

Chapter 2

Preoperative Optimisation and Conditioning of Expectations

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Introduction

Enhanced recovery aims to reduce the systemic response to surgical stress and in doing so improve the quality and rapidity of a patient's recovery. It is a structured evidence-based process that encompasses the perioperative period of care and produces considerable reduction in postoperative complication rates and length of hospital stay [1–4]. The majority of patients undergoing elective colon and rectal surgery are suitable for this process. This chapter focuses on colorectal surgery but the principles are transferrable to many other surgical specialities. The chapter aims to cater to the needs of the multidisciplinary team, and a more detailed scientific explanation of some of the aspects covered in this chapter will be available from other sources. We explore the rationale for the preoperative optimisation and conditioning of expectations and describe how the multidisciplinary team can achieve this and how general practitioners can participate in the process.

The Rationale for Preoperative Optimisation and Conditioning of Expectations

For enhanced recovery to be successful it is essential that patients be adequately prepared for surgery and preoperative preparation is the first stage in this process. It sets the expectations of the patient and their family for planned surgery and emphasises how this can affect the patient. Pre-assessment requires liaison

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between primary and secondary care such that patient evaluation can identify medical and social factors that can be modified preoperatively, not only to reduce the effects of surgery upon the patient, but also ensure an efficient enhanced recovery process.

Pre-assessment Clinics

The pre-assessment, pre-admission or preoperative assessment clinic is the vehicle by which the early components of the enhanced recovery process are delivered and it allows for risk assessment and adjustment.

The key elements of the pre-assessment clinic are:

- *Full* assessment and clinical examination with anaesthetic consultation shortly after a decision to operate has been made.
- The patient has the maximum opportunity to optimise fitness for surgery and anaesthesia.
- Expectations are conditioned; the patient fully understands the proposed operation and is made ready to proceed.
- Staff identify and co-ordinate all essential resources and discharge requirements.
- Suitable admission *and discharge dates are agreed*.

This process is delivered by a specifically trained nursing team in close liaison with junior and senior surgical and anaesthesia staff and, where necessary, enterostomal therapists, occupational therapist, dietician and physiotherapist along with the patient's general practitioner. The aim is to assess the patient's fitness for anaesthesia and surgery and ideally, this interaction should be approximately 4 weeks before elective surgery, however, the nature of many colorectal cancer cases is such that this time frame is often a luxury owing to specified treatment time targets [5]. Employing the pre-assessment process means that cancellation owing to ill health or failure to attend can be avoided and same day admission and early discharge are more likely, producing improvements in the efficiency of a patient's care [6].

Treating Co-morbidity Before Surgery

A large population of high-risk general surgical patients exists, accounting for approximately 13% of all surgical admissions but more than 80% of postoperative deaths [7]. Successive NCEPOD reports indicate that most deaths occur in older patients who undergo major surgery and have severe co-existing disease with mortality rates between 5% and 25% [8].

Complications within 30 days in postoperative surgical patients have been found to be an important determinant of long-term survival and to be of a greater influence in some reports than preoperative co-morbidity and intraoperative adverse events. Avoiding or reducing complications is therefore of paramount importance. Detecting and modifying co-morbidities before an operation is central to the early stage of enhanced recovery and allows for a reduction in morbidity and in the need for more complex supportive care, such as intensive care [6]. Preoperative assessment allows realistic evaluation of the risk of surgical intervention and gives an opportunity to manage the risk to an individual patient by making modifications to improve the patient's general condition and organ function [9]. Understanding and quantifying the risk of perioperative complications and determining the likely type of complications are therefore required. These include cardiopulmonary morbidity and cardiac adverse events, postoperative gut dysfunction, surgical site infection, blood transfusion and the requirement for intensive care or high dependency care and readmission. Central to pre-assessment is optimisation through the determination of cardiovascular risk, nutrition, correction of anaemia and multiple other medical conditions.

Specific Examples

Cardiovascular Risk

The cardiovascular management of high-risk surgical patients is of particular importance and a large body of evidence now exists that can guide the clinician in delivering optimal care. The ACC/AHA Task Force Guidelines provide appropriate evidence-based guidance and are quoted throughout this chapter [10].

Major abdominal surgery is associated with a marked inflammatory response with an associated rise in tissue oxygen requirements that enforces a rise in the cardiac output. This response is related to the magnitude of tissue injury and surgical invasion and is associated with an elevation in heart rate and blood pressure with a neuroendocrine and thrombosis/fibrinolysis system response that predisposes high-risk patients to acute coronary events/syndrome, ischaemia and heart failure. The incidence of significant cardiovascular adverse events in a population undergoing non-cardiac surgery such as the colorectal surgery population is approximately 1–2% and multiple risk factors have been associated. [7] These adverse events include cardiac arrest, non-ST elevation myocardial infarction (MI), Q-wave MI and new cardiac arrhythmias. A patient's condition preoperatively, presence of co-morbidities [e.g., ischaemic heart disease (IHD), left ventricular failure (LVF)], pulmonary, renal disease and diabetes and the magnitude, duration and type of surgery will impact upon the likelihood of cardiovascular morbidity [7, 10, 11]. High-risk patients are those who are unable to spontaneously elevate their cardiac output to the required level. This at-risk group can be identified based upon clinical assessment and are likely to benefit from optimisation both preoperatively and intraoperatively.

The literature on cardiac adverse events has evolved from prediction to optimisation through intervention. The risk factors found to be independent predictors of outcome differ between analyses, and some traditional medical risk factors are believed to be less relevant today as the medical management of these conditions has improved, for example some of the risk factors identified in the Goldman criteria are no longer independent predictors on some more recent analyses, e.g., diabetes and chronic renal failure. Recent risk factors include age; congestive cardiac failure (CCF); body mass index (BMI) > 30; emergency surgery; previous cardiac intervention; cardiovascular disease (CVD); hypertension; duration of surgery; blood transfusion units; obesity has been previously found to be a predictor of coronary artery disease but more recent analyses find that an elevated BMI is an independent predictor of perioperative adverse cardiac events [7].

Though laparoscopy yields multiple short-term benefits for recovery, the advantages in patients with significant cardiac dysfunction have not been established. Therefore, cardiac risk in patients with heart failure is not diminished in patients undergoing laparoscopy compared with open surgery, and both should be evaluated in the same way [11].

Assessing Cardiac Risk and Need for Cardiology Assessment

Advances in preoperative risk assessment have reduced perioperative cardiovascular morbidity and rely on a complete history and physical examination to identify patients who have cardiovascular risks that may have previously been undocumented. Where a patient's history yields active cardiac conditions such as acute coronary syndrome, unstable angina, recent MI, decompensated heart failure, significant arrhythmias or severe valvular disease, then elective colorectal surgery should be postponed until modifications are made in liaison with a cardiologist and the patient's general practitioner.

It is recommended that clinical risk indices be used for postoperative risk stratification [11]. During the last 30 years, several risk indices have been developed, based on multivariate analyses of observational data, which examine the association between clinical characteristics and perioperative cardiac mortality and morbidity [11–13]. These indices assist in the assessment of preoperative cardiac risk based upon the presence of defined clinical risk factors and the number of these risk factors allows triage to further assessment. The Lee index is a modification of the original Goldman index and currently regarded as the most informative cardiac risk prediction index for non-cardiac surgery, though it has some shortcomings [12]. The risk factors identified include 'high-risk surgery'; prior MI (according to the universal definition of MI); heart failure; stroke/transient ischaemic attack (TIA); renal dysfunction (serum creatinine >170 $\mu\text{mol/L}$ or 2 mg/dL or a creatinine clearance of <60 mL/min); diabetes mellitus (DM) requiring insulin therapy. All factors contribute equally to the index (with 1 point each), with major cardiac complications estimated to be 0.4%, 0.9%, 7% and 11% in patients with an index score of 0, 1, 2 and 3 points, respectively. The index has a high capability for discriminating between

Table 2.1 Cardiac risk factors

Clinical factors	'Erasmus' index
<i>Definitions in text</i>	
Age	Y
IHD [Angina/IHD]	Y
Heart failure	Y
Stroke/TIA	Y
DM (on insulin)	Y
Renal dysfunction/Haemodialysis	Y
Surgical risk group	High, intermediate, low group
<i>Note:</i> Derived from a retrospective analysis of the Lee index from the administrative database of the Erasmus Medical Centre in Rotterdam, Netherlands, stratified by non-cardiac surgical procedure type. High-risk: [>5%, 30-day risk of cardiac death or MI] – e.g., aortic or vascular surgery; Intermediate [1–5% risk] – e.g., abdominal, head and neck, neurological, orthopaedic, transplant, urology, major; Low-risk [<1% risk] – e.g., breast, endocrine, gynaecological, urology, minor	

patients who do and do not sustain a major cardiac event [11]. Modification with the refinement of the addition of a more detailed description of the type of surgery and age increases the prognostic value of the subsequent ‘Erasmus’ model for perioperative cardiac events (Table 2.1) [13].

‘Functional capacity’ is a measure of how well a patient is able to perform a spectrum of activities, an integral component of the preoperative evaluation of the cardiac risk patient for non-cardiac surgery and can be ascertained based upon a structured history [14]. For example, a patient’s capacity to climb stairs has been found to have perioperative prognostic importance and can predict survival after lung resection and is associated with complications after major non-cardiac surgery [15–17]. After thoracic surgery, a poor functional capacity has been associated with an increased mortality. By making this assessment we can decide on the need for further investigation. There will be patients who are classified as high risk owing to age or coronary artery disease yet are asymptomatic and run for 30 min a day. Such a patient is unlikely to require further cardiac investigation and management will rarely be changed based on the results of any cardiovascular testing. In contrast, there will be patients who are sedentary with no recorded history of cardiovascular disease but are only able to manage to climb only a flight of stairs before the onset of symptoms. This group will require further cardiac evaluation.

Examples of activities are presented in Table 2.2 and determining functional capacity may prevent unnecessary cardiac evaluation and inefficient resource usage. One metabolic equivalent of task (MET) is the effort required whilst reading this chapter sitting. One MET represents the resting oxygen consumption of an adult (approximately 3.5 mL/kg/min) [18]. To some purist physiologists, the definition of MET is misinterpreted, however, a discussion on this aspect is beyond the scope of this chapter [19]. Nevertheless, the concept is helpful in assessing a patient’s fitness for surgery.

Although assessment of functional capacity is useful in identifying patients with good or excellent capacity, where prognosis will be excellent even in the presence

Table 2.2 Functional capacity

MET	Activity	Capacity
<4 METS	<ul style="list-style-type: none"> – Unable to walk ≥ 2 blocks on level ground without stopping due to symptoms – Eating, dressing, toileting, walking indoors, light housework 	Poor
>4 METS	<ul style="list-style-type: none"> – Climbing ≥ 1 flight of stairs without stopping – Walking up hill ≥ 1–2 blocks – Scrubbing floors – Moving furniture – Golf, bowling, dancing or tennis – Running short distance 	Moderate/excellent [Excellent: >10 METS, Good: 7–10 METS, Moderate: 4–6 METS]

of stable IHD or other risk factors, its use in predicting survival after major non-cardiac surgery in those with a reduced functional capacity is less effective [11]. For example, as mentioned above, thoracic surgery outcome is strongly related to functional capacity, potentially reflecting the importance of lung function to functional capacity, however, this association has not been convincingly replicated with other non-cardiac surgeries and age has been found to be more predictive of a poorer outcome [17]. Therefore using functional capacity evaluation prior to surgery, measured by the ability to climb two flights of stairs or run for a short distance indicates a good functional capacity. On the other hand, when functional capacity is poor or unknown, it will be the presence and number of clinical risk factors suggested above in relation to the risk of surgery that will determine the preoperative risk stratification, assessment and perioperative management.

Other measures of risk have been assessed. For instance, how a patient performs under actual physical exertion has been tested [20, 21]. This has been termed cardiopulmonary exercise testing (CPEX or CPET) and to date is only available in a few centres in the UK. It has been employed to determine perioperative aerobic capacity and is reported in terms of the anaerobic threshold (AT). AT is the oxygen uptake at which anaerobic adenosine triphosphate (ATP) synthesis starts to supplement aerobic ATP synthesis. During gas exchange, it is the point at which the slope of CO_2 production increases more than the oxygen uptake. It is assumed that myocardial ischaemia develops at or above the AT, meaning that early ischaemia is associated with a lower AT and hence mortality, although non-cardiac and non-respiratory factors such as skeletal muscle function and physical training can underestimate aerobic metabolic activity. In simple terms, where an earlier switch from aerobic to anaerobic metabolism is required, poorer fitness is identified and a poorer outcome more likely.

A patient with a low AT is likely to benefit from more intensive perioperative care and risk modification [21]. For example, AT values of >11 mL/min/kg have a perioperative mortality of $<1\%$ and are unlikely to need higher level care; AT values ≤ 11 mL/min/kg have a perioperative mortality of 18% and should be considered for either intensive recovery, post-anaesthesia care unit (PACU), high-dependency unit

(HDU) or intensive care unit (ICU); AT <8 mL/min/kg have a perioperative mortality of 50% and should be considered and prepared for an extended stay in the ICU.

The real benefits of CPET in colorectal surgery are still unclear at the time of writing and whilst there may be a role in stratifying risk for the level of perioperative care, whether it changes clinical decision-making more than existing parameters is unclear. Therefore the role of CPET in preoperative risk assessment is yet to be established and CPET should not be considered to be a substitute for other forms of testing in routine practice.

What Investigations Should Be Considered?

The most suitable investigations in at-risk individuals are based upon clinical risk stratification assessed upon history, examination and determination of functional capacity as emphasised above (Table 2.3). Directed non-invasive investigation of patients with coronary artery disease and heart failure should only be considered where the results may effect a change in a patient's management, and therapy should only be changed where it will improve a patient outcome [10, 11]. These decisions are likely to be at the discretion of both anaesthetist and cardiologist and local preferences may vary.

12 Lead Resting ECG

Though the ideal time preoperatively to perform an electrocardiogram (ECG) is unclear, ideally it should be performed within 30 days of planned colorectal surgery and is indicated when patients are to undergo intermediate or major colorectal surgery and have at least one clinical risk factor such as ischaemic heart disease or an established history of coronary heart disease (CHD), peripheral arterial disease or cerebrovascular disease [10, 11].

Non-invasive Stress Testing

Echocardiography can be used to provide information on left ventricular (LV) function. Where a patient has breathlessness of unknown origin or has a history of current or prior heart failure with worsening breathlessness or any other change clinically, then echocardiography should be considered, particularly if an assessment has not been made within the preceding 12 months. In the setting of a known cardiomyopathy, if a patient has remained clinically stable then reassessing LV function would not be regarded as necessary [10, 11].

Echocardiography may be supplemented by pharmacological cardiac manipulation as in a dobutamine stress echocardiography (DSE). Non-invasive stress testing using techniques such as DSE are employed in patients with at least one to two clinical risk factors associated with a poor functional capacity (i.e. <4 METS) who are to undergo major colorectal surgery. DSE uses pharmacological manipulation

Table 2.3 Stepwise perioperative cardiac risk evaluation and management

Step	Categories	Action	Management
Step 1	Assess for active cardiac conditions	Unstable angina Acute heart failure Significant cardiac arrhythmia Symptomatic valvular heart disease Recent MI	Postpone surgery if active condition present Cardiology and Anaesthesia opinion Otherwise Step 2
Step 2	Assess risk of surgical procedure	Low risk Intermediate and high risk	Proceed with surgery Move to Step 3 Assess functional capacity and clinical risk factors
Step 3	Assess functional capacity	>4 METS and no symptoms Poor <4 METS or unknown	Proceed with surgery Move to Step 4 Assess clinical risk factors Consider CPEX where available
Step 4	Clinical risk factors	3 or more risk factors 1 or 2 risk factors	Cardiology and Anaesthesia opinion: Stress testing [DSE] if will modify management Optimise medical therapy and heart rate control before proceeding with surgery Cardiology and Anaesthesia opinion: Stress testing [DSE] if will modify management Optimise medical therapy and heart rate control before proceeding with surgery
Step 5	Surgery	For no, mild or moderate stress-induced ischaemia, a statin and low-dose beta-blocker therapy are considered before surgery. For extensive stress-induced ischaemia, management is individualised and may employ optimal medical therapy, angioplasty, [drug-eluting] stenting or CABG. No risk factors	

with increasing doses of supratherapeutic dobutamine that increases cardiac muscle contractility and the heart rate, which can be assessed by cardiac ultrasonography. It aims to identify significant coronary artery disease by identifying regional wall motion abnormalities within the distribution of the affected vessels [10, 11].

Cardiovascular risk in high-risk individuals may be minimised by coronary revascularisation where a large ischaemic burden is identified preoperatively, and/or by pharmacological intervention (e.g., beta blockers can reduce cardiac events/non-fatal MI and all-cause mortality), modifications to anaesthesia (e.g., neuraxial blockade, postoperative analgesia) and perioperative monitoring techniques.

Pulmonary Risk

Patients with co-existing pulmonary disease represent a group at higher risk of perioperative morbidity, particularly pulmonary complications and mortality. Any condition causing impairment of lung function is culpable and includes chronic obstructive pulmonary disease (COPD), asthma, acute respiratory tract infections, interstitial lung disease and cystic fibrosis. One in ten patients is likely to have COPD and this is a major cause of morbidity and mortality [22]. Smokers are also at increased risk of pulmonary morbidity and the merits of even short-term smoking cessation a few weeks prior to surgery can be emphasised at the pre-assessment clinic. Emphasising the importance of postoperative mobilisation in the pre-assessment clinic encourages measures to prevent atelectasis. Other actions that a patient may participate in include deep breathing and incentive spirometry exercises. There is good evidence that these lung expansion interventions can reduce pulmonary risks in the perioperative period.

In general, if significant pulmonary disease is suspected based upon history or physical examination and determination of functional capacity then response to bronchodilators and the evaluation for the presence of carbon dioxide retention through arterial blood gas analysis may be justified. If there is evidence of infection, appropriate antibiotics are critical, and steroids and bronchodilators may need to be considered. Close liaison with a patient's general practitioner may facilitate this process.

Rarely, cardiac assessment may be required with pulmonary conditions for instance COPD and pulmonary arterial hypertension.

Anaemia

A large proportion of patients undergoing elective surgery for colorectal cancer are anaemic and iron deficient at the time of diagnosis. In the pre-assessment clinic it should be established which type of anaemia is present and a full blood count (FBC) should be checked. Where other forms of anaemia are present then these should be managed according to appropriate local guidelines; however most patients are likely to have iron deficiency anaemia in the colorectal cancer group. It is recommended

that elective surgery patients should receive a haemoglobin (Hb) determination a minimum of 30 days before the scheduled surgical procedure, however, this may not be feasible in the UK given colorectal treatment target times [23].

The need for blood transfusion may indicate a high-risk situation and in cardiac surgery the need for blood transfusion is an independent risk factor for mortality.

Mild anaemia is associated with a more advanced disease stage and is associated with a higher mortality, morbidity and length of hospital stay [24]. Unsurprisingly, some studies identify that a low preoperative haematocrit and haemoglobin level is an independent risk factor for blood transfusion [25] with transfusion rates of between 10% and 30% in the literature [26]. Blood transfusion, other than being an expensive and a limited resource, is associated with potentially serious complications, such as transfusion reactions and transmission of viral infection; is well recognised to be associated with higher postoperative systemic infection rates; and is also associated with a higher colorectal cancer recurrence rate with a dose-related increase in the odds of recurrence by 30% with every additional two units of blood that are transfused [26]. In addition, autologous transfusion (following self-donation) does not alter prognosis or decrease cancer recurrence risk when compared to allogeneic transfusion. Moreover, a theoretical risk of autologous transfusion is the re-introduction of tumour cells that may impair cancer outcome [27]. Transfusion also has the unwanted effect of immunosuppression and may alter outcomes owing to reduced tumour surveillance. It affects the immune system and on a cellular level seems to be associated with decreased T-cell-mediated immunity, induction enhancement of the acute inflammatory response and increased cytokine production. Leukocyte reduction of transfused blood neither changes recurrence rates nor survival in transfused colorectal cancer patients [28].

Blood transfusion and intense surgical stress might synergistically affect the long-term progress after curative resection of colorectal cancer and therefore avoiding transfusion where possible appears to be a sensible solution. Strategies in patients with anaemia are therefore centred upon increasing haemoglobin levels preoperatively without resorting to blood transfusion and restricting intraoperative surgical blood loss to an absolute minimum.

Debate exists regarding the threshold level of haemoglobin for intervention without transfusion and what the target level should be prior to surgery. A haemoglobin level of below 10 g/dL is often regarded as the minimum threshold for intervention but is likely to evolve as further evidence is published. There is also debate around the threshold for blood transfusion. Practice guidelines from the American Society of Anesthesiology suggest transfusion at a level of 6 g/dL but not at 10 g/dL [29]. In a patient within the range 6–10 g/dL, decisions therefore need to be taken based on individual circumstances (e.g., co-morbidity, organ ischaemia, intravascular volume, ongoing bleeding, risks of inadequate oxygenation).

Options to treat anaemia preoperatively to avoid transfusion include oral and intravenous iron supplements, with or without erythropoietin stimulation [30–33]. These agents have been submitted to study in randomised clinical trials in the correction of perioperative anaemia in an attempt to reduce allogeneic blood transfusion and the consequences above.

In colorectal cancer, Lidder found that ‘oral ferrous sulphate given preoperatively in patients undergoing colorectal surgery offers a simple, inexpensive method of reducing blood transfusions’ and improved the haemoglobin and ferritin levels [30]. Other groups have identified this benefit in non-randomised studies and have suggested that supplementation for at least 2 weeks prior to surgery is required [34]. Oral iron therapy is cheap but there are a number of caveats to its use. Patients already taking a variety of tablet and capsule medications may find the addition of oral iron a burden. Poor compliance, intolerance, duration of treatment, poor (unpredictable) response, continuing blood loss and anaemia of chronic disease (associated with inflammation and surgery) also restrict the appropriateness of oral iron therapy. Intravenous iron in some studies is felt to be more convenient and achieves target Hb levels and repletes iron stores more quickly but its role in colorectal cancer surgery has been less convincing to date.

A consensus statement published on the role of intravenous iron in perioperative management by Beris concluded that currently recommendations can be made for use in orthopaedic surgery and that more evidence is needed for surgery in other specialities such as colorectal surgery [35]. However, intravenous iron has been shown to be more effective than oral iron in post-partum anaemia, resulting in a more rapid rise and sustained Hb levels [36].

Erythropoietin levels are reduced in patients with cancer and recombinant erythropoietin is widely used to treat anaemia in patients undergoing chemotherapy and improves quality of life. However, data from a recent Cochrane meta-analysis indicate that, currently, there is insufficient evidence to recommend the use of erythropoietin in the pre- and perioperative period in colorectal cancer surgery [33].

There are also concerns pertaining to administration of erythropoietin-stimulating agents (ESAs) to patients with cancer. These have been associated with increased risk of veno-thromboembolism and mortality by some. In the USA, the Federal Drug Agency (FDA) issued a recommendation in 2008 substantially limiting the use of ESAs to treat anaemia in cancer patients, indicating that they be restricted to advanced cancer patients. National Institute for Health and Clinical Excellence (NICE) has also indicated that ESAs should only be used in patients with an Hb less than 8 g/dL or where blood transfusions are inappropriate. We would therefore regard it as inappropriate to use ESAs in patients with iron deficiency anaemia who are to undergo elective colorectal cancer surgery. Further multi-centre randomised trials are needed to define how best to treat anaemia avoiding transfusion prior to major colorectal surgery.

Nutrition

Poor nutritional status is associated with poorer outcome after major surgery. Hiram Studley first reported this in the 1930s where preoperative weight loss and higher postoperative complications were linked [37]. A proportion of colorectal cancer patients would be nutritionally challenged at the time of presentation. It is established that both infectious and non-infectious complications and even mortality are significantly increased in the malnourished patient [38].

Table 2.4 Nutritional Risk Score (NRS)

		Mild	Moderate	Severe
		1	2	3
Age (years)		>70		
Nutritional status	BMI		18.5–20.5	<18.5
	Food intake [%]	50–75	25–50	<25
	Weight loss <5%	3 months	2 months	1 month
Disease severity	Example	Hip fracture	Major surgery	BM Transplant

Table 2.5 Nutritional Risk Score and postoperative morbidity

		NRS	Complications (%)	Infections (%)
Minor surgery	<3	6		2
	>3	10		7
Major surgery	<3	23		13
	>3	58		35

An assessment of a patient’s nutritional status is not straightforward and currently there is a lack of standardisation in the definition of nutritional depletion and there is no consensus on the best method for assessing the nutritional status of hospitalised patients. Multiple factors have been found to be associated with poor nutritional status and it is perhaps not one particular system that matters over another but that some assessment and consideration for intervention is given when nutritional depletion is thought to be present.

A recent retrospective single-centre study from Italy assessed 1,410 major gastrointestinal cancer operations and found advanced age, weight loss, low serum albumin and a lack of nutritional support (and pancreatic surgery) to be independent risk factors for postoperative complications. Others have identified pre-albumin, transthyretin, BMI, oral intake, disease severity, bio-impedance, hand-grip strength and anthropometry measurements (e.g., triceps skin-fold) as risk factors. Multiple systems exist to predict nutritional ‘risk’ including subjective global assessment (SGA); mini-nutritional assessment; Nutrition Risk Index and Nutrition Risk Score (NRS) [39].

Recently, the Nutrition Risk Score (see Tables 2.4 and 2.5) has shown some promise in the identification of at-risk individuals. This score is based upon age, disease severity and nutritional status (BMI, food intake, weight loss >5% time) and where three or more factors are positive then this is associated with poorer outcome in a major surgery [40].

Where patients are identified as nutritionally ‘at-risk’, then the most suitable pre-operative intervention is the initiation of oral nutritional supplements and a dietician should be involved in the decision-making process. Preoperative oral nutritional supplements should be given to patients with insufficient food intake and given preferably before admission to hospital [41]. The benefits of oral nutritional supplements and enteral tube feeding have been confirmed in meta-analysis [42]. The evidence for how long oral nutritional supplements should be given pre- and postoperatively is less clear but is suggested to be 5–7 days before surgery and for 5–7 days after

uncomplicated surgery [41]. The most appropriate supplement is a standard whole protein formula for most patients but more recently, the role of ‘immunonutrition’ with formulas containing arginine, omega-3 fatty acids and ribonucleic acid (RNA) has been assessed and evidence is building for its role in major abdominal cancer surgery and after severe trauma [41]. It is imperative that the data be interpreted in the context of individual patient’s risk since specialty formulas appear most beneficial in patients at risk of subsequent complications or those with significant pre-existing malnutrition. Preoperative immunonutrition in malnourished patients has been more beneficial than perioperative conventional nutritional support.

Where severe nutritional risk is identified (e.g., weight loss >10–15%/6 months; BMI <18.5; Subjective Global Assessment Grade C; serum albumin <30 [with normal renal/hepatic function]) surgery should be delayed where possible and nutritional deficits corrected as soon as this risk is identified. This group is unlikely to follow a complete enhanced recovery after surgery (ERAS) pathway although some components would still be suitable. The role of other nutritional supports including parenteral feeding and enteral tube feeding is beyond the scope of this chapter.

Obesity

Obesity is a significant problem among most of the European patient population and with this comes obesity-related disease. Obese patients have significantly more surgical site infections and soft tissue complications after surgery and have a greater proportion of deep venous thromboses, incidence of postoperative lung dysfunction and metabolic disturbance postoperatively. In some cases, elective surgery can be postponed to allow weight loss by medical means or bariatric surgery; however, in the colorectal cancer population this is not feasible.

Hypertension

Hypertension treatment is associated with a reduced mortality from stroke and coronary heart disease. In surgical patients, however, it is apparent in the literature that if a patient has a systolic blood pressure below 180 mmHg and a diastolic blood pressure less than 110 mmHg (stage 1 or stage 2) then high blood pressure is not an independent risk factor for cardiovascular complications in the perioperative period [10]. Despite this finding, identification of hypertension in the pre-assessment clinic is an opportunity to initiate treatment via the patient’s general practitioner even though it is unlikely to have an effect upon the overall outcome of the planned surgery.

Where a systolic and diastolic blood pressure is identified as over 180 and 110 mmHg, respectively (stage 3 hypertension), then postponing surgery to initiate or optimise anti-hypertensive medications may be merited if the risk of delaying surgery is acceptable. Nevertheless, one randomized trial was unable to demonstrate

a benefit to delaying surgery for a diastolic blood pressure between 110 and 130 mmHg in a group with no previous MI, unstable or severe angina pectoris, renal failure, pregnancy-induced hypertension, left ventricular hypertrophy, previous coronary revascularization, aortic stenosis, preoperative dysrhythmias, conduction defects or stroke [10, 43]. The trial patients received 10 mg of nifedipine delivered intranasally to rapidly control blood pressure and the control group had surgery postponed and had in-patient blood pressure control and no significant differences in postoperative morbidity was observed. This suggests that Stage 3 hypertension on the day of surgery in the absence of significant cardiovascular morbidity need not delay surgery.

Patients taking angiotensin-converting enzyme (ACE) inhibitors and angiotensin II (ATII) receptor antagonists are at higher risk of intraoperative hypotension and reports vary on the effect upon cardiac and renal complications in the perioperative period and this has prompted a move for ACE I and ATII receptor inhibitors to be withheld on the morning of surgery [10] with the recommendation that once a patient is deemed euvolaemic postoperatively that they be restarted owing to concerns regarding perioperative renal dysfunction.

Diabetes

It is well established that poor glucose control in the perioperative period is an independent predictor of postoperative infection and mortality independent of diabetic status [44] countering the historical acceptance of relatively high glucose levels in the perioperative period. The control of blood glucose concentration is therefore more crucial than making a diagnosis of diabetes.

Nevertheless, while clinical trials demonstrate the harmful effects of perioperative hyperglycaemia, the ideal target for cardiovascular benefit of intraoperative and postoperative glycaemic control are not yet entirely clear. In addition, tight glycaemic control may exert a cost in terms of increased incidence of severe hypoglycaemia. The ultimate goal in the management of diabetic patients is to achieve equivalent outcomes as those patients without diabetes.

Diabetes mellitus is common in the colorectal surgery population and its presence should heighten suspicion of occult coronary artery disease (CAD) as both CAD and myocardial ischaemia and heart failure are more likely in patients with diabetes mellitus. The requirement for insulin in diabetes is an independent cardiac risk factor in the Lee index. Mortality rates in diabetic patients are estimated to be up to five times greater than in non-diabetic patients. This has been attributed to end-organ damage caused by the disease. Chronic complications resulting in microangiopathy (retinopathy, nephropathy and neuropathy) and macroangiopathy (atherosclerosis) directly increase the need for surgical intervention and the occurrence of surgical complications due to infections and vasculopathies. In general, infections account for 66% of postoperative complications and nearly one quarter of perioperative deaths in patients with diabetes. Data suggest that impaired leukocyte function, including altered chemotaxis and phagocytic activity, may underlie this finding.

Optimisation of glucose control preoperatively is the ideal and should be done in cooperation with the patient's general practitioner and endocrinologist/diabetic liaison nurse and individualised to the patient. Comprehensive preoperative assessment and intensive intraoperative and postoperative management by a multidisciplinary team are recommended. It is estimated that one quarter of diabetic patients are unaware that they have the disease hence it is prudent to screen all patients undergoing major colorectal surgery by checking glycosylated haemoglobin (HbA1c or A1C). A recent novel study in colorectal cancer patients showed that every fourth patient undergoing colorectal surgery without known diabetes had an elevated HbA1c as an indicator of glucose intolerance. These patients also had a higher glucose level after surgery, higher CRP levels and more complications, in particular infectious complications. [45]

In addition to standard preoperative information, details of a patient's current diabetes management should be documented, e.g., duration of treatment, specific medication regimen and issues with insulin resistance or hypersensitivity. Preoperative measurement of HbA1c may identify patients at higher risk of poor glycaemic control and postoperative complications and general practitioners may be able to offer this information during the preoperative work-up.

In general, on the day of surgery, patients on oral hypoglycaemic agents are advised to discontinue them owing to their potential to cause hypoglycaemia. In addition, sulfonylureas have been associated with interfering with ischemic myocardial pre-conditioning and may theoretically increase the risk of perioperative myocardial ischaemia and infarction. Metformin should be discontinued preoperatively because of the risk of developing lactic acidosis. For such patients, short-acting insulin may be administered subcutaneously as a sliding scale or as a continuous infusion, to maintain optimal glucose control, depending on the type and duration of surgery. Patients will be advised of these modifications at the pre-assessment clinic. Maintenance insulin may be continued, based on the history of glucose concentrations and the discretion of the endocrinologist/diabetic liaison team.

Smoking and Alcohol Intake

Smoking and high alcohol intakes are important risk factors for perioperative morbidity in all elective and emergency surgery. The most common perioperative complications related to smoking are impaired wound healing, wound infection and cardiopulmonary complications. Even in young smokers, reduced pulmonary capacity, increased mucus production and reduced ciliary function are recorded [46].

All patients presenting for surgery should be questioned regarding smoking and hazardous drinking as clear benefit is obtained by intensive interventions to encourage their cessation as this translates to benefit by significantly reducing the incidence of several serious postoperative complications, including wound and cardiopulmonary complications and infections. The duration of these interventions can, however, be between 3 and 8 weeks or longer meaning that patients requiring prompt surgery may not gain this advantage [47].

Patient Education and Conditioning of Expectations

The colorectal surgery patient is faced with high psychological and physical stress levels and the threat of significant disruption in a number of valued role areas: work function and career, as a parent and spouse, community involvement, recreational activities, gender identity, possible stoma and no longer being a 'well person'. This may lead to depression and lowered self-esteem as well as placing additional strain on the social support systems that are already trying to cope with the surgery process itself. This can be reduced with patient education and conditioning of expectations.

Particularly in cancer patients, it would be regarded as more appropriate for information to be given about perioperative care in enhanced recovery in a subsequent separate session from the appointment when the diagnosis is discussed, as a distressed patient is less likely to respond to attempts to educate and modify expectations.

The enhanced recovery consensus is that preoperative information is beneficial and patient education should describe the patient's journey and condition expectations for the period of hospitalisation. Intensive preoperative patient information facilitates postoperative recovery, reduces anxiety and pain, and improves postoperative self-care and symptom management, particularly in patients who exhibit the most denial and the highest levels of anxiety [48–52]. Several meta-analyses have demonstrated the benefits of preoperative education outcome [53, 54].

Delivering information during pre-assessment appears to be more effective than in the immediate preoperative period [55, 56]. Patient education includes emphasising the importance of a patient's role in his or her own recovery and a clear explanation of what is to happen encourages adherence to the ERAS care pathway as compliance is currently believed to be central to a successful programme [57]. Patients should be engaged in their recovery by being given tasks to perform and targets to meet during the postoperative period, for instance food intake and mobilisation, and criteria that should be met to permit discharge from hospital. Suitable discharge criteria comprise the ability to tolerate solid food, to be able to fully mobilise, oral analgesia adequately resolving the pain and flatus and/or faeces are passed indicating gut function is maintained, the patient is afebrile and agrees for discharge [2]. If criteria for discharge are not adequately explained this can result in a delayed discharge [58]. Social aspects of a patient's care may hinder the patient's timely discharge. Often patients are medically fit for discharge but have insufficient social circumstances to support their discharge or they may be unwilling to be discharged despite suitable medical fitness [57]. Pre-assessment should aim to determine what social aspects are deficient that may delay discharge. Wherever possible, these factors should be modified preoperatively in cooperation with social workers, general practitioners and occupational therapists.

As yet there is no single definitive method of information giving that will suit all patients or enhanced recovery teams to achieve preoperative optimisation, but basic guidelines for patients are useful and should be both oral and written (and easily readable) forms for the intended audience [59]. The use of patient diaries may benefit patient understanding, motivation and assist in audit of patient compliance. There may also be benefit in showing patients and relatives the ward onto which they will be

admitted and familiarising them with its layout as part of the pre-admission process. Patients are likely to recover more quickly in an elective-only environment and the ward should be designed to facilitate the feeling of security, encourage independence and allow free access to food preparation and self-care facilities [60].

Setting realistic goals and discussing potential morbidity is also important and has a positive impact upon recovery [61]. 'Informative preparations' can be both 'procedural' and 'sensory information' indicating what the patient will see, hear, feel and taste. Hendry reported that about half of unselected patients were able to have their intravenous fluids removed the day following surgery and about half were able to get out of bed on the day of surgery and about two-thirds were able to resume a full diet on the day after surgery [62]. Morbidity is reduced overall and readmission rates around 10% and reoperation rates below 8% are quoted in recent studies [63, 64]. Post-discharge expectations should be clarified; King reported 58% of patients undergoing open colorectal surgery felt fully recovered at 12 months compared to almost 90% of laparoscopic surgery patients within an enhanced recovery programme [64].

Despite preoperative education being clearly beneficial, how well a patient processes this information depends upon their information comprehension, recall ability (attention span, memory capacity, age, past experiences, educational level and coping style) and attitude [65]. Standardising an educational program for patients that is provided by nurses may therefore not always address an individual patient's needs. Nonetheless, experienced pre-assessment nursing staff will be able to respond to this and will not assume patient information needs, tailoring education according to an individual's knowledge and needs, whilst still emphasising the crucial aspects of ERAS that a patient participates in.

Evidence is evolving for how the host response to surgery may be modified by patient psychology and psychological interventions exerting influences upon immune function, wound healing and short-term postoperative recovery [66]. Of interest a link between molecular markers [vascular endothelial growth factor (VEGF) pre- and postoperatively] in colorectal cancer and anxiety/depression and functional well-being levels has been identified and psychological intervention in a randomised clinical trial in advanced breast cancer patients, natural killer (NK) cell function was elevated [67, 68].

Preparing patients for surgery by education and conditioning of expectations may therefore induce physical changes that will improve outcome. Factors that are considered relevant are: the patient's attitude towards surgery and enhanced recovery and pre-morbid personality significantly influence emotional status during the decision-making process. In turn, emotions have a direct effect on 'stress' hormones and these modulate immune function: Personality type has been found to influence hospital stay and it is likely to exert an effect upon pain threshold. In a recent study postoperative morbidity and extroversion were predictors of length of stay [69, 70]. Postoperative anxiety and depression are closely linked to preoperative levels using validated psychological questionnaires and are related to postoperative quality of life [69]. Preoperative health behaviour can also influence outcome, including immune and endocrine function, wound healing and overall postoperative rehabilitation. When patients are under stress, they may increase negative short-term

destructive coping behaviours including smoking, alcohol and caloric intake and these can have a deleterious effect on not only immune and neuroendocrine function, but also on postoperative physical recovery.

Cognitive behavioural techniques, hypnosis, relaxation techniques, visualisation, imagery and psychosocial interventions have been employed in preoperative patients with significant benefit to outcomes however; these techniques are beyond the scope of this chapter.

Summary

- Preoperative assessment is essential to determine and modify patient co-morbidity prior to surgery to improve recovery and reduce complications.
- Cardiopulmonary function can be optimised in high-risk patients in close liaison with a cardiologist and an anaesthetist.
- Attention to a patient's functional capacity and cardiac risk factors can identify patients requiring further specialist assessment prior to surgery.
- Poor nutrition should be addressed preoperatively, where possible, and oral nutritional supplement will be suitable for most patients.
- Anaemia should be treated preoperatively, where possible, to reduce the need for perioperative blood transfusion.
- Conditioning patient expectations prior to the operation improves patient recovery and reduces anxiety.

Conclusions

Enhanced recovery aims to reduce the surgical stress response, improve the quality of recovery and reduce complications. Pre-assessment is first step in this process. Providing appropriate information to patients ensures co-operation and reduces anxiety. Pre-assessment ensures modifiable risks can be adjusted and appropriate investigation performed to permit optimisation of a patient's condition for surgery. An optimised and informed patient can expect a more rapid and better quality recovery.

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