Title

The full blood count blood test for colorectal cancer detection: a systematic review, meta-analysis, and critical appraisal

Authors and affiliations

Pradeep S. Virdee[1], Ioana Marian[1], Anita Mansouri[1], Leena Elhussein[1], Shona Kirtley[1], Tim Holt[2], Jacqueline Birks[1, 3]

[1]Centre for Statistics in Medicine, NDORMS, University of Oxford, OX3 7LD, UK

[2]Nuffield Department of Primary Care Health Sciences, University of Oxford, Oxford, OX2 6GG, UK

[3]NIHR Oxford BRC, Oxford University Hospitals NHS Foundation Trust, John Radcliffe Hospital, Oxford, OX3 9DU, UK

Introduction

Colorectal cancer is common in the UK. Around 55% of patients are diagnosed late-stage (Stage 3 and 4), where likelihood of survival is reduced: five-year survival is 93% at Stage 1 versus 10% at stage 4. A full blood count (FBC) is a common blood test including 20 individual parameters, such as haemoglobin and platelets. We systematically reviewed studies that assessed the use of the FBC for colorectal cancer diagnosis, identifying opportunities for early detection. We also reviewed FBC-based prediction models for colorectal cancer risk.

Methods

MEDLINE, EMBASE, CINAHL, and Web of Science were searched until 3rd September 2019 to identify relevant studies. For each parameter, the mean difference between patients with and without diagnosis was meta-analysed if at least three studies had available data. Otherwise, summary statistics

were used. A two-sided 5% significance level was used for statistical testing. We critically appraised the development and validation of FBC-based prediction models.

Results

We included 53 eligible articles. In meta-analysis, patients diagnosed had statistically significantly lower haemoglobin (1.87 (95% CI=1.33-2.42) g/dL) and higher white blood cell count (0.58 (95% CI=0.40-0.75) 10^9/L) and platelets (53.29 (95% CI=39.69-66.89) 10^9/L 0-6 months from the FBC measurement compared to patients without a diagnosis. Mean platelet volume showed no association (0.06 (95% CI=-0.36-0.49) fL). Of the remaining 16 parameters with insufficient data for meta-analysis, red blood cell count, mean corpuscular volume, and red blood cell distribution width were associated with diagnosis in all studies, with FBCs measured more than three years before diagnosis in some studies.

Thirteen FBC-based prediction models were identified. Model performance was commonly assessed using the c-statistic (range 0.72-0.91) and calibration plots. Some models with reportedly good performance include symptoms to make long-term predictions, but performance may be driven by many short-term diagnoses in symptomatic individuals.

Conclusion

Changes in red blood cells, haemoglobin, mean corpuscular volume, red blood cell distribution width, white blood cell count, and platelets are associated with diagnosis and could warrant further investigation. Existing FBC-based prediction models might not perform as well as expected and need further critical testing.

Impact statement

Guide development of a new prediction model for early detection, potentially saving many lives.