How We Make It: Low-Cost Suction-Irrigator System for Endonasal Endoscopic Procedure

Original Article

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ABSTRACT

Introduction: Ensuring optimal visualization of the surgical field is paramount during endoscopic procedures. However, endonasal endoscopic surgery often encounters challenges such as blurred vision due to blood, smoke from cautery devices, and bone dust. While commercial tools exist to address these issues, they are costly and unavailable in resource-constrained settings.

Materials and Method: In our study, we devised a low-cost solution using a modified disposable triple lumen catheter commonly used in urology. This catheter was attached to the rigid nasoendoscope using disposable water-resistant tape. The system was then connected to a suction machine, with a syringe acting as a two-way system—providing continuous suction and serving as an irrigator. This setup allowed for clear vision during endoscopic endonasal procedures.

Conclusion: Our easy-to-build system has significantly improved the endoscopic endonasal procedure in terms of both time consumption and maintenance of clear surgical fields. As a result, it has made the entire procedure easier for both the main surgeon and assistants. However, further studies are needed to objectively measure the improvement and compare it with conventional procedures and commercially available endoscopic-assisted surgical devices.

Key Words: Endoscope irrigation system, endoscopic endonasal surgery, low-cost continuous suction irrigator.

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INTRODUCTION

Endoscopic endonasal surgery (EES) is a well-established, minimally invasive procedure used for treating both rhinosinusitis and oncologic diseases of the sinonasal area. Despite its effectiveness, EES can be a time-consuming procedure that demands skills from both the primary surgeon and the assistants due to the limited space within the nasal cavity.

Challenges such as the accumulation of blood, fluid, smoke or bone dust can complicate the procedure, requiring the surgeon to continually suction, irrigate or clean the endoscope tip. The sinonasal area's rich blood supply often leads to a surgical field contaminated by blood, further complicating the procedure. The use of bipolar or monopolar cautery, which produces thick smoke, can also compromise the view field[1–4]. To address these issues, we have developed a low-cost, safe and effective device, alternative to the dedicated system, aiming to make EES more manageable and time-efficient.

MATERIALS AND METHOD

Our system is based on the Karl-Storz image endoscopic system with an Olympus 0-degree sinuscope that is 4 mm in diameter and 175 mm in length. The preparation requires a disposable triple lumen catheter No-20 Fr, a suction connecting tube, suction catheter No. 8-10 Fr, an extension tube for the syringe, a 20 cc/50 cc syringe, disposable water-resistant tape, and an additional suction machine. The suction catheter is cut at the tip in a sloping design to direct the liquid flow in the same direction as the rigid nasoendoscope. This design prevents any significant bulkiness at the tip of the endoscope. It provides two holes: the first at the proximal endoscope serves as an irrigator and another at the tip of the endoscope acts as a suctioning device. To allow the endoscope to easily pass through the catheter, we make a vertical incision between the two holes of the catheter. The suction catheter fixed to rigid endoscope using several water resistant tape (Figures 1,2).

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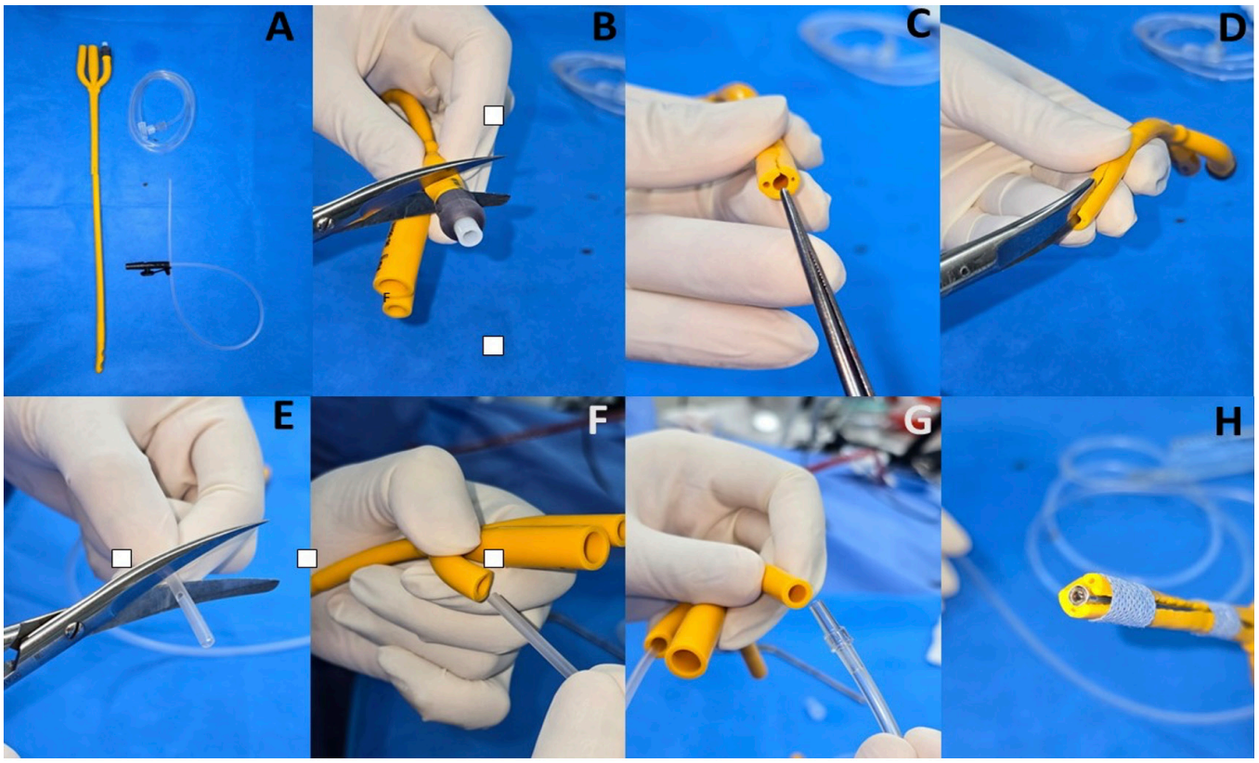

Fig. 1: Step-by-step guide to make an endoscope suction-irrigator system (A) Material needed (B) Cut the balloon channel of the suction catheter (C) Cut the tip of catheter in sloping design so it have the same length as the endoscope (D) Make an vertical incision along between two holes (E) Cut the tip of suction catheter (F & G) Connect the lumen with the suction catheter and the syringe via extension tube (H) Showed the final cut of the tip and endoscope fixed with several water-resistant tapes.

With this method, we found that the catheter attachment can easily withstand a 2-hour procedure. If there is a loose connection due to fluid contamination, tape can be easily added to strengthen the attachment. The suction machine can be operated at 50-60 kPa. We found this pressure to be adequate and balanced for suctioning power, without being overwhelming and interfering with the procedure. The best solution to minimize smudging of the lens is by using warm saline irrigation. This extension tube is designed so that the surgical assistant can easily perform the irrigation without interfering with the movement of the main surgeon or occupying the nostril.

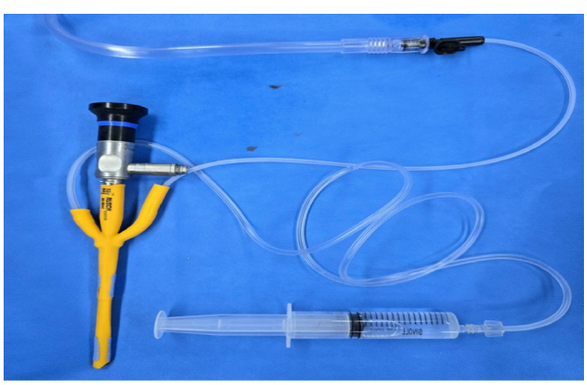

Fig. 2: Completed endoscope suction-irrigator system

DISCUSSION

Endoscopic endonasal surgery has made quite long journey in otolaryngology field since Prof. Messenklinger introduce the endoscopic endonasal surgery[5,6]. Many tools has developed to make this procedure easier, safer, and more comfortable. One of the problem in this field of surgery is obstruction of visual field, which is major hindrance during endonasal endoscopic surgery. Surgeon must remove the endoscope from the nose and keep wiping the tip of the lens, making procedure longer and difficult. Solution that can achieve a rapid and effective method for cleaning lens will definitely improve overall procedure[7,8]. There were several commercial system available to overcome this problem, example for Medtronic® EndoScrub, and Olympus® InstaClear all of this solution would be cost more than 1000 USD and not readily available especially for low resource health care.

This system requires some basic equipment that may always available in every operating room. The cost of triple lumen catheter is only under 4 USD in Indonesia, and the rest equipment needed may be add about another 5 USD. These can be under 10 USD system that can very easy to replicate in every centre. The best thing is because all of these equipment is readily available in sterile form and not required the extra cost for sterilizing.

There were another study in literature intended in the same manner, Sekar and Hassan use the 16 Fr Catheter to make irrigator only and claimed achieve also promising result[2]. Review study to achieves optical surface cleanliness by Kreeft *et al*. revealed that the most promising to achieve clear visual field is by using the hydrophilic or hydrophobic coating on the endoscope lens combined with lens irrigation system. The combination of these should achieved optimal result compare than only using one method to prevent accumulation of fluid, fume or other contaminant on the tip of lens[3,9-10]. Another prospective randomized controlled trial study in the field of laparoscopic surgery by Cassera *et al*4 made the conclusion that an intraabdominal laparoscopic cleaning device can lead to less workflow interruption and shorter operation time which also can be case in endoscopic endonasal surgery.

The weakness of the system is we need to constructed the system in every procedure hence might be consumed time, and also the bigger tip of the endoscope may not be suitable for paediatric patient or the adult which have small nostrils, even though these same system is also possible achieved using smaller endoscope and catheter if the smaller diameter rigid endoscope available. And for the different angle of the lens, we should cut different angle of catheter to achieved optimal result. On the other hand, the strength of this system is definitely the cost which can be easily affordable for every hospital, and also the system has both mechanism in irrigating and suctioning in which very convenient for the surgical team.

CONCLUSION

The system definitely improved the procedure both from time consumed and maintenance of clear surgical field, makes the whole procedure easier for both main surgeon and assistants. Further comparative study is needed to objectively measure the improvement and difference with conventional procedure and also from commercially available endoscopic assisted surgical devices.

CONFLICT OF INTERESETS

There are no conflicts of interest.

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