

Systematic assessment of complications after laparoscopic colorectal surgery for advanced colorectal cancer: A retrospective study using Clavien–Dindo classification, 5-year experience

Mahmut Said Degerli¹, Alp Omer Canturk¹, Hilmi Bozkurt², Orcun Alpay¹, Muzaffer Akinci¹, Yusuf Emre Altundal³, Turgay Yildiz⁴, Dogan Yildirim¹

1. Department of General Surgery, University of Health Sciences, Haseki Training and Research Hospital, Istanbul, Turkey
2. Department of Gastrointestinal Surgery, University of Health Sciences, Haseki Training and Research Hospital, Istanbul, Turkey
3. Department of General Surgery, T.R. Ministry of Health Istanbul Arnavutkoy State Hospital, Istanbul, Turkey
4. Department of General Surgery, Avrasya Hospital Gaziosmanpasa, Istanbul, Turkey

*Corresponding Author: Mahmut Said Degerli, Email; drmsdegerli@gmail.com

Abstract

Aim

The presence and frequency of surgical complications indicate the quality of the surgery performed. However, a standard classification system should specify, describe, and compare complications. Clavien Dindo classification is an easily applicable classification in the evaluation of complications. Our study aimed to reveal the severity of complications and the factors affecting them by using the Clavien Dindo classification in patients undergoing laparoscopic colorectal surgery.

Methods

Between January 2015 and December 2020, we retrospectively collected the laparoscopic colorectal surgery complications using Clavien Dindo grading in patients in our colorectal surgery unit in the database. The outcome variables studied were age, gender, BMI, ASA score, postoperative length of hospital stay, operation procedure, cancer size, postoperative mortality.

Results

There were 53 males and 17 female patients, with a mean age of $56,9 \pm 13,4$ (19-81). Seventy patients, 32 (45%), had at least one postoperative complication. About complications; 58.6% were rated as Clavien I, 22.9% as Clavien II, 8.6% as Clavien IIIa, 4.3% as Clavien IIIb, 2.9% as Clavien IVa, and 2.9% as Clavien V. There was no Clavien grade IVb complication in any of the patients. Length of hospital stays was significantly higher in patients with had major complex surgery and had higher scores. Clavien Dindo classification was positively statistically significantly related to the day of hospitalization in male and female sex ($p < 0.001$ for all). In addition, positively significantly related to Clavien Dindo classification and tumor diameter in the female sex ($p = 0.014$) detected.

Conclusions

In laparoscopic colorectal surgery, the Clavien–Dindo classification can be easily applied and used safely to determine complication rates. The reason for this statistical difference that we detected in our study and that occurs in women may be due to anatomical differences or the surgeon's experience.

Keywords: Postoperative complications, Clavien–Dindo classification, Colorectal Cancer, Laparoscopic Colorectal Surgery

Introduction

The first and most crucial step in surgeons' self-development is studying complications and learning from them. Each surgical operation has some complications with it, even if this surgical technique is minimally invasive laparoscopic surgery. Unfortunately, there was no accepted standard definition for the degree of surgical complications in clinical practice for many years. Although many classifications have been developed to classify postoperative complications, these classifications need to be simple, easy to apply, effective, and consistent to be used frequently in practice. Clavien Dindo scoring, published in 2004, has been widely accepted because of these features and is commonly used in clinical practice^{1,2}. The Clavien–Dindo classification was first introduced in 1992 under the "T92 score". In their study, Clavien et al. showed the relevance of classification on 650 cases of elective cholecystectomy³. This study aimed to contribute to the literature and make new inns by

classing our laparoscopic colorectal surgery experience and complications between 2015 and 2020 according to Clavien Dindo's classification.

Material and Methods

Ethical approval of this study was obtained from the ethics committee of the University of Health Sciences of the Haseki Training and Research hospital, with approval n^o: 235-2020, dated 09.12.2020

Data of patients who underwent laparoscopic colorectal surgery at Haseki Training and Research Hospital between January 2015 and December 2020 were collected retrospectively from the electronic database.

We used Clavien Dindo scoring to evaluate postoperative complications. Besides, we analyzed patients' demographic data such as age, gender, duration of surgery, hospitalization day, etc. statistically together with Clavien Dindo scoring and reported our results.

Statistics

SpSS 15.0 for Windows program was used for statistical analysis. Descriptive statistics; For categorical variables, number and percentage, numeric variables were given as mean, standard deviation, minimum, maximum. The One-Way ANOVA Test was made to compare numeric variables in more than two independent groups when the normal distribution condition was met, and the Kruskal Wallis test when the normal distribution condition was not met. Sub-group analyses were performed with the Mann Whitney U test. Spearman was examined with Correlation since numerical variable-to-variable relationships were not met as normal distribution conditions. The statistical alpha significance level was $p < 0.05$.

Results

From January 2015 to December 2020, 70 patients underwent laparoscopic colorectal surgery. There were 53 (75.7%) males and 17 (24.3%) females in the study group (Table 1). There was no statistically significant difference in the mean age of male and female sex ($p=0.116$). Their ages ranged from 19 to 81 Y with a mean age of $56,9 \pm 13,4$ (mean \pm SD). There was no statistically significant difference in gender rates and mean age in Clavien Dindo Scoring ($p=0.053$ $p=0.358$)

Table 1. General properties of the work group

		n	%
Gender	Male	53	75,7
	Female	17	24,3
		Average \pm SD	Min-Max
Age		56,9 \pm 13,4	19-81
Operation Time		232,7 \pm 82,1	105-475
Leight of Stay		10,9 \pm 9,3	5-74
Tumor Size		5,5 \pm 2,6	1-14
Lymph Node		13,9 \pm 8,8	1-43

(Table 2). Length of stay (LOS) ranged from 5 to 74 days (median 10.9 days, mean 9.3 days). There was a statistically significant difference in length of stay averages in Clavien Dindo Scoring ($p < 0,001$) (Table 3).

Clavien Dindo 1 hospitalization day average was lower than Clavien Dindo 2 and 3A. Clavien Dindo 2 hospitalization day average was statistically significantly lower than 3A ($p < 0.001$ $p < 0.001$ $p = 0.001$ $p = 0.001$) (Table 3). Of these 70 patients, 25 (%35) patients were treated by laparoscopic low anterior resection, 15 (%21) patients were treated by laparoscopic anterior resection, 18 (%25) patients were treated by laparoscopic right hemicolectomy, 7 (%10) patients were treated by laparoscopic left hemicolectomy, 2 (%2.8) patients were treated by laparoscopic subtotal colectomy, 3 (%4.2) patients were treated by laparoscopic abdominoperineal resection. All of the operations were performed laparoscopically; however, 6 (%8.5) operations were started laparoscopic but finished in open surgery. Duration of surgery ranged from 105 to 475 minutes of $232,7 \pm 82,1$ (mean \pm SD). There was no statistically significant difference in the mean duration of surgery in Clavien Dindo Scoring ($p = 0.702$) (Table 3). Tumor size ranged from 1 cm to 14 cm with a mean size of $5,5 \pm 2,6$ cm (mean \pm SD).

Table 2. Gender rates and mean age in Clavien Dindo Scoring

		Gender		Age Ort. \pm SD (Min-Maks)
		Male n (%)	Female n (%)	
Clavien Dindo	1	32 (78,0)	9 (22,0)	54,8 \pm 13,1 (25-78)
	2	14 (87,5)	2 (12,5)	60,3 \pm 10,0 (42-74)
	3A	4 (66,7)	2 (33,3)	54,7 \pm 12,6 (38-75)
	3B	1 (33,3)	2 (66,7)	49,7 \pm 27,5 (19-72)*
	4A	2 (100)	0 (0,0)	66,0 \pm 1,4 (65-67)*
	5	0 (0,0)	2 (100)	79,5 \pm 2,1 (78-81)*
	p	0,053		0,358

*Not included in the analysis

Table 3. Operation time and lenght of stay averages in Clavien Dindo Scoring

		Operation Time			Lenght of Stay		
		Average \pm SD	Min-Max	Median	Average \pm SD	Min-Max	Median
Clavien Dindo	1	228,2 \pm 88,6	105-420	200	7,4 \pm 1,9	5-17	7
	2	241,6 \pm 87,9	150-475	240	10,4 \pm 1,5	8-13	10
	3A	240,3 \pm 65,7	180-360	240	18,2 \pm 9,0	11-36	15,5
	3B*	240,0 \pm 60,0	180-300	240	21,0 \pm 6,9	13-25	25
	4A*	242,5 \pm 24,7	225-260	242,5	15,0 \pm 8,5	9-21	15
	5*	210,0 \pm 42,4	180-240	210	46,5 \pm 38,9	19-74	46,5
	p	0,702			<0,001		

Table 4. Tumor size and lymph node in Clavien Dindo Scoring

		Tumor Size			Lymph Node		
		Ort.±SD	Min-Maks	Median	Ort.±SD	Min-Maks	Median
Clavien Dindo	1	5,0±2,3	1-9	5	13,7±8,9	2-43	13
	2	6,1±2,8	2-14	6,5	16,7±10,3	1-36	14
	3A	5,3±1,3	4-7	5,5	8,7±5,7	2-16	8,5
	3B*	6,0±2,8	4-8	6	18,0±4,4	13-21	20
	4A*	4,0±1,4	3-5	4	8,0±4,2	5-11	8
	5*	10,0±5,7	6-14	10	14,0±5,7	10-18	14
	p	0,514			0,186		

*Not included in the analysis

Table 5. Rates of Clavien Dindo Scores

		n	%
Clavien Dindo	1	41	58.6
	2	16	22.9
	3A	6	8,6
	3B	3	4,3
	4A	2	2,9
	5	2	2,9

Table 6. Age, lenght of stay, lymph node and tumor size in Clavien Dindo Scoring

	Clavien Dindo	
	r	p
All Group		
Age	0,208	0,085
Lenght of Stay	0,805	<0,001
Lymph Node	0,012	0,925
Tumor Size	0,140	0,292
Male		
Age	0,161	0,250
Lenght of Stay	0,761	<0,001
Lymph Node	0,082	0,569
Tumor Size	-0,068	0,661
Female		
Age	0,364	0,151
Lenght of Stay	0,899	<0,001
Lymph Node	-0,308	0,229
Tumor Size	0,619	0,014

There was no statistically significant difference in tumor diameter, and lymph node(LN) means in Clavien Dindo Scoring (p=0.514 p=0.186) (Table 4).

Distribution of patients according to Clavien Dindo classification, 58.6% were Clavien I, 22.9% as Clavien II, 8.6% as Clavien IIIa, 4.3% as Clavien IIIb, 2.9% as Clavien IVa, and 2.9% as Clavien V (Table 5). Clavien grade IVb complication was not observed in any of the patients. Clavien Dindo classification was positively statistically significantly related to the day of hospitalization in male and

female sex (p<0,001 for all). Positively significantly related to Clavien Dindo classation and tumor diameter in female sex (p=0.014) (Table 6).

Discussion

Until Clavien et al. published their classification in 1992, there was no widely accepted method for standardizing surgical complications^{3,4}. Although several clinically proven classification systems exist, the Clavien Dindo classification stands out as an easy-to-apply and straightforward

classification. In this context, it can also be safely used in quality management in general surgery clinics⁵.

It is an important problem that there are some differences in terminology for complications that may develop after surgical procedures. Although the same complication is mentioned, using different terminology in different clinical studies causes difficulties determining the actual complication rates⁴. For example, when talking about mesenteric ischemia in the literature, we can see that different concept are used, such as mesenteric vascular occlusion, bowel ischemia, acute small bowel ischemia⁶⁻⁸. Apart from the fact that complications are named differently, there may be differences in interpreting the classifications created in practice. Different surgeons can interpret many expressions used in classifications differently⁴. For example, while evaluating surgical site infection, some surgeons may accept the presence of minimal hyperemia in the incision site as wound site infection. In contrast, some surgeons may not consider even minimal abscess drainage as wound site infection.

The Clavien-Dindo classification is based on the type of treatment required to correct the complication rather than the definition or grading of complications. Since it is a classification focused on the final result and treatment, it is suitable for quality control in surgical clinics.

Clavien Dindo scoring has attracted much attention because it is an easily applicable, understandable, and practical classification. When looking at PubMed searches, the popularity of Clavien Dindo scoring can be seen over the years(359 articles in 2015, 482 in 2016, 567 in 2017, 680 in 2018, 795 in 2019, 567 in 2017, 1065 in 2020). In addition, it is discussed in many surgical procedures, especially in urology, pediatric surgery, and general surgery^{5,9,10}.

Studies have shown that the Clavien Dindo classification can also be used in different patient groups. The critical result obtained from the studies is that patients with high Clavien Dindo scores have significantly longer LOS^{1,2,5}. As a matter of fact, in our study, the mean LOS was found to be 15 days in patients with Clavien IVa, 25 days in patients with Clavien IIIb, 46.5 days in patients with Clavien V, and 15.5 days in patients with Clavien IIIa. Patients who did not develop complications were discharged in 7 days on average. It was observed that the length of hospital stay was statistically significantly longer in patients with a high Clavien Dindo score. This is an essential helper in estimating the severity of the disease and the length of hospitalization

time using Clavien Dindo scoring. The positive statistically significant relationship between Clavien Dindo scoring and tumor diameter in the female sex may indicate that patients with large tumor diameter and females are surgically higher complications candidates, and intraoperative enhanced complications increase morbidity in the postoperative period. Suppose laparoscopic surgery is performed in female patients with large tumor diameters. In that case, morbidity should be calculated in advance, and it should be taken into account that it may be high. The reason for this statistical difference that we detected in our study and that occurs in women may be due to anatomical differences or the surgeon's experience.

Limitations of the study

The most important limitation of the study is that it is retrospective. Therefore, prospective studies with larger groups are needed.

Conclusion

The Clavien Dindo classification is an easily applicable and effective classification for evaluating postoperative complications in laparoscopic colorectal surgery. Since the Clavien Dindo classification is a classification that focuses on the final result and the applied treatment, it can be safely used in quality management in general surgery clinics. In addition, we think that the statistical difference in the women we found in our study may be due to anatomical differences or the surgeon's experience.

Acknowledgments

There is no acknowledgment to declare.

Ethical approval: This study was approved by the Ethics Committee of the Ministry of Health Istanbul Haseki Research and Training Hospital. This article does not contain any studies with animals performed by any authors.

Funding

There is no funding.

Conflict of interest statement

The authors declare that they have no conflict of interest.

References

1. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg.* 2004;240(2):205–13. doi:10.1097/01.sla.0000133083.54934.ae
2. Clavien PA, Barkun J, de Oliveira ML, et al. The Clavien-Dindo classification of surgical complications: five-year experience. *Ann Surg.* 2009;250(2):187–96. doi:10.1097/SLA.0b013e3181b13ca2
3. Clavien PA, Sanabria JR, Strasberg SM. Proposed classification of complications of surgery with examples of utility in cholecystectomy. *Surgery.* 1992;111(5):518–26.
4. Katayama H, Kurokawa Y, Nakamura K, et al. Extended Clavien-Dindo classification of surgical complications: Japan Clinical Oncology Group postoperative complications criteria. *Surgery today.* 2016;46(6):668-85. doi: 10.1007/s00595-015-1236-x.
5. Bolliger M, Kroehnert JA, Molineus F, Kandioler D, Schindl M, Riss P. Experiences with the standardized classification of surgical complications (Clavien-Dindo) in general surgery patients. *European Surgery.* 2018;50(6):256-61. doi: 10.1007/s10353-018-0551-z.
6. Angelelli G, Scardapane A, Memeo M, Stabile Ianora AA, Rotondo A. Acute bowel ischemia: CT findings. *Eur J Radiol.* 2004;50(1):37-47. doi:10.1016/j.ejrad.2003.11.013.
7. Goller HR, Kroczeck HG. Mesenterialgefäßverschlüsse [Mesenteric vascular occlusion]. *Chirurg.* 1981;52(4):261-64.
8. Segatto E, Mortelé KJ, Ji H, Wiesner W, Ros PR. Acute small bowel ischemia: CT imaging findings. *Semin Ultrasound CT MR.* 2003;24(5):364-76. doi: 10.1016/s0887-2171(03)00074-x.
9. Yoon PD, Chalasani V, Woo HH. Use of Clavien-Dindo classification in reporting and grading complications after urological surgical procedures: analysis of 2010 to 2012. *J Urol.* 2013;190(4):1271-74. doi: 10.1016/j.juro.2013.04.025.
10. Thompson H, Jones C, Pardy C, et al. Application of the Clavien-Dindo classification to a pediatric surgical network. *J Pediatr Surg.* 2020;55(2):312-15. doi: 10.1016/j.jpedsurg.2019.10.032.