Title

Trends over time in the full blood count blood test for colorectal cancer detection

Authors and affiliations

Pradeep S. Virdee[1], Jacqueline Birks[1, 2], Tim Holt[3]

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

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

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

Introduction

The full blood count (FBC) is a common blood test performed in general practices and consists of up to 20 individual parameters. Our recent systematic review has highlighted that many individual FBC parameters change over time, and these changes are influenced by the presence of colorectal cancer. Our aim was to identify trends over time in the FBC to facilitate early detection of colorectal cancer.

Methods

We performed a retrospective, longitudinal, case-control analysis. FBC data were obtained from the Clinical Practice Research Datalink, an electronic record of UK primary care patient data. We used mixed effects models to model FBC data up to 10 years before diagnosis in cases or a randomly selected end date in the patient's record for healthy controls. Models included age at diagnosis/end date, time before diagnosis/end date, colorectal cancer status, and an interaction between the latter two as fixed effects. Each patient was modelled using a random intercept and time using a random slope with an unstructured covariance matrix to account for repeated measures. In FBC parameters with apparent differences between cases and controls over time, time was also modelled using

penalised splines as random effects, with a knot at each year from one to nine years. Analyses were stratified by sex. Male cases were matched 1:10 and female cases 1:31 to make use of as much of the data available. A two-sided 5% significant level was used for statistical testing.

Results

Of 61,655 males included, 9.1% (n=5,605) had a colorectal cancer diagnosis. Of 156,160 females, 3.1% (n=4,880) had colorectal cancer. On average, there was no apparent difference between cases and controls in all FBC parameters from 4-10 years before a diagnosis/end date. Within 4 years, FBC results for cases diverged from controls for many parameters, including red blood cell count, haemoglobin, white blood cell count, and platelets. Often, the rate of change increased as diagnosis approached.

The World Health Organisation defines anaemia as <13g/dL for males and <12g/dL for females, which is a known risk factor for colorectal cancer and is used in general practice as a criterion for referral for further testing. On average, anaemia appeared around 6 months before diagnosis for both males and females. However, trends over time between cases and controls diverged at much earlier time points (up to 4 years).

Conclusion

The changes in the FBC levels over time are different between those with and without a diagnosis. Our trends could help identify those with colorectal cancer earlier than relying on the onset of symptoms.