Peertechz

Medical Group

Global Journal of Perioperative Medicine

DOI CC By

Kyle G. Cologne[1]*, Loriel Liwanag[1], Bikash Devaraj[1], Elizabeth Arcila[1], Glenn T. Ault[1], Adrian E. Ortega[1] and Anthony J. Senagore[2]

[1]Division of Colorectal Surgery – Keck School of Medicine at the University of Southern California, Los Angeles, CA, USA
[2]University of Texas Medical Branch at Galveston, USA

Dates: Received: 13 December, 2016; **Accepted:** 03 February, 2017; **Published:** 06 February, 2017

***Corresponding author:** Kyle G. Cologne, MD, Division of Colorectal Surgery, Keck School of Medicine at the University of Southern California, Los Angeles, CA, USA, Tel: 323-865-3690; Fax: 323-865-3671, E-mail: kyle.cologne@med.usc.edu

Keywords: Colectomy; Inflammation; Postoperative complications; Readmission; Anastomotic leak

https://www.peertechz.com

Research Article

Predicting Readmission and Leak Rates Following Colectomy with Red Cell Distribution Width: A Simple but Effective Test

Abstract

Introduction: Prediction of readmission as a result of either delayed presentation of infection, or worse an anastomotic leak is difficult. Efficient reduction in the length of stay and being able to predict problematic patients who may be readmitted or develop complications would be advantageous. To date, other tests including CRP have proven to be insufficiently sensitive for this task.

Materials & Methods: We performed a single center, retrospective review of patients admitted to a large, urban safety net hospital who underwent colectomy over a two year period to determine the predictive value of red cell distribution width (RDW) on the development of anastomotic leak or readmission within 30 days following hospital discharge.

Results: A total of 118 patients underwent colectomy during this period. Readmission and/or anastomotic leak occurred in 49 patients. The sensitivity of elevated RDW levels (greater than or equal to 14.0) at detecting future readmission and/or leak was 89.8%. The negative predictive value for a normalized RDW below 14.0 at predicting the non-occurrence of leak or readmission was 87.7%. The specificity of an elevated RDW was 72.4% and the positive predictive value was 76.5%.

Conclusions: Elevated RDW level is a readily available criterion to predict readmissions and anastomotic leaks following colectomy. A normal RDW is a good predictor of an uncomplicated postoperative course and may potentially allow clinicians to feel more confident in early discharge of patients.

Introduction

Quality metrics are increasingly being scrutinized as part of today's health care environment. Two important quality metrics include length of stay and readmission rates. Colorectal surgery is known to have one of the highest morbidity rates, accounting for a disproportionate amount of complications compared with other procedures [1]. Readmission rates following colorectal surgery can be 20% or more [2-6]. The ability to predict some of these complications has been an elusive goal. Recent studies show that only a small proportion of readmissions could be predicted [7]. More importantly, pay for performance measures including readmission rates are currently used to drive reimbursement [8-9]. Therefore the ability to predict adverse events would be very helpful in assessing risk, as this can be used to adjust expected versus actual morbidity following surgery. Many studies have assessed inflammatory measures as potential predictors of anastomotic leak and readmission. In particular, there is some evidence that C-reactive protein (CRP), an acute phase reactant that is released in response to ongoing inflammation, can be predictive of leak or readmission following colorectal surgery [10-11]. None, however, have been sufficiently sensitive to withhold discharge compared to standard clinical assessment. We hypothesized that red cell distribution width (RDW) can be used as an alternative measure of ongoing nonspecific inflammation, and this may predict future morbidity.

RDW is a measure in size variation of circulating red blood cells. Increased size (anisocytosis) can represent a variety of conditions, including nutritional deficiency, various types of anemia, hemoglobinopathies and it is a non-specific marker of inflammation. It has previously been used to predict mortality, though its ability to predict other adverse events remains uncertain.

Citation: Cologne KG, Liwanag L, Devaraj B, Arcila E, Ault GT, et al. (2017) Predicting Readmission and Leak Rates Following Colectomy with Red Cell Distribution Width: A Simple but Effective Test. Glob J Perioperative Med 1(1): 008-012.

Methods

A retrospective review of patients admitted to a large, urban safety-net hospital over a two year period from 2010-2012. An administrative database kept within the division of all procedures performed was reviewed after Institutional Review Board approval was obtained. Variables obtained from a retrospective chart review included age, gender, surgical procedure, length of hospital stay (LOS), values of RDW at all time periods, the incidence of anastomotic leak, and readmission rates within 30 days following hospital discharge. While labs are typically obtained routinely on day 1 and 2 postoperatively (and include RDW), any laboratory values obtained later than this were deemed clinically necessary and not done as part of a standardized protocol. A cutoff of 14.0 was used as the upper limit of normal for RDW. The reference range for our laboratory was 9-14%. Positive and negative predictive values as well as sensitivity and specificity were calculated (as defined in Table 2). Inclusion criteria included any partial colectomy with an anastomosis ≥ 10 cm from the anal verge. Anastomotic leak was defined as contrast extravasation or peri-anastomotic fluid or gas on radiographic imaging or breakdown of the anastomosis seen at operative re-exploration. All surgeries were performed by a colorectal surgery resident or general surgery chief resident with the help of one of 5 board certified colorectal surgeons. All patients were managed postoperatively with an enhanced recovery protocol that has previously been published [12]. Discharge criteria included tolerance of a diet without need for supplemental intravenous fluids or intravenous narcotics, evidence of bowel function (flatus, bowel movement, or similar ostomy output), and no clinical concern for an infectious process such as anastomotic leak. Emergent cases were excluded.

Results

A total of 118 patients underwent colectomy during this period. Clinical characteristics can be found in Table 1. Fifty eight percent were male with an average age of 58.4±14.6. Average ASA was 2.9±0.6. Average LOS was 7.2± 8.6 days (range: 2-64). 58% of procedures were attempted laparoscopically with a conversion rate of 22.5%. Readmission and/or anastomotic leak occurred in 49 patients. There were 28 anastomotic leaks. Thirteen patients with a leak required reoperation. Four leaks (14%) were managed with antibiotics alone, and 11 (39%) required percutaneous drainage. Thirty-one patients (26.2%) were readmitted within 30 days following surgery. Ten patients overlap and had both a readmission and anastomotic leak detected at readmission. The remainder were diagnosed during the initial hospital stay. Readmission for leak represented roughly one third of the readmissions, and none appeared to be predicted based on clinical characteristics prior to discharge (such as leukocytosis, fever, lack of return of bowel function, or failure to reach discharge criteria). Specific RDW values and degree of elevation above 14 was not predictive of outcome more so than simply having an elevated RDW. There was no correlation of RDW values with the type of surgery, approach (laparoscopic vs. open), or primary pathology.

Table 1

Patient characteristics Age	58.4+14.6
ASA	2.4+0.4
BMI	28+5.9
%male	58%
Procedure	
Left Colectomy / Sigmoid	47% (55/118)
Right Colectomy	25% (30/118)
Low Anterior resection**	22% (26/118)
Total / Subtotal	6% (7/118)

ASA: American Society of Anesthesiologist's Score
*Of the 40 patients with cancer as indication for surgery
**Defined as resection to level below peritoneal reflection but above 10 cm

The sensitivity of elevated RDW levels (greater than or equal to 14.0) at detecting future readmission or anastomotic leak was 89.8%. The negative predictive value for a normalized RDW below 14.0 by the time of hospital discharge at predicting the non-occurrence of leak or readmission was 87.7% (Table 2). The specificity of an elevated RDW was 72.4% and the positive predictive value was 76.5%. Reasons for readmission are characterized in Table 3. There was no difference in readmission rates among various groups at high risk for alterations in RDW (Table 4). Positive predictive value for each individual event was lower: 42% for readmission, 48% for leak.

Discussion

The ability to predict (and therefore possibly prevent) complications such as readmission and anastomotic leak following surgery has been an elusive goal. Recent studies show that only a small proportion (21%) of surgical readmissions could be predicted [7].. Dehydration and infection were some of the more commonly cited areas of preventable readmissions – areas that we also saw as common reasons for admission. Thus, the ability to predict and therefore more closely scrutinize these patients may be a useful tool, particularly when pay for performance measures will start to use readmission rates as benchmarks. This is particularly true in tertiary care or safety net hospitals such as our own, where our previously reported results on complex patients suggest this is a difficult problem [9,13,14]. Therefore the ability to accurately adjust expected versus actual morbidity following surgery will become increasingly important, and there are limited tools for this type of evaluation. Our data suggests that RDW may be one tool to effectively do that.

There have been other studies, specifically regarding C-reactive protein (CRP) to try and achieve similar predictive models after colectomy. Krapta et al [15]. Demonstrated that non-elevation of CRP was able to accurately predict shorter length of hospital stay ($p<0.01$) with average CRP values of 6.3 in those with a LOS < 3 days, vs 11.7 in those with LOS > 4 days. Although the CRP values were different in readmitted vs. non-readmitted patients (11.8 vs. 9.9), the difference did not reach statistical significance. Despite the small sample size, their early data have given promise to the ability to predict adverse outcomes, and thus risk

Citation: Cologne KG, Liwanag L, Devaraj B, Arcila E, Ault GT, et al. (2017) Predicting Readmission and Leak Rates Following Colectomy with Red Cell Distribution Width: A Simple but Effective Test. Glob J Perioperative Med 1(1): 008-012.

Table 2: Sensitivity and Negative Predictive value of RDW at predicting readmission or leak following colectomy.

Number of Patients	118
Sensitivity of RDW > 14.0*	89.8%
Negative predictive value if RDW <14**	87.7%

*As defined as those with RDW>14 with leak or readmission (true positive) / (true positives +those with leak or readmission and RDW < 14). **Defined as those without leak or readmission and RDW < 14 (true negatives) / (true negatives + readmission or leak with RDW < 14).

Table 3: Readmission reasons (n=31)

Reason for Re-Admission	n (%)
Anastomotic Leak	10 (32%)
Ileus/small bowel obstruction	7 (23%)
SSI (other than leak)	5 (16%)
Ileostomy dysfunction	4 (13%)
Abdominal pain	2 (6%)
Upper GI bleed, stroke, UTI	Each n=1 (3%)

SSI (surgical site infection) UTI (urinary tract infection)

Table 4: Characteristics of higher risk groups with potentially altered RDW

	N	RDW>14	%readmission
All patients	118	68	26%
Age ≥ 65	20	10	30%C
BMI ≥ 30	45	28	28%
Male	69	35	18%

adjust predictive models in an era of pay for performance. Others have also investigated CRP as a predictor of safe, early discharge without subsequent complication. Giaccaglia et al [16]. Demonstrated a >96% negative predictive value for leak when the CRP was <16.9mg/mL on postoperative day 3 and >98% when CRP was <12.5mg/mL on day 5. While they suggested that procalcitonin may enhance this negative predictive effect, it is an expensive test [17], and not routinely ordered. IL-6 is another non-specific inflammatory marker that also has similar (albeit lower) predictive value for subsequent complications [18]. Ortega-Deballon et al [19] also showed that CRP (cutoff of 125 mg/L on postoperative day 4) had a negative predictive value of 95.8%. There is also a meta-analysis of 7 studies that demonstrated CRP was a useful negative predictive test for leak [20].

With these types of serum biomarkers for adverse events, authors have shown that a positive predictor of leak is a much more difficult entity. Our results suggest similar findings, in that positive predictive values overall were 76.5%, but were much lower for an individual event (42% for readmission, 48% for leak). No single biomarker has been shown to be effective to accurately predict a positive occurrence of a complication. However, negative prediction seems to be more feasible [21].

These serum biomarkers are not part of a routine order set, so we sought to characterize something that is readily available on existing tests. The role of RDW as related predictor has not been well characterized in colorectal surgery. However, there is some precedent that RDW values are a non-specific marker for ongoing inflammation and thus can potentially be used as a predictor of outcomes. It has been used to predict mortality in many medical patients [22-25], with hazard ratios for increased risk of death ranging from 1.09-1.31 for each 1% increase in RDW values. These differences in mortality persisted even after adjusting for severity using APACHE scores and including comorbid conditions such as renal failure, respiratory failure, and other potential confounding factors. It has been shown to potentially be superior to C-reactive protein (CRP) as a predictor of adverse outcome [26]. The true value of RDW in surgical patients has been incompletely studied. Our study suggests, as seen in the medical studies, that it may be helpful in predicting adverse outcomes.

In acute pancreatitis, Senol et al. [27] reported that an elevated RDW above 14.8 as part of a predictive model correctly predicted adverse outcome in 77% of cases. Elevated RDW has also been used to predict ongoing disease activity in ulcerative colitis and Crohn's disease patients [28-29]. These studies suggest that RDW can be used as an active predictor of ongoing inflammation, which could signify an impending problem such as anastomotic leak, abscess, or other problem that would require readmission. A study in hernia patients further substantiated this claim [30]. The ability to predict ongoing inflammation may not be as accurate in obese patients [31].

It has been established that an elevated RDW is a potential indication for colonoscopy. In one study, RDW was 84% sensitive and 88% specific for right sided colon cancer [32]. in appropriately selected patients. These numbers parallel our findings and further suggest the potential role for RDW of an ongoing inflammatory process.

There is much more limited data on surgical patients. Warwick et al. [33]. showed similar results to our study in lung surgical patients. RDW was a significant predictor in need for mechanical ventilation, LOS, in-hospital and long term mortality. Similar results were observed by Polat et al [34], who found that elevated RDW values were predictive of ICU and overall LOS as well as mortality in pediatric heart surgical patients. To our knowledge, this is the first application to colectomy patients, and the results suggest this could become a useful tool for predicting adverse outcomes. Our data are surprising in that such a simple test can be used to accurately predict adverse outcome, with sensitivity of 89.8%. Furthermore, the lack of elevation (negative predictive value for a normalized RDW) is also comforting in that it too predicts lack of adverse outcome (negative predictive value in our data = 87.7%). The test is not as specific, in that a number of other things may cause this elevation.

Several aspects of our study deserve some additional scrutiny. We describe a relatively high leak rate (23.7%) compared to reported data. This is likely a result of multiple factors, including the fact that our patient population is at high risk based upon advanced stage of disease, urgency of procedure, and nutritional deprivation. These are a byproduct of working at a large urban safety-net hospital. Of all surgeries, 46 were performed for cancer. Early T-stage

Citation: Cologne KG, Liwanag L, Devaraj B, Arcila E, Ault GT, et al. (2017) Predicting Readmission and Leak Rates Following Colectomy with Red Cell Distribution Width: A Simple but Effective Test. Glob J Perioperative Med 1(1): 008-012.

(T1 or T2) was seen in only 5 patients, with the remainder being T3 or T4. This significantly increased the complexity of many operations and is a factor with documented impact on preoperative inflammatory state, which likely contributed to the higher leak rates. Similarly, our patients are often disadvantaged with multiple comorbidities and limited home resources (average BMI 28+5.9, average ASA 2.4+0.4). We have previously published several works (including a large series) describing how infectious and other complications can be increased in our population [9,14]. This also likely contributed to increased length of stay (7.2 days) and higher readmission rates (26.2%). Within this as our study population, an elevated RDW was highly predictive of certain postoperative problems that are becoming increasingly scrutinized. More importantly, a normal RDW had a high negative predictive value for the non-occurrence of adverse events (87.7%), which may be the more important point as it is difficult to know what to do with an elevated nonspecific inflammatory marker.

It seems clear that RDW may have a role in predicting adverse events, particularly non-occurrence if the value is within the normal range. As it is a component of a CBC (which is ordered as a part of most routine lab work postoperatively), it can be a simple, but effective additional factor that allows early discharge with confidence after colorectal surgery.

Our study also has several limitations. It is a single center, retrospective study, with a small overall number of patients. This may limit the generalizability of our findings. Second, the measurement of RDW values was not standardized as part of a protocol, nor were baseline values prior to surgical intervention obtained. While it would be ideal to correlate preoperative with postoperative high risk variables (such as anemia and pre-existing elevated RDW), this information was not universally available in our patient population, as many preoperative tests were done outside and this information was unable to be obtained. Furthermore, ongoing treatments such as chemotherapy and other condtions may have had an effect on RDW values. Since this information was not always available, we could not account for these potential confounders. An additional consideration is that different lab instruments may yield a different reference range, so results are not always generalizable (Lippi et al. 2014 (Clin Biochem 47:1100-1103). Complications and anastomotic leak rates were quite high, likely as a result of our complex patient population with advanced disease and multiple risk factors for complications [9,14]. This could bias the results and make them less applicable in other scenarios, as our patients may have had a higher pre-test probability for detecting problems. For this reason, we also include the negative predictive value, which is also insightful and as pointed out earlier, probably more feasable than positive predictive values (which have proven remarkably elusive). Finally, RDW is a non-specific laboratory value and the clinical implications of an elevated value are uncertain (as it could represent a wide range of etiologies). This problem has also been seen with other non-specific inflammatory markers (e.g. CRP). Similarly, the accuracy of either occurrence alone (e.g. leak alone or readmission alone), is not as good as a composite using both endpoints. This is because there is a process going on that may give a false representation of what is going on if only one is investigated. Despite this, the use of RDW is a readily attainable factor that can be useful in predicting readmission and leak rates following major colorectal surgery. Our results show some initial promise regarding this approach and further study is needed. It remains unclear whether the threshold for discharge should be higher in patients who do not have RDW<14, but our study suggests they should perhaps have closer follow-up. Larger, more prospective and randomized studies will be required to confirm these findings.

References

1. Schilling PL, Dimick JB, Birkmeyer JD (2008) Prioritizing quality improvement in general surgery. J Am Coll Surg 207: 698-704. Link: https://goo.gl/yqNgbS

2. O'Brien DP, Senagore A, Merlino J, Brady K, Delaney C (2007) Predictors and outcome of readmission after laparoscopic intestinal surgery. World JSurg 31: 2430-2435. Link: https://goo.gl/aGNnii

3. Andersen J, Hjort-Jakobsen D, Christiansen PS, Kehlet H (2007) Readmission rates after a planned hospital stay of 2 versus 3 days in fast-track colonic surgery. Br J Surg 94: 890-893. Link: https://goo.gl/BCi6he

4. Delaney CP (2008) Outcome of discharge within 24 to 72 hours after laparoscopic colorectal surgery. DisColon Rectum 51: 181-185. Link: https://goo.gl/d5f3p0

5. Guinier D, Mantion GA, Alves A, Kwiatkowski F, Slim K, et al.(2007) Risk factors of unplanned readmission after colorectal surgery: a prospective, multicenter study. Dis ColonRectum 50: 1316-1323.Link: https://goo.gl/zDRmyY

6. Kariv Y, Delaney CP, Senagore AJ, Manilich EA, Hammel JP, et al. (2007) Clinical outcomes and cost analysis of a „fast track" postoperative care pathway for ileal pouch-anal anastomosis: a case control study. Dis Colon Rectum 50: 137-146. Link: https://goo.gl/xvcxP6

7. Dawes AJ, Sacks GD, Russell MM, Lin AY, Maggard-Gibbons M, et al (2014) Preventable readmissions to surgical services: lessons learned and targets for improvement. J Am Coll Surg 219: 382-389. Link: https://goo.gl/ekZg9J

8. Khanduja K, Scales DC, Adhikari NK (2009) Pay for performance in the intensive care unit – opportunity or threat? Crit Care Med 37:852-858. Link: https://goo.gl/rNOAGd

9. Cologne KG, Hwang GS, Senagore AJ (2014) Cost of practice in a tertiary/quaternary referral center: Is it sustainable? Tech Coloproctol 18: 1035-1039. Link: https://goo.gl/P27pPa

10. Korner H, Nielsen HJ, Soreide JA, Nedrebø BS, Søreide K, et al. (2009) Diagnostic accuracy of C-reactive protein for intraabdominal infections after colorectal resections. JGastrointest Surg 13: 1599-1606. Link: https://goo.gl/Sm6czY

11. Welsch T, Muller SA, Ulrich A, Kischlat A, Hinz U, et al. (2007) C-reactive protein as early predictor for infectious postoperative complications in rectal surgery. Int J ColorectalDis 22: 1499-1507. Link: https://goo.gl/vPkiuw

12. Rona K, Choi J, Sigle G, Kidd S, Ault G, et al. (2012) Enhanced recovery protocol: implementation at a county institution with limited resources. Am Surg 78:1041-1044. Link: https://goo.gl/Edprrn

13. Cologne KG, Keller DS, Liwanag L, Devaraj B, Senagore AJ (2014) Use of the American College of Surgeons NSQIP surgical risk calculator for laparoscopic colectomy: How good is it and how can we improve it? J Am Coll Surg 220: 281-286. Link: https://goo.gl/uYDyfx

14. Cologne KG, Skiada D, Beale E, Inaba K, Senagore AJ, et al. (2014) Effects of diabetes mellitus in patients presenting with diverticulitis: clinical

Citation: Cologne KG, Liwanag L, Devaraj B, Arcila E, Ault GT, et al. (2017) Predicting Readmission and Leak Rates Following Colectomy with Red Cell Distribution Width: A Simple but Effective Test. Glob J Perioperative Med 1(1): 008-012.

correlations and disease characteristics in more than 1,000 patients. J Trauma Acute Care Surg 76: 704-709. Link: https://goo.gl/GY0dLk

15. Krapta DM, Keller DS, Samina H, Lawrence J, Obokhare I, et al. (2013) Evaluation of inflammatory markers as predictors of hospital stay and unplanned readmission after colorectal surgery. Pol J Surg 85:198-203. Link: https://goo.gl/yBkYd4

16. Giaccaglia V, Salvi PF, Antonelli MS, Nigri G, Pirozzi F, et al. (2016) Procalcitonin reveals early dehiscence in colorectal surgery. The PREDICS Study. Ann Surg 263: 967-792. Link: https://goo.gl/2tC6ck

17. Dupre A, Rivoire M, Gagniere J, Karem S, Samba H (2016) CRP predicts safe patient discharge after colorectal surgery. Ann Surg Link: https://goo.gl/lusJHd

18. Rettig TC, Verwijmeren L, Dijkstra IM, Boerma D, van de Garde EM, et al. (2016) Postoperative Interleukin-6 Level and Early Detection of Complications After Elective Major Abdominal Surgery. Ann Surg 263:1207-1212. Link: https://goo.gl/r4vA4u

19. Ortega-Deballon P, Radais F, Facy O, d'Athis P, Masson D, et al. (2010) C-reactive protein is an early predictor of septic complications after elective colorectal surgery. World J Surg 34:808-814. Link: https://goo.gl/0f2Qsm

20. Sing PP, Zeng IS, Srinivasa S, Lemanu DP, Connolly AB, et al. (2014) Systematic review and meta-analysis of use of serum C-reactive protein levels to predict anastomotic leak after colorectal surgery. Br J Surg 101:339-346. Link: https://goo.gl/YCks27

21. Dupee A, Slim K (2012) Anastomotic leakage after colorectal surgery: can it be detected earlier and more easily? J Visc Surg 149:3287-3288. Link: https://goo.gl/5yRV9S

22. Perstein TS, Weuve J, Pfeffer MA, Beckham JA (2009) Red blood cell distribution width and mortality risk in a community-based prospective cohort: NHANES III: RDW and mortality risk. Arch Int Med 169:588-594. Link: https://goo.gl/mikner

23. Hunziker S, Celi LA, Lee J (2012) Howell MD Red cell distribution width improves the simplified acute physiology score for risk prediction in unselected critically ill patients. Crit Care 15:R89. Link: https://goo.gl/Dtcw2c

24. Patel KV, Ferucci L, Ershler WB, Longo DL, Guralnik JM (2009) Red cell distribution width and the risk of death in middle-aged and older adults. Arch Int Med 169:515-523. Link: https://goo.gl/D0lXFb

25. Wang F, Pan W, Pan S, Ge J, Wang S, et al. (2011) Red cell distribution width as a novel predictor of mortality in ICU patients. Ann Med 43:40-46. Link: https://goo.gl/Dy57Fz

26. Veeranna V, Zalawadiya SK, Panaich S, Patel KV, Afonso L (2013) Comparative analysis of red cell distribution width and high sensitivity C-reactive protein for coronary artery disease mortality prediction in multi-ethnic population: Findings from 1999-2004 NHANES. Int J Cardiol 168:5156-5161. Link: https://goo.gl/mcSsZN

27. Senol K, Saylam B, Kocaay F, Tez M (2013) Red cell distribution width as a predictor of mortality in acute pancreatitis. Am J Emergen Med 31:687-689. Link: https://goo.gl/BPCzWp

28. Song CS, Park DI, Yoon MY, Seok HS, Park JH, et al. (2012) Association between red cell distribution width and disease activity in patients with inflammatory bowel disease. Dig Dis Sci 57:1033-1038. Link: https://goo.gl/HdvKKl

29. Yesil A, Senates E, Bayoglu IV (2011) Gut and Liver 5:460-467.

30. Geletzke AK, Rinaldi JM, Phillips BE, Mobley SB, Miller J, et al. (2014) Prevalence of systemic inflammation and micronutrient imbalance in patients with complex abdominal hernias. J Gastrointest Surg18:646-655. Link: https://goo.gl/oLIvvW

31. Vaya A, Alis R, Hernandez-Mijares A, Solá E, Cámara R, et al. (2014) Red blood cell distribution width is not related with inflammatory parameters in morbidly obese patients. Clin Biochem 47:464-466. Link: https://goo.gl/4zkCh3

32. Spell DW, Jones Jr. DV, Harper WF, Bessman JD (2004) The value of a complete blood count in predicting cancer of the colon. Cancer Detection Prev 28:37-42. Link: https://goo.gl/rLUeGq

33. Warwick R, Mediratta N, Shackcloth M, Shaw M, McShane J, et al. (2014) Preoperative red cell distribution width in patients undergoing pulmonary resections for non-small cell lung cancer. Eur J Cardiothoracic Surg 45:108-113. Link: https://goo.gl/7onH7T

34. Polat V, Iscan S, Etli M, Helin EK, Gürsu Ö, et al (2014) Red cell distribution width as a prognostic indicator in pediatric heart disease and after surgery. BioMed Research International 2014:1-6. Link: https://goo.gl/el8ov1

Citation: Cologne KG, Liwanag L, Devaraj B, Arcila E, Ault GT, et al. (2017) Predicting Readmission and Leak Rates Following Colectomy with Red Cell Distribution Width: A Simple but Effective Test. Glob J Perioperative Med 1(1): 008-012.