

Title

Total Pelvic Exenteration Surgery - Considerations for Healthcare Professionals

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Background: Associated with considerable risk of morbidity, Total Pelvic Exenteration (TPE) is a life-altering procedure involving a significant prolonged recovery. As a result, and with the view of achieving the best outcomes and lessen short and long-term morbidities, a well-thought-out and coordinated multidisciplinary team approach, is crucial to the provision of safe and high-quality care.

Method: Using a nominal group technique and qualitative methodology, this article explores the current practices in the care of oncology patients who undergo TPE surgery, in a tertiary cancer centre, by highlighting considerations of a collaboratively multi-disciplinary team.

Results: This article provides guidance on the multi-disciplinary team approach, relating to TPE surgery, with discussion of clinical concerns, and with the goal of high patient satisfaction, provision of effective care and the lessening of short and long-term morbidities.

Conclusion: Oncology patients that undergo TPE surgery benefit from the contribution of a diversified multidisciplinary team as skilled and competent care that meets patient's health and social care needs is provided in a holistic, comprehensive, and timely care manner. Improving patient's care, pathway and postoperative outcomes, with the use of clinical expertise and support from professionals in the multidisciplinary team, can maximise care.

Keywords: Colorectal Cancer; Colorectal Surgery; Pelvic Exenteration; Rectal Cancer; Exenteration.

Background

In 2017 there were around 42000 new cases of bowel cancer diagnosed in the United Kingdom (UK), making it the 4th most common cancer in the UK and accounting for 12% of all new cancer cases, with a large proportion being cases of rectal cancer¹.

Overview

Total Pelvic Exenteration (TPE) is a major operation performed with curative intent in patients with advanced rectal cancers affecting adjacent structures and pelvic organs². It can include the removal of the anus, rectum, sigmoid colon, bladder, prostate in men or uterus, cervix, vagina and ovaries in women². In addition, a urostomy and colostomy are formed, and often the perineal defect and vagina are reconstructed using a flap². As a result, they are resource and labour-intensive, requiring long operating times, patient admission to a critical care unit who may require intubation and ventilation for several days due to significant inflammatory response, and lengthy hospital inpatient stay³.

Described first by Alexander Brunschwig in 1948 as a palliative procedure aimed at symptom relieve and with a significant post-operatively mortality rate⁴; pelvic exenteration, and despite advancements in complex pelvic oncological surgery in the last few decades, is still associated with substantial morbidity risk. Therefore, careful planning and case selection are crucial in order to maximise survival outcome and improvement in patients' quality of life⁵.

While exceptional and practice-altering guidelines are available for individual cancers, such as cervical, bladder and rectal, which have enhanced national standards and allowed many patients access to services, there is no equivalent for the most intricate of cancers requiring exenterative surgery⁶. However, a well-thought-out and coordinated multi-disciplinary team approach, with discussion of clinical concerns and shared decision making relating to the provision of safe and high-quality care, can undoubtedly lead to high patient satisfaction and the lessening of short and long-term morbidities⁷.

Patient Selection

The role of the surgical team in the care of patients who undergo TPE begins from the point of referral. TPEs are performed in a handful of units in the UK. Such centres require a multidisciplinary team (MDT) with expertise in the diagnosis and curative management of locally advanced and recurrent anorectal cancers. Patients are universally discussed in MDT meetings to assess the resectability of the cancer.

By definition, a TPE is offered to patients who have cancers which involve or threaten the circumferential resection margin. That is to say, a standard total mesorectal excision of the rectum by anterior resection or abdominal perineal resection cannot guarantee the complete removal of the cancer. Often, such cancers directly invade adjacent organs such as the prostate gland in men, or the vagina or uterus in women. Therefore, a TPE, which removes most or all of the pelvic organs, is the only option for local control and potential cure⁵.

Resectability is confirmed with a combination of rectal MRI and examination under anaesthesia. Cancer involvement in other pelvic compartments, such as the pelvic side wall or the sacrum must be identified⁸. In such cases, pelvic side wall clearance or sacrectomy could be offered in conjunction with the TPE; however, the latter is associated with significantly higher morbidity⁹. Other factors which contribute to patient selection include the absence of distant metastatic disease (using CT and PET CT scans) and the patient's fitness for surgery¹⁰.

Pre-Operative Counselling and Build-Up to Surgery

Effective preparation before any hospital treatment has long been found to improve patient outcomes¹¹. Cancer patients generally report being overwhelmed during appointments¹² and when they are being prepared for something as significant as exenterative surgery, pre-operative preparation is particularly significant.

1 When a patient is referred to the surgical clinic to discuss possible TPE, they attend with varying
2 levels of knowledge on the reason for them being there. Some patients have simply been told that they
3 have been referred to a specialist centre for their surgery, whereas others have beforehand been
4 informed of the magnitude of the likely surgical treatment. Where TPE surgery will be discussed, we
5 prefer face to face outpatient appointments and recommend that patients bring one person with them
6 to help them process the information given and provide support. It is important that the patient does
7 not feel that they have been overloaded with information, and that any information given it is tailored
8 to their needs and emotions, so that they can process the information effectively¹². Patients are given
9 the contact details of the CNS and encouraged to call or get in contact with any questions or concerns
10 that they have during the work up for surgery. This can be particularly important if the patient has
11 found the consultation distressing or overwhelming, as the importance of the CNS and how their role
12 positively impacts the patient experience has been widely reported¹³.

14 Overview

- 15 • During the consultation, the patient is seen by the Colorectal Consultant Surgeon and Clinical
16 Nurse Specialist (CNS), who initially ascertain what their current level of knowledge is on the
17 proposed treatment.
- 18 • The surgery and the rationale for it are then explained with the aid of drawings and diagrams.
- 19 • Short and long-term side effects of surgery are outlined, in particular, the requirement for
20 permanent faecal and urinary diversions, psychosocial impact, the inevitable cessation of
21 fecundity and fertility, and possible perioperative complications which are re-discussed, but
22 more extensively, once patient sees the anaesthetist.
- 23 • Following this appointment, patients may be required to have up to date imaging, which can
24 include CT, MRI and PET-CT scans, and are referred to the other specialities, such as
25 urologists, gynaecologists, plastic surgeons, who will be involved in their surgery, as well as
26 anaesthetics and pre-assessment unit.
- 27 • Patients will then be booked into these specialist clinics and given the opportunity to meet the
28 team of CNSs who have expertise in TPEs and stoma care and are able to support both patient
29 and relatives and help with their decision making.

34 Recommendations

- 35 • Written information, concerning both the surgical procedure as well as stoma care, in addition to
36 reliable informative websites, is given to patients after they process the initial information.
- 37 • When appropriate, the patient is offered to meet and discuss the planned surgery with another
38 patient who has undergone TPE; to find out more about the procedure and the experience. This
39 is what we call the “buddy” system.

42 In the “buddy” system, we try and match patients up on gender and age range as much as possible.
43 Patients that have been through this process have all reported finding it beneficial, as they are able to
44 ask questions about the inpatient experience but also what to expect once home. A number of patients
45 have also reported feeling that the “buddy” system allowed them to appreciate that it was possible to
46 live a “normal” life following TPE surgery, which they could not imagine until they met other
47 patients, who have had it. Regardless of the benefits, not all patients wish to take part, but
48 nevertheless, it is offered to everyone.

51 **Pre-assessment and Surgical Optimisation**

52 Patient’s surgical pathway can be extensive, encompassing different stages and being the pre-
53 assessment one of them. Following appointments with surgical teams and relevant MDT members,
54 where treatment is explained to and agreed by the patient; subsequently, an appointment is made with
55 the pre-assessment team, to ascertain surgical fitness. TPE is considered a major surgical procedure
56 where preparation and optimisation of the patient is crucial to ensure optimal outcome from the initial
57 surgical appointment up to post-operatively discharge home¹⁴, and an appropriate and thorough pre-
58 assessment can play a significant role.

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Overview

- Nurse-Led Pre-Assessment Clinic which includes assessment of patient's general health and fitness via thorough clinical history and physical assessment, blood tests, vital signs, echocardiogram, electrocardiogram, cardiopulmonary exercise test (CPET) and others that might be relevant depending on the patient specific needs and encountered concerns.
- Patients are also routinely assessed by a Consultant Anaesthetist and, particularly in the cases where they have complex past medical history and/or are identified as frail, then a wider MDT approach is used with the added input of physiotherapists (PTs), occupational therapists (OTs), pharmacists, dietitians, and complex discharge team.
- The nurse's role and experience are extremely valuable at this stage as patients are assessed in a holistic fashion.
- The whole process of pre-assessment might need to take place in more than one visit depending on how much optimisation or preparation patient might need, and consult with other MDT members, e.g., Cardiology and/or Respiratory Physician, might be required for possible further assessment and optimisation.

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Relating to CPET, this has become a valuable and beneficial instrument for clinicians regarding decision making and post-operative patient management. Over the last 20 years CPET has been established as part of the preoperative assessment particularly for those who are considered high-risk patients undergoing high-risk surgery, such as TPE¹⁵. CPET aids the identification of fitter or deconditioned patients, indicating how great their physiological reserve might be to undergo surgery and to recover sooner with fewer postoperative complications¹⁵; therefore, CPET has been proved to be an excellent indicator of patient's expected performance during and after major surgery¹⁵.

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Recommendations

- Acknowledging patient's vulnerabilities that need addressing, managing patient expectations, and acting on any care gaps with the help of MDT members, are essential on patient preparation and optimisation.
- Accomplishing all the benefits of an MDT approach can be a lengthy process and, therefore, it is vital that patients are reviewed as soon as possible in order to prepare them both physically and psychologically for such a major operation in a safe and timely manner.
- Constant communication and explanation of the intended outcomes needs to occur, to get patient involvement and compliance.
- The nurse's role in the preoperative assessment is to identify the patient's needs and risk factors that may be affected by the surgical experience and during the entire perioperative care trajectory.

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In complex diseases, an MDT approach and input, results in greater patient satisfaction, better staging, improved surgical experience and increased survival^{16,17}. With all relevant MDT members input, a plan is designed and agreed with the patient, and when thought to be fully optimised and ready for surgery, the surgical team is notified, and a date for surgery is booked. In the occasions where, following all MDT input, patient is deemed not physically fit for surgery; then the patient is referred back to the surgical team with the explanatory reasons on why. In cancer settings where patients are frequently anxious about their diagnosis and treatment, a positive relationship may be notably significant in helping the patient and the healthcare professional to develop collaboration in determining on suitable interventions^{18,19,20}. It can be a situation where there might be space and time for improvement and optimisation of fitness level, with adequate interventions, so that patient can be reconsidered for the planned surgery with the input of the MDT members involved, such as dietitian, OT, PT, etc. If still patient is deemed not fit for major surgery, then discussion at MDT meeting will occur to ascertain any other available options of cancer treatment.

Management of Intra-Operative Time

Planning for TPE surgery from a theatre's department perspective, commences at least the week before the actual due date of the surgery. It is pivotal that staffing levels, appropriate skill mix, equipment and instruments required, are well-thought-out and planned, which will consequently promote adequate use of theatre resources, avoid overspending, and contribute to departmental efficiency^{21,22,23}.

Overview

- Prior to patient being brought to the operating room, a briefing takes place with all relevant theatre team members and representatives of all surgical specialities, ensuring patient safety²².
- TPE surgery requires the input of multiple specialties, such as, Colorectal, Gynaecology, Urology, Plastics, Anaesthetic and/or Vascular.
- Each team will have their own equipment and specific members of staff, such as an operating department practitioner or scrub nurse. This can subsequently translate into a demanding operating room with frantic foot traffic, as at any giving time, up to fourteen members of staff might be present.
- During the briefing, any equipment and instruments required is requested, prioritization of tasks and sequence of the surgery is established, and surgical or anaesthetic concerns are discussed.
- Once the patient is anaesthetised, and the operating room prepared, lithotomy positioning of the patient is adopted for the first part of the surgical procedure.
- Surgery is usually initiated by the colorectal team, followed by the urology team. In the event of a female patient who requires gynaecologic team input, at a certain point, three surgical teams may be operating simultaneously, each with their own scrub and circulating nurses, to facilitate anticipated surgical outcomes and optimisation of theatre time
- The final part of the surgical procedure is led by the Plastic's team.

Recommendations

- The briefing allows introductions and awareness of professional roles amongst all involved, and to prepare ahead for any anticipated potential outcomes, such as difficult airway, challenging anatomical resection, blood loss and/or cardiac event.
- It is important to ensure pressure areas are protected. An anti-slip matt should also be considered due to the extreme head down positioning required. Positioning of the patient's legs must avoid hyper-flexion or extension of the hips and knees joints to reduce the risk of pressure injury and thromboembolism. Prolonged elevation of the legs must also be avoided to reduce the risk of inadequate perfusion and subsequent compartment syndrome.
- Where more than one surgical team is undertaking the surgery, to prevent cross-contamination and to reflect the needs of the surgery and the surgeon's preferences, separate sets of instruments and drapes (e.g., for abdominal and perineal approach) should be utilised.
- Patient positioning is vital for executing the intended flap reconstruction²⁴, particularly when patient must be prone positioned, which often requires a reinforced endotracheal tube, the use of another operating table with specific attachments, and enough staff available to carry out the transfer and repositioning in a safe manner.
- Clear communication, and a calm and professional approach from everyone involved, is key. It is important that the various surgical teams involved in the operation communicate openly and coordinate the timing of their portion of the operation.

Due to the complexity of TPE surgery, it is imperative that the team leader, for the theatre team, has a high level of skills and knowledge and delivers appropriate leadership, so that each member has a good understanding of their duties and the standards of performance expected from them^{22,23,25}. This is the case for record keeping, as in such an extensive surgery such as TPE, bleeding is anticipated and therefore documenting blood loss from blood-soaked swabs and suction unit, and update the whole team with the running total, is paramount. Concurrently, the same applies regarding fluid balance, and

1 swab usage, as at any giving point, over twenty litres of fluids can be administered, including blood
2 products and intravenous (IV) fluids. In addition, the theatre team leader should continuously evaluate
3 risks and ensure constant provision of measures that will contribute to patient safety and avoid
4 potential errors²². This is the case for the upkeep of the theatre equipment and instruments being
5 utilised during the surgery, which is the responsibility of the theatre team²¹, but due to the multiple
6 speciality collaboration in TPE surgery, can be challenging to carry out. For these reasons, it is crucial
7 that the theatre team have a close working relationship and create a positive work environment so that
8 a culture of safety and prevention of unnecessary harm to the patient is maintained²⁶.

9 **Post-operative Management and Prevention of Clinical Deterioration**

11 Clinical deterioration may occur at any time in a patient's illness with patients being especially
12 susceptible to deterioration following surgery, emergency admission or during recovery from critical
13 illness²⁷.

16 **Overview**

- 17 • TPE surgery patients are required to be admitted to a Critical Care environment for continuous
18 invasive monitoring, to reduce the risk of complications associated with prolonged surgery and
19 period of anaesthesia.
- 20 • Due to the stress response to the surgery, patients may develop a systemic inflammatory
21 response syndrome (SIRS) leading in some cases to secondary multi organ dysfunction and
22 potentially, death¹⁰. To minimise the SIRS response and optimise patient's recovery, the
23 intensive care focus is on maintaining hemodynamic stability and ensure adequate organ
24 perfusion and oxygenation using goal-directed therapy via invasive monitoring with an arterial
25 line and cardiac output monitoring, to guide through fluid resuscitation and the use of inotropes
26 and vasopressors^{10,28,29}.
- 27 • Critical care length of stay depends on patient's hemodynamic stability but, overall, is
28 approximately between 3 to 4 days, pending patient being clinically stable and with pain well
29 controlled. Once stepped down to the ward, patients are reviewed and closely monitored by a
30 member of the Critical Care Outreach Team (CCOT) until deemed in good health from a
31 clinical perspective.
- 32 • Routinely, ward staff use the National Early Warning Score 2 (NEWS 2) system to guide
33 observation frequency, urgency of clinical review and competency requirements of team
34 undertaking the review.

35 The NEWS was developed, initially in 2012 and later updated to NEWS 2 in 2017, to improve the
36 detection of and response to clinical deterioration³⁰, following the finding that warning signs of
37 deterioration prior to cardiac arrest were present in 75% of all cases, however, these signs were poorly
38 recognised, acted upon infrequently and only occasionally escalated to senior doctors³¹. The NEWS 2
39 uses an aggregate scoring system of physiological measurements providing a systematic approach and
40 track and trigger system for monitoring all hospital in-patients³⁰; escalation to the CCOT and surgical
41 teams takes place with aggregated NEWS score of 5 or of 3 in one parameter, extremely beneficial for
42 patients post TPE surgery as early identification of clinical deterioration, will allow timely treatment,
43 essential in preventing serious complications with significant consequences³⁰.

Complications

- Examples of TPE post-operative complications include haemorrhage, pelvic abscess, urinary and gastrointestinal injury (leakage, stricture, fistula), being the most common, surgical collections^{5,32}.
- Infection is also a possible complication, with potential sources that include surgical site, both deep and superficial, respiratory, urinary, and/or from lines such as central venous catheter^{9,32}.
- In addition, the risk of thromboembolism is not insignificant³², due to prolonged periods of immobility, as post TPE surgery, patient positioning and mobilisation can be challenging as both are restricted by the presence of a flap.
- Late complications may include incisional, perineal and peristomal hernias, stoma narrowing and bowel obstruction^{33,34}.
- Low albumin levels pre-operative, blood products transfusion intra-operatively, and/or post-operative malnutrition, have been found to increase the risk for post-operative complications following TPE surgery^{32,35}, however, complications occurrence does not seem to affect the overall survival rate³².

Amongst these many possible complications, chest infection and specifically hospital acquired pneumonia (HAP), is one important to look out for; as it can lead to significant patient safety issues and have substantial influence on health care use, costs, patient morbidity and mortality, with the latter ranging between 30% -70%^{36,37,38}. HAP usually develops 48 hours or more after admission to hospital³⁷ and, in the context of post TPE surgery, it is associated with reduced lung volumes as a result from a shallow breathing pattern which may be caused by analgesia, general anaesthesia, and pain^{39,40}.

With the aid of the NEWS 2, changes in physiological parameters, such as heart rate, respiratory rate, oxygen saturation, blood pressure, temperature, conscious level/new confusion, are more easily identifiable⁴¹. In view of how extent TPE surgery is, signs of clinical deterioration should be scrutinised; in addition, prevention of clinical deterioration is more likely to succeed, when a multi-professional and collaborative approach with the input of CCOT, physiotherapists, pain team, pharmacists, surgical team, ward nursing team, and other relevant healthcare professionals, is in place with a patient centred approach³⁹.

If one of the aforementioned complications is suspected; CT scan is routinely the imaging of choice for further investigation^{5,32,42}. In addition, prophylactic low molecular weight heparin (LMWH) should be given for 28 days post-operative, with the view of preventing thrombotic events⁴³.

Furthermore, HAP can be successfully managed with appropriate antibiotic choice and with a range of fitting interventions^{39,41,44,45}.

Recommendations

- Early recognition of worsening physiological measurements is paramount.
- The NEWS 2, along with accurate fluid balance monitoring and regular pain assessments, help to identify potential deterioration in the patient's clinical condition.
- Conservative management of complications is, most of times, the best approach, but, in other times, return to theatre or interventional radiology (IR) procedures is inevitable.
- LMWH should be started as soon as clinically safe.
- In HAP, rapid diagnosis and immediate initiation of empirical antimicrobial treatment is vital to avoid patients developing respiratory failure, sepsis, and multi organ failure.
- Deep breathing exercises, early mobilisation, coughing, positioning, and optimal pain control are 5 interventions that may help lessening the likelihood of a patient developing HAP.
- Patients must gradually stand and walk as part of their rehabilitation, combined with lying on one side or the other whilst in bed, and while practicing deep breathing exercises in order to reduce the likelihood of respiratory complications.
- Psychological support should be offered to patients to help manage the impact of lengthy hospital stay and help to adjust to life after major surgery.

Pain Management

In TPE surgery, pain management begins pre-operatively when patients are counselled and assessed by a Consultant Anaesthetist, who explains the strategies to manage their expected post-operative pain and alleviate any potential concerns. This ‘prehabilitation’ can contribute to the lessening of preoperative anxiety and catastrophising which the Faculty of Pain Medicine⁴⁶ suggests it may lead to improved post-surgical outcomes including better pain management.

Overview

- Standard first line practice for post-operative pain management is a tunnelled lumbar epidural with 0.125% levobupivacaine and 4mcg/ml Fentanyl. While in patients with compromised renal function, allergy or advancing age, a stand-alone plain 0.125% levobupivacaine may be considered.
- In addition, IV patient-controlled analgesia (PCA) with Fentanyl, Morphine or Oxycodone may be added, as part of the multi modal analgesia approach, either in conjunction with a plain levobupivacaine epidural or after the epidural has been discontinued.
- Paracetamol administered throughout the post-operative stay and, when given IV, results in higher central nervous system concentration and faster onset of analgesia, compared to the oral route⁴⁷, which is used once allowable.

There is a growing body of evidence to support the use of anti-neuropathic agents in the reduction of post-operative pain, with research suggesting that, in general, its implementation can reduce pain scores and post op analgesic requirements⁴⁸. Commonly, pregabalin is our first line option due to its pharmacokinetic advantages over gabapentin, including faster rate of absorption with peak blood plasma concentration achieved within one-hour, equal bioavailability regardless of the dose, and potentially fewer side effects⁴⁹. Practice still varies locally and within departments, as to whether prophylactic pregabalin is started in the pre, peri or post-operative phase; however, it is likely that in the future, its use will be standardised via a formal enhanced recovery protocol for TPE surgery. Regardless, our understanding is that the use of pregabalin is of benefit particularly in patient’s undergoing sacrectomy as part of their TPE surgery, as neuropathic pain is expected due to the sacrifice of the sciatic nerve roots⁹.

Considerations

- Patients on epidural require dynamic pain assessment involving motor assessment using the bromage scale and sensory assessment utilising the dermatome map⁵⁰.
- PCA has several associated complications including masking of potential post-operative complications like pulmonary embolism (PE) or opioid toxicity, including opioid induced ventilatory impairment, nausea and/or vomiting, which require nursing intervention and on-going assessment⁴⁷.
- Non-pharmacological therapies have also been shown to be of great benefit in the pain management of patients who undergo TPE surgery, in addition to, overall, supporting their journey of recovery⁵¹.

Recommendations

- Monitoring patients on epidural promotes early detection of rare but serious adverse events, including epidural abscess or haematoma, requiring dedicated time during each nursing shift.
- PCA in our TPE patient cohort, who may remain without diet for up to two weeks, can be an effective way of providing IV opioid analgesia, in addition to permit patient independence over the pain control element of their treatment pathway.
- Routinely, massage and reflexology, aromatherapy and/or music therapy, are provided by our complimentary therapies team, in addition to relaxation strategies provided by our occupational therapy team and heat therapy by the nursing staff.

Nutritional Support

Nutrition is a significant element of the patient's cancer journey which can potentially have a negative impact on body composition, regardless of cancer type and stage⁵². Furthermore, malnutrition is commonly associated with poor outcomes such as increased risk of toxicity to systemic treatments, increased risk of post-operative complications, reduced survival and diminished quality of life⁵³. Therefore, it is vital to identify patients who are at risk of malnutrition, which can be done via a validated nutrition screening tool and subsequently referred to a dietitian for advice. Ideally, a 10-to-14-day period is needed to optimise nutritional status⁵⁴ through either food fortification/dietary advice, or the use of appropriate nutritional supplements that can provide additional energy, protein, vitamins, and minerals.

Overview

- Whilst enteral feeding is typically the preferred route of feeding in post-operative periods due to lower costs, reduced risk of complications and shorter length of stay⁵⁵; in TPE surgery this presents challenges, as patients might be ventilated for the first few days and often in short-term ileus and/or gastroparesis secondary to such major and prolonged gastrointestinal surgery. Therefore, parenteral nutrition (PN) is more indicated⁵⁴, which is standard practice in our centre, as an alternative method of nutrition support, sometimes used up to 14 days post-op, whilst trying to establish patients on an adequate oral intake, and to avoid malnutrition.
- PN is the provision of nutrients directly into a vein. It should be used for patients who have a non-functioning gastrointestinal tract or for whom access to the gastrointestinal tract for the purposes of feeding is not possible⁵⁶. It can provide energy, nitrogen, glucose and fat as well as vitamins, minerals and trace elements to support recovery⁵⁶. It can help to maintain nutritional status but is not designed to improve nutritional status in the short term⁵⁵. However, it can increase the risk of infections and can worsen liver function, glucose levels and fluid balance⁵⁵.
- Oral intake post-surgery will be guided by the surgical team but tends to start with sips water and increases to clear fluids (e.g., consommé soup, jelly, and fruit juice), then free fluids (e.g., creamy soup, milk, ice cream and yoghurt), and finally a soft diet (e.g., fish, mashed potatoes, eggs, and cereal).
- By the time of discharge, patients tend to have a good nutritional status, however, their nutritional status can decline once at home⁵⁷.

Recommendations

- Nutritional supplements are often prescribed, and as the diet is progressed, to help ensure adequate nutrition, a good recovery and to supplement any deficit that has been identified.
- PN is usually discontinued once patients have either been fully established on a soft diet or having sufficient nutritional intake that their remaining needs can be met by choosing appropriate supplements.
- Patients are advised to continue a soft diet for 4-8 weeks after the surgery, to have small but frequent meals throughout the day and ensure a good fluid intake of at least 2000mls daily. This is advised with the intent of facilitating digestion and to avoid pressure on the recently operated bowel.
- Patients are often followed by a Dietitian once at home for further advice and support, and to monitor nutritional status.

The progression beyond the soft diet is to a normal and healthy balanced diet. As most patients will have a colostomy, ordinarily, there is no need for any dietary adjustment, however, recommendations can be provided by a dietitian, stoma nurse or alternatively accessed on the internet by the patient. Though, the principle here is to, daily, have five portions of fruit and vegetables, base meals on carbohydrate foods (e.g., bread, rice, pasta and potatoes), choose sources of higher fibre (e.g., broccoli, carrots, sweetcorn, peas, beans and pulses), have some protein-based foods (e.g., meat, fish, eggs), and have unsaturated fats in small amounts (e.g., oils and spreads)⁵⁸.

Flap Care

Reconstruction of the perineum, as part of TPE surgery, can be performed through a variety of options that fill the dead space created after exenteration, rebuild the pelvic floor, and essentially enable closure of the perineum in a tension free manner using the patient's own tissue, also known as autologous tissue⁵⁹.

Overview

- A flap is the term used when autologous tissue is moved from one part of the body to another and can be described as free or pedicled²⁴. A free flap has its blood supply divided at the donor site and is anastomosed to vessels at a distant recipient site, whereas a pedicled flap remains attached to its original blood supply and is transposed to a recipient site that is local or regional to its blood supply²⁴.
- The specific flap choice is based on a variety of factors but is fundamentally dependent on tissue availability and the extent of the resected defect. Pedicled flaps are generally favoured in perineal reconstruction as part of TPE surgery, the most common being the vertical rectus abdominal muscle (VRAM), oblique rectus abdominal muscle (ORAM) or inferior gluteal artery perforator (IGAP) flaps.

The VRAM or ORAM reconstruction involves using an abdominal wall pedicled flap based on the deep inferior epigastric artery and vein and composed of abdominal skin, fat, and rectus abdominus muscle⁶⁰. This is pivoted on its axis into the pelvic/perineal defect. The rectus muscle and fat provide tissue to fill the dead space in the pelvis, created by the exenteration, which if not filled would leave room for fluid to accumulate and possibly become infected⁵⁹. The flap is sutured to the border of the excised perineum, giving a skin island, and, in female patients, there may also be a vaginal reconstruction using a portion of this flap. The gluteal advancement flap, on the other hand, involves mobilizing and advancing the gluteus maximus muscle and overlying buttock skin medially, to reconstruct the perineal defect and fill the pelvic dead space⁶¹. The blood supply is based on the inferior gluteal artery perforator hence the common abbreviation of this flap is IGAP⁶². This can be a unilateral or bilateral flap depending on the extent of resection.

Flap complications, including dehiscence and infection, can be particularly challenging to manage following TPE surgery⁶⁰. Factors such as medical history, position of suture lines, previous radiotherapy, and nutritional status, can all contribute to delayed wound healing⁶³.

Recommendations

- Keep compression off the reconstruction site to reduce the risk of vascular compromise and keep patient in a full lateral position to avoid direct pressure on the flap.
- Reposition patient from side to side routinely every two hours, and ensure the bedding is crease free and that the patient is not lying on any lines or tubes, as these can cause pressure injuries.
- Use an air mattress for pressure management and place a pillow between patient thighs to reduce perineal compression. It can be difficult to maintain a patient in this position; therefore, frequent repositioning and prompting may be required.
- Ensure the flap is clean and dry; this usually involves meticulous perineal cleansing and drying four times a day, as well as vaginal douching, when vaginal reconstruction has been performed.
- Encourage early mobilisation when clinically suitable post-operatively and at the earliest opportunity.
- In the VRAM or ORAM flap setting, an abdominal binder is used to reinforce the abdominal wall repair and give additional support during mobilisation and overall patient recovery. This is not required in the IGAP setting as the integrity of the abdominal wall has not been compromised to create the flap.
- Sitting is avoided for 7 days following surgery to ensure the flap vasculature has had time to become robust and is able to tolerate direct pressure.
- Sitting is introduced on a Valley cushion, starting with 15-minute periods twice daily and gradually increased to 45 minutes four times a day. However, this may not be achievable at the

point of discharge, because of the discomfort experienced by some patients, particularly where a surgical drain is required to remain in situ for a prolonged period, leading to patients taking more time to build up tolerance for sitting. This can cause feelings of frustration for patients and is often the limiting factor restricting them returning to normal daily activities, including returning to work.

- Wound complications are regularly managed with antibiotics and conventional dressings or topical negative pressure dressings (VAC), which can potentially delay discharge until the wounds are at a level that can be managed in the community.

Mobility

Patients undergoing exenterative surgery trend towards worse physical function than the general population, and the TPE procedure itself results in a further decline in an individual's functional capacity¹⁴. The degree of deterioration is influenced by the patient pre-operative state, length of hospital stays, and the incidence of post-operative complications¹⁴. This decline is often significant enough to cross the functional threshold, or line of dependency which impacts on an individual's ability to participate in normal activities of daily living, such as walking^{64,65}. For this reason, patients often have complex multi-professional rehabilitation needs in the post-operative period.

Overview

- The recovery can be challenging and may take weeks or even months⁶⁶.
- The aim of early mobilisation is mitigating the risk of developing post-operative pulmonary complications (PPC)^{43,67}; increased due to duration of anaesthesia, large surgical incision, post-operative pain and mobility restrictions, as patients will often have to remain in side lying positions for long periods of time during the early post-operative period, which reduces functional residual capacity and results in suboptimal lung mechanics for effective coughing^{68,69}.
- Functional rehabilitation and mobilisation can be challenging after TPE surgery. Movement restrictions are often in place to avoid unwanted pressure on the flap and to allow optimal healing⁵⁹.
- Common barriers or limitations to mobilisation are post-operative pain, hypotension/orthostatic intolerance and multiple post-operative drains and attachments.
- Atelectasis are common post-operatively, particularly following abdominal surgery⁷⁰. Mobilisation as part of enhanced recovery after surgery (ERAS) protocols appears to be an effective way of managing atelectasis, as well as other PPC^{43,71}.

Recommendations

- Early rehabilitation and mobilisation to support the patient to regain functional independence, improve functional capacity and enhance recovery, is vital.
- Respiratory physiotherapy techniques and airway clearance exercises can assist in the management of sputum retention.
- Patients can require significant assistance and the use of mobility aids to regain function, even in high functioning patients, who are likely to require assistance for the management of attachments and for support to avoid pressure through the flap.

Pharmacology

TPE surgery is exceptionally complex and associated with a high risk of complications which can be minimised with careful planning and efficient perioperative management, leading to improved clinical outcomes and survival for patients⁷². In 2002, the 'National confidential enquiry into peri-operative deaths' highlighted that many patients were not being given essential regular medicines before their operations⁷³. NICE⁷⁴ and WHO⁷⁵ identified medicines reconciliation as a key priority for patient safety around the world and have provided guidance. An effective medicines reconciliation process at an early stage of the pre-assessment period will help support the delivery of medicines optimisation⁷⁶.

Overview

- Early review of any prescribed medicines is essential with the aim of optimisation, reducing the chances of medicine related adverse events and possibly reducing the length of admission⁷⁶.
- Through the means of multidisciplinary collaboration, a comprehensive pre-operatively pharmaceutical plan can be developed, medicines optimised, and careful planning can be thought out, in regards to which medicines can be safely continued and/or if any new medicines need to be initiated in the post-operative period, to help manage patients pre-existing comorbidities and improve outcomes⁷⁶.
- Optimising long-term conditions such as diabetes, hypertension, atrial fibrillation and/or anaemia, in addition of reviewing any prescribed medications preoperatively, will help reduce the overall patient morbidity and mortality threat^{74,77}.

A core priority postoperatively, from a pharmacology point of view, is to minimise medicine related complications, associated with patients remaining nil-by-mouth for a long period of time or when gastric absorption may be an issue, in which seeking alternative routes of administration should be considered.

Common medicines prescribed after colorectal surgery include:

- protein pump inhibitors (PPIs), with the purpose of decreasing gastric acidity, reducing the risk of stress related gastric ulcer⁷⁸.
- medicines with prokinetic properties, such as metoclopramide or erythromycin, particularly for the management of postoperative ileus which has a prevalence of 17% to 80% in adult surgical patients though some research has found that neither are successful in expediting the resolution of ileus⁷⁹.
- antiemetics, such as Ondansetron and Metoclopramide, however, appropriate selection is crucial as, the first is known to be constipating⁸⁰, which might not be suitable if patients are at an increased risk of ileus or bowel obstruction, and the latter might enhance gastrointestinal motility⁸¹.
- antimotility drugs, such as loperamide or codeine, particularly in cases of overactive stoma, with the aim of reducing intestinal motility and promote water to be absorbed and consequently thickening the stools and reducing stoma output⁸². However, codeine can have a sedative side-effect and cause fat malabsorption⁸³, while loperamide capsule formulation is generally not well absorbed^{82,84}.
- antisecretory drugs, such as octreotide, however only in rare cases and to aid stoma output decrease, as it can reduce gastrointestinal, biliary, and pancreatic secretions, as well as decrease gastrointestinal motility, although inhibiting glucagon and insulin release^{85,86}.
- antimicrobials, either for treatment or prophylactic, for example in recurrent urinary infections where low dose of prophylactic antimicrobials might prevent deterioration that might lead to life-threatening situations such as urosepsis⁸⁷.
- anti-coagulants, to reduce the risk of thromboembolic events^{34,88}.

Recommendations

- A key indicator of general health and of any likely postoperative complication, is the medicines the patient takes.
- The time between pre-assessment and surgery provides a unique opportunity to create individualised perioperative pharmaceutical plans.
- The pharmaceutical plan is individualised and provides a unique opportunity to understand the patient's experience of their medicines, ensuring they are taking it correctly and that medicines are prescribed appropriately, avoiding unnecessary drugs, and reducing medicines wastage.
- IV PPIs are routinely prescribed postoperatively and until patient is fully established on an oral diet.
- Postoperative ileus is routinely managed by keeping patients' nil-by-mouth, which in turn promotes bowel rest, and with prokinetics, only prescribed after thoughtful consideration.
- Ondansetron is usually preferred over metoclopramide, to manage postoperative nausea and vomiting.
- Where opioids such as morphine or oxycodone are prescribed for pain management, regular laxatives to avoid constipation might also be prescribed when clinically appropriate.
- As most patients are usually given PN as a form of nutrition, which requires to be clinically screened for any possible interactions with any other medication prescribed; blood results such as liver function and electrolytes need monitoring.
- When required, loperamide is usually prescribed over codeine, and either in the liquid or dispersible formulation.
- Where octeotride is prescribed, stoma output, liver function, thyroid function, observations like blood pressure and heart rate, and blood glucose levels, should be closely monitored.
- Patients should remain on LMWH, or suitable alternative, for up to 28 days post operatively.

Once the patient is clinical suitable for discharge, the pharmacist and surgical team will prepare the medicines required to be continued at home, which are usually for a short-term period, and reviewed again in the follow-up clinic.

Stoma Care

TPE is a life-altering surgery, with the effect of permanent change in body image and potential psychosexual issues, as it requires the formation of bowel and urinary diversions, most commonly in the form of an end colostomy and an ileal conduit⁸⁹. On certain occasions, a double-barreled wet colostomy (DBWC), or Carter's stoma, may be offered to the patient, which is when both urine and faeces are diverted to one pouch as opposed to having two separate stomas⁹⁰. In our experience, however, most patients choose the latter, citing lack of specific pouches designed for a DBWS as well as, being a lesser-known type of stoma to many community stoma nurses⁸⁹ coupled with concern about lack of support after surgery. Adequate pre-operative planning is therefore imperative to support a patient's psychological wellbeing, and hopefully promote early acceptance and subsequent coping to life with a stoma⁹¹. This is perhaps even more important for patients having two stomas.

Overview

- Routinely, the specialist stoma nurse meets the patient for pre-operative counsel on two separate occasions, easing concerns and elucidating about stoma care, which, hopefully, will lead post-operatively to the patient becoming promptly confident and competent in stoma care⁹¹.
- The first appointment will be to counsel the patient in having two stomas, or less often a Carter stoma. This includes discussing the post-operative pathway and what the patient should expect, along with ensuring the patient is fully aware of what a stoma is, types of stomas, associated care, and types of available and suitable pouches (e.g., open vs. closed pouch). Relevant literature and practice kits are given to the patient and referral for psychological support is offered if deemed required.
- The second appointment is on the day of admission, routinely the day before the surgery, where any further questions from the patient are answered and the ideal stoma site is marked on the

1 patient's abdomen. This is a very important element of the pre-operative preparation, as the
2 patient will most likely have two permanent stomas and, therefore, sensible consideration needs
3 to be given to the optimal stoma sites⁹², ensuring sufficient abdominal area to position two
4 pouches and the patient being able to see both stoma sites⁹³.

- 5 • Once the patient undergoes TPE surgery, it can take several days before they feel up to
6 engaging with stoma care. Patients are often intubated for a few days and even when extubated,
7 the use of opioid analgesia might affect their concentration and understanding⁴⁷. This coupled
8 with the challenge of the patient being able to visualize their stomas when being nursed side to
9 side, to maintain adequate blood flow to the flap reconstruction, tends to slow the teaching
10 process.

11 Considerations

- 12 • A patient's quality of life can be significantly affected due to challenges in managing their
13 stoma that can arise from poorly siting⁹⁴. Siting for a stoma however can be a complex task in
14 some patients and requires careful consideration from the stoma nurse with involvement of the
15 patient⁹⁵. Challenges such as obesity, presence of deep skin folds and scarring can affect
16 position⁹⁴.
- 17 • Since this patient group are often inpatients for around 3 weeks, with 15.6% of patients
18 remaining as an inpatient at 30 days⁵; there is the benefit of time to teach and develop a more
19 individualized program⁹⁶.
- 20 • During surgery, ureteric stents are inserted into the kidneys via the newly formed ileal conduit
21 to protect the ureteroileal anastomosis and to ensure urine output is not compromised by
22 pressure exerted on the ureters with post-operative abdominal swelling^{97,98}.
- 23 • Stoma leakage from the stoma appliances in the early days following surgery is not uncommon,
24 often due to compromised pouch adhesion through the patient being nursed side to side, in
25 addition to the presence of a long midline abdominal surgical wound (unless performed
26 robotically) and surgical drains, often meaning the overlapping of dressings with the stoma
27 appliances. However, it is critical to manage and minimise it to reduce the risk of wound
28 infections or peristomal skin damage as well as caring for the patient psychological wellbeing
29 whereby leakage is found to exacerbate feelings of fear, embarrassment, and reduce quality of
30 life⁹⁹.

31 Recommendations

- 32 • Ward staff follows a protocolized stoma care pathway to aid monitoring of the stoma
33 appearance and temperature, peristomal skin, output and psychological wellbeing of the patient;
34 and a structured teaching guide in how to help patients become self-caring.
- 35 • It is important to monitor the stents for patency and dripping as, at times, these can become
36 blocked with mucus or blood clots, and in these occasions, flushing it with 0.5 to 1ml of normal
37 saline is indicated to avoid hydronephrosis or undue pressure being placed on the anastomosis.
38 Stents are usually removed 14 days post-surgery by trained ward staff, with prophylactic
39 antimicrobial cover to reduce the incidence of febrile events, such as urosepsis.
- 40 • Regular patient reviews from the stoma nurse along with educating and supporting ward staff on
41 tips to minimise the risk of leakages such as use of barrier rings and/or convexity, cutting the
42 aperture off center or applying the stoma bag before dressings is therefore imperative to provide
43 appropriate stoma care and patient guidance, and avoid related post-operative stoma
44 complications.

45 Once the patient is almost clinically fit for discharge, stoma competent and confident, a referral to the
46 local stoma care nurse that includes details of the surgery and pouches currently being used by the
47 patient is sent. In addition, the patient is given a two-week supply of their products from the hospital,
48 and they are set up with a Dispensing Appliance Contractor (DAC) who will deliver the stoma
49 products to their home address. The patient is given appropriate contact numbers and the information
50

needed to obtain more supplies. A letter will also be sent to their GP detailing their product requirements and community stoma nurse contact details.

Long-Term Outcomes

TPE is a major and radical procedure; therefore, a thorough pre-operative assessment should be safeguarded so that, if clinical concerns arise, a specialist comprehensive, streamlined, and timely management plan is put in place; including assessment and formulation of clinical decisions to provide ongoing care and treatment^{7,100}. For example, a patient might be found to be anaemic and therefore an iron transfusion might prove to be beneficial from an optimisation point of view¹⁰¹. After discharge, patients are scheduled to attend clinic for review and discuss the result of the histological features of the cancer. Some patients will be referred on to have further treatment, such as chemotherapy. During review, particular attention is paid to the health of the stomas and wound healing. Due to the higher rates of local and regional recurrence compared to non-locally advanced cancers, surveillance following TPE continues for at least 5 years and often includes regular tumour markers monitoring (CEA), cross sectional imaging (MRI and CT), and colonoscopy surveillance of the proximal colon per stoma.

Measuring outcomes on a wider scale, rather than locally, is challenging as long-term morbidity is probably under-reported and underestimated. However, the international PelvEx Collaborative⁵ data on survival outcomes following TPE is the largest available series to date. Of 1291 patients undergoing TPE for primary advanced rectal cancer, a median overall survival of 43 months and a 3-year survival of 56.4% was observed, in those who had clear resection margin (R0 resection), which was 79.9% of the 1291 patients. In patients who had R1 and R2 resections, the median overall survival was 21 and 10 months and 3-year survival of 29.6% and 8.1%, respectively (P < 0.001). In addition, for all 1291 patients, the 30-day postoperative mortality was 1.5% and 37.8% of patients experienced one or more major complication⁵. Furthermore, the psychological and quality of life impact following TPE can be significant, and therefore, centres which perform TPE surgery should have the facility to collect patient related outcomes and respond to these with appropriate support^{34,42,102}.

Conclusion

Oncology patients that undergo TPE surgery benefit from the contribution of a diversified multidisciplinary team as skilled and competent care that meets patient's health and social care needs is provided in a holistic, integrated, comprehensive, streamlined, and timely care manner. Improving patient's care, pathway and postoperative outcomes, with the use of clinical expertise and support from professionals in the multidisciplinary team, can maximise care.

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