

Nebulizer Underwater Sealed Chest Tube Drain Assembly: An Innovation for Irrigation in Laparoscopy and Endoscopy Procedures

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ABSTRACT

Background: The conventional method of irrigation during laparoscopy and endoscopy is well documented in literature. The use of nebulizer or underwater sealed chest tube drain to achieve this has not been designed or studied in literature.

Aim: To showcase an innovation using nebulizer and underwater sealed chest tube drain assembled for irrigation during laparoscopy and endoscopy procedures.

Materials and methods: A prospective preliminary experimental study was conducted using a newly designed method of irrigation in laparoscopic and endoscopic surgeries performed from March 2021 to March 2022 in a tertiary center and a private hospital in South Southern, Nigeria. Ethical approval was obtained from the hospital ethics committee and informed consent was obtained from patients. The effectiveness of this new method was compared with standard irrigation machine as control. The patients were blocked into laparoscopy and colonoscopy procedures, respectively. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS version 26).

Results: The results showed that the use of nebulizer underwater sealed chest tube drain assembly was very effective in laparoscopy and colonoscopy procedures. In three cases of fundoplication operations, five cases of cholecystectomies and 30 cases of hydro-jet insufflation colonoscopies were performed with good outcomes.

Conclusion: This new novel method will serve a very good alternative irrigation method in laparoscopy and endoscopy procedures. It is currently being studied in other methods, such as hysteroscopy, cystoscopy, and therapeutic endoscopies.

Keywords: Irrigation, Laparoscopy and endoscopy, Nebulizer, Underwater sealed chest tube drain.

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INTRODUCTION

The routine act of obtaining clear vision is an asset during laparoscopy and endoscopy procedures.¹ Conventionally, methods of irrigation during such laparoscopy and endoscopy have well documented literature reviews.^{2,3} However, the use of nebulizer or underwater sealed chest tube drain to achieve irrigation with clear vision has not been designed or studied in literature.

AIM

To showcase an innovation using nebulizer and underwater sealed chest tube drain assembled for irrigation during laparoscopy and endoscopy procedures.

MATERIALS AND METHODS

A prospective preliminary experimental study was conducted using a newly designed method of irrigation in laparoscopic and endoscopic surgeries performed from March 2021 to March 2022 in a tertiary center and a private hospital in South Southern, Nigeria. Ethical approval was obtained from hospital ethics committee and informed consent was obtained from patients. The effectiveness of this new method was compared with standard irrigation machine as control. The patients were blocked into laparoscopy and colonoscopy procedures, respectively. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS version 26).

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RESULTS

The result showed that the use of nebulizer underwater sealed chest tube drain assembly was very effective in laparoscopy and colonoscopy procedures. In three cases of fundoplication, five cases of cholecystectomies and 30 cases of hydro-jet insufflation colonoscopies performed with good outcome. [Figures 1 to 4](#) show the images of the different parts of the assembly.

DISCUSSION

Clear and clean intraoperative field during laparoscopic and endoscopic surgical dissection aids good outcome during



Fig. 1: Nebulizer



Fig. 2: Underwater sealed chest tube



Fig. 3: The nebulizer and underwater sealed chest tube assembled

diagnostic and therapeutic procedures.¹ Having a good irrigation system is an advantage supplementary to laparoscopic and endoscopic armamentaria.

The dissection of laparoscopic procedures has only been documented using blunt and sharp dissections too. Hematomata

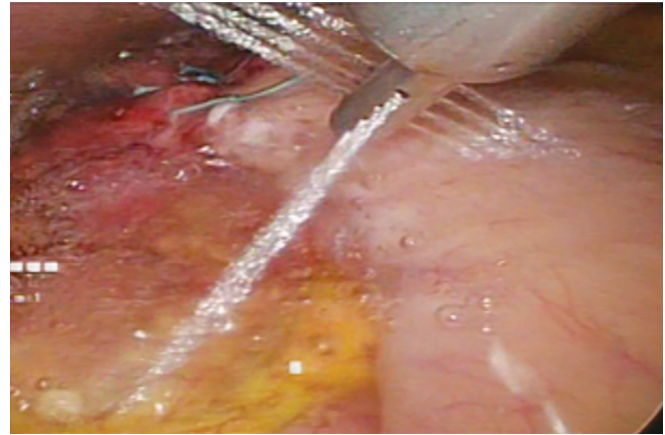


Fig. 4: The action of irrigation

can be produced by vigorous dissection. For more than 20 years, hydro-jet has been used during laparoscopy.¹⁻⁴ A particular hydro-jet generator is needed for hydro-jet dissection, which generates a high-pressure jet with a pressure range of 1500–4500 mm Hg. Several irrigation techniques also employed an irrigation probe with a hypodermic needle-like tip, including the “original” hydro-jet systems that drove the fluid through a central cannula.⁵⁻⁷ Yet to make is the nebulizer underwater sealed assembly utilized in dissection and proper irrigation. It is simply connected the nebulizer to under water sealed chest tube drain filled with saline. This system is inexpensive, easily accessible, and user-friendly. Under pressure, the saline acts less like a knife with size 11 scalpel and more like a mild blunt dissector. It can also serve for clear vision during endoscopies or endoluminal surgery. It might theoretically spread cancerous cells or purulent materials but this is still under study.⁸ A very thin water is produced via hydro-jet tubing system when in action.

It is possible to anticipate less postoperative pain with less tissue dissection. By more precisely delineating the anatomy. Hydro-dissection minimizes injury to the bile ducts.⁹ The underwater sealed chest tube drain assembly gave a very clear vision during fundoplication surgery in author’s experience.

Another method of separating tissues along bloodless natural planes is called hydro-dissection, which involves injecting a one-time fixed amount of saline/adrenaline solution into adherent tissues to cause water logging.^{10,11} I observed this mechanism better with under water sealed chest tube drain assembly when used for bleeding diverticular disease especially in an unprepared or poorly prepared bowel during emergency colonoscopy.

The author used physiological warm normal saline or sterile (especially in malignant cases), which was easily accessible and reasonably priced, in the chest tube. It was easily absorbed in body, cleansed bodily systems, diluted any blood, and promoted hemostasis. Because anatomical bloodless tissue planes were easier to see, dissection proceeded more quickly. Laparoscopic procedure requires the identification of such bloodless tissue planes to prevent injury to adjacent structures.

The nebulizer under water sealed chest tube drain assembly also work like the multistream saline jet (MSSJ), except that saline is not the only fluid used in nebulizer under water sealed chest tube system. The MSSJ dissection is not hemostatic itself just as the nebulizer underwater sealed chest tube drain assembly too. In theory, it might dislodge any clots and therefore promote

bleeding, but in fact, it aids the surgeon in locating any bleeding vessels so that they can be diathermized.¹² The author utilizes warmed fluids since consuming significant volumes of cold saline or water can cause hypothermia. The warmth also relieves the CO₂-induced hypothermia. Saline or water retention in the tissues can result in fluid overload, which is something to keep in mind, especially if the patient has liver, heart, or renal failure. To prevent saline-related problems like fluid overload and sepsis, I suctioned the peritoneal cavity dry at the end of the surgery. I also irrigated and suctioned out during endoscopic procedure. With laparoscopic procedures, the habit to always utilize heated blankets and a warmer is the norm. I had used this irrigation method in a different format during my earlier beginning in laparoscopy and endoscopy procedures.¹³ I have also designed some innovation helpful in training residents in laparoscopic surgery.¹⁴ and focused in research to aid performing laparoscopy in low- and middle-income economy. This method will not only add to literature but serve in immense value for beginners in laparoscopy and endoscopy procedures.

The use of nebulizer attracted a lot of interest to both the surgical and physicians especially during the oral presentation in the scientific conference and hence opens avenue for more research and collaboration in this regard. It is currently being studied in other methods, such as hysteroscopy, cystoscopy, and therapeutic endoscopies.

CONCLUSION

This new novel method will serve a very good alternative irrigation method in laparoscopy and endoscopy procedures. It served for clear vision in this regard.

PRESENTATIONS

- Society of Gastroenterology and Hepatology for Nigerian (SOGHIN) Kano 2022. As "Nebulizer Underwater sealed chest tube drain assembly: An innovation for irrigation in laparoscopy and endoscopy procedures."
- Proposal for further research in in therapeutic endoscopy in MD program of the National Postgraduate College of Nigeria.

AUTHORS' CONTRIBUTION

The author has read and approved the final manuscript". POI was involved in conception and design and has given the final approval of the version to be published and agreed to be responsible for all aspects of the work in making that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. POI has involved carried out the

acquisition of data, or analysis and interpretation of data and drafting the manuscript.

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