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High red cell distribution width value is a good predictive factor for detecting the complexity and difficulty of the laparoscopic cholecystectomy

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ABSTRACT

Introduction: Several studies demonstrated that high red cell distribution width (RDW) values are associated with the severity of inflammatory processes. A recent study found that high RDW values significantly decrease after laparoscopic cholecystectomy (LC) in patients with acute cholecystitis. Therefore, we aimed to investigate, whether pre-operative RDW can predict the complexity of surgery and the risk of conversion from LC to open cholecystectomy (OC).

Materials and Methods: Patients were divided into two groups according to the severity of inflammation with dense adhesions surrounding the gallbladder as Group I (n=140 patients); films adhesions around the gallbladder that allow easy dissection, Group II (n=100 patients); severe adhesions encasing the gallbladder, including fibrosis, which makes dissection difficult.

Results: The mean age was 46.54±12.21 years. Eighty-five patients were female and 155 patients were male. The mean percentage of pre-operative RDW was significantly higher in Group II patients when compared with Group I (15.26±2.0 vs. 12.53±0.84, p<0.001). Conversion cholecystectomy was performed significantly higher in Group II patients (n=18, %18) than in Group I patients (n=3, 2.1%), (p<0.001).

Conclusion: Results of the present study indicate that high RDW values are associated with inflammation and dense adhesions both in the gallbladder and surrounding tissue which make operation difficult and increase rate of conversion to open surgery. Future studies consisting of large populations are needed to reach a definite conclusion.

Keywords: Conversion rate, Predictive factors, Red cell distribution width, Symptomatic cholelithiasis

Introduction

Laparoscopic cholecystectomy (LC) is the gold standard for symptomatic cholelithiasis. The conversion rate of LC to open cholecystectomy (OC) is ranging from 5% to 10%.[1] Reasons for conversion are inflammation and fibrosis of Calot's triangle, dense adhesions covering the gallbladder, difficulty in anatomic identification, uncontrollable bleeding, and injury to the bile duct. Several studies have

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been intended to determine preoperatively the complexity of surgery and the risk factors for conversion to OC.[2,3] Some frequently reported risk factors are elderly patients, male sex, obesity, and presence of acute cholecystitis. Long interval between symptom onset and operation, increased number of cholecystitis attacks (or chronic cholecystitis), may also contribute to higher rates of conversion due to inflammatory and fibrotic changes both in the gallbladder and surrounded tissues.[4]

Red cell distribution width (RDW) is a quantitative dimension of variability in the size of circulating erythrocytes. It higher values reflect greater heterogeneity in red cell sizes. Several studies detected that a high RDW value is a prognostic factor that may indicate an underlying inflammatory process and is an independent factor for increased risk of mortality.[5-10] Elevation of RDW value in acute cholecystitis has been previously shown.[11] However, an association between RDW values and conversion from LC to OC has not been studied.

The aim of the present study is to examine the relationship between pre-operative RDW values and the severity of inflammation with dense adhesions covering the gallbladder that makes LC complex and difficult. Second, to determine, whether pre-operative RDW can predict the risk of conversion to OC.

Materials and Methods

The study is evaluated and approved by the ethics board of our center (Ethics board number: E1-20-1400). All procedures performed in this study involving human participants were in accordance with the ethical standards of the Institutional and/or National Research Committee, and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

A total of 240 patients who underwent LC for chronic cholecystitis or symptomatic gallbladder stones between January 2017 and July 2018 in our hospital were retrospectively analyzed. All patients diagnosed as acute cholecystitis, cholangitis, acute pancreatitis, choledocholithiasis, biliary tract malignancy, and a history of percutaneous or endoscopic biliary drainage procedure before surgery were excluded from the study.

Demographic data (age, gender, and body mass index (BMI), pre-operative, and post-operative laboratory findings, including white blood cell count (WBC), RDW, C-reactive protein (CRP), ultrasound findings, pathology report, comorbid disease, American Society of Anesthesiologists score, severity of adhesion in the gallbladder region (as defined below), post-operative complications, post-operative follow-up course, and histopathological examination findings, were retrospectively analyzed.

Grading the Severity of Adhesions Covering the Gallbladder

The extent and thickness of the adhesions in the gallbladder area was scored according to the severity of adhesion as per the following grading score scale suggested by Ercan et al.[12] Grade I; absence of the adhesions around the gallbladder, Grade II; Flimsy adhesions that allow to easy dissection, Grade III; severe adhesions encasing the gallbladder, including fibrosis, which makes dissection difficult, and Grade IV; severe adhesions covering the gallbladder and other organs, such as the duodenum or colon, which do not permit to a safe dissection and needs conversion to OC.

The Patients Were Divided Into Following Two Groups

Group I: Patients who had Grades I and II adhesion score (easy cholecystectomy)

Group II: Patients who had Grades III and IV adhesion score (difficult cholecystectomy).

After the publication of the clinical study number 12 in 2010, in which we refer to in the material and method section, we definitely write down the severity of adhesions covering the gallbladder grading number (Grade I to IV) on all patients surgery notes. For this reason, we did not have any deficiencies in this data during retrospective file scanning.

Statistical Analysis

The Statistical Package for the Social Sciences 20 Inc., Chicago, IL, USA was used for statistical analysis. The patients were compared in terms of their demographic and laboratory characteristics, treatment modalities, and hospital stay. The continuous variables were expressed as mean±standard deviation (minimum – maximum values), and they were compared through the Student t-test. The categorical variables were expressed in frequencies and percentages and were compared through Fisher test or Chi-square test. $P \leq 0.05$ was accepted as statistically significant.

Results

A total of 240 patients underwent cholecystectomy for chronic cholecystitis and symptomatic cholelithiasis. The mean age was 46.54±12.21 (min-max: 25–85) years. Eighty-five patients (35.4%) were female and 155 patients were (65.6%) male. The mean BMI was 26.99±2.28 kg/m^2. Group I consisted of 140 (58.3%) patients and Group II consisted of 100 (43.7%) patients, respectively.

Group I patients consisted of 52 female and 88 male patients, whereas Group II consisted of 33 female and 67 male patients. The mean age was 45.89±11.93 (min-max: 27–84) years in Group I and 47.45±12.59 (min-max: 25–85) years in Group II patients. The mean BMI was 27.11±4.19 kg/m2 in Group I patients and 26.88±4.37 kg/m^2 in Group II patients. There was no statistically significant difference between the groups in terms of age, gender, BMI, CRP, and WBC count (p=0.22, p=0.68, p=0.87, p=0.37, and p=0.32, respectively). The mean percentage of pre-operative RDW was significantly higher in Group II patients than in Group I (15.26±2.0 [min-max: 11.20–15.20] vs. 12.53±0.84 [min-max: 12.20–18.9], p<0.001) (Table 1).

There was no significant difference regarding the mean operation time between the two groups (p=0.33). No significant difference has been found according to the number of pre-operative comorbidities, such as hypertension, diabetes mellitus, coronary artery disease, or chronic obstructive pulmonary disease. Conversion to OC occurred in three patients (2.1%) of Group I and 18 patients (18%) of Group II, and the difference was significant (p<0.001). A laparoscopic subtotal cholecystectomy was performed in two patients of Group II. There was no significant difference between the two groups according to hospital stay (p=0.31). Wound infection occurred in three patients (2.1%) of Group I and five patients (5%) of Group II, and the difference was not significant (p=0.19) (Table 2).

Although statistically not significant, pre-operative RDW values were higher in patients who underwent conversion to OC (21 patients, 8.75%) when compared with those (219 patients) who did not (14.8±2.13 vs. 13.40±1.69, p=0.162).

Discussion

RDW is a widely used inexpensive test which is a performed as a part of the complete blood count. It is calculated by dividing the standard deviation of erythrocyte

Table 1. Patient characteristics and demographic data

	Group I, n (%)	Group II, n (%)	p
Number of patients	140 (%58.3)	100 (%43.7)	
Mean Age (years) (min-max)	45.89±11.93 (27-84)	47.45±12.59 (25-85)	0.22
Female/Male	52 / 88	33 / 67	0.68
Mean BMI (kg/m^2) (min-max)	27.11±4.19 (23.12-29.24)	26.88±4.37 (24.12-29.70)	0,87
Preop Mean RDW (%) (min-max)	12.53±0.84 (11.20-15.20)	15,26±2.07 (12.20-18.9)	<0.001
Preop Mean WBC (min-max)	6.65±1.56 (3.70-10.20)	6.54±1.73 (2.80-11.84)	0,32
Preop CRP (min-max)	1.65±0.78 (0.02-5)	1.72±0.82 (0.02-5.72)	0.34
Preop Mean Hemoglobin (min-max)	14.58±0.58 (12.84-15.08)	14.67±0.61 (12.97-15.28)	0.92

RDW: Red cell distribution width; WBC: White Blood cell count.

Table 2. Comparison of the patients according to the severity of adhesion scores

	Group I, n (%)	Group II, n (%)	p
Mean operative time (minute) (min-max)	124.29±46.39 (40-360)	129.89±52.56 (45-360)	0,33
Number of conversion to OC	3 (%2,14)	18 (%18)	<0.001
Mean hospital stay (min-max)	1.19±0.43 (1-3)	1.28±0.67 (1-4)	0.31
Postoperative wound infection	3(2.1%)	5 (5%)	0.19

OC: Open cholecystectomy.

volume from the mean corpuscular volume and multiplied with 100 to convert a percentage.[13]

Numerous inflammatory biomarkers are associated with the alteration of the production of erythroid precursors and thereby impair the erythropoiesis which results in an elevated RDW. This has prompted several researchers to test the predictive value of this biological parameter in the early diagnosis of several diseases.[14]

RDW has been reported in recent studies as a significant prognostic marker for patients with cardiac problems and those with history of cancer.[15-17] A meta-analysis determined strong correlation between high RDW levels and increased mortality in patients with chronic kidney disease.[18] It has also been previously shown that RDW has a high sensitivity in predicting the outcomes of patients with hepatic and gastrointestinal inflammatory diseases.[19,20] In additional, increased RDW levels are associated with poor outcome in septic patients.[21]

As expected, the rate of conversion increases in patients with acute cholecystitis due to a thickened and friable gallbladder wall with dense scarring. On the other hand, conversion may also require in some patients – particularly old male patients – in the absence of acute cholecystitis. Identifying patients with significant risk factors for conversion could offer useful information to the surgeon about what kind of difficulty may occur during surgery.

Results of the present study indicate that RDW is a useful laboratory test that can yield advance information about the degree of intense adhesions covering the gallbladder, difficulty of surgery, and the risk of conversion. In parallel with the severity of inflammation, RDW values increase. This has been proven in the study by Yazıcı et al.,[11] where RDW values significantly decrease after LC in patients with acute cholecystitis. In the present study, pre-operative RDW values were significantly increased parallel to inflammation and dense adhesions covering the gallbladder. Further, although statistically not significant, RDW values were higher in patients who underwent conversion to OC than those who did not. The high pre-operative RDW values of patients with dense adhesions (Group II) from the present study were also in accordance with the pre-operative RDW values of patients with acute cholecystitis reported by Yazıcı et al.[11] (15.26±2.07 vs. 14.3±1.3). All these findings support the role of RDW in identifying patients with risk of conversion to OC.

The present study has some limitations. First, it is a retrospective study with relatively small sample size. On the other hand, this is the first study which examined the relationship between RDW values and the degree of intense inflammation with adhesions covering the gallbladder to determine the risk of conversion to OC. Third, conditions such as nutritional deficiency, chronic disease, or familial disease that disrupt oxygen transport and therefore have an effect on RDW values could not be evaluated due to the retrospective nature of the study.

Conclusion

RDW is a low-cost marker that is routinely examined in complete blood count test and provides useful information on inflammatory processes of the body. High pre-operative RDW level can associated with severe inflammation and dense adhesions covering the gallbladder that complicates cholecystectomy and can increase the risk of conversion to OC. Further studies consisting of larger patient populations are needed to reach a definitive conclusion.

Disclosures

Ethichs Committee Approval: The study is evaluated and approved by the ethics board of our center (Ethics board number: E1-20-1400).

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

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