

Neonatal enterostomy complications—Can a simple drainage device inspired by prepuce surgery prevent?

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Research Article

Keywords: Neonatal laparotomy, Neonatal enterostomy, complications of enterostomy, extremely low birth weight infants

Posted Date: May 17th, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-1642760/v1>

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Abstract

Background Complications frequently occur after neonatal enterostomy. Enterostomy formation is a common outcome following emergency neonatal laparotomy. This study aims to determine whether the incidence of complications after enterostomy can be decreased with a drainage device and we introduce a new method for improving proximal enterostomy in newborns.

Methods This study is a retrospective case note review of emergency neonatal enterostomy incidence over 3 years (2/2016-2/2019) at our center. All surgeries were performed by a single surgeon. Intraoperative findings and complications, operative times, and postoperative complications were reviewed for all children.

Results All 47 surgeries were successfully completed (32 boys and 15 girls). Average daily age (3.49 ± 5.61) d (mean \pm S.D.). Full-term children in 22 cases, 25 infants were preterm. Eleven patients were diagnosed with ARMs, twenty with NEC, and eleven with SIP requiring laparotomy. Two patients had congenital intestinal atresia (CIA), one had incarcerated inguinal hernia (IIH), and two had congenital megacolon (HD). Twenty of these cases used a modified drainage device, one case of prolapse of the intestinal, one case of premature surgery due to excessive orifice flow, and one case of peristomy dermatitis. Other patients not experienced intraoperative or postoperative complications.

Conclusions Based on our preliminary observations, the simple drainage device is a safe and effective operation device that can reduce the risk of stoma-related complications.

Introduction

Enterostomy plays an important role in the treatment of several severe neonatal gastrointestinal diseases. It improves survival rates among extremely low birth weight infants (ELBWIs) and infants with meconium obstruction of prematurity (MOP), spontaneous intestinal perforation (SIP), congenital anorectal malformations (ARMs), congenital intestinal atresia (CIA), necrotizing enterocolitis (NEC) or severe gastrointestinal malformation to the greatest extent possible and stabilizes infants for further treatment [1-3]. Early management is critical and life-saving. However, enterostomy is not without its own risks: stoma-related complications (such as, incision hernia, intestinal prolapse, perioral dermatitis and surgical site infection) frequently occur after neonatal enterostomy and can seriously endanger the lives of newborns. Stoma bags leak and this was an especially unique problem in tiny infants with small abdomens. In this study, we describe a modified neonatal enterostomy procedure involving a simple drainage device used to prevent complications and report our operative experience. We determined that our modification is affordable, is associated with a negligible postoperative complication rate and can improve the satisfaction of parents and nurses involved in enterostomy care.

Patients And Methods

This retrospective study was approved by the Ethics Committee of Dongguan Maternal and Child Health Hospital. We retrospectively reviewed our registry for infants who underwent neonatal enterostomy at our center between 02/2016 and 2/2019(a total of 47 cases). It was divided into modified surgery groups(20 cases) and traditional surgery groups(27 cases). All surgeries were performed by a single surgeon. Modified surgery groups using a device we have termed “a simple drainage device for neonatal enterostomy”.In this study, 32 of the patients were boys and 15 were girls (the boys to girls ratio was2.13:1). The mean birth weight was 2.64 ± 0.81 kg (mean \pm S.D.). Average daily age (3.49 ± 5.61) d (mean \pm S.D.).The mean gestational period was 35.62 ± 3.76 weeks (mean \pm S.D.). Patient demographics, clinical features, operative time, complications of enterostomy, hospital stay and outcomes were investigated.

Operative procedure

The traditional surgical group uses conventional single or double lumen enterostomy; The modified surgical group added a simple drainage device on the proximal enterostomy.

Our simple drainage device consists of several materials: a foreskin cerclage staple (Chong Qing BORN Biological Technology Co. Ltd., Sichuan, China), a condom ,and 0- Mersilk Silk braided nonabsorbable suture (ETHICON 15x60cm).(Fig. 1A)

1. The condom was fixed to the foreskin ring with 0-Mersilk silk braided nonabsorbable sutures. (Fig. 1B)
2. Before the device was constructed the inner diameter of the intestinal tube of the proximal stoma was measured and a foreskin ring suitable for the inner diameter of the intestinal tube was selected. The lubricant was wiped of the condom, and a notch was cut out at the end of the condom. (Fig. 1C, Fig. 1D)
3. The prepuce ring was inserted into the stoma tube and fixed to the proximal tube with elastic thread. (Fig. 2A, Fig. 2B, Fig. 2C, Fig. 2D)
4. The handle on the wrapping ring was broken and the end of the condom was fixed with a small clip, A latex finger sleeve was placed on the outside of the small clip, and then fixed with a rubber band to prevent the metal clip from damaging the baby's skin. (Fig. 3A, Fig. 3B)
5. All layers of the abdominal wall were closed with the indwelling abdominal drainage tube, and the exposed intestinal tube stoma was covered with Vaseline gauze. If the child had a double-chamberstoma, the distal orifice was made 5 ~ 8 cm from the proximal orifice to allow it to fit the artificial pocket later.(Fig. 3C , Fig. 3D)

Result

A single surgeon performed all surgeries. Assessment of the infant attributes revealed that with a mean birth weight of 2640 ± 810 g, and a mean age of 4.80 ± 1.6 days. This study included 32 male patients,

and 15 female patients (the boys: girls ratio was 2.13:1). There were no significant differences between the two groups with respect to gestation, birth weight and age or weight at surgery (**Table.1**).

Table 1 Patients' details at birth and time of laparotomy where stomas were created

	Traditional surgery groups (n=27)		Modified surgery groups(n=20)		<i>P</i>
	Median	Range	Median	Range	
Gestation at birth (weeks)	34.89	25-41	36.60	29-41	1.13-4.00
Birth weight (kg)	2.60	1.13-4.00	2.70	1.35-4.20	1.13-4.00
Operation time (min)	86.07	55-120	88.30	65-125	1.13-4.00
Postoperative hospitalization time (min)	25.52	5-60	20.05	12-27	1.13-4.00
Intraoperative bleeding (ml)	5.33	2-10	5.30	2-10	1.13-4.00

Mann-Whitney test used for comparison between groups

In the modified surgery group: Eight patients were diagnosed with ARMs, Six with NEC, and three with SIP requiring laparotomy. In addition, one patient each with CIA, IIH, and HD was included (Fig. 4). Included nine double lumen stomas, ten single-chamber stomas and one Bishop-Koop intestinal anastomosis. The mean surgical duration was: 88.30 ± 16.75 min. The operation time was slightly higher than that in the traditional group (86.07 ± 17.27 min), and there was no significant difference between the two groups ($P > 0.05$). Total complication rates, unplanned reoperation rates, wound-related complications and stoma-related complications were significantly different between the two groups (**Table. 2**). The patients were fed 5% glucose 5 ~ 7 d after the operation, and the foreskin ring that was fixed to the proximal intestinal tube fell off 6 ~ 7 d after the operation. If no abnormalities were found the abdominal drainage tube was removed after abdominal color Doppler, and the abdominal wall wound suture was removed 7 ~ 9 d after the operation. The average hospitalization time (postoperative) was 20.05 ± 4.47 days. Comparison with the traditional groups (25.52 ± 12.06 days) was statistically significant. Follow-up was performed 3 to 6 months after discharge, and second or third stage surgical treatment was performed after reevaluation. The modified group only occurred one case of prolapse of the intestinal, one case of premature surgery due to excessive orifice flow, and one case of peristomy dermatitis, Other patients not experienced intraoperative or postoperative complications.

Table 2 Complications in each group

Complications	Traditional surgery groups (n=27)	Modified surgery groups(n=20)	P
Total complications	20 (74%)	3 (15%)	0.0002 ^a
Wound-related	9 (33%)	1 (5%)	0.0290 ^a
Dehiscence and Infection	9	1	
Stoma-related	11 (41%)	2 (10%)	0.0250 ^a
Necrosis/retraction	3	0	
Obstruction	1	0	
Leak	3	1	
Parastomal hernia	2	0	
Prolapse	2	1	
Further surgery required for complication	10 (37%)	1 (5%)	0.0140 ^a

^a Difference between groups compared using Chi-squared unless single values were less than five, where Fisher's exact test was used

Discussion

Neonatal enterostomy is usually performed in children with critical acute abdomen. The stoma is mostly temporary (including in loop enterostomy, double barrel enterostomy, exteriorization, and single port surgeries)[4]. Its purpose is to ensure defecation with proximal enterostomy, reduce intestinal pressure, control infection and stabilize infants for further treatment. However this treatment is also associated with serious complications including postoperative incision infection, incisional hernia, surrounding inflammation and intestinal prolapse .

Some complications tend to occur long after surgery. Incision infection and surrounding inflammation are the two most common complications, for the following reasons: 1) the position of the stoma and the wound are too close: and 2) peristomal dermatitis is known to be influenced by the distance from the ligament of Treitz [5, 8]. The higher the position of the stoma, is the more alkaline the intestinal fluid, which promotes the development of skin disorders. According to previous research peripheral dermatitis and incision infection account for more than half of all complications[4, 6], that seriously endanger the life and health of infants. Studies have found that the incidence of postoperative SSI is 0.7%~16.6%, which could directly lead to prolonged hospitalization and increase the risk of death[9–10].

Since many complications are associated with exposure to intestinal fluid, we wondered if it would be possible to completely separate the intestinal fluid from the wound. We were inspired by circumcision procedures. Circumcision is based on the principle of chronic cutting of elastic lines with delayed

shedding of the circumcision ring, resulting in formation of a regular incision for healing[11–14]. We assembled a simple intestinal ostomy drainage device with foreskin cerclage staple, elastic thread a condom and mousse thread. The foreskin ring was fixed on the stomata with an elastic line and automatically fell off 5–7 days after the operation. During this period, the stoma fluid was drained to the area outside the wound through the condom, which was completely isolated from the surgical incision, thus effectively preventing complications such as wound infection, incisional hernia and peripheral dermatitis. In our study, one patient died of multiple organ failure due to postoperative septic shock, and one patient underwent stoma surgery before the procedure because of excessive orifice wear and excessive intestinal fluid flow. There were no obvious complications in the remaining patients. In clinical practice, we found that our enterostomy drainage device has the following advantages: 1) the surgical incision can be effectively isolated and healing time is adequate; 2) delayed shedding of the wrapping ring prevents the need for replacement of the artificial pocket, not only decreasing medical costs, but also reducing nursing workload; 3) the transparency of the condom allows observation of the characteristics of intestinal fluid and exhaust, making nursing more convenient; 4) circumcision style detachment allows the formation of an intestinal tube with a more regular shape, which is conducive to the closure of pocket.

Neonatal enterostomy technology often requires experienced doctors and the operation, is difficult. Our operation method simplifies the treatment of ostomy tubes, the operation method is simple, and is easy to master even for beginners. The surgical techniques can be summarized as follows: 1) An appropriate foreskin ring should be chosen according to the diameter of the intestinal tube: usually the diameter of the circumcision ring needs to be slightly smaller than the diameter of the intestinal tube; 2) The condom used needs to be colorless and transparent, and thus convenient for postoperative observation; 3) Elastic line must be used rather than a mousse line, and the line knot must not be too tight. If it is too tight, it can easily cause the prepuce ring to fall off prematurely, and thus effective wound isolation would not be achieved; 4) The exposed orifice tube should be 2–3 cm long, a longer length can cause intestinal tube prolapse; 5) Vaseline gauze should be used to wrap the orifice tube after the operation to avoid excessive drying and to protect the intestinal tube from mechanical damage.

Although the present study only included a small number of patients, Peristomy dermatitis occurred in only one patient with an incidence of 5.26%, suggesting the effectiveness of the procedure. We think this method has no significant effect on long-term complications such as intestinal prolapse and improvement of stoma flow. However, whether there is an improvement in incidence of intestinal prolapse and other complications still needs to be further confirmed by multicenter studies and studies with a large sample size.

Conclusion

Our modified technique called the “a simple drainage device avoid complications” is safe and effective for use in infants. The follow-up results revealed that the operation method is effective and safe. We determined that our modification would be more affordable, have a lower postoperative complication rate, and more popular with nursing staff.

Declarations

Acknowledgements

This work was supported by the grants from the General Project of Social Science and Technology Development in Dongguan City of China (No.20185071 50071531),The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Authors' contributions Statement

Kun Wang , Jing Cai , performed the data analyses and wrote the manuscript; Xiao Wei Li, Guo Min Zhai contributed to the conception of the study; Gang Quan Wu performed the surgeries; Ying Chou Lu, contributed significantly to analysis and manuscript preparation; Jia Kang Yu, Gang Quan Wu, helped perform the analysis with constructive discussions. All authors reviewed the manuscript.

Funding

Open access funding provided by the grants from the General Project of Social Science and Technology Development in Dongguan City of China (No.20185071 50071531).

Disclosures

Kun Wang, Jing Cai, Jia Kang Yu, Ying Chou Lu, Xiao Wei Li, Guo Min Zhai, Gang Quan Wu have no conflicts of interest or financial ties to disclose.

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Figures

Fig. 1

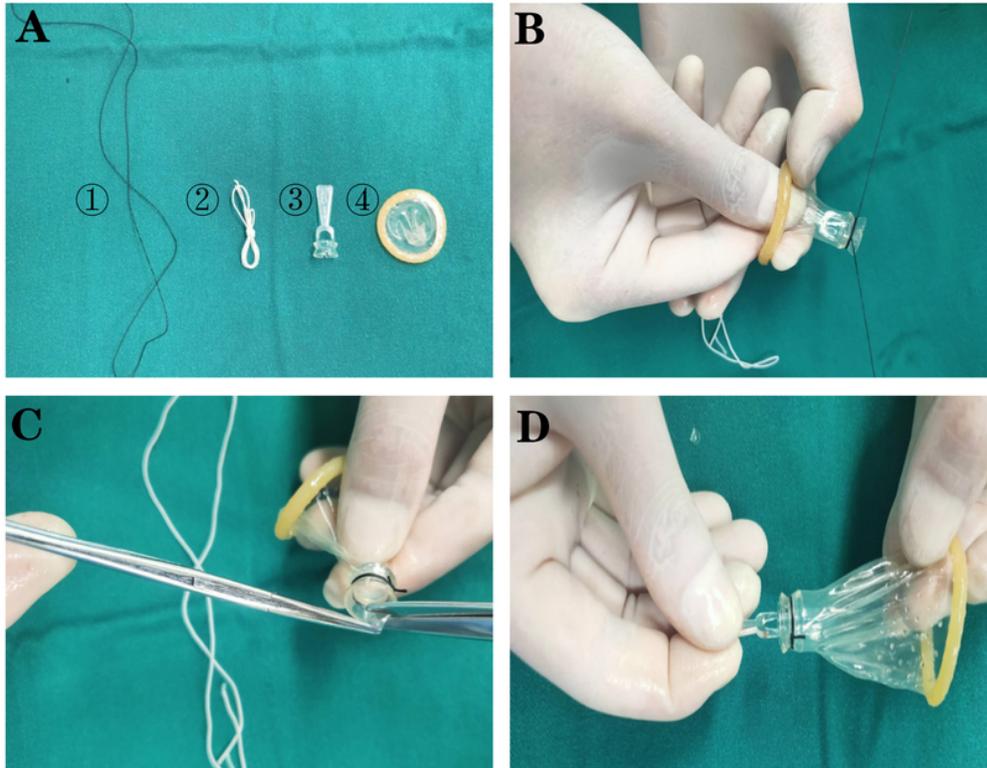


Fig. 1A. The device consists of four parts: ①.2—0 mousse ②. Elastic thread ③. Foreskin cerclage stapling ④ Condom
Fig. 1B. Put the foreskin ring at the end of the condom and fix it with the wire
Fig. 1C. Cutting the end of the condom and form a stoma
Fig. 1D. Turn the direction of the condom

Figure 1

See image above for figure legend.

Fig. 2

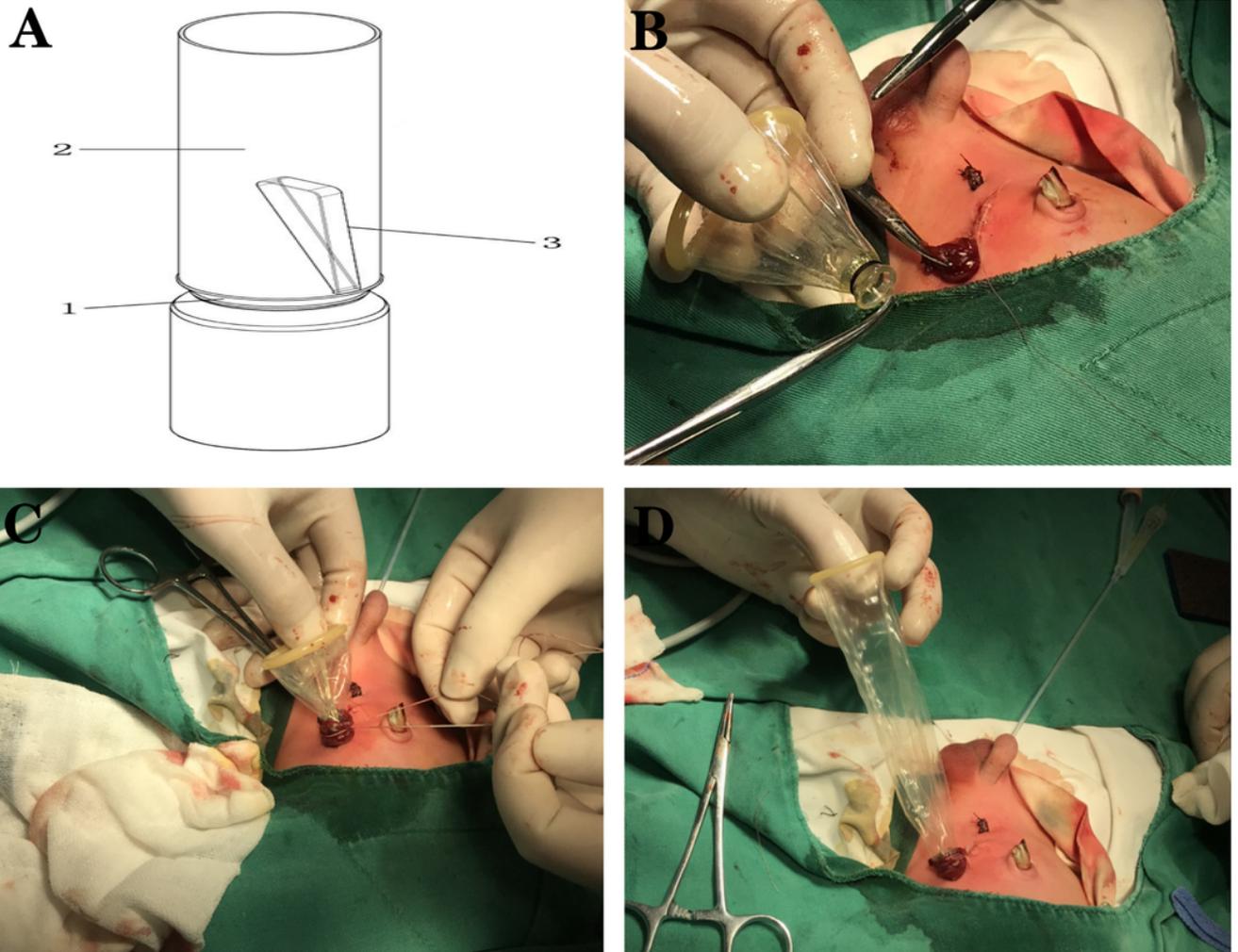


Fig. 2A. Schematic diagram of device

Fig. 2B. Put the foreskin ring into the intestinal tube

Fig. 2C. Fasten the foreskin ring to the tube with an elastic thread

Fig. 2D. Open the condom completely, ligate the ends

Figure 2

See image above for figure legend.

Fig. 3



Fig. 3A. Vaseline gauze covers the exposed bowel and covers the excipient

Fig. 3B. Condoms filled with fistula fluid and gas after operation

Fig. 3C. The fistula fluid was completely separated from the wound and healed well after operation

Fig. 3D. A regular vent hole (about 1.5-2.0 cm in diameter) is formed when the wound is completely healed to facilitate the closure of the fistula bag

Figure 3

See image above for figure legend.

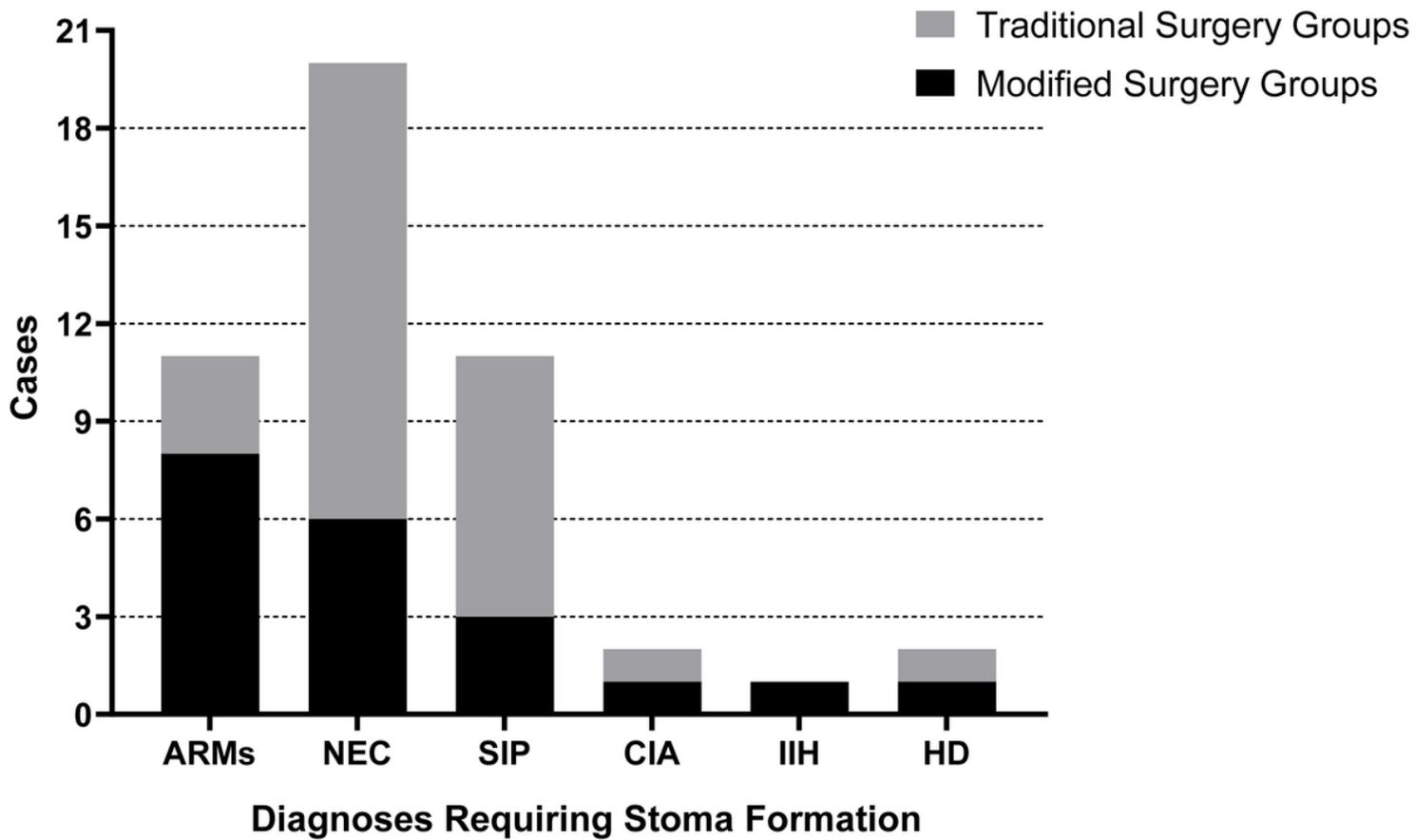


Figure 4

Diagnoses Requiring Stoma Formation