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GRADING OF COMPLICATIONS FOLLOWING BOWEL ANASTOMOSIS USING CLAVIEN-DINDO SYSTEM: OUR EXPERIENCE

General Surgery

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ABSTRACT

Introduction: The Clavien-Dindo classification (CDS) of surgical complications has been validated for other surgeries but not for bowel anastomosis. Our study evaluates CDS in bowel anastomosis.

Methods: Data of 318 anastomosis were collected over 2 years. Complications were graded according to the CDS. Factors associated with complications were analysed.

Results: 22.2% had grade IIIb, 19.4% had grade I, 19.4% had grade II, 11.1% had grade Iva, 8.3% had grade IIIa and 19.4% had grade V complication. We had no problem in assigning grades to all complications and had uniform management directive in treating them. Orientation of anastomosis, technique and setting of operation were not significant whereas anemia, diabetes and hypertension, hypovolemia, sepsis and hypoalbuminemia were significant factors for occurrence of complications.

Conclusion: We recommend that CDS be used across all centres for uniform reporting of complications following bowel anastomosis.

KEYWORDS

Bowel anastomosis, Surgical complications, Clavien-Dindo grades, Bowel surgery

Introduction

Bowel resection and anastomosis (BA) is the commonest GI tract surgery done by the current day general surgeons (1). The fear of complications following BA have given nightmare to surgeons regardless of their level of experience and skill (2).

Though numerous studies are published discussing complications following BA, nonetheless there's lack of agreement concerning definition and severity-grading of complications. Existence of vague definitions to grade complications haven't solely hampered the analysis of this surgery however additionally adversely affected the comparison of various techniques and newer advancements in field of anastomosis within same centre and across different centres (1).

Clavien-Dindo stratification of complications provides a standard platform for communication among surgeons. Its application has been validated in general surgery but its utility in BA has not been reported(3–5). This study aims to evaluate Clavien-Dindo grading system (CDS) in "reporting" and "grading" of complications following BA. The objectives were to assess its applicability and efficacy in management of complications as well as to study the incidence and various factors attributable for complications following BA.

Material and methods

A prospective observational study was done at a tertiary care hospital for 02 years. All consecutive patients undergoing BA for varied pathological causes were included whereas bilio-enteric and pancreatico-enteric anastomosis were excluded. Follow-up was done for 03 months postoperatively.

Detailed history, investigations, operative details and follow-up details were entered into Microsoft access database. Statistical analysis was done by using SPSS 20.0. Chi-square test and Fisher's exact test was used to find the significance between various factors and complications following bowel anastomosis. P-value < 0.05 considered as significant.

Results

A total of 318 anastomoses was done in 203 patients during the study period. General characteristics of patients is shown in table 1. 65% of patients were males and 35% were females with male to female ratio being 1.82:1. Most age-distribution was within the range of 41-80 years with a mean of 47.17 years. Anemia was the most common co-morbidity while hypoalbuminemia was the most prevalent risk factors. Malignancy was commonest cause for BA.

The operative detail is shown in table 2. 166 patients (81.77%) underwent surgery in an elective setting while 37 patients (18.22%) had to undergo emergency surgery. Bowel preparation was not-done in 47% of patients while it was done in 53%. Jejuno-jejunal (J-J) (33.5%), Colo-colic (C-C) (28.57%) and ileo-ileal anastomoses (I-I) (21.67%) were the commonest location of anastomosis. There were total of 133 end-end (E-E) (41.82%), 128 side-side (S-S) (40.25%) and 57 end-side (E-S) (17.92%) anastomosis based on orientation of the two ends of bowel of which 48% were hand-sewn (H-S) anastomoses and 52% were stapled anastomoses.

Table 1 : General characteristics of patients

		Number of patients (%)
Gender	Male	131 (64.5)
	Female	72 (35.5)
Age group (years)	≤ 20	38 (18.7)
	21 - 40	26 (6.9)
	41 - 60	63 (15.3)
	61 - 80	68 (46.8)
	> 80	8 (12.3)
Co-morbidities	Hypertension	27 (13.3)
	Diabetes Mellitus	25 (12.3)
	Tuberculosis	6 (3.0)
	Anemia	65 (32.0)
Addictions	Alcohol	15 (7.4)
	Tobacco	20 (9.9)
Known Risk factors	Hypoalbuminemia	52 (25.6)

	Deranged INR	7 (3.4)
	Sepsis	22 (10.8)
	Hypovolemia	10 (4.9)
	Malnutrition	52 (25.6)
	Radiation	29 (14.3)
Cause of resection of bowel and anastomosis	Malignancy	101 (49.8)
	Stricture	16 (7.8)
	Anorectal malformation	15 (7.4)
	Obstruction	13 (6.4)
	Benign growth	11 (5.4)
	Hirschprung's disease	11 (5.4)
	Perforation peritonitis	9 (4.4)
	Meckel's diverticulum	4 (2.0)
	Tracheo-esophageal fistula	4 (2.0)
	Gangrene	3 (1.5)
	Aneurysm	2 (1.0)
	Duodenal atresia	2 (1.0)
	Intussusception	2 (1.0)
	Ischemia	2 (1.0)
	Crohn's disease	1 (0.5)
	Entero-cutaneous fistula	1 (0.5)
	GI Bleed	1 (0.5)
	Injury	1 (0.5)
	Penetrating trauma	1 (0.5)
	Rectal Prolapse	1 (0.5)
	Strangulation	1 (0.5)
	Abdominal tuberculosis	1 (0.5)

fiTable 2: Operative detail

		Number (%)
Setting of surgery	Emergency	37 (18.2)
	Elective	166 (81.8)
Bowel preparation	Done	108 (53.2)
	Not done	95 (46.8)
Anatomical location	Jejuno-jejunal (J-J)	68 (33.50)
	Colo-colic (C-C)	58 (28.57)
	Ileo-ileal (I-I)	44 (21.67)
	Colo-rectal (C-R)	39 (19.21)
	Gastro-jejunal (G-J)	39 (19.21)
	Esophago-gastric (E-G)	20 (9.85)
	Ileo-colic (I-C)	18 (8.87)
	Esophago-jejunal (E-J)	12 (5.91)
	Esophago-colic (E-C)	8 (3.94)
	Gastro-colic (G-C)	8 (3.94)
	Duodeno-duodenal (D-D)	1 (0.49)
	Esophago-ileal (E-I)	1 (0.49)
	Ileo-rectal (I-R)	1 (0.49)
	Ileo-jejunal (I-J)	1 (0.49)
Orientation	End to End (E-E)	133 (41.82)
	End to side (E-S)	57 (17.92)
	Side to Side (S-S)	128 (40.25)
Technique	Hand sewn (H-S)	153 (48.11)
	Stapled	165 (51.89)

Table 3: Analysis of complications

		Number of patients (%)
Occurrence of Complications	Present	36 (17.7)
	Absent	167 (82.3)
Complications	Anastomotic Leak (AL)	12 (5.9)
	Wound infection	16 (7.9)
	ECF (Enterocutaneous fistula)	5 (2.5)
	Respiratory	6 (3.0)
	Septicaemia	13 (6.4)
	Stricture	2 (1.0)
	Mortality	7 (3.4)
Clavien - Dindo Grades of surgical complications	I	7 (19.4)
	II	7 (19.4)
	IIIa	3 (8.3)
	IIIb	8 (22.2)
	IVa	4 (11.1)
	V	7 (19.4)
	Length of hospital stay (days)	
	Uncomplicated group	**Complicated group**
Mean	13.39	33.61
Median	11.50	20.50
Minimum stay	5	2
Maximum stay	37	182
Interquartile range	8	26

The complications following bowel anastomosis is shown in table 3. 36 patients (17.7%) had complications of which 16 (7.9%) had wound infection, 13 (6.4%) developed septicaemia, anastomotic leak (AL) was observed in 12 (5.9%), 06 (3.0%) developed respiratory complications, 5 (2.5%) developed entero-cutaneous fistula (ECF) and 02 (1.0%) had stricture and 07 patients (3.4%) died following surgery. We had 20% CDS grade I, 20% grade II, 8% grade IIIa, 22% grade IIIb, 11% grade Iva and 19% grade V complications. Mean stay in hospital was 13.39 days for uncomplicated group while it was significantly delayed to 33 days in complicated group. The complications were further qualified using CDS as shown in table 4 and the multivariate analysis of various parameters attributable to complications is shown in table 5.

Table 4: Detailed qualification of complications and their management guidelines

Grade	Complication	Management	
I	Anastomotic leak (n=3)	Minimal hemoserous drainage with no systemic features	Clinical observation and drainage through existing drainage tube
	Surgical site infection (n=3)	Southampton grade 1-3	Antibiotics
II	Anastomotic Leak (n=1)	Significant sanguinous drain output with corresponding systemic features and fall in Hb	Blood Transfusion
	Enteral nutrition not feasible (n= 2)		TPN
	Wound Infection (n=2)	Southampton grade 4-5	Parenteral antibiotics & bedside drainage of pus/hematoma
	Enterocutaneous fistula (n=2)		Controlled drainage through existing drainage tube + TPN
IIIa	Wound Infection (n=3)	Localised collection	Image-guided percutaneous drainage of collection
	ECF (n=1)		Image-guided percutaneous drainage of collection
IIIb	Anastomotic leak (n=2)		Re-exploration under GA
	Wound Infection (n=5)		Exploratory laparatomy + peritoneal toilet under GA
	ECF (n=1)		Resection & anastomosis
	Sepsis (n=6)		Exploratory laparotomy + peritoneal toilet under GA
	Stricture (n=2)		Resection & anastomosis
Iva	AL leading to acute myocardial infarction (n=1)		Admitted to ICU
	Sepsis with single organ dysfuction (n=2)		
	ECF with single organ dysfunction (n=1)		
	ARDS (n=1)		
V	Death (n=7)		

AL with minimal drain output and no systemic features were graded as CDS-grade I complication and were managed with clinical observation, while AL manifesting with decrease in haemoglobin was treated with transfusion and graded as CDS-grade II complication. Similarly, any localised collection was graded as CDS-grade IIIa complication and was managed with image-guided percutaneous drainage. Generalised peritonitis was graded as CDS-grade IIIb and patients underwent re-exploratory laparotomy under general anesthesia (GA). Complications leading to organ failure were graded as CDS-grade IV and were managed in intensive care unit (ICU). Thus, we had no problem in assigning grades to all complications and furthermore also had a clear and uniform management directive in treating them.

Table 5: Multivariate analysis of complications

Parameter	Occurrence of complication	Number	p-value
Orientation	Side to side	19	0.290
	End to side	13	0.180
	End to end	21	0.864
Technique	Stapled	21	0.874
	Hand-sewn	23	0.874
Setting of surgery	Emergency	26	0.150
	Elective	10	
Co-morbidities	**Anemia**	19	**0.006**
	Tuberculosis (TB)	3	0.070
	Hypertension (HTN)	12	**0.001**
	Diabetes mellitus (DM)	13	**0.001**
Addictions	**Tobacco/smoking**	8	**0.012**
	Alcohol	4	0.311
Known risk factors	Radiation	6	0.608
	Malnutrition	18	**0.001**
	Hypovolemia	6	**0.003**
	Sepsis	9	**0.006**
	Deranged INR	2	0.610
	Hypoalbuminemia	18	**0.01**

On multivariate analysis, orientation of anastomosis, technique and setting of operation were not significant (NS) for occurrence of complications. Anemia, DM and HTN were significant co-morbidity for occurrence of complications while tobacco use was a significant addiction. Malnutrition, hypovolemia, sepsis and hypoalbuminemia were directly attributable and significant factors for occurrence of complications.

Discussion

Management of a surgical complication is varied, due to several reasons, starting from lack of uniform definitions to individual surgeon's preference in addressing them, to existing difference in various institute protocols and individual surgeon's judgement to record and grade a complication. Confusion in defining and grading complications had greatly hampered the evolution of surgical procedures in past.

The classification system for complications, initiated in 1992 by Clavien and Dindo (6) relies on the kind of medical care required to correct them. The principle of classification is straightforward, reproducible, flexible, and applicable. The Clavien-Dindo Classification (CDS) seems reliable and represent a compelling tool for quality-assessment in surgery. It has been validated in varied surgical subspecialties successfully however the same has not been used for BA (3,5).

In this study, CDS was used to grade AL, qualify the leak and frame a standardised management guideline. 12/203 had AL (5.9%) in our study. Age and male gender was NS for AL consistent with Schrock, Deveney and Dunphy et al (7) and Lipska et al (8).

1 patient of carcinoma rectum, on 2nd postoperative day, had fall in hemoglobin due to bleeding per rectum which was attributed to bleeding from suture line and was graded as CDS grade II complication. She was treated with blood-transfusion. Other patient of carcinoma rectum developed feculent discharge from lower 1/3rd of surgical wound on 6th postoperative day with 30 ml of feculent drain output which was graded as CDS grade III. He underwent re-exploration and a subcentimeteric perforation was found over posterior suture line of anastomosis with feculent peritonitis. Loop ileostomy was done and patient was discharged on 33rd postoperative day. These two patients were categorised into two different CDS grades and had a different management guideline altogether, which otherwise would have been vaguely labelled as "anastomotic leak" with skewed statistical figure.

1 patient of carcinoma esophagus developed AL from the cervical E-G anastomosis diagnosed in the form of persistent drainage of serosanguinous drain fluid till the 26th postoperative day, graded as CDS grade I complication. He was managed conservatively and no intervention done as per standard guidelines (9,10). Other patient of carcinoma esophagus leaked from J-J site and had to be reoperated as per CDS grade IIIb management guidelines (11,12). Thus CDS, provided a roadmap to surgeons in planning, executing and managing the patients as per uniform guidelines which can be replicated over all centers.

One patient of perforated jejunal diverticulitis who underwent emergency resection of gangrenous jejunum with H-S S-S jejuno-jejunal anastomosis developed leak on 2nd post op day and was managed in intensive care unit as she was hemodynamically unstable and had severe respiratory compromise and septicaemia. She was initially reported as CDS grade IV complication but later on revised to CDS grade V complication as she developed atrial fibrillation on 2nd post op day and succumbed to her illness. The acute diverticulitis with perforation has been reported as high as 2.3% among patients with jejunal diverticulosis and is associated with high mortality (13) and emergent laparotomy with segmental bowel resection and primary anastomosis is the treatment of choice (14) as was done in our case and CDS helped surgeons and intensivist to manage and report this case without much ambiguity.

1/3rd of patients who had leak were operated on emergency basis in our study which is also concluded in various studies (7,15). HTN, DM and preoperative hypovolemia were found to significantly associated with AL in our study, similar to findings of A Fawcett et al (104) and Kassis, Edmund S. et al (16,17) and Schrock, Deveney and Dunphy et al (7). Type of anastomosis, orientation of anastomosis and bowel preparation was NS factor for AL in our study as shown in various studies (18–21).

16/203 had wound infection (7.9%), 5/203 patients (2.5%) had developed ECF following the surgery, 6/203 patients (3.0%) had respiratory complications, 13 patients developed septicaemia (6.4%), 2 patients had developed stricture (1.0%) and 7 patients died (3.4%) in our study. HTN, DM, tobacco smoking, anemia, hypoalbuminemia, sepsis and hypovolemia, malnutrition, setting of operation were significant factors while age, sex and type of anastomosis and bowel preparation were NS for ECF, respiratory complications, stricture, septicaemia and mortality in this study consistent with other studies (8,11,13,17,22–30). Patients with respiratory complications had to be kept on mechanical ventilation in the postoperative period as per CDS grade IV complication guidelines.

Data exists to suggest that CDS is a reliable and valid tool in general surgery and it has numerous advantages ranging from uniformity in reporting, comparison of results across globe and conduct of adequate research (3,4,31). Till date ours is one of the first study on used of CDS in bowel anastomosis. We had complications in 36/203 patients, and we did not face any difficulty in grading them. In addition, it was also useful in assessing various risk factors for complications following bowel anastomosis. Grading of complications using CDS in our study was relevant and increased length of hospital stay due to postoperative complications was significantly associated with higher CDS grades. CDS system was useful in assessing various risk factors responsible for postoperative complications following bowel anastomosis and provided clear management directives for treatment of complications.

We had a 03 month follow up period, where not all complication could have occurred, but we are sure that this system can be used on any delayed complication as well.

Conclusion

CDS is a simple, non-time consuming, easy and straight-forward tool. We recommend that it should be used across all centres for uniform reporting of complications following bowel anastomosis. This will aid not only to all those are involved in patient care but also those involved in scientific research. We require use of this system for honest

reporting and grading of complications and follow standardised management protocol, for the betterment of surgery.

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