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Spring active drain using bladder (50–60 ml) syringe (De Adotey's drain)

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ABSTRACT

INTRODUCTION: Closed active drainage system with a syringe is an accepted way to let out fluid in a surgical wound. We present a simple spring active (negative suction) drainage (SAD) system using locally improvised metallic spring and 60 ml (bladder syringe); SAD of Adotey, a newly designed compression–expansion spring mechanism which serves especially in situations where an active drainage system is of utmost importance.

CONCLUSION: De Adotey's drain is a 60 ml bladder syringe with spring mechanism which is used to provide a negative pressure as an active drain.

1. Introduction

A drain is a piece of appliance that serves as a channel of exit for fluid from a wound cavity. De Adotey's drain was first used in drainage of effluent from a patient who had subtotal thyroidectomy for Toxic multinodular goitre.

2. Materials and methods

1. One 50 or 60 ml syringe.
2. Infusion giving set (the lock and connector).
3. Any French gauged Ryles' tube, urine bag tube or Pennine tube if available.
4. A wire (from a condemned umbrella or mosquitoes' net or direct source metal steel 1/6 or 1/4 inch thickness? and a metal cutter.
5. Plier.

2.1. How to fashion the spring (technique)

1. Fix a wire in a stable rod such as generator's handle. Wrap the wire or steel around the handle (Wound) to make a spring. The wire is then cut to a matching spring size with the piston of the syringe.
2. On the operating table, open an infusion giving set. Remove the luer lock and the connector and connect to the sizeable feeding tube and the terminal end of the 50 ml syringe respectively. The connection to the 50 or 60 ml syringe may not be necessary if the end of feeding tube can fit directly like in Pennine tube.
3. Disconnect the piston and connect the spring snugly around the piston and couple back the syringe with spring (Figs. 1 and 2).

2.2. Mechanism of spring action

The drain works by simple compression–expansion mechanism. The compression (Fig. 3) is the charging process while the expansion (Fig. 4) pushes the piston and plunger away thereby creating a vacuum (negative pressure) in the syringe. The negative pressure thus sucks fluid into the chamber.

2.3. How to change the system?

The drain can be changed by locking the system just like in infusion giving set, then disconnect syringe from the tube. Thereafter it can be emptied by compressing the spring just like in charging process. Then the same drain reconnected and system unlocked to continue function. This procedure is performed in aseptic field.

3. Discussion

Mechanisms of surgical drainage have been tried in developing economy such as Africa. Such mechanisms included the use of urine bag as drainage [1] and the use of infusion bottle as suction drainage [2]. The use of syringe as a means of drainage has been documented in literature. Our drain is designed with a different syringe and spring system. It is considered user friendly especially by nurses, because it can easily be changed without requiring any form of assistance, well calibrated to determine amount of fluid drained unlike in Redivac drain. The spring can be sterilized if need be, but the syringe comes in a sterile pack, especially the type made in the United States of America and China. In terms of cost, the US

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Fig. 1. Uncoupled set.

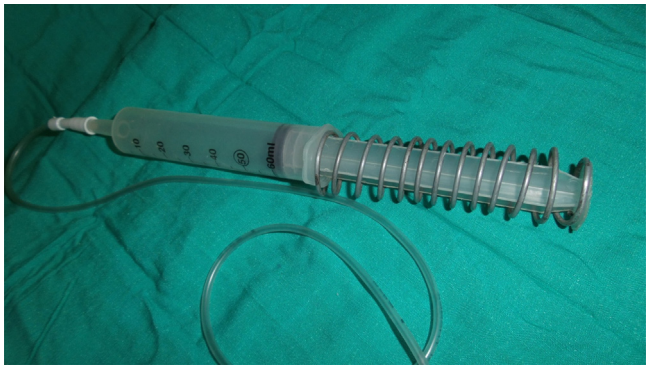

Fig. 2. Coupled set fitting snugly.

Fig. 3. Compression (the charging process).

Fig. 4. Expansion (the active process).

Fig. 5. Differences in the piston.

made syringe costs $5.88 while that of China costs $2.94. Those made in other countries are available but the cost and durability are yet to be determined.

The negative pressure generated was measured with a manometer and it ranged between 300 to 500 mm of Hg depending on the "charging" and regulation.

This newly devised system can be used in all the minor and moderate surgical procedures in the neck, breast, foot, extremities and so on. It is more economical and easy to handle and similar to the one used in standard or Redivac drain and Singh et al. [3]. Dwivedi and Gupta [4], Gopal and Kumar [5], Park et al. [6] and the method used by Sundearraj [7]. Smaller spring can be made to simulate our spring active drain in these types. The method used by Singh and Singh [8] with the use of K wires in the place of spring makes the pressure static like other syringe drains and also unidirectional compared to our method with dynamic pressure changes desired by the surgeon. Improvisation method has been tried by Venkatachalapathy et al. [9]. The use of different tubes and cannula [10] as drain tubes designed by Ellur [11]. Jain et al. [12] and Zhi-Yong and Guo-Qian [13] does not have regulated pressure like in our drain, where regulation of pressure is done by adjusting the lock just like in infusion giving set mechanism. However, pressure regulation is optional and case dependent. This is because this drainage system is being tried in delicate tissue like close to bowel (pelvic cavity) at reduced pressure especially when cloth blockage reduces drainage mechanism as observed in passive drains. The drain is left in situ until the desired drainage is achieved. In thyroidectomy, within 48 h the drain can be removed, while in breast operation may be left up to 5 days.

Initially when the drain was invented, differences in the two pistons used were observed, as shown in Fig. 5, the groove in the second piston may cause reduction in spring expansion, hence reduction in effective drainage. The first piston is preferred to the second. Besides, no case of drainage system failure or spring breakage has been recorded, and spring ends are preferably cut blunt with welding machine to avoid sharp injuries. The whole system could be disposed or only the spring could be re-used after sterilization. Local tissue trauma and infectious complications have not been observed in this drainage system.

4. Conclusion

The use of a spring mechanism could be fashioned with a syringe. De Adotey's drain is a 60 ml bladder syringe with spring mechanism which is used to provide a negative pressure as an active drain.

Authors' role

First and corresponding author; device design and literature review. Co-authors; contributions and corrections.

Conflict of interest

Authors declare no conflict of interest.

Consent

Written informed consent was obtain from the patient involved.

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Author contribution

Instrument design and case study was done by author: Patrick Okechukwu Igwe.

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