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Utility of RDW in Prediction of Strangulation in Emergency Setting Hernias

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Most of the small bowel obstruction cases are due to adhesions and hernias. Identifying strangulated cases may save patients from consequences of unnecessary operations and save patients who need urgent intervention by early detection. Serum markers of intestinal ischemia may help to identify and detect strangulation. The aim of this study was to identify if certain blood values such as RDW can accurately predict presence of strangulation preoperatively. We reviewed files of 127 patients who were operated because of incarcerated abdominal hernias for serum biomarkers and evaluated them with the operative findings. Our results show that elevation in red cell distribution width and white blood cell count may reflect strangulation. These findings may be useful in identifying the strangulated cases that need urgent surgical intervention.

Key words: Hernia – Small bowel – Strangulation – Red cell distribution width

Red cell distribution width (RDW), which is the quantitative measurement of variations in red blood cell volume, is useful in the differential diagnosis of anemia.[1] High red cell distribution width is diagnostic for iron deficiency anemia.[2] Several studies suggested the presence of an association between high RDW levels and increased mortality in general population as well as in patients with cardiovascular disease, cerebrovascular disease, septic shock, chronic obstructive pulmonary disease, the activity of inflammatory bowel disease, and pulmonary functions.[3] Red cell distribution width is an inexpensive, routinely reported parameter as a part of complete blood count tests used in hospital settings.[4]

Bowel obstruction comprises more than 15% of admissions from the emergency department for abdominal pain.[5] Intestinal obstructions (85% small bowel, 15% large bowel obstructions) cause more than 300,000 hospitalizations in the United States.[6,7] Hernias are the second most common cause of small bowel obstruction, which make up 15% of the cases in developed countries. Due to increased rate of elective repair of hernias, small bowel obstruction caused by hernias declined from 40% down to lower percentages in the last few decades.[8] Consequently,

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mortality from small bowel obstruction is not as high as it used to be (*i.e.*, 60%) in the beginning of the century. The reported mortality rate for small bowel obstruction related to hernia is 3 to 7% in uncomplicated cases, but exceeding 15% in the presence of strangulation.[9,10] Strangulation of incarcerated hernias is still a surgical problem, and if strangulation can be predicted early, specific measures may be taken for a better management decision.

The aim of this study was to identify if certain blood values such as RDW can accurately predict presence of strangulation preoperatively.

Patients and Methods

We analyzed inpatient records of 127 cases who underwent surgery because of incarcerated hernias between March 2010 and March 2014 in Numune Training and Research Hospital Emergency Surgery Department. Patients were referred to surgery either when manual reduction was not possible or if there was a history of irreducible mass lasting more than 6 hours, white blood cell elevation, fever, tenderness or swelling over the hernia, ileus, signs of peritoneal irritation, and presence of radiologic findings suggesting strangulation.

The patients were divided into 2 groups according to the presence of resection. The 2 groups (resection group, n = 35; hernia repair group, n = 92) were compared according to the hospital stay, age, hemoglobin, hematocrit, white blood cell count, and RDW.

One patient had omental cake incarcerated through umbilical hernia, and another patient had peritoneal metastasis of colorectal cancer. These patients were excluded from the study because of possible RDW changes secondary to carcinomatosis.

Demographic data, radiologic findings, hematologic parameters, hospitalization time, type of surgery, and complications were recorded. Data were tested for normality and were found to be nonnormally distributed except hemoglobin levels. Accordingly, all data were presented as median values, and thus nonparametric analyses were used to assess differences. Univariate analysis was performed using the Mann-Whitney U test and χ^2 test as appropriate.

Results

A total of 127 cases were found eligible for the study. Sixty-three (49.6%) were female, and 64 (51.4%) were male. The median age of the patients was 61 years (25–90). Ninety-two (72%) patients had hernia repair, and 35 (28%) patients had to undergo resection because of strangulation. Thirteen of the resections included omentum, and 22 of the patients underwent bowel resection because of strangulation. Median hospital stay was 2 days. The longest stay lasted 27 days in a patient whose bowel was resected and who had cardiac and pulmonary complications. Two patients—one male aged 57 years who underwent hernia repair and omentectomy and another male aged 85 years who underwent right hemicolectomy and inguinal hernia repair—lost their lives in the postoperative period due to cardiac and pulmonary complications. The resection group included both omentectomy and bowel resection. The hospital stay was longer in the resection group with 5 days (min: 1 day, max: 27 days) versus 3 days (min: 1 day; max: 18 days). The median RDW for the resection group was 14.7% (min: 11.9%; max: 23.5%) and 13.7% (min: 11.8%; max: 20.2%) for the nonresection group. The median white blood cell count for the nonresection group was 10.5 ($10^3/\mu L$; min: 2.8; max: $26.6 \times 10^3/\mu L$) and 13.2 ($10^3/\mu L$; min: 6.4; max: $35 \times 10^3/\mu L$) for the group with resection. The differences between groups in RDW, hospital stay, and white blood cell count were found to be statistically significant ($P < 0.05$).

Discussion

Red cell distribution width is elevated in the presence of erythropoietic stress (*e.g.*, iron, vitamin B12, and folate deficiency). Oxidative stress and inflammatory processes were suggested to influence RDW. Increased RDW was shown in impaired renal function, inflammatory bowel disease, and pulmonary insufficiency. Association between elevated RDW and decreased survival might be secondary to the effects of antioxidants on RDW.[11] Proinflammatory cytokines were shown to inhibit erythropoietin-induced erythrocyte maturation. Inflammation could lead to anisocytosis via release of immature red blood cells into the circulation.[12] As a newly popular prognostic marker, RDW has been evaluated in many clinical conditions in both chronical and acute settings.

However, to our knowledge, this is the first study where RDW was evaluated in acute strangulated hernia in emergency department settings. Small bowel obstruction may lead to strangulation and bowel necrosis, which is a serious condition where surgical intervention is mandatory.[13–15] A timely diagnosis is needed to prevent morbidity and mortality, which may occur if operative management

is delayed.[16,17] Bowel resection rate and morbidity increase in proportion to the time elapsed from the onset of symptoms. In a study, bowel resection rate in patients operated more than 48 hours from onset was 27%, when compared with 7% rate in patients operated within 24 hours from onset.[18,19]

In a retrospective study, mortality from septic shock was associated with higher RDW levels.[20] In addition to this, the elevation of RDW in 72 hours from the onset was found to be a prognostic factor for septic shock.[21] In a recent study by Senol *et al*,[4] increased RDW at admission was found to be an independent predictor of mortality in patients with acute pancreatitis. In our study, RDW level in the resection group was found to be significantly higher than the non-resection group and also slightly higher than the normal serum value. Our results might as well be applicable for small bowel obstructions arising from adhesions which are usually treated nonoperatively but always with a risk of impending strangulation.

Conclusion

Our data points out that RDW may have an importance in identifying strangulated hernias preoperatively, thus speeding up and directing the decision process. A randomized study is needed to confirm our results in hernias and for potential applications of RDW in other small bowel obstructions.

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