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Letter to Editor

C-reactive protein for predicting infectious complications after colorectal surgery within enhanced recovery after surgery: Results from Thailand's largest university hospital

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To the editor,

Enhanced recovery after surgery (ERAS) promotes patients recovery and allows an early discharge. However, some infectious complications including wound infection and anastomotic leakage might not be clinically presented in the immediate postoperative period thus resulting in unplanned revisiting and readmission.¹ This suggests that clinical criteria for patient's discharge in ERAS program may be insufficient for a safe and early discharge. Accordingly, many surgeons have used C-reactive protein (CRP), an acute phase protein produced by hepatocytes in a response to pro-inflammatory cytokines with a half-life of 20 h, as a sensitive biomarker to predict postoperative infectious complications.² Several systematic reviews and meta-analyses have shown that serum CRP level on postoperative day (POD) 3 had a high diagnostic accuracy for detecting infectious complications following colorectal surgery with a cut-off CRP value of 140–180 mg/L.^{3,4} However,

these results were mainly derived from Western population. It is known that CRP could differ among ethnics – in which Asian populations have a lower CRP level than Caucasians.⁵ Also, there is no published study evaluating the association between CRP and complications following colorectal surgery within well-established ERAS in Asia.

To ascertain the impact of CRP on postoperative infectious complications in Asian people, we reviewed a prospectively-collected ERAS registry of patients undergoing 'elective' open colectomy and/or proctectomy from 2016 to 2019 at the Faculty of Medicine Siriraj Hospital - the largest tertiary hospital in Thailand. Two practical cut-off values of CRP on POD 3 were determined for predicting overall and intraabdominal infectious complications using logistic regression and areas under the receiver operating characteristic curve (AUC).

This study included 174 eligible patients with median age of 65 years. Most operations (93%) were for colorectal cancer. Thirteen cases (7.5%) developed infectious complications within POD 30. Seven cases (4%) had either anastomotic leakage or infected intra-abdominal collection/abscess. Patients with infectious complications had a significantly higher level of CRP on POD 3 than those without: 160 (IQR 114–229) vs 89 (IQR 59–125) mg/L, $p < 0.001$ – so did the patients with intraabdominal infectious complications: 229 (IQR 156–270) vs 90 (IQR 59–127) mg/L, $p = 0.002$.

According to the AUC of 0.78 (95%CI 0.65–0.92) for the highest diagnostic accuracy for predicting infectious complications, the optimal cut-off value of CRP on POD 3 was 133 mg/L – with sensitivity 69.2%, specificity 79.5%, positive predictive value (PPV) 21.4%, negative predictive value (NPV) 97.0% and accuracy 78.7%.

Table 1

Diagnostic values of C-reactive protein (CRP) on postoperative day 3 for predicting overall and intraabdominal infectious complications following 174 elective major colorectal operations within enhanced recovery after surgery. Results are presented as number, or percentage (95% confidence interval).

	Overall infectious complications	Intraabdominal infectious complications
Number of patients (cases)	13 ^a	7
Complication rate (%)	7.5 (4.0–12.4)	4.0 (1.6–8.1)
CRP cut-off value (mg/L)	133	216
Sensitivity (%)	69.2 (38.6–90.9)	71.4 (29.0–96.3)
Specificity (%)	79.5 (72.4–85.5)	94.0 (89.3–97.1)
Positive predictive value (%)	21.4 (14.5–30.5)	33.3 (18.9–51.7)
Negative predictive value (%)	97.0 (93.4–98.6)	98.7 (96.1–99.6)
Accuracy (%)	78.7 (71.9–84.6)	93.1 (88.3–96.4)

^a Note: 13 cases; 5 superficial incisional surgical site infection (SSI) with CRP level of 48, 114, 134, 139 and 160 mg/L; 5 intraabdominal collection/abscess with CRP level of 92, 94, 229, 266 and 281 mg/L; 1 anastomotic leakage requiring reoperation with CRP level of 274 mg/L; 1 superficial incisional SSI and pelvic collection/abscess with CRP level of 218 mg/L; 1 deep incisional SSI with CRP level of 181 mg/L.

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According to the AUC of 0.85 (95%CI 0.69–1.00) for the highest diagnostic accuracy for predicting intraabdominal infectious complications, the optimal cut-off value of CRP on POD 3 was 216 mg/L – with sensitivity 71.4%, specificity 94.0%, PPV 33.3%, NPV 98.7%, and accuracy 93.1% (Table 1).

This study demonstrated that CRP <133 mg/L on POD 3 had a high NPV for predicting infectious complications after open colorectal surgery within ERAS. Patients could be discharged safely if their CRP level was below this value and clinical criteria of discharge were fulfilled. Meanwhile, CRP >216 mg/L raised suspicion of anastomotic leakage, infected intraabdominal collection/abscess thus requiring close monitoring or early investigation including abdominal CT.

Statement of ethics

The study protocol was approved by the institutional ethics committee of Faculty of Medicine Siriraj Hospital (Certificate of Approval: Si 498/2017)

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Author contributions

VL outlined the content. VL, BP and SL collected data. VL and BP interpreted and analyzed data. BP reviewed literature. VL wrote the manuscript. BP and SL critically reviewed the manuscript. All authors approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Declaration of competing interest

The authors declare that we have no conflict of interest.

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References

1. Lohsiriwat V. The influence of preoperative nutritional status on the outcomes of an enhanced recovery after surgery (ERAS) programme for colorectal cancer surgery. *Tech Coloproctol.* 2014;18:1075–1080.
2. Pepys MB, Hirschfield GM. C-reactive protein: a critical update. *J Clin Invest.* 2003;111:1805–1812.
3. Cousin F, Ortega-Deballon P, Bourredjem A, Doussot A, Giaccaglia V, Fournel I. Diagnostic accuracy of procalcitonin and c-reactive protein for the early diagnosis of intra-abdominal infection after elective colorectal surgery: a meta-analysis. *Ann Surg.* 2016;264:252–256.
4. Singh PP, Zeng IS, Srinivasa S, Lemanu DP, Connolly AB, Hill AG. Systematic review and meta-analysis of use of serum C-reactive protein levels to predict anastomotic leak after colorectal surgery. *Br J Surg.* 2014;101:339–346.
5. Kelley-Hedgpeeth A, Lloyd-Jones DM, Colvin A, et al. Ethnic differences in C-reactive protein concentrations. *Clin Chem.* 2008;54:1027–1037.

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