Proposal for a national triage system for the management of ventral hernias

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ABSTRACT

Ventral hernia disease is becoming increasingly prevalent and complex. Subspecialisation for patients with challenging conditions requiring surgery has been shown to improve postoperative outcomes. Worldwide, there is an emergence of specialist hernia centres using new and innovative techniques to repair large and complicated ventral hernias. After a national meeting of hernia experts, we present an algorithm to be used as a national triage system for patients with ventral hernias, with the aim of ensuring that patients are operated on by the most appropriate surgeon. Evidence-based clinical risk factors and ventral hernia parameters are used for risk stratification and patient triage. We hope that this algorithm will guide future ventral hernia management in the UK.

KEYWORDS

Ventral hernia – Abdominal wall – Algorithm

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Introduction

With an ageing and increasingly obese population there is a growing prevalence of ventral hernia disease.^{1,2} Ventral hernias are increasing in size and complexity and present a significant challenge to the general surgeon. Recurrence rates after incisional hernia repair remain high, between 10% and 40%, and the rate increases after each subsequent attempt at repair.² As with most diseases, research into ventral hernia disease has focused on both prevention and treatment. The main discovery for ventral hernia prevention is the 'small bites' laparotomy closure technique, which has been shown to half the incisional hernia rate at one-year follow-up.³ However, the question remains how best to treat these patients, especially those with complex ventral hernia disease and those with a number of previously failed attempts at repair. In recent years, many countries have shifted towards ventral hernia repair subspecialisation, with the creation and implementation of specialist hernia centres.^{4,5} In Sweden, this has already been shown to improve post-operative outcomes for inguinal hernia surgery.⁶

Creation of a formal hernia subspecialisation pathway (including referral, where appropriate, to specialist hernia centres) is reliant upon an accurate, widely accepted and relevant grading system to establish the severity of the ventral hernia and the need for specialist input. In recent years, several grading scales have been proposed^{7,8,9} but few have been externally validated and with limited success.¹⁰ In

addition, these scales are not practical for clinical use and do not allow for ventral hernia triage as many evidence-based predictor variables are not used.

Overview of the pathway

We present an evidence-based triage system in response to an identified need at a national meeting of hernia specialists.¹¹ This pathway classifies hernias into three groups based on patient- and hernia-related risk factors. After triage, patients can be referred to the appropriate surgeon for hernia management. We propose that patients with tier-1 hernias can be treated by any consultant general surgeon. Patients with tier-2 hernias can be treated by a district general surgeon with a specialist interest in hernia surgery and patients with tier-3 hernias should be referred to a specialist hernia centre (Fig 1).

Preoperative patient assessment and optimisation of risk factors prior to surgery are emphasised. For tier-3 and hernia specialist centres, the use of a multidisciplinary team is recommended. This should include general surgeons, radiologists, nutritionists, intensivists and bariatric surgeons.

Patient-related risk factors

The current evidence suggests that there are a few patient risk factors that worsen ventral hernia repair outcomes. An international consortium of hernia specialists identified smoking, obesity (body mass index, BMI, greater than 35),

American Society of Anesthesiologists (ASA) grade 3 or above, previous surgical site infection, superficial skin changes and enterocutaneous fistula formation as the most relevant patient risk factors that affect operative outcome.¹¹ We describe the evidence for each risk factor and the respective targets for preoperative optimisation.

Smoking

Studies show a significant increase in the risk of postoperative complications in smokers, such as wound dehiscence, pain, hernia recurrence, venous thromboembolism and hospital readmission.^{12,13} The mechanism by which smoking leads to complications is multifactorial but is likely to be attributed to the smokers' chronic cough increasing the intra-abdominal pressure and to chronic tissue hypoxia and altered inflammatory response in surgical wounds. Smoking cessation is recommended for at least four weeks prior to surgery and has been shown to reduce postoperative complication rates by 50%.¹⁴ In some centres, surgeons refuse to operate if a patient has failed to stop smoking. The use of

nicotine replacement therapy is contradictory with some studies supporting its use¹⁵ and others saying its use is equally harmful.¹⁶ The evidence for electronic cigarettes is insufficient.¹⁶

Obesity

Obesity poses surgical and anaesthetic challenges to the treatment of ventral hernias. A BMI over 35 kg/m² has been shown to be the one of the most significant predictors of severe adverse outcomes after ventral hernia repair.¹⁶ A recent systematic review and expert consensus found high-grade evidence for obesity leading to postoperative complications and recommended that elective ventral hernia repair surgery should not be performed on patients with a BMI over 50 kg/m².¹⁶ The same review recommended that for patients with a BMI of 30–50 kg/m² ventral hernia surgery should not be undertaken without a weight loss intervention. No cutoff BMI below which obese patients should be listed for bariatric surgery is mentioned.¹⁶ In the UK, we recommend that these patients be treated according to National

Institute of Health and Care Excellence (NICE) guidelines and be listed for bariatric surgery if indicated and approved by a bariatric surgeon. Weight loss interventions may include dietician or physician counselling, exercise and weight loss programmes or bariatric surgery. Weight loss surgery is the only sustainable method for prolonged weight loss but may not be appropriate for all patients.¹⁷ Patients with diabetes should not have surgery until their HbA1c is 6.5–8%.¹⁶

There are several reasons why a high BMI is believed to increase the risk of postoperative complications, including longer operating times, higher blood loss and a higher number of potential spaces in which infection can develop with a reduced blood supply to adipose tissue. Additionally, it has been suggested that a chronic inflammatory state is induced in patients with excess adipose tissue, characterised by dys-metabolism and an increased likelihood of infection and delayed healing.¹⁸

Our triage pathway identifies a BMI of over 35 kg/m² as a significant risk factor. In the UK, patients over a BMI of 35 kg/m² are classified as obese and if they fulfil NICE guidelines they qualify for bariatric surgery. This should be considered for all patients who are obese who have tier-3 hernias in conjunction with a low calorie diet, medical weight loss programme or a personalised exercise regimen prior to surgery.

American Society of Anaesthesiologists grade

High ASA grades (3 and 4) have been shown to predispose patients with ventral hernias to an increased length of hospital stay, higher wound infection and hospital readmission rates, venous thrombotic events and a higher overall complication rate.¹⁸ Indeed, two recently published and internally validated risk stratification scores include an ASA grade of greater than or equal to 3 as a major predictor for surgical site infection and recurrence following ventral hernia repair surgery.^{8,9}

Our pathway recognises ASA grade 3 or above as a risk factor and, in the presence of other patient factors, may result in patients being referred to and treated in a specialist hernia centre. In addition, patients are stratified preoperatively based on risk and a multidisciplinary team approach is taken to optimise medical comorbidities before surgery.

Previous surgical site infection

There is extensive evidence to show that a previous surgical site infection either after primary laparotomy or after incisional hernia repair predisposes to hernia recurrence.²⁰ The strength of the abdominal wall following injury is dependent on a collagen network formed during the remodelling phase of tissue healing. Infection leads to an exaggerated inflammatory response that impairs the remodelling process, leaving a weak abdominal wall that is prone to herniation. Consequently, it is recommended that surgeons take appropriate precautions at the time of primary surgery and at any subsequent hernia repair to reduce the risk of surgical site infection.

Perforator vessel preservation is advised to improve tissue blood flow and has been shown to reduce the chance of local

wound complications.²¹ Sterile precautions during mesh implantation are advised as mesh infection predisposes to not only hernia recurrence but also to mesh explantation and repeat surgery.²⁰ In recent years, the development of negative pressure dressings has significantly reduced the incidence of surgical site infections and their use is advised for all high-risk patients.²²

The expert panel at the international consortium of hernia specialists agreed that patients with prior infections at the incision site are at significantly greater risk of hernia recurrence, based on their own clinical experiences.¹¹ It has therefore been included as part of the presented hernia triage algorithm.

Active skin changes

Although only a few case reports exist in the literature,²³ patients with active skin changes or ulceration over the ventral hernia site do pose a challenge during reconstructive surgery. Ulceration usually indicates a lack of blood supply and a chronic inflammatory process under the skin. These areas are usually resected where possible, leaving reconstructive challenges not frequently encountered by a district general surgeon. The associated surrounding inflammation disrupts tissue planes and renders the tissues friable and prone to inadvertent injury. Unintentional enterotomy with contamination greatly increases the risk of postoperative complications in this subgroup and, for this reason, ulceration has been selected as one of the triaging risk factors. Other overlying skin rashes or cellulitis can indicate the presence of autoimmune disease, another independent risk factor for poor wound healing.²⁴

Enterocutaneous and gastrointestinal fistulas

Patients with enterocutaneous fistulas have complex abdominal anatomy and require intensive nutritional and medical support. These are Ventral Hernia Working Group grade 4 hernias and require referral to an intestinal failure unit.⁷ Patients often require preoperative parental nutrition together with intravenous antibiotics to treat any malnutrition and surrounding abdominal wall sepsis prior to surgical intervention. Operative timing for these high-risk patients is critical. Only tertiary centres with intestinal failure multidisciplinary teams are able to offer comprehensive multidisciplinary team management for these patients.

Hernia-related factors

Hernia morphology needs to be considered prior to repair and can aid risk stratification. Hernia defect width directly correlates with an increased risk of postoperative complications and hernia recurrence.²⁵ In addition, recurrent hernias are increasingly difficult to repair with each attempt and have an associated higher recurrence rate that increases after each subsequent repair.² As a result, the width of the hernia defect and the number of previous hernia repairs are included as risk factors in our triage algorithm.

Although poorly characterised in the literature, loss of domain is a concept that many hernia surgeons use to describe the displacement of abdominal viscera into the

hernia sac. We propose a simple definition of loss of domain as the ratio of the hernia sac volume divided by the remaining abdominal cavity volume.²⁶ As this ratio increases, returning the contents of the hernia sac into the abdominal cavity and closing the abdominal wall can be problematic and represents a greater challenge requiring referral to an experienced specialist hernia surgeon.

Large hernias with a width of greater than 10 cm and with significant loss of domain (set in our algorithm at 0.25 or 25%) must therefore be treated in tertiary hospitals equipped to perform these repairs. Specialised techniques such as preoperative botulinum injections into the abdominal wall musculature,²⁷ preoperative pneumoperitoneum,²⁸ posterior component separation with transverse abdominis release²⁹ or endoscopic anterior component separation⁵⁰ are required and are only performed at tertiary centres.

Treatment strategies

Our pathway places patients into three tiers relating to their preoperative risk factors. The tier system specifies the most appropriate level of hernia specialist and surgical unit to treat the patient to provide optimal management (Fig 1). Tier-1 hernias can be managed by general surgical teams familiar with straightforward ventral hernias repairs within district general hospitals. These hernias are not large and the patients have three or fewer of the first four patient risk factors. Patients with more than three patient-related risk factors or overlying skin changes are considered to have tier-2 hernias. These hernias have less than 25% loss of domain and two or fewer previous repairs. Tier-2 hernias can be treated by a district general surgeon with a specialist interest in hernia repair surgery. The presence of an enterocutaneous fistula, loss of domain of greater than 25% or over two previous repairs warrants tier-3 status. Tier-3 hernias require referral to a hernia specialist centre or a tertiary centre. These specialist hernia centres are also frequently intestinal failure units equipped to manage enterocutaneous fistulas.

Future directions

We believe that a national, evidence-based triage algorithm for the management of ventral hernias is required to improve ventral hernia repair outcomes, ultimately reducing the postoperative complications, hernia recurrence rates and cost. Research has already demonstrated better outcomes for inguinal hernia surgery in specialist centres⁶ and we suggest that, in the UK, we should be moving towards a recognised specialism for hernia surgery and particularly for ventral hernia surgery, for which complication rates are still high. Hernia specialists should possess the skills to treat complex ventral hernias to prevent the spiralling costs to the NHS from complications and recurrence. These specialists should work within dedicated hernia centres that provide adequate resources and pre- and postoperative care pathways for the most challenging ventral hernia repairs. As the field of hernia surgery evolves to incorporate more complex treatment strategies, specialist hernia centres are required

to teach and develop these new techniques. In calling for specialist centres, we recognise the need for stringent quality assurance. In Germany, registered specialist hernia surgeons are required to have certification and to perform a certain number of cases per year with a specified low complication rate.⁵ The introduction of a similar system in the UK, with regional general surgeons (working in district general hospitals) with a specialist interest in hernia surgery (tier 2) and national hernia specialist centres (tier 3) may serve to improve operative outcomes and standardise ventral hernia surgery in this evolving subspecialty.

Finally, we recommend that a national hernia database should be established in the UK to collect ventral hernia data. National databases collecting a large amount of prospective data have shown significant outcomes and aided research in other countries.²⁷ Collaborative data from throughout the UK would stimulate interest and focus contributing surgeons on improving the postoperative outcomes and operative technique at their participating centre.

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