

Case Series

Syringe-based closed negative suction drainage for small surgical wounds: a case series and review of low-cost surgical innovation

Prashant Oli*

Department of Surgery, B. D. Pandey District Hospital, Nainital, Uttarakhand, India

Received: 06 March 2026

Revised: 20 March 2026

Accepted: 23 March 2026

***Correspondence:**

Dr. Prashant Oli,

E-mail: prashantoli54@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Postoperative fluid accumulation within surgical wounds can lead to complications such as hematoma, seroma, surgical site infection, and delayed wound healing. Closed suction drainage systems are commonly used to prevent these complications by eliminating dead space and facilitating continuous evacuation of fluid collections; however, commercially available systems may not always be accessible in resource-limited settings. This prospective observational case series was conducted at B. D. Pandey District Hospital, Nainital, India, from January 2024 to June 2025, including 24 patients undergoing minor surgical procedures with anticipated dead space formation. A syringe-based closed suction drainage system was assembled using a disposable syringe and infant feeding tube to generate negative pressure drainage. The mean age of patients was 28 years, with 16 males and 8 females. Indications included excision of soft tissue swellings, minor reconstructive procedures, and closure of wounds with potential dead space. Mean drainage volume was 25 ml on postoperative day 1, 12 ml on day 2, and 4 ml on day 3, with a mean drain duration of 3 days. No hematoma or seroma formation was observed, while two patients developed superficial surgical site infection managed conservatively. Syringe-based closed negative suction drainage is a simple, safe, and cost-effective alternative for small surgical wounds, particularly useful in low-resource healthcare settings.

Keywords: Syringe suction drain, Closed suction drainage, Low-cost surgical innovation, Postoperative wound drainage, Negative pressure drainage

INTRODUCTION

Postoperative fluid accumulation within surgical wounds is a common cause of complications such as hematoma, seroma, infection, and delayed wound healing. Surgical drains are therefore frequently used to evacuate fluid collections and prevent the formation of dead space following surgical dissection. Suction drains play an important role in postoperative management by removing fluid from subcutaneous, intra-abdominal, and retroperitoneal spaces while also allowing monitoring of postoperative bleeding and leakage.¹ Drains are broadly classified into open and closed systems. Closed drainage systems consist of a conduit connected to a collection chamber and may function through gravity or negative

pressure. Closed suction systems such as Jackson-Pratt and Blake drains are widely used because they reduce contamination risk and facilitate efficient evacuation of fluid collections.¹

Negative pressure drainage has been shown to enhance wound healing by maintaining tissue plane approximation and reducing dead space formation. Fox and Golden described continuous suction drains as functioning like an “atmospheric bandage” that promotes adherence of tissue planes and accelerates wound healing following subcutaneous surgical procedures.²

Closed suction drainage systems also reduce the risk of bacterial contamination. In an experimental animal study,

Raves et al demonstrated that retrograde bacterial migration occurred in 90% of Penrose drains compared with only 20% in closed suction drains, indicating the superiority of closed suction systems in preventing infection.³

Clinical studies have demonstrated the benefits of subcutaneous suction drainage in reducing postoperative complications. Harish et al. reported that subcutaneous closed suction drains significantly reduce the incidence of surgical site infections by draining hematoma and serous fluid that serve as a medium for microbial growth.⁴ In head and neck surgery, negative pressure wound therapy has been associated with improved wound healing and reduced infection rates.⁵ Similarly, Naik et al observed reduced SSI rates, wound dehiscence, and shorter hospital stay when subcutaneous suction drains were used in emergency laparotomy.⁶ Comparable findings were reported by Pandey et al who demonstrated decreased rates of hematoma, seroma, and wound complications with the use of vacuum suction drains.⁷ Similar benefits have been reported in gynaecologic oncology procedures following cytoreductive surgery.⁸

One of the earliest reports by Moss described a simple suction drain assembled using butterfly infusion sets and vacuum containers for small surgical wounds.⁹ Despite their advantages, commercially available suction drains may be costly or unavailable in resource-limited healthcare settings. To overcome this limitation, several authors have described improvised syringe-based suction drainage systems assembled from readily available operating theatre materials such as disposable syringes and feeding tubes.¹⁰⁻²² These systems provide an inexpensive and effective method for achieving closed suction drainage.

The present study aims to evaluate the clinical effectiveness and safety of a syringe-based closed negative suction drainage system in patients undergoing minor surgical procedures.

CASE SERIES

This prospective observational case series was conducted at B. D. Pandey District Hospital, Nainital, India, from January 2024 to June 2025. A total of 24 patients undergoing minor surgical procedures with anticipated postoperative dead space or fluid accumulation were included. Patients undergoing major surgeries with high expected drainage output or those with severe systemic infection were excluded.

The study population had a mean age of 28 years and included 16 males and 8 females. The syringe-based closed suction drainage system was utilized in a variety of clinical scenarios, including excision of soft tissue swellings (n=12), minor reconstructive procedures (n=7), and surgical wounds with potential dead space (n=5). Procedures performed included Limberg flap, suturing of

avulsion lacerations, secondary suturing, epigastric hernia repair, and excision of lesions such as lipomas, epidermoid cysts, dermoid cysts, and other subcutaneous swellings.

The drainage system (Figure 1) was constructed using a disposable syringe (20–50 ml) connected to an infant feeding tube. The distal end of the feeding tube was perforated and placed within the surgical cavity prior to wound closure. After closure, the proximal end was attached to the syringe, and negative pressure was generated by withdrawing the plunger. The plunger was secured in position using a stopper fashioned from another syringe plunger and adhesive tape. The system allowed continuous closed suction drainage with easy monitoring of output.

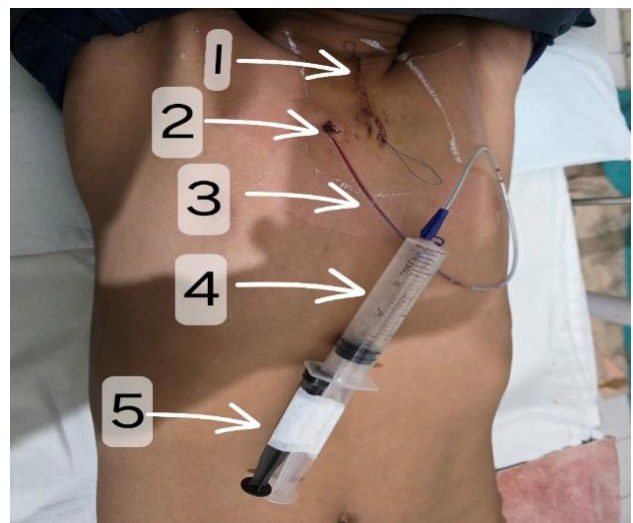


Figure 1: Our syringe suction drain technique (1- surgical wound, 2-drain fixation with silk suture, 3- infant feeding tube, 4-20cc syringe, 5-plunger of 10cc syringe used as stopper and secured with adhesive tape).

Outcomes

A total of 24 patients undergoing minor surgical procedures requiring postoperative wound drainage were included in this prospective case series.

Table 1: Patient demographics.

Parameters	Value
Mean age	28 years
Male	16
Female	08
Total patients	24

Patient demographics

The mean age of the study population was 28 years. The majority of patients were male (n=16), while 8 patients were female (Table 1).

Surgical indications

The syringe-based suction drainage system was used across a variety of minor surgical procedures where postoperative dead space or fluid accumulation was anticipated. The most common indication was excision of soft tissue swellings, followed by minor reconstructive procedures and dead space wound closure (Table 2). Our procedures included limberg flap; suturing of avulsion laceration; secondary suturing; epigastric hernia repair; excision of presternal epidermoid cyst, large labial dermoid cyst, large lipomas and cyst.

Table 2: Surgical indications.

Procedure	Number
Soft tissue swelling excision	12
Minor reconstructive procedures	07
Dead space wound closure	05

Postoperative drainage and outcomes

The syringe-based suction drainage system functioned effectively in all patients and allowed continuous evacuation of postoperative fluid with easy monitoring of drainage volume through syringe markings. The highest drainage volume was observed on the first postoperative day, with a mean output of 25 ml. This decreased progressively to 12 ml on postoperative day two and 4 mL on postoperative day three, demonstrating gradual obliteration of the surgical dead space. The mean duration of drain placement was three days, after which drains were safely removed in most patients once drainage output had significantly decreased. Importantly, no patients developed postoperative hematoma or seroma, indicating effective evacuation of wound collections by the suction system. Two patients (8.3%) developed superficial surgical site infection, which was successfully managed with oral antibiotics and local wound care without requiring further surgical intervention (Table 3).

Table 3: Patient outcomes.

Outcome	Result
Mean drainage volume on day 1	25 ml
Mean drainage volume on day 2	12 ml
Mean drainage volume on day 3	4 ml
Mean drain duration	3 days
Hematoma	0
Seroma	0
Surgical site infection	2

Overall, the syringe-based drainage system provided reliable negative pressure drainage, effective prevention of postoperative fluid accumulation, and satisfactory clinical outcomes in all patients.

DISCUSSION

Effective postoperative wound drainage is an important component of surgical care, as accumulation of blood, serous fluid, or inflammatory exudate within a surgical cavity can predispose to complications such as hematoma, seroma, wound infection, delayed healing, and wound dehiscence. Closed suction drainage systems are widely used to eliminate postoperative dead space and facilitate continuous evacuation of wound collections while minimizing the risk of retrograde contamination.¹

The principle of negative suction drainage in surgical wounds was emphasized by Fox and Golden who described suction drainage as functioning like an “atmospheric bandage,” maintaining close approximation of dissected tissue planes and promoting faster wound healing following subcutaneous surgical procedures.² In addition to improving tissue approximation, closed suction systems offer an important microbiological advantage over open drainage systems. In an experimental study comparing Penrose drains with closed suction drains, Raves et al demonstrated that retrograde bacterial migration occurred in 90% of Penrose drains compared with only 20% of closed suction systems, highlighting the reduced infection risk associated with closed drainage techniques.³

The present prospective case series evaluated the effectiveness of a syringe-based closed negative suction drainage system in 24 patients undergoing minor surgical procedures. The drainage system functioned effectively in all cases and allowed simple monitoring of postoperative drainage volume through the syringe barrel markings. In our study, the mean drainage volume was highest on postoperative day one (25 ml) and progressively decreased to 12 ml on day two and 4 ml on day three, reflecting gradual obliteration of the surgical dead space. The mean duration of drain placement was three days, after which the drains were safely removed in most patients.

These findings are comparable to those reported by Mehrotra et al, who described the use of a syringe suction drainage system in small surgical wounds and noted that the majority of postoperative drainage occurred within the first two to three days, after which drain output decreased significantly, allowing early removal of the drainage system.¹² Similar observations were also reported by Sun and Yin, who demonstrated that simple syringe suction drainage systems provide adequate negative pressure drainage for minor surgical wounds while allowing easy monitoring of drainage volume.¹³

A key finding of the present study was the absence of postoperative hematoma or seroma formation in all patients, indicating effective elimination of postoperative dead space. Comparable results have been reported in studies evaluating conventional closed suction drainage systems. Pandey et al demonstrated that vacuum suction

drainage significantly reduced postoperative complications such as hematoma formation, seroma formation, and wound disruption following abdominal surgery.⁷ These findings support the principle that continuous negative pressure drainage prevents accumulation of fluid collections that may otherwise compromise wound healing.

The incidence of surgical site infection in our study was 8.3% (2 patients), and both cases were superficial infections that resolved with conservative management using antibiotics and local wound care. Previous studies have emphasized the role of closed suction drainage in reducing postoperative infection by preventing accumulation of hematoma and serous fluid, which act as a medium for bacterial growth. Harish et al demonstrated that the use of subcutaneous closed suction drains significantly reduced the incidence of surgical site infection compared with control groups without drainage.⁴ Similarly, Naik et al reported a lower incidence of SSI and wound dehiscence in patients undergoing emergency laparotomy when subcutaneous suction drains were used.⁶ These findings support the beneficial role of suction drainage in preventing wound complications, particularly in surgical wounds with potential dead space.

In addition to conventional suction drainage systems, several authors have described low-cost improvised suction drainage techniques using disposable syringes, particularly for use in resource-limited settings. One of the earliest reports of such a system was by Moss, who described a simple suction drain assembled using butterfly infusion sets and vacuum containers for small surgical wounds.⁹ This concept was further refined by Singh et al who introduced a syringe-based suction drainage system using a glass syringe and spring mechanism to generate negative pressure.¹⁰ Subsequent modifications replaced glass syringes with disposable plastic syringes and simplified the mechanism used to maintain negative pressure.¹¹

Several additional innovations have been proposed to improve the practicality and reliability of syringe-based drainage systems (Table 4). Weng et al described an adjustable suction drainage system that allowed regulation of suction pressure using an infusion set connected to a syringe reservoir.¹⁴ Sunderraj introduced a simplified syringe suction drainage technique using a piston-locking mechanism, enabling repeated recharging of suction without complex equipment.¹⁵ Similarly, Dwivedi and Gupta reported a syringe-based vacuum drainage system that utilized dual plunger mechanisms to maintain negative pressure within the syringe chamber.¹⁶

Clinical applications of syringe-based suction drainage systems have also been reported across various surgical procedures. Venkatachalapathy et al described the successful use of a syringe suction drain following thyroid surgery and excision of benign subcutaneous

swellings, demonstrating effective prevention of postoperative fluid accumulation.¹⁷ Gopal et al also reported favourable outcomes using syringe suction drainage for small surgical wounds, highlighting the simplicity and cost-effectiveness of the technique.¹⁸

Table 4: Chronological evolution of syringe suction drainage techniques reported in the literature.

Study	Innovation
Singh et al ¹⁰	Original syringe suction drain made of 20cc glass syringe and metallic spring
Singh et al ¹¹	Modified technique by using 20cc disposable syringe and k wire passed through plunger as stopper
Kamath et al ²²	Improvised two-in-one syringe suction drain using triway cannula to drain 2 spaces in Dupuytren's contracture.
Sunderraj ¹⁵	Simplified syringe suction drain with plunger and rubber band as stopper
Sun ¹³	Simple syringe suction drain with needle cap as stopper
Weng et al ¹⁴	Adjustable suction in syringe drain by using infusion set
Venkatachalapathy et al ¹⁷	Simple syringe suction drain with perforated tube drain and needle cap as stopper in thyroid surgery.
Dwivedi et al ¹⁶	Syringe vacuum drain using 2 plungers as stopper
Igwe et al ²⁰	Spring-assisted De Adotey drain using 60ml bladder syringe.

Other authors have proposed further modifications to enhance suction stability and expand the clinical applications of syringe drainage systems. Park et al described the use of negative suction drainage during auricular reconstruction to maintain close adherence of skin flaps over cartilage frameworks.¹⁹ Igwe et al later introduced a spring-assisted syringe drainage system capable of generating sustained negative pressure using a bladder syringe mechanism.²⁰

More recently, syringe-based suction drainage systems have been applied in a variety of surgical settings. Vazifdar et al demonstrated that syringe suction drainage effectively prevented postoperative seroma formation following cesarean section.²¹ Similarly, Kamath et al described an improvised two-in-one syringe suction drainage system capable of draining two adjacent surgical cavities simultaneously using a three-way cannula connection.²²

The findings of the present study are consistent with these previously reported innovations and further demonstrate that syringe-based suction drainage systems can provide effective, safe, and economical postoperative wound drainage. In addition to preventing hematoma and seroma formation, the system allows accurate monitoring of drainage volume, easy re-priming of suction, minimal patient discomfort, and low cost, making it particularly useful in rural hospitals and resource-limited healthcare settings.

Despite these advantages, the present study has certain limitations. The sample size was relatively small and the study did not include a control group using conventional commercial suction drainage systems. Larger comparative studies would therefore be useful to further evaluate the effectiveness and cost-benefit profile of syringe-based drainage systems. Nevertheless, the results of this case series suggest that syringe-based closed suction drainage represents a practical and reliable alternative to commercially available suction drains for small surgical wounds, particularly in settings where access to specialized surgical equipment may be limited like our institution.

CONCLUSION

Syringe-based closed negative suction drainage is a simple, effective, and economical technique for postoperative wound management in selected surgical cases. The system can be assembled easily using readily available materials and provides reliable negative pressure drainage with minimal complications. This technique represents a valuable low-cost surgical innovation particularly useful in rural hospitals and low-resource healthcare settings. Larger studies are required to further validate its clinical applicability.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

REFERENCES

- Ramesh BA, Evans JT, Marietta M, Jayalakshmi BK. Suction Drains. 2025 Feb 23. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2026.
- Fox JW, Golden GT. The use of drains in subcutaneous surgical procedures. *Am J Surg.* 1976;132:673-4.
- Raves JJ, Slifkin M, Diamond DL. A bacteriologic study comparing closed suction and simple conduit drainage. *Am J Surg.* 1984;148(5):618-20.
- Harish R, Kazi FN, Sharma JVP. Efficacy of Subcutaneous Closed Suction Drain in Reduction of Postoperative Surgical Site Infection. *Surg J (N Y).* 2021;7(4):e275-e280.
- Strub GM, Moe KS. Negative pressure therapy in head and neck wounds. *Facial Plast Surg Clin North Am.* 2013;21:137-45.
- Naik A, Arya S, Sharma A. Role of subcutaneous suction drain in reducing SSI in emergency laparotomy. *Int Surg J.* 2022;9:616.
- Pandey V, Chandra D, Kumar R, Singh A, Pratap T, Agarwal S, et al. Role of vacuum suction drain in prevention of abdominal wound complications. *Int Surg J.* 2020;7:1873.
- Kim SI, Lim MC, Bae HS, Shin SR, Seo SS, Kang S, Park SY. Benefit of negative pressure drain within surgical wound after cytoreductive surgery for ovarian cancer. *Int J Gynecol Cancer.* 2015;25(1):145-51.
- Moss AL. The DIY mini suction drain. *Br J Plast Surg.* 1987;40(5):542-3.
- Singh A, Thind MS, Mander KS, Singh GP. Syringe suction drain. *Br J Plast Surg.* 1992;45(6):484-5.
- Singh A, Singh G. Syringe suction drain--II. *Br J Plast Surg.* 2003;56(3):313.
- Mehrotra S, Mohanty SK, Maudar KK, Tyagi AK. Syringe suction: a simple and effective closed drainage system. *Med J Armed Forces India.* 1997;53(4):327-8.
- Sun ZY, Yin GQ. An easy-to-make suction drain system. *Int J Surg.* 2009;7(1):82-3.
- Weng R, Li QF, Zheng Y. A renovated adjustable syringe suction drain. *J Plast Reconstr Aesthet Surg.* 2009;62(6):e162-3.
- Sunderraj, Ellur. Syringe suction drain further simplified. *Indian Journal of Plastic Surgery.* 2007;40:107-8.
- Dwivedi JS, Gupta AS. Syringe Suction Vacuum Drain: A Cheap Alternative. *JPGO.* 2014;1(4).
- Venkatachalapathy TS, Nagendra Babu T, Sreeramulu PN. A simple syringe suction drain for surgical procedures. *J Clin Case Rep.* 2012;2:216.
- Gopal SV, Kumar M. A simple negative suction drainage for small surgical wounds. *Indian J Surg.* 2005;67:282-3.
- Park DH, Song CH, Han DG, Ahn KY, Byun JS. A simple negative suction drain for ear reconstruction. *Plast Reconstr Surg.* 1999;103(3):972-5.
- Igwe PO, Dodiya-Manuel A, Adotey JM. Spring active drain using bladder (50-60ml) syringe (De Adotey's drain). *Int J Surg Case Rep.* 2016;20:30-2.
- Vazifdar S, Gavali UG. Syringe suction drainage for prevention of seroma formation. *Int J Reprod Contracept Obstet Gynecol.* 2021;10:2780-4.
- Kamath J, Kamath RK, Bansal H. Improvised two-in-one syringe suction drain. *Indian J Plast Surg.* 2005;38.

Cite this article as: Oli P. Syringe-based closed negative suction drainage for small surgical wounds: a case series and review of low-cost surgical innovation. *Int Surg J* 2026;13:599-603.