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Prehabilitation for older patients with colorectal cancer: patient selection, targets and effectiveness

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General introduction



GENERAL INTRODUCTION

In general, there is no doubt about the necessity of a strict training program, adequate nutrition, and social support to succeed in running a marathon [1]. Therefore, it feels reasonable that the similar pillars - physical training, nutritional supplements, and mental support - will help to resist the impact of surgery. This concept is also known as 'prehabilitation'.

Prehabilitation is a multidisciplinary approach that aims to enhance physical capacity prior to surgery and subsequently to improve postoperative outcome. Multimodal prehabilitation includes exercise, nutritional advice, psychosocial support, smoking cessation, and additional medical optimization. Prehabilitation has been studied for various types of surgery, such as spinal, cardiac, aortic, and cancer surgery.

In recent years, prehabilitation is increasingly executed in clinical practice, especially in the field of colorectal cancer (CRC). In the Netherlands, colon and rectal cancer have a serious health impact with 12.000-13.000 new cases per year. Surgery is still the primary treatment option. Because more than half (approximately 55%) of the newly diagnosed patients are 70 years and older [2], surgeons are frequently performing cancer resections in this older population.

Surgery is considered a major stressor and therefore it is not remarkable that older patients with CRC have an increased risk of mortality, complications and increased length of stay after surgery compared to younger patients [3-5]. However, age itself is not the sole determinant of these unfavorable outcomes. Other patients' characteristics are responsible for the increased risk of adverse postoperative outcomes. Identifying these risk factors is challenging, especially in a population that consists of individuals with extremely different health and functional life courses. Frailty - a decreased physiological state based on somatic, functional, cognitive, and psychosocial aspects - is therefore an interesting and relevant patient characteristic. Several studies have demonstrated that frailty is not only associated with mortality and morbidity after CRC surgery, but also with functional decline and lower quality of life [6-8]. The golden standard for identifying frailty includes a geriatric screening followed by a geriatric assessment (GA), that describes somatic, functional, cognitive, and psychosocial impairments.

The complication rate and the risk of functional decline in older patients is still high after CRC surgery despite several care developments in the past decade (such as minimally invasive surgery and enhanced recovery programs (ERAS)) [9]. Prehabilitation is therefore an interesting care improvement as it may reverse frailty characteristics with the aim of lowering the risk of adverse postoperative outcome.

Current evidence shows that prehabilitation in CRC surgery improves pre-and postoperative physical capacity. However, the effect on other postoperative adverse outcomes, for instance postoperative complications, is still not clear [10-14]. One randomized controlled trial (RCT) found a significant reduction of overall postoperative complications after prehabilitation [15] and another RCT found a reduction of severe and medical complications [16]. Other RCT's found no effect on postoperative complications [17-20]. Several challenges must be addressed before the effect of prehabilitation is accurately determined and an effective prehabilitation program is successfully implemented in clinical practice. It is essential to identify the patients with the highest risk of adverse postoperative outcomes, who are most likely to benefit from prehabilitation, and to determine the adverse postoperative outcomes which are most relevant to these patients.

THE AIM OF THIS THESIS

The aim of this thesis is to shape and concretize the concept of prehabilitation towards clinical practice for older patients with colorectal cancer undergoing elective surgery by

1. Identifying preoperative frailty
2. Identifying relevant postoperative outcomes
3. Investigating the effect of prehabilitation

THESIS OUTLINE

In **Part I** of the thesis, several frailty modalities and their potential to identify patients at risk of adverse outcome after CRC surgery were investigated. In **Chapter 2** we analyzed the interaction between comorbidity and age (the old, older and oldest patients) on postoperative complications in a cohort of 38.638 patients ≥ 70 years in the Netherlands between 2011-2019. In **Chapter 3**, we performed an external validation of the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) surgical risk calculator in patients ≥ 70 years undergoing elective non-metastatic CRC surgery in the Netherlands. In **Chapter 4**, we assessed the predictive value of selected geriatric parameters for postoperative outcomes in older patients with rectal cancer.

In **Part II**, relevant postoperative outcomes for older patients with CRC were identified. Time-trends and age-specific differences of surgical and non-surgical complications after CRC surgery were studied in older patients in the Netherlands between 2011-2019 (**Chapter 5**). The postoperative course of physical functioning and quality of life of patients with and without frailty is discussed in **Chapter 6**.

Part III shows the results of two retrospective cohort studies including older CRC patients who participated in a prehabilitation program in Reinier de Graaf Hospital in Delft. In **Chapter 7**, the cohort was stratified by prehabilitation and differences in surgical and non-surgical complications were assessed. In **Chapter 8**, the long-term survival and hospital admissions were studied between patients participating in the prehabilitation program and patients who received standard care.

In the last chapter (**Chapter 9**), the findings in this thesis will be discussed and future perspectives will be provided.

REFERENCES

1. Haugen, T., et al., *The Training Characteristics of World-Class Distance Runners: An Integration of Scientific Literature and Results-Proven Practice*. Sports Med Open, 2022. **8**(1): p. 46.
2. IKNL. *Integraal Kankercentrum Nederland. Cijfers over kanker*. [cited 2021 January]; Available from: <https://www.iknl.nl/nkr-cijfers>. .
3. Dekker, J.W., et al., *Cause of death the first year after curative colorectal cancer surgery; a prolonged impact of the surgery in elderly colorectal cancer patients*. Eur J Surg Oncol, 2014. **40**(11): p. 1481-7.
4. Bos, A., et al., *Postoperative mortality in elderly patients with colorectal cancer: The impact of age, time-trends and competing risks of dying*. Eur J Surg Oncol, 2019. **45**(9): p. 1575-1583.
5. Gonzalez-Senac, N.M., et al., *Colorectal Cancer in Elderly Patients with Surgical Indication: State of the Art, Current Management, Role of Frailty and Benefits of a Geriatric Liaison*. Int J Environ Res Public Health, 2021. **18**(11).
6. Montroni, I., et al., *Predicting Functional Recovery and Quality of Life in Older Patients Undergoing Colorectal Cancer Surgery: Real-World Data From the International GOSAFE Study*. J Clin Oncol, 2023. **41**(34): p. 5247-5262.
7. Ronning, B., et al., *Quality of life in older and frail patients after surgery for colorectal cancer-A follow-up study*. J Geriatr Oncol, 2016. **7**(3): p. 195-200.
8. Souwer, E.T.D., et al., *The impact of colorectal surgery on health-related quality of life in older functionally dependent patients with cancer - A longitudinal follow-up study*. J Geriatr Oncol, 2019. **10**(5): p. 724-732.
9. de Neree Tot Babberich, M.P.M., et al., *Achievements in colorectal cancer care during 8 years of auditing in The Netherlands*. Eur J Surg Oncol, 2018. **44**(9): p. 1361-1370.
10. Jetten, E.E.J., et al., *Evaluating the therapeutic quality of prehabilitation programmes in patients scheduled for colorectal surgery: A systematic review and meta-analysis*. Colorectal Dis, 2025. **27**(2): p. e70023.
11. Molenaar, C.J., et al., *Prehabilitation versus no prehabilitation to improve functional capacity, reduce postoperative complications and improve quality of life in colorectal cancer surgery*. Cochrane Database Syst Rev, 2022. **5**(5): p. CD013259.
12. Franssen, R., et al., *Real-life effectiveness of prehabilitation to improve postoperative outcomes in patients with colorectal cancer approaching surgery: A systematic review and meta-analyses of observational studies versus randomized controlled trials*. Eur J Surg Oncol, 2024. **50**(12): p. 108708.
13. Bruns, E.R., et al., *The effects of physical prehabilitation in elderly patients undergoing colorectal surgery: a systematic review*. Colorectal Dis, 2016. **18**(8): p. O267-77.
14. Machado, P., et al., *Effect of home-based exercise prehabilitation on postoperative outcomes in colorectal cancer surgery: a systematic review and meta-analysis*. Support Care Cancer, 2024. **33**(1): p. 20.
15. Berkel, A.E.M., et al., *Effects of Community-based Exercise Prehabilitation for Patients Scheduled for Colorectal Surgery With High Risk for Postoperative Complications: Results of a Randomized Clinical Trial*. Ann Surg, 2021.
16. Molenaar, C.J.L., et al., *Effect of Multimodal Prehabilitation on Reducing Postoperative Complications and Enhancing Functional Capacity Following Colorectal Cancer Surgery: The PREHAB Randomized Clinical Trial*. JAMA Surg, 2023. **158**(6): p. 572-581.
17. Bousquet-Dion, G., et al., *Evaluation of supervised multimodal prehabilitation programme in cancer patients undergoing colorectal resection: a randomized control trial*. Acta Oncol, 2018. **57**(6): p. 849-859.

18. Dronkers, J.J., et al., *Preoperative therapeutic programme for elderly patients scheduled for elective abdominal oncological surgery: a randomized controlled pilot study*. Clin Rehabil, 2010. **24**(7): p. 614-22.
19. Fulop, A., et al., *The effect of trimodal prehabilitation on the physical and psychological health of patients undergoing colorectal surgery: a randomised clinical trial*. Anaesthesia, 2021. **76**(1): p. 82-90.
20. Gloor, S., et al., *Prehabilitation in patients undergoing colorectal surgery fails to confer reduction in overall morbidity: results of a single-center, blinded, randomized controlled trial*. Langenbecks Arch Surg, 2022. **407**(3): p. 897-907.