



Efforts towards solving the problem of nutritional and electrolyte imbalance in patients having post operative small bowel stoma by newly developed 'MukadamStoma Device'

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ABSTRACT

Introduction: Patients who undergo surgery and have to undergo an ileostomy are at nutritional risk, especially if the ileostomy placement is higher to ileo-caecal junction and the residual lower loop of bowel is not fully utilised. Total parenteral nutrition (TPN) is used frequently to maintain the nutritional status, but its use is associated with increased complications. This is a case study documenting the effectiveness of feeding proximal stomal output or any other nutrients into distal stomal opening to maximally utilise the distal gastrointestinal tract and to allow normal digestion and absorption of nutrients, electrolytes, minerals, and fluid.

Methodology: This study describes ten cases of small intestinal stoma. After adequate surgical treatment of the primary lesion, all ten patients were given refeeding of succus entericus by our device for variable amount of time and significant improvement noted in terms of nutritional and electrolyte balance, weight gain as well as patients' satisfaction. Also, early stoma closure was possible with this kind of distal refeeding.

Conclusion: Distal bowel refeeding is beneficial for patients who have undergone a bowel resection with creation of a stoma. Clinicians should use distal bowel refeeding to decrease a patient's dependence on TPN and the morbidities associated with long-term TPN use. Also, distal bowel refeeding has the potential to reduce the cost of providing care to these patients by reducing TPN-associated morbidity. It makes patient ready earlier for closure of stoma as it converts patient in positive catabolic state.

Key-words: Distal Bowel Refeeding, TPN (Total Parenteral Nutrition), Succus Entericus Reinfusion, Mukadam-Rathod Stoma Device.

Patients who undergo an intestinal resection for a gastrointestinal disorder may require creation of a stoma, which can increase morbidity and mortality [1]. Depending on the type of stoma created, it may cause functional short bowel syndrome because of decreased bowel surface area available to digest and absorb nutrients and fluids. This decreased absorption capacity can place the patient at risk for malnutrition and fluid imbalances, especially if the stoma is in the proximal small bowel and the remaining portion of the bowel is not being used. Patients who have a proximal jejunostomy are difficult to manage because of their high stoma output which results in fluid and electrolyte imbalance with repeated hospital admissions and the necessity for expensive total parenteral nutrition (TPN) to meet their nutritional and hydration needs. Although TPN can effectively meet their nutritional needs, patients receiving TPN for greater than 2 weeks are at risk of developing cholestasis [2], osteopenia [3], sepsis [4, 5], etc. Also, as it is said, there is no ideal alternative of succus entericus for nutrition [6]. Previous studies have shown that reinfusion of proximal stomal output into distal stoma decreases or eliminates patient's dependence on TPN [6, 7, 8, and 9]. In the present case study, we collected the output of the proximal stoma and refeed it into distal stomal opening in patient with proximal jejunostomy. The expected benefits of reinfusing succus entericus are to prevent atrophy of the distal gastrointestinal tract and to allow normal digestion and absorption of nutrients, electrolytes, minerals, and fluid. Using the distal portion of the gastrointestinal tract allows the TPN volume to be decreased or even for TPN to be discontinued. The need of a device which simultaneously collects the output and eases input of contents in distal loop was sought of and such device is created with handy and simple instruments.

Patients and methods: With the intent of our purpose of simultaneous feeding of contents of

I. INTRODUCTION:-



nutritional value through the distal tube we tried of using different styles of device which collects the output and simultaneously feeding can be achieved. Our experience and observations are narrated below

Index Case (Case A)

A 60 years old male presented to surgical casualty with complaints of generalised abdominal pain, abdominal distension, vomiting and constipation for 4days. Upon admission and further investigation, he was found to have free gas under right dome of diaphragm in abdominal x-ray. Taking general condition of this patient into account emergency exploratory laparotomy was planned.

Upon exploration, we found, generalised peritonitis with inflamed bowel loops. Posterior wall of caecum was found to be perforated with sloughed out walls. Appendix was found to be inflamed. Appendectomy was done and perforated caecal wall was repaired primarily. Approximately six feet proximal to ileo-caecal junction double barrel stoma was done in the proximal ileal loop and brought out at the right lumbar region.

Post-operative recovery of the wound and maturation of stoma was uneventful. Parenteral

nutrition was given to patient via central vein catheter starting day 1 post op. However, the patient developed electrolyte imbalance in the form of hyperkalaemia, altered lipid profile, and mild elevation of liver function test. On Post-Operative day 10th we started to collect the output from the proximal stoma and reinfuse it into the distal stoma through the sterile Foley's catheter.

Fluid from proximal stoma containing bile and pancreatic secretions was collected via pre-sterilized plastic tubing placed with bowel lumen and through the stoma bag & reinfused manually using 50 cc pre sterilized syringe via another pre-sterilized Foley's catheter placed in distal lumen.

Refeeding was continued with this method for next 6 weeks and later on demonstration to patient relatives and patient education for continued refeeding using same device at home was also tried. After successful attempts parenteral nutrition was stopped. We found that there was no need to supplement patient's oral intake with parenteral nutrition along with normalization of minor derangements of metabolism due to TPN. This method of refeeding resulted in 4 kg weight gain and early return to work, as well as early stoma closure approx. 60 days after primary surgery.



Other Cases:

Case B: A 35 years old male presented with h/o blunt abdominal trauma. This resulted in perforation peritonitis from injury to proximal jejunum approximately 5cm distal to DJ junction. As the laceration was more than 30% of total bowel lumen circumference, proximal jejunal stoma was done.

During initial attempts at refeeding large diameter Abdominal Drain Catheters were used

along with 50 cc syringe and Foley's catheter for refeeding. Initial attempts were made by our consultants in presence of stoma care experts & continued changes were made as & when required. Foley's catheter and tubing were replaced by two plastic tubing with one tube in proximal lumen and another tube in distal stomal opening to allow for easy collection of succus entericus from proximal bowel and instillation into distal bowel.



Patient was given distal refeeding from day 6th post-operative day. Patient's recovery was uneventful with 2.5 kg weight gain and stoma

closure surgery was done around 58th post-operative day



Case C: A 48 years old malnourished and anaemic female presented with clinical features s/o bowel obstruction. Upon evaluating with abdominal imaging, she was diagnosed to have Koch's stricture 4cm in size at jejunum approximately 10 cm distal to DJ junction. The segment was resected and proximal jejunostomy was made.

Two separate tubings were replaced by single looped plastic tubing with proximal end of tubing in proximal lumen and distal end in distal

stomal opening to allow for continuous passage of succus entericus into distal bowel. The problem of kinking of connecting loop was solved by a metallic tubing device made on special order according to measurements

Distal refeeding was started from 8th post-operative day and patient's recovery was uneventful with 3kg weight gain and stoma closure surgery was performed around 66th postoperative day.





Case D: A 34 years old male presented with stab injury approx 2cm towards right of umbilicus. Upon exploration proximal ileum was found to be lacerated with longitudinal tear in the mesentery of approx 7 cm in length. Due to the risk of bowel ischemia double barrel stoma was performed.

The issue kinking of connecting loop and unavailability of metallic tubing device was solved by procuring PVC tubing from 3 ball spirometer.

Another issue of slippage of proximal end of tube was solved by elastic adhesive strapping. The feeding and collecting tube was fixed through stoma bag by silk thread.

Distal refeeding was started from 7th post-operative day. Patient's recovery was uneventful with 2kg weight gain and stoma closure surgery was performed around 62nd postoperative day.



Case E: A 42-year-old housewife presented with complaints of generalised abdominal distension, bilious vomiting and obstipation for 2 days. Upon evaluation she was diagnosed to have acute intestinal obstruction. CT scan of abdomen revealed sealed off perforation at terminal ileum with two short segment strictures at proximal jejunum and terminal ileum respectively.

On exploration we found, generalized peritonitis with multiple abscesses within peritoneal cavity. A 5 cm long stricture in terminal ileum approximately two feet proximal to ileo-caecal junction with perforation at the proximal end

was present. The segment was resected and primary ileo-ileal anastomosis was performed. Another similar short segment stricture was found at the proximal jejunum approximately 1 feet from DJ junction. This segment was also resected and double barrel stoma was made at left lumbar region.

Distal refeeding with the final modified stoma device was started from 7th post-operative day. Patient's recovery was uneventful with 3kg weight gain and stoma closure surgery was performed around 60th postoperative day.





Case F: A 32-year-old female presented with complaints of generalised abdominal distension, vomiting and obstipation for 2 days. Upon evaluation she was diagnosed to have acute intestinal obstruction. CT scan of abdomen revealed dilated small bowel loops and necrotic lymph nodes suggestive of Koch's etiology.

On exploration generalized peritonitis and a terminal ileum stricture was found. The rest of the bowel loops were inflamed. Resection of stricture and ileo-ileal anastomosis with proximal loop ileostomy was done.

Distal refeeding with the final modified stoma device was started from 7th post-operative day. Patient's recovery was uneventful with 3kg weight gain and stoma closure surgery was performed around 60th postoperative day.

Case G: A 17-year-old female presented with complaints of weight loss, abdominal pain, vomiting and inability to pass stools for 3 days. She had history of similar complaint 1 year ago which was relieved by conservative management. CECT abdomen showed dilated jejunal loops with collapsed ileum.

Exploratory laparotomy was done, and a mid-jejunal stricture was found. Double barrel jejunostomy was performed.

Distal refeeding was started on 5th post-operative day. Patient's recovery was uneventful with 6 kg weight gain and stoma closure surgery was performed around 62nd postoperative day.

Case H: A 28-year-old male presented with history of stab injury over abdomen, and abdominal x ray showed free gas under right dome of diaphragm.

Exploratory laparotomy was done, and 3 perforations in distal jejunum and ileum were found. Primary repair and proximal loop jejunostomy were performed.

Distal refeeding was started on 6th post-operative day. Patient's recovery was uneventful with 4 kg weight gain and stoma closure surgery was performed around 55th postoperative day.

Case I: A 55-year-old female presented with complaint of fecal discharge from stitch line and in intra-abdominal drain after undergoing resection and anastomosis for distal jejunal stricture in another hospital. Patient had a high output fistula and presented with hypotension and tachycardia.

Resuscitation was done and exploratory laparotomy was performed. Anastomotic leak was found. Double barrel jejunostomy was performed.

Distal refeeding was started on 7th post-operative day. Patient's recovery was uneventful with 4 kg weight gain and stoma closure surgery was performed around 60th postoperative day.

Case J: A 30-year-old male presented with complaints of weight loss, abdominal pain, vomiting and inability to pass stools for 3 days. CECT abdomen showed features of Koch's abdomen and small bowel obstruction.

Exploratory laparotomy was done, and a ileal stricture was found with inflamed adjacent bowel. Resection and anastomosis of stricture with proximal loop ileostomy was performed.

Distal refeeding was started on 5th post-operative day. Patient's recovery was uneventful with 5 kg weight gain and stoma closure surgery was performed around 61st postoperative day.



**II. RESULTS:****A. Demographic Profile**

| NAME | AGE(y ears) | GENDER | DIAGNOSIS | TYPE OF STOMA | CO-MORBIDITIES | DURATION OF DISTAL REFEEDING(days) |
|--------|-------------|--------|---|---------------------|--------------------------------|------------------------------------|
| Case A | 60 | Male | Infective Caecal Perforation | Double Barrel Stoma | Hypertension | 40 |
| Case B | 35 | Male | Proximal ileal perforation in case of Blunt abdominal trauma | Loop Jejunostomy | None | 29 |
| Case C | 48 | Female | Acute intestinal obstruction due to ileal stricture | Loop Jejunostomy | Pulmonary tuberculosis, Anemia | 35 |
| Case D | 34 | Male | Distal ileal laceration due to stab injury | Loop Ileostomy | None | 26 |
| Case E | 42 | Female | Distal intestinal obstruction due to band formation | Double Barrel Stoma | Diabetes Mellitus Type II | 25 |
| Case F | 32 | Female | Acute intestinal obstruction due to ileal stricture | Loop Ileostomy | Anemia | 28 |
| Case G | 17 | Female | Acute intestinal obstruction due to jejunal stricture | Double Barrel Stoma | None | 26 |
| Case H | 28 | Male | Multiple perforations due to stab injury | Loop Jejunostomy | None | 30 |
| Case I | 55 | Female | High output fecal fistula in a operated case of jejunal resection anastomosis | Double Barrel Stoma | Abdominal Koch's | 36 |
| Case J | 30 | Male | Acute intestinal obstruction due to ileal | Loop Ileostomy | Pulmonary TB | 28 |

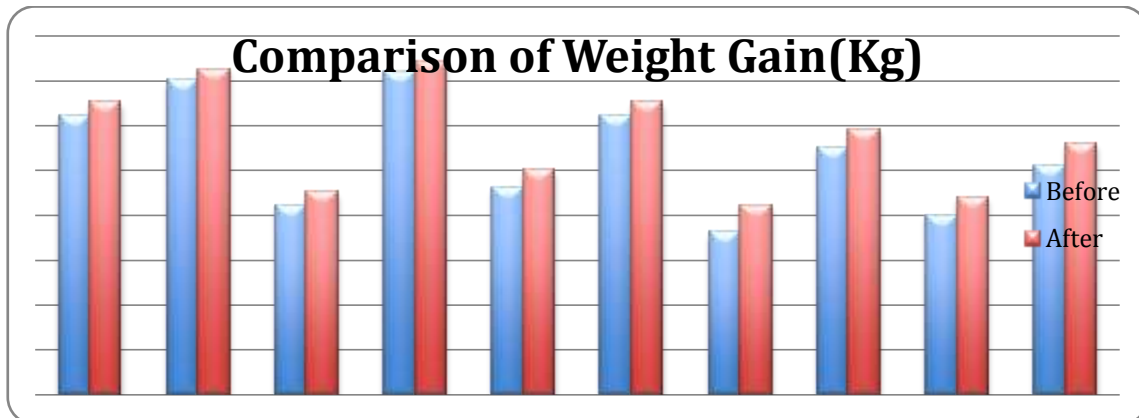


stricture



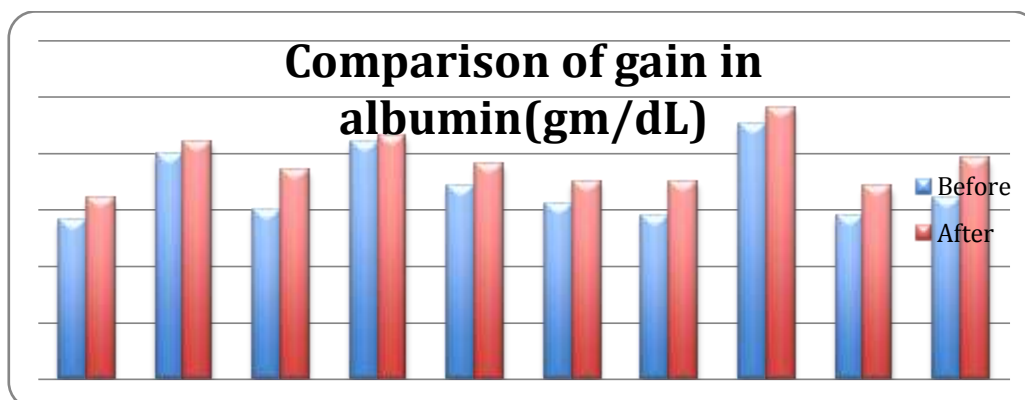
B. Comparison of Weight

| NAME | WEIGHT (kg) | | Weight Gain (%) |
|--------|-------------|-------|-----------------|
| | BEFORE | AFTER | |
| Case A | 62 | 65 | 6.4 |
| Case B | 70 | 72.5 | 3.6 |
| Case C | 42 | 45 | 7.1 |
| Case D | 72 | 74 | 2.8 |
| Case E | 46 | 50 | 8.7 |
| Case F | 62 | 65 | 4.8 |
| Case G | 36 | 42 | 16.6 |
| Case H | 55 | 59 | 7.2 |
| Case I | 40 | 44 | 10 |
| Case J | 51 | 56 | 9.8 |



C. Comparison of Serum Albumin of patients

| NAME | Serum ALBUMIN (g/dl) | |
|--------|----------------------|-------|
| | BEFORE | AFTER |
| Case A | 2.8 | 3.2 |
| Case B | 4.0 | 4.2 |
| Case C | 3.2 | 3.7 |
| Case D | 4.2 | 4.3 |
| Case E | 3.4 | 3.8 |
| Case F | 3.1 | 3.5 |
| Case G | 2.9 | 3.5 |
| Case H | 4.5 | 4.8 |
| Case I | 2.9 | 3.4 |
| Case J | 3.2 | 3.9 |



D. Interval between stoma creation and closure

| NAME | INTERVAL BETWEEN STOMA CREATION AND CLOSURE (days) |
|--------|--|
| Case A | 60 |
| Case B | 58 |
| Case C | 66 |
| Case D | 62 |
| Case E | 60 |
| Case F | 60 |
| Case G | 62 |
| Case H | 55 |
| Case I | 60 |
| Case J | 61 |



E. parameters of other nursing and medical care of the patient till he has stoma

| Cases | Urethral Catheter(days) | Ryle's tube(days) | Injectable antibiotic(days) | Drainage tube(days) | Total duration of stay |
|-------|-------------------------|-------------------|-----------------------------|---------------------|------------------------|
| A | 05 | 04 | 05 | 10 | 12 |
| B | 06 | 05 | 05 | 07 | 10 |
| C | 06 | 05 | 05 | 11 | 15 |
| D | 06 | 06 | 07 | 10 | 12 |
| E | 05 | 04 | 07 | 09 | 10 |
| F | 05 | 04 | 07 | 09 | 10 |
| G | 06 | 05 | 07 | 08 | 10 |
| H | 04 | 04 | 06 | 07 | 09 |
| I | 06 | 05 | 08 | 11 | 15 |
| J | 05 | 05 | 07 | 08 | 10 |

F. Satisfaction score of patients upon recovery was calculated on the basis of the following questionnaire:

| STATEMENTS | NONE OF THE TIME | RARELY | SOME OF THE TIME | OFTEN | ALL OF THE TIME |
|--|------------------|--------|------------------|-------|-----------------|
| I've been feeling optimistic about the future | 1 | 2 | 3 | 4 | 5 |
| I've been feeling useful | 1 | 2 | 3 | 4 | 5 |
| I've been feeling relaxed | 1 | 2 | 3 | 4 | 5 |
| I've been feeling interested in other people | 1 | 2 | 3 | 4 | 5 |
| I've had energy to spare | 1 | 2 | 3 | 4 | 5 |
| I've been dealing with problems well | 1 | 2 | 3 | 4 | 5 |
| I've been thinking clearly | 1 | 2 | 3 | 4 | 5 |
| I've been feeling good about myself | 1 | 2 | 3 | 4 | 5 |
| I've been feeling close to other people | 1 | 2 | 3 | 4 | 5 |
| I've been feeling confident | 1 | 2 | 3 | 4 | 5 |
| I've been able to make up my own mind about things | 1 | 2 | 3 | 4 | 5 |
| I've been feeling loved | 1 | 2 | 3 | 4 | 5 |
| I've been interested in new things | 1 | 2 | 3 | 4 | 5 |
| I've been feeling cheerful | 1 | 2 | 3 | 4 | 5 |



| NAME | SATISFACTION SCORE |
|--------|--------------------|
| Case A | 62 |
| Case B | 56 |
| Case C | 53 |
| Case D | 58 |
| Case E | 60 |
| Case F | 56 |
| Case G | 58 |
| Case H | 56 |
| Case I | 54 |
| Case J | 55 |

III. DISCUSSION:-

The need to construct a stoma often arises in emergency abdominal surgery with septic peritonitis and multiple bowel injuries due to unhealthy bowel ends which precludes the anastomosis. According to statistical records, 1.5 per thousand of the world population lives with a stoma. Taking the age factor into account, the incidence of stoma corresponds to over 0.3 per thousand of the adult population in world ^[10].

During the first days after the construction of stoma, the effluent usually increases, but it decreases rapidly following intestinal adaptation ^[11]. When this adaptation fails or is prolonged, patients must face the challenge of controlling large losses of fluid that can lead to a state of chronic dehydration ^[12]. When these losses occur, stoma patients present major deficits of water, sodium and magnesium ^[13] and can also suffer malnutrition and long-term weight loss. This occurrence is even more significant when stoma is created in proximal part of enteric system. This event is known as High Output Stoma (HOS) and among stoma patients Baker et al revealed a prevalence of HOS of 16 % ^[14].

A study by Ekingen et al found that using succus entericus reinfusion allowed for higher volume advancement of enteral feedings, therefore allowing the clinicians to decrease the TPN volume ^[15]. There are many case reports documenting the effectiveness of distal bowel refeeding. A systematic review by Richardson et al found that patients had better weight gains when receiving a combination of TPN and distal bowel refeeding versus TPN alone ^[16]. All the patients analyzed were able to have their TPN volumes decreased when receiving distal bowel refeeding, which

resulted in reducing their risk for cholestatic jaundice ^[16]. Finally, patients who had distal bowel refeeding were able to undergo early stoma closure, and it was postulated that this shortened time was a result of feeding the distal portion of the bowel, therefore encouraging intestinal adaptation ^[16].

The problem with High Output Stoma (Proximal Jejunostomy) is that it causes the patient to have less surface area to absorb nutrients. The jejunum is a primary site for nutrient absorption. When patients undergo a jejunal resection they are at risk for the onset of nutrient deficiencies of major substrates, minerals, and vitamins ^[17]. **The main principle behind advocating the practice of distal bowel refeeding is to allow the continuation of the digestive and absorptive process.**

Although using TPN to maintain a patient's nutrition status may be beneficial in the short term, absence of enteral nutrition after stoma surgery is associated with morphological and functional changes in distal gut as indicated by decreases in intestinal absorptive surface, decrease in enzyme activity, and an increase in gut permeability ^[18]. An obstacle when beginning enteral feedings in patients with High Output Stomas, especially proximal jejunostomies, is gastric hypersecretion. Two factors that stimulate gastric hypersecretion are massive bowel resection and the initiation of enteral feedings ^[19]. Gastric hypersecretion can continue for 2 to 5 weeks after surgery ^[19]. The excess gastric secretion can interfere with nutrient absorption ^[20]. Intravenous ranitidine can be prescribed to treat gastric hypersecretion. Ranitidine therapy has been shown to be effective at reducing gastric secretions by approximately 50% ^[20].



Table 1 – Constituents of Total Parenteral Nutrition

| Per 100 ml, | |
|--------------|----------|
| Water | 80 ml |
| Carbohydrate | 12.5 g |
| Fat | 3 g |
| Protein | 1.7 g |
| Sodium | 0.09 g |
| Potassium | 0.07 g |
| Calcium | 0.07 g |
| Phosphorus | 0.04 g |
| Magnesium | 0.02 g |
| Iron | 0.09 mcg |
| Zinc | 0.5 mcg |
| Copper | 0.03 mcg |
| Manganese | 0.02 mcg |

Studies have shown that using continuous enteral feedings through distal bowel refeeding improve adaptation in distal bowel after stoma surgery [21, 22, 23, and 24]. Providing continuous feedings can enhance absorption, decrease TPN dependence, and reduce hepatic injury often caused by TPN. Parker et al found that by providing continuous feedings to patients with proximal ostomies, they had a better energy balance of nutrients, less diarrhoea, and significant increases in body weight when compared with intermittent feedings [22]. Providing continuous enteral feedings can reduce volume output from the stoma and allow for better absorption of nutrients.

Our case study results depicts that at an average duration of stoma was 61 days and patients were given distal stoma refeeding for 31 days. The average duration of urinary catheterization was 6 days and Ryle's tube insertion was 5 days, injectable antibiotics were given for 6 days, the drainage tube were placed for 9 days, the average duration of hospital stay was 12 days. We noticed an average weight gain of 2.9 kilograms and an average increase in serum albumin of 0.32 gm/dL. The satisfaction score of all the patients was found to be around 56.8 .

Based on our experience we recommend this type of distal bowel refeeding in following indications of stoma,

- Proximal ostomy
- Patients underwent repeated surgery and bowel resection
- High output stoma
- Severely malnourished patients
- Patients who are at risk of TPN related complications

IV. CONCLUSION:-

This study supports our hypothesis that distal bowel refeeding is beneficial for patients who have undergone a bowel resection with creation of an ostomy. Clinicians should use distal bowel refeeding to decrease a patient's dependence on TPN and the morbidities associated with long-term TPN use. Also, distal bowel refeeding has the potential to reduce the cost of providing care to these patients by reducing TPN-associated morbidity. Finally, distal bowel refeeding allows the process of digestion and absorption of nutrients to continue in the distal bowel, thereby reducing the risk of feeding intolerance—following re-anastomosis because it can prevent gut atrophy of the distal portion of the bowel. The device, which is simultaneously, a collecting bag and also has feeding mechanism, is very much useful for the said purpose. Any device which simultaneously collects the output of stoma and allows the feeding from distal lumen should be identified as 'Mukadamstoma device' . Future modifications maybe of variations like metal, plastic, paper, rubber. The variation maybe of the stoma size, adhesive material. The variation maybe of the tubes having bulb or cuff and collecting bag or non traumatic tube. Any basic or modified stoma device should be named as 'Mukadam stoma device'. We recommend use of this simple device frequently by the surgical fraternity for the betterment of the patients having stoma.

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