a distance of 10 cm (1.34 inch) from the syringe or BOV's dispensing orifice. Impact force over time was automatically recorded at a frequency of 100 values per second from 19 to 121 mN. Values were exported to a commercially available software for further analysis. Maximum pressure in the system (i.e., system pressure) was manually recorded from the manometer. Actuation time and total delivered volume was recorded and the average flow rate calculated.

Discussion

Achieving the right performance in low-pressure instillation is critical to effectively remove debris and debris, while preserving wound integrity and avoiding damage. Following a simple method to compare marketable wound wash products, with literature-recommended syringe and needle instillation. We found an impact force of 6.4 to 24.0 mN onto a simulated wound surface at an 10 cm distance that is corresponding to literature recommended system pressure levels (4-15 PSI).

The performance of the test equipment is either user-dependent (syringe, bottle, or total immersion in a whirlpool bath) or totally independent of the user's judgement.

Materials

- 35 ml syringes connected to 19-gauge angiocaths
- Manometer (Kistler Germany, Type 501A)
- Commercially available saline wound wash products

Methods

- Assessment of syringes and needle procedure performance
- Connection of needle, syringe, and manometer
- Characterization of commercial wound wash products

Results

- Impact forces ranging from 6.4 to 24.0 mN
- Correlation of maximum impact force and system pressure

References


Impact forces during emptying of available wound wash products

Figure 1: Set-up of measurement equipment for impact force and system pressure

Figure 2: Correlation of maximum impact force and system pressure during manual actuation at different effort

Figure 3: Maximum impact force of selected wound wash products

Figure 4: Impact force changes during emptying of available wound wash products

Figure 5: Characterization and assessment of selected wound wash products

Table 1: Characterization and assessment of selected wound wash products

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Figure 6: Correlation of maximum impact force and system pressure during manual actuation at different effort