Screening for Early-Onset Colorectal Cancer: Current Limitations, Barriers to Early Detection and Future Directions- A Literature Review

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Abstract

Colorectal cancer (CRC) is considered a disease of older adults, however the incidence of early onset colorectal carcinoma (EOCRC), defined as diagnosis before the age of 50 years, has been rising in many populations. The majority of screening programmes have contributed to declining CRC mortality in older individuals, however young adults are excluded from these routine screening methods. Therefore, EOCRC is frequently diagnosed after symptom onset, often at an advanced stage with poor prognosis. This review examines CRC screening in young adults, focusing on epidemiology, risk factors, limitations of age-based screening, and challenges in early detection. It evaluates current screening modalities and identifies gaps in detection strategies for this population. Literature was identified using PubMed, Embase, and the Cochrane Library. Studies published between 2010 and 2025 addressing EOCRC epidemiology, risk factors, screening modalities, and early detection were included following title and abstract screening. Despite rising EOCRC incidence, significant barriers to early detection persist. Non-specific symptoms are frequently misattributed to benign conditions, delaying investigation. In addition, age-based referral practices limit access to diagnostic procedures such as colonoscopy. Although screening strategies such as faecal immunochemical testing (FIT) have been implemented in some countries, individuals under 45–50 years are largely excluded from routine screening. EOCRC represents an emerging clinical challenge not adequately addressed by current screening strategies. Greater clinical awareness and the development of risk-stratified screening approaches are required to improve early detection and outcomes in younger populations.

Epidemiology

Colorectal cancer (CRC) is a growing global health concern, currently ranking as the third leading cause of cancer-related mortality worldwide. CRC has been traditionally associated with malignancy of older adults, with the median age of diagnosis at approximately 70 years in both men and women (1). However, recent evidence demonstrates a significant rise in CRC in individuals under the age of 50, a subgroup known as early onset colorectal cancer (EOCRC).

Studies have shown that the incidence of CRC in adults under 50 years has increased by almost 1.4%, while there has been a decline in incidence in adults over the age of 50 by approximately 3.1% yearly, due to established screening programmes (2). According to GLOBOCAN, there were approximately 188,069 new cases of EOCRC globally with increasing incidence in different countries and greater chances in developing countries (3). The increasing trend in EOCRC may include primary risk factors such as

genetic predispositions or lifestyle factors such as smoking, excessive alcohol intake, physical inactivity and diets high in red and processed meats.

Despite increased incidence, most CRC screening programmes remain age restricted, typically designed for individuals over the age of 50, therefore excluding younger adults from routine screening. As a result, EOCRC is often diagnosed following symptom onset, which usually presents at a more advanced stage with aggressive tumour characteristics and a poor prognosis (1). A meta-analysis demonstrated that 60% of EOCRC versus 49% of CRC were diagnosed at an advanced stage (stage III-IV), with significantly higher rates of distant and regional metastasis in young patients (4). This presentation at an advanced stage contributes to poor survival outcomes compared to older adults who are diagnosed earlier, typically between stages 1-2. A significant proportion of EOCRC cases occurs in individuals without traditional risk factors, highlighting the gaps present in screening strategies (5).

Risk factors relevant to early onset CRC

Genetic and Hereditary Risk Factors

Early-onset colorectal cancer (EOCRC) is increasingly recognised in individuals under 50 years of age, with established risk factors including male sex and family history of colorectal cancer (6). Hereditary syndromes play a significant role, particularly those involving germline mutations that predispose individuals to malignancy.

Inflammatory Factors

Chronic inflammatory conditions, such as Inflammatory Bowel Disease (IBD), are strongly associated with increased risk of EOCRC (6). Chronic intestinal inflammation promotes an inflammation dysplasia carcinoma sequence, characterised by oxidative stress, impaired epithelial barrier function and clonal expansion of genetically dysregulated epithelial cells. This creates a pro-malignant environment that drives genomic and epigenetic instability, with alterations involving chromosomal instability, microsatellite instability, and CpG island methylation observed in subsets of cases (7).

Lifestyle Factors

Western, processed diets can promote gut dysbiosis and enrichment of sulfur-metabolising bacteria, increasing hydrogen sulfide production and mucosal injury. Alcohol intake leads to acetaldehyde accumulation, generating reactive oxygen and nitrogen species that damage DNA and disrupt intestinal homeostasis (7). Moreover, obesity contributes to EOCRC risk through insulin resistance and chronic low-grade inflammation. Similarly, smoking promotes tumourigenesis through exposure to carcinogenic compounds that induce DNA damage and epigenetic modification (7).

Current Screening Modalities and Limitations in Young Adults

Faecal Immunological Testing (FIT)

Incidence of CRC in young adults has progressively risen over time, emphasizing the importance of early screening. Current screening approaches include faecal based and endoscopic methods, with Faecal immunological testing (FIT) and Colonoscopies as widely used first line choices.

FIT is a commonly used tool in many countries, as it is non-invasive and easy to administer. It involves using antibodies that target human haemoglobin to detect occult blood in stool samples (8). Multitarget Stool DNA testing can be used in adjunct with FIT to enhance its sensitivity by detecting methylated and tumour associated DNA. Studies have shown that FIT has good sensitivity for detection of CRC, however, its sensitivity for advanced adenomas is substantially lower (9). The performance of FIT also varies across age groups. Evidence from a recent study assessed FIT in symptomatic patients under 50 years old, and found that although sensitivity was high, the positive predictive value (PPV) was low in patients under 40, demonstrating that FIT may not be suited for those in this population without the addition of risk stratification (10).

Notably, evidence from population-based cohort studies suggests that initiating FIT screening at 40-49 years old may be associated with reduction in CRC mortality and incidence compared with starting screening at age 50 (11).

Endoscopic Screening

Colonoscopy is used for direct visualisation and biopsy of colorectal lesions, offering a high sensitivity for CRC, while also enabling detection and removal of precancerous polyps (12). Colonoscopies are often performed following a positive non-invasive test, but can be used as a primary screening method as well. Despite its high sensitivity, adherence rates are generally low compared to FIT based screening, as it is an invasive procedure, requiring bowel preparation and sedation (13). In young adults, additional barriers include lower perceived risk and reduced likelihood of referral to endoscopy services, which may contribute to delayed diagnosis in this population (14).

Alternative Modalities

Computed tomography (CT) colonograms detect intestinal polyps through three dimensional reconstruction of the colon. Although it is less invasive and does not need sedation, it does require bowel preparation and may account for further investigations due to extracolonic findings. In younger populations, where adherence to invasive procedures such as colonoscopy may be lower and screening is not routinely implemented, CT colonography may represent a potential alternative. However, its role remains limited due to a lack of robust evidence and concerns regarding cost-effectiveness and follow-up requirements (15) (16).

Barriers in screening in young adults

The most significant barrier to diagnosing CRC in young adults is related to patient age. Symptoms such as altered bowel habits, abdominal pain, and rectal bleeding are important but non-specific features of CRC and are highly prevalent in the general population. However, these symptoms are often attributed to benign conditions, resulting in delayed investigation (17)(18).

Furthermore, younger adults face additional barriers to accessing healthcare. They are less likely to be referred for specialist assessment or diagnostic investigations, particularly due to the non-specific nature of their symptoms (18). Even when referral occurs, access to colonoscopy may be limited due to age-based triage systems that prioritise older individuals, which can further delay investigation in younger patients whose symptoms are perceived as lower risk.

Implications and future directions

In young adults, early-onset colorectal cancer (EOCRC) is frequently diagnosed at advanced stages due to delayed detection. This is largely due to asymptomatic screening programmes that enable detection of stage I–II disease in older populations that are not routinely implemented in younger individuals. Consequently, diagnosis in young adults relies predominantly on symptom presentation. The misattribution of early symptoms to benign conditions, further contributes to delayed diagnosis (17). As a result, colorectal cancer is less frequently suspected in this age group, leading to prolonged diagnostic delay.

Over time screening guidelines from across countries have begun to adapt to the rising incidence of EOCRC. In the United States, the recommended screening age has been lowered to 45 years for at-risk individuals. Similarly, the UK has incorporated biennial FIT testing starting at age 50 into their screening programmes (8). Significant guideline changes have also been observed in many other regions to account for the rapidly increasing number of younger colorectal cancer patients. However, as these changes are recent, their impact on CRC incidence and effectiveness in reducing mortality in younger populations has yet to be understood. Longitudinal studies evaluating the effectiveness of lowered screening thresholds in reducing EOCRC burden are needed. Despite these changes, individuals under 45 years old are largely excluded from routine screening programmes, highlighting a continued gap in early detection.

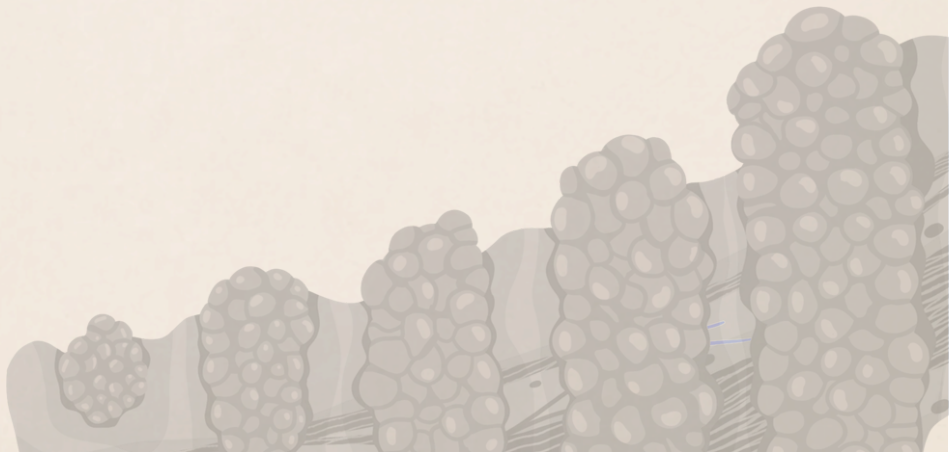
EOCRC is therefore more commonly diagnosed at an advanced stage, with multiple studies demonstrating that patients under 50 years of age are more likely to present with stage III–IV disease compared with older adults. To address this, risk-stratified screening approaches have been proposed. These include the use of polygenic risk scores (PRS) and environmental risk scores (ERS) to identify younger individuals at increased risk who may benefit from earlier screening, potentially in their 30s or 40s (19). Risk stratification incorporates familial predisposition, with individuals who have a first-degree relative with colorectal cancer or a family history of early-onset disease being at higher risk. In addition, symptom-based stratification highlights clinical red flags such as persistent rectal bleeding, iron-deficiency anemia, unintentional weight loss, sustained changes in bowel habits, and abdominal pain accompanied by systemic features. Medical history is also relevant, as individuals with conditions such as inflammatory bowel disease are at increased risk and should be evaluated with a lower threshold for investigation (20).

Despite this, current risk-stratification models have important limitations. Environmental risk scores rely predominantly on adult lifestyle data and self-reported exposures, which may fail to capture critical early-life and adolescent risk factors that are particularly relevant to EOCRC. Future improvements in screening strategies should focus on developing multivariable risk models that incorporate childhood exposures, antibiotic use, microbiome alterations, early-life diet, and obesity trajectories (19). Integrating these factors may enable more accurate identification of high-risk young adults and facilitate earlier detection of EOCRC.

Conclusion

The emerging incidence of EOCRC questions the effectiveness of current age based screening strategies, which largely excludes individuals under 45-50 years of age. As a result, EOCRC is diagnosed at advanced stages, contributing poor survival outcomes in this population in comparison to older adults. While existing strategies such as FIT and colonoscopy are effective in the older population, the use in younger adults remains limited due to its low PPV, aged base referral and reduced clinical suspicion. Studies suggest that initiating screening at younger ages may reduce CRC incidence and mortality, however, rigorous evidence based studies are needed. EOCRC risk is heterogeneous and shaped by factors such as genetic susceptibility, inflammatory conditions and modifiable lifestyle factors, many of which are not integrated in current screening models. Therefore, risk stratified approaches that incorporate these factors is a potential framework for identifying high risk young adults.

In order to bridge these gaps, a combination of individualized screening strategies, increased clinical awareness and further longitudinal research is required to evaluate the effectiveness of targeted early screening in this population.



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