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Original Research Article

Derangement in renal function after stoma creation in a tertiary care centre

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ABSTRACT

Background: We assessed the derangements of renal functions and glomerular filtration rate (GFR) due to dehydration and poor nutrition in stoma patients before the creation of stoma, on discharge and on readmission (closure/complication).
Methods: We conducted a retrospective cohort study in 50 patients of both sexes of age group 16-80yr undergoing stoma formation either as an emergency or elective procedure. Changes in levels of urea, creatinine and GFR were checked preoperatively, on discharge and on follow up within 3 months. Diet of the patient, possibility of sepsis and other treatment including nephrotoxic drug treatment history was assessed.
Results: Fifty patients including 27 males and 23 females of age group 16-75yr were included in this study. The most common stoma was loop ileostomy in 32 cases followed by double barrel ileostomy in 11 cases. Ileal perforation and ileal stricture are the 2 most common causes of stoma formation and 78% of stoma were made as an emergency procedure. We found that 56% of the cases presented with deranged renal functions and GFR on readmission.
Conclusions: Deranged GFR was due to dehydration by high output and poor intake leading to renal injury and deranged renal functions. Proper counselling of the patient regarding nutritious diet, refeeding and adequate hydration is important to prevent renal failure in stoma patient.

Keywords: Creatinine, Dehydration, Ileostomy, Renal insufficiency, Stoma

INTRODUCTION

A stoma is the exteriorization of either the small bowel (duodenal/jejunal/ileal) or large bowel (colostomy) through the anterior abdominal wall. Intestinal stomas can be either temporary or permanent.[1]

Intestinal stomas play an important role in the management of various life-threatening gastrointestinal diseases like intestinal perforation, colorectal cancers, inflammatory bowel disease, diverticular diseases, intestinal obstruction, traumatic bowel injuries, gangrenous bowel, and anastomotic leak.[2-5]

Stomas are associated with many complications like prolapse or stenosis, receding of stoma, cutaneous excoriation, parastomal hernias, haemorrhage and necrosis.[6-8] One of the common complications seen after creation of a stoma is the loss of fluid and electrolyte imbalance causing abnormalities in the renal functions of the patients.[9]

In the GI tract, the salivary glands produce approx. 1.5 l of fluid per day, the stomach secretes 2.5 l of gastric juice, the liver produces 0.5 l of bile, the pancreas produces 1.5 l of enzyme and bicarbonate-rich fluid. The small intestine absorbs 6.5 l of fluid, and the colon

absorbs 1.3 l of fluid against significant osmotic gradients.[10]

A normal functioning ileostomy can secrete up to 1,000 mL of fluid effluent with major electrolytes which further causes shunting of total circulatory volume and create a state of dehydration and renal injury by hypovolemia.

This is followed by the activation of renin-angiotensin-aldosterone system which helps to absorb sodium and water from the collecting duct in kidney.[11] When these compensatory mechanisms fail the patient has deranged renal functions. Dehydration, sepsis and poor nutrition are the major causes of progression to renal failure.

At least 20% of the patients with high output stoma and dehydration presented with significant decrease in glomerular filtration rate (GFR) and raised renal function tests following creation of a stoma compared to their preoperative values.[12-13]

The reported incidence of high output stoma varies between 1% and 17% and it is the cause for 4% to 43% of readmissions of patients.[14-15]

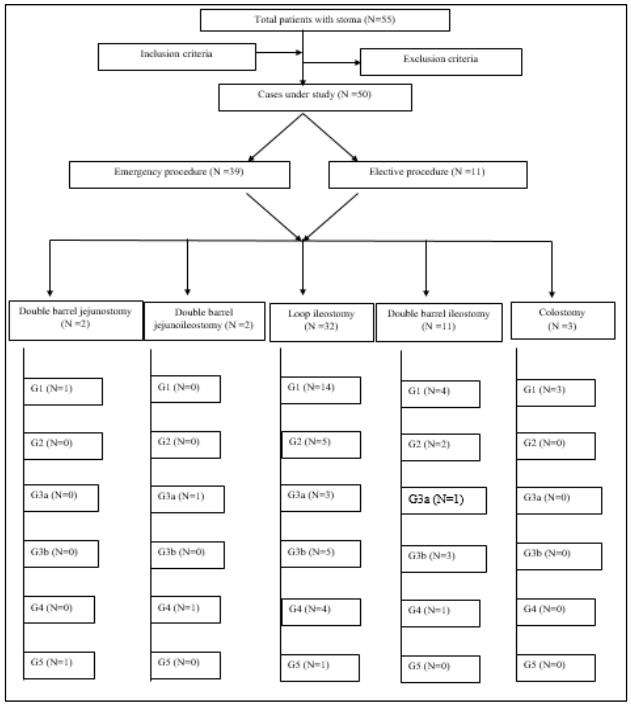

Figure 1: Study flow-chart.

Correction of electrolytes and dehydration by refeeding, proper diet and avoiding sepsis by proper stoma care can prevent progression to renal failure

Proper care of a patient with stoma starts from the moment itself when the stoma is created by proper counselling of the patient regarding diet and hydration and by giving a proper diet chart to the patient catered on his stoma output to compensate for the shunting of circulatory volume by the stoma.

In case of very proximal stomas refeeding via a feeding tube in the distal limb of the stoma after enriching them with multivitamin, iron, folic acid, honey and other high energy nutritional substances should be encouraged and proper guidelines should be given to the patient on discharge. We aim to establish the relationship between the derangement of GFR due to dehydration and poor nutrition associated with different intestinal stomas by observation of renal functions preoperatively, on discharge and after readmission due to various reasons.

METHODS

This retrospective observational study was conducted on 50 patients who underwent stoma creation during January 2023 to December 2023 in the Department of General Surgery of S. M. S. Medical College and Hospital, Jaipur after taking approval from ethical committee from the institute. There were 50 patients including 27 males and 23 females of age group 16-75yrs. We observed levels of urea, creatinine and GFR was calculated before the stoma creation, on discharge and at the time of follow up or readmission either for closure or any stoma related complications.

All the patients who underwent stoma creation were advised dietary modifications and lifestyle changes and identification of early signs of dehydration at home and use of ORS and other electrolyte rich solutions when the patient was discharged to compensate for the shunted circulatory volume. After readmission, proper charting of the patient's diet was done during the time when he was at home, including the total calories and 24 hr fluid intake of the patient and total output of the stoma was charted.

We also studied the association of several demographic and clinical factors on changes in GFR (age, gender, body weight, any pre-existing renal disease, muscular dystrophies, diabetes, hypertension, concurrent chemoradiation and other long term medication use including use of nephrotoxic drugs).

The Modification of Diet in Renal Disease (MDRD) study equation was used to calculate the GFR (ml/min/1.73m^2 BSA) based on patient's serum creatinine (Cr) levels and age as follows[16-17:] GFR = 186 × S. Creatinine(mg/dL) $^{-1.154}$ × (age)$^{-0.203}$ × (0.742 in females).

The patients were then divided in groups according to the 2012 KDIGO CKD classification into 6 categories based on glomerular filtration rate (G1 - G5 with G3 split into 3a and 3b).[18]

Inclusion criteria

Patients admitted to the department of general surgery between age group 16-75yr and undergoing stoma

formation either during an emergency or elective procedure were included.

Exclusion criteria

Patients with history of pre-existing renal disease, muscular dystrophies, concurrent chemoradiation, nephrotoxic drug use, patients who did not gave not gave consent for stoma creation or did not follow up were excluded from the study.

Statistical analysis

Statistical analysis of data was done and represented in form of proper tables and charts.

RESULTS

Fifty patients were included in this study 27 (54%) male and 23 (46%) female, maximum number of patients were from the age group 15-30yrs, the median age being 34.5years (range 16-75) as indicated by Table 1.

Table 1: Patient characteristics.

Variables	Number of patients (n=50)	Percentage
Gender		
Male	27	54
Female	23	46
Age (years)	Mean- 34.5yr.	
<15	0	0
15-30	19	38
31-45	14	28
46-60	11	22
61-75	6	12
Stoma creation surgery		
Emergency procedure	39	78
Elective procedure	11	22
Reason for stoma formation		
Jejunal perforation	1	2
Ileal perforation	14	28
Colonic perforation	4	8
Ileal stricture	7	14
Jejunal stricture	1	2
Gut gangrene	5	10
Meckel's diverticulum	4	8
GI tuberculosis	2	4
Appendicular perforation	1	2
Obstructed hernia	2	4
Colorectal cancer	6	12
Burns	1	2
Blunt and penetrating trauma	2	4

The various reasons for stoma formation are shown as in Table 1, the most common of which was found to be ileal perforation in 14 cases (28%) followed by ileal stricture in 7 cases (14%). It was also done as a diversion procedure in colorectal cancers (19) in 6 cases (12%).

There was also a case of severe burn with involvement of 45% of TBSA with peritoneal breach and an ileal perforation for which a diversion loop ileostomy was made after exploration (Table 1).

All the stoma made were temporary and were made with the purpose to be closed within 6-8 wks. The various position of stoma made are mentioned in Table 2 maximum of which was loop ileostomy in 32 (64%) of patients (Figure 1).

Table 2: Stoma characteristics.

Variables	Number of patients (n=50)	Percentage
Type of stoma		
Temporary	50	100
Permanent	0	0
Position of stoma		
DB jejunostomy	2	4
Loop ileostomy	32	64
DB ileostomy	11	22
DB jejunoileostomy	2	4
Loop colostomy	3	6

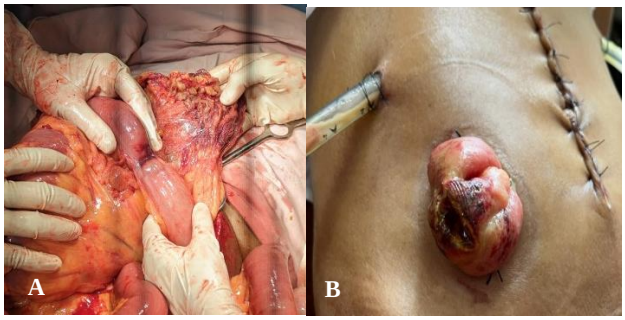

Figure 1 (A and B): Picture depicting a case of ileal stricture which has been exteriorised as loop ileostomy.

Table 3: Causes of readmissions.

Reason for readmission	Number of patients (%)
Dehydration	22 (44)
Stoma closure	16 (32)
Anastomotic leak	2 (4)
Intrabdominal abscess	1 (2)
Surgical site infection	4 (8)
Urinary tract infection	2 (4)
Obstructed stoma	2 (4)
Receded stoma	1 (2)
Prolapsed stoma	0
Total	50 (100)

Out of the 50 patients for which stoma were made, maximum 22 (44%) were readmitted with dehydration (20-22) and only 16 (32%) cases were admitted for closure (Table 3).

About 42 cases (84%) had GFR >60ml/min before the creation of a stoma which increased to 46 patients (92%) on discharge, but on readmission only 29 cases (58%) cases had GFR >60 ml/min while other progressed to progressive renal failure (Table 4). Serum creatinine level for men with normal kidney function is approximately 0.6 to 1.2 mg/dl and between 0.5 to 1.1 mg/dl for women (23). The normal range of blood urea nitrogen is 5 to 20 mg/dl, or 1.8 to 7.1 mmol urea per litre (24). The results of changes in the renal function tests of the patients are as mentioned in Table 4.

Table 4: Categorical classification of patients according to renal functions.

Renal failure grading	Renal function	GFR (ml/min/1.73m^2)	No of patients before stoma creation (%)	No of patients on discharge (%)	No of patients on readmission (%)
G1	Normal or high	>90	34 (68)	39 (78)	22 (44)
G2	Mildly decreased	60-89	8 (16)	7 (14)	7 (14)
G3a	Mild to moderately decreased	45-59	5 (10)	2 (4)	5 (10)
G3b	Moderately to severely decreased	30-44	3 (6)	2 (4)	8 (16)
G4	Severely decreased	15-29	0	0	6 (12)
G5	Kidney failure	<15	0	0	2 (4)
Serum creatinine (mg/dl)					
<1.2			41 (82)	46 (92)	29 (58)
1.2 - 3			8 (16)	4 (8)	17 (34)
3-6			1 (2)	0	2 (4)
>6			0	0	2 (4)
Serum urea (mg/dl)					
<40			37 (74)	41 (82)	28 (5)
40-80			10 (20)	9 (18)	9 (18)
81-120			1 (2)	0	8 (16)
121-160			1 (2)	0	2 (4)
161-200			0	0	1 (2)
>200			1 (2)	0	2 (4)

We found that there was an elevation of serum creatinine after readmission in total 38 patients (76%) with an average rise of 101.97% as compared to their levels on discharge of the patients.

The derangement in GFR according to various position of stoma are as shown in Figure 2.

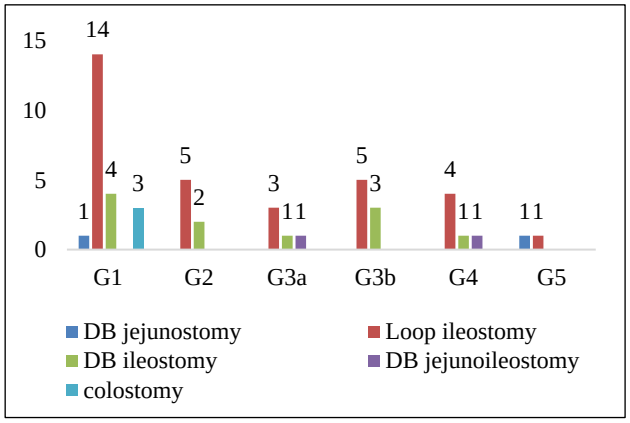

Figure 2: Derangement in GFR by stoma position.

DISCUSSION

In this retrospective observational study of 50 cases consisting of 27 males and 23 females we found the maximum number of stomas were formed in age group of 15-40 yrs. Similar age distribution was reported by Aziz et al.[25]

About 39 (78%) of the stomas were formed as a result of emergency procedure and in only 11 (22%) patients the stoma was formed during an elective procedure. In contrast to our study, a lower incidence of emergency stoma creation was reported by Ahamad et al.[26] As emergency 66% and elective 34% and Redha et al reported as emergency 46.25% and elective 53.75%.[27]

We found that most common stoma present was a loop ileostomy in 64% of the cases followed by double barrel ileostomy in 22% of cases and the most common cause of formation of these stomas were ileal perforation in 28% of the cases followed by an ileal stricture. Similar findings were reported by Ahmadet al which showed ileostomy around 76%.[28]

We observed the patients for a period of 3 months from the time of stoma formation to follow up. 44% of patients with stoma creation either after an emergency or elective procedure suffered from high output related complications, mainly dehydration with electrolyte imbalances and acute renal failure causing readmission in the hospital for IV fluids and hydration. Similar rates of readmission have been previously published.[29-30] Similar study evaluating the complications were done by Pandiaraja et al.[31]

Despite the potential lifesaving advantages of a stoma, we should note the high morbidity associated with it.[32] A high-output stoma is associated with increased loss of water and sodium, which causes dehydration, hyponatremia, hypomagnesemia, and hyperaldosteronism. In our study we found that on readmission only 44 % of the patients had normal renal function and 14% cases have mild 10% cases have mild to, 16% cases had moderately to severely deranged renal functions and 12% cases had severely deranged renal functions and 4% of cases progressed to renal failure. There was a 101.97% rise in serum creatinine levels on discharge and on readmission.

In our institute, diversion loop ileostomy is performed at a distance of 30 from the ICJ. Some known causes of high output are proximal stomas, intraabdominal sepsis, enteritis, intermittent bowel obstruction, less than 200 cm of small bowel length, recurrent disease in the remaining bowel (e.g., inflammatory bowel disease or radiation enteritis), bacterial overgrowth, and medications.[33] The identification of patients at risk of developing high stoma output and its related complications is of paramount importance to implement interventions to decrease readmissions.[20] Patients with a stoma requires special attention, and preventing dehydration represents an opportunity to improve outcomes and finally closure of the stoma.

Nagle et al, reported decreased in hospital readmissions (the readmission rate for dehydration dropped from 15.5% to 0%) with the “ileostomy pathway” that included a set of patient education tools throughout the perioperative process with post-discharge tracking of intake and output.[34]

More studies are needed to answer these questions. The limitations of our study are largely attributable to the sample size and the single institutional nature of our investigation which is prone to selection bias.

CONCLUSION

In this study we conclude that a stoma is associated with various complications especially dehydration and subsequent renal failure which should be tackled properly with proper management using proper counselling techniques to the patient regarding the diet and adequate hydration at home and iv fluids and antibiotics in case of readmissions to provide better outcome for the patient.

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