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The implications of neurogenic bowel dysfuncton for urinary tract reconstruction in neurogenic urinary tract dysfunction: An International Continence Society working group report

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ABSTRACT

Introduction: The consequences of neurogenic bowel dysfunction in patients with neurogenic lower urinary tract disease requiring urinary tract reconstruction with bowel harvest remains unclear. A working group was formed by the International Continence Society (ICS) to generate a consensus statement highlighting the key issues to be addressed and optimised peri-operatively.

Methods: Nominal group technique was used to derive consensus. Principal aspects of assessment and surgery decision-making were agreed and a series of statements was generated by a core focus group of experts, which were subsequently modified and ratified by the wider working group. This was followed by final voting by the full working group.

Results: General considerations included the importance of understanding the neurological condition in terms of degree of disability, prognosis and risk of progression, an assessment of cognition and dexterity and an inter-disciplinary assessment to ensure suitability and feasibility of surgery. Peri-operative recommendations included using an enhanced recovery after surgery (ERAS) protocol when appropriate and taking additional precautions if there is a risk of autonomic dysreflexia or the presence of implants such as ventriculo-peritoneal shunts, baclofen pumps, sacral or spinal cord stimulators. Extra consideration must be taken post-operatively to minimise the risk of venous thrombo-embolism formation, formation/exacerbation of pressure sores and long-term bowel disturbance.

Conclusion: The consensus opinion indicates that urinary tract reconstruction using bowel segments is feasible in carefully selected and optimised patients with neurogenic bowel dysfunction, provided the potential implications for serious adverse events are carefully considered and there is access to appropriate inter-disciplinary expertise.

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1. Introduction

There are a number of neurological conditions that can result in both bladder and bowel dysfunction. Examples include multiple sclerosis, spina bifida and spinal cord injury to name a few. When considering the urinary tract, these conditions can result in bothersome neuro-urological symptoms affecting quality of life in addition to more serious sequelae, such as renal failure. In such cases, urinary tract reconstruction may be required, often requiring the use of bowel. Elective indications for surgery include the management of continence and improvement of quality of life but in some cases, surgical intervention may be unavoidable to prevent deterioration in renal function, for example in the small capacity, poorly compliant bladder. Furthermore, patients with neurological disease can also develop urinary tract malignancies which may require urinary tract reconstruction as part of their cancer management.

In the neurogenic population, the most common reconstructive operations which require harvesting bowel include augmentation cystoplasty, formation of a continent catheterisable channel (appendicovesicostomy or Monti Mitrofanoff) and ileal conduit urinary diversion.

Complex urinary tract reconstruction with bowel is associated with morbidity even in otherwise healthy individuals. Well recognised complications include infections, anastomotic leaks (bowel and urine), metabolic disturbance, renal impairment, urolithiasis, stricture formation, altered bowel habit and less commonly, malignancy. Predictors for complications following surgery are multi-factorial. The risk of complications is dependent upon the type of urinary tract reconstruction performed, overall performance status of the patient, as well as any history of bowel disease such as bowel malignancy, inflammatory bowel disease, diverticular disease or volvulus.

Patients with neurogenic bladder dysfunction often have concomitant bowel dysfunction in the form of constipation, abdominal pain, abdominal distension and faecal incontinence. It remains unclear if these patients are at a higher risk of post-operative bowel dysfunction and morbidity following urinary tract reconstruction using bowel when compared with the non-neurogenic population. Nonetheless there are many factors to consider in order to minimise overall peri-operative and long-term morbidity, and to that end, patients must be carefully selected and counselled prior to performing any major reconstructive surgery.

Accordingly, a working group was set up under the auspices of the International Continence Society (ICS) to develop recommendations regarding the safe use of bowel for urinary reconstruction in adult patients with neurological disease.

2. Methods

A working group was formed by open advertisement to members of the International Continence Society (ICS), European Society of Coloproctology (ESCP) and the American Society of Colon and Rectal Surgeons (ASCRS) with the remit of developing consensus documents on the use of bowel in a range of disease states for urinary tract reconstruction. Detailed literature searches were conducted using Ovid MEDLINE and PubMed databases from inception until December 2022.

A core focus group of experts in the fields of neuro-urology, neurogastroenterology and urinary tract reconstruction was assembled from this working group. The working group considered the use of bowel for urinary tract reconstruction in patients with neurogenic disease under the subheadings of ‘General considerations’, ‘Pre-operative considerations’, ‘Peri-operative considerations’ and ‘Post-operative considerations and follow up’ following the same format of our consensus document on inflammatory bowel disease [1].

The nominal group technique (NGT), a semi-quantitative structured interview procedure [2,3], was used to identify the principal aspects of assessment and surgery decision-making, and for prioritisation to achieve consensus on urinary tract reconstruction.

Online meetings were structured to include: 1. Introduction and explanation, 2. Silent generation of ideas (as individuals), 3. Sharing ideas (round-robin format), until saturation of concepts, 4. Group discussion and 5. Ranking. This process enabled generation of an initial series of statements, which were revised on serial rounds of review by the focus group. It was followed by ratification by the wider working group and final voting by the sub-specialist expert focus group and the working group (Fig. 1). All members of the working group and focus group voted and agreed on the final statements. In total the consensus statements underwent five rounds of discussion.

3. Results

3.1. General considerations

3.1.1 Neurogenic bowel dysfunction is not an absolute contraindication to urinary tract reconstruction using small or large bowel.
Urinary tract reconstruction using bowel can be performed in patients with neurological disease when the disease is in a stable state.

3.1.2 An inter-disciplinary discussion is strongly recommended to provide an assessment on the feasibility and optimal timing for surgery. It can help to provide a recommendation on the segment and length of bowel to harvest in cases of bladder augmentation, neobladder or conduit.
The inter-disciplinary team should ideally include a specialist in reconstructive urology, specialist nurses, dietetics, radiologists and a specialist in colorectal surgery (particularly in cases of concomitant bowel disease or previous significant bowel surgery). Input from neurologists, rehabilitation medicine and gastroenterology (preferably with a specialist interest in neuro-gastroenterology) may also be required.

3.1.3 A cognitive and prognosis assessment should be performed as part of the patient’s global assessment when assessing suitability for major urinary tract reconstruction. This should also include an assessment of the patient’s adherence with treatment and follow-up.
The Mini-Mental State Examination (MMSE) can be used as a tool for cognitive assessment.

3.1.4 In select neurological conditions, where clean intermittent self-catheterisation or stoma care may be required, an assessment of overall functional capacity and dexterity with a formal hand function assessment by a specialist nurse should be performed, bearing in mind the potential for neurological progression.
Examples of these neurological conditions include spinal cord injury above T6, multiple sclerosis involving the upper limbs and stroke involving the dominant hand.

3.1.5 When choosing the type of reconstructive procedure most appropriate for the patient, various factors need to be considered including the patient’s willingness and ability to perform intermittent self-catheterisation, the age of the patient, the prognosis of their neurological disease and the presence of any co-existing bowel disease (inflammatory bowel disease, previous surgery or radiotherapy)

3.2. Pre-operative considerations

3.2.1. Selection of bowel segment

3.2.1.1 Ileum is the preferred choice for bowel harvest however colon may be preferential in some circumstances. A tailored approach must be adopted according to the patient’s neurological condition and the co-existence of other bowel disease. The surgeon must have experience in harvesting alternative bowel segments.

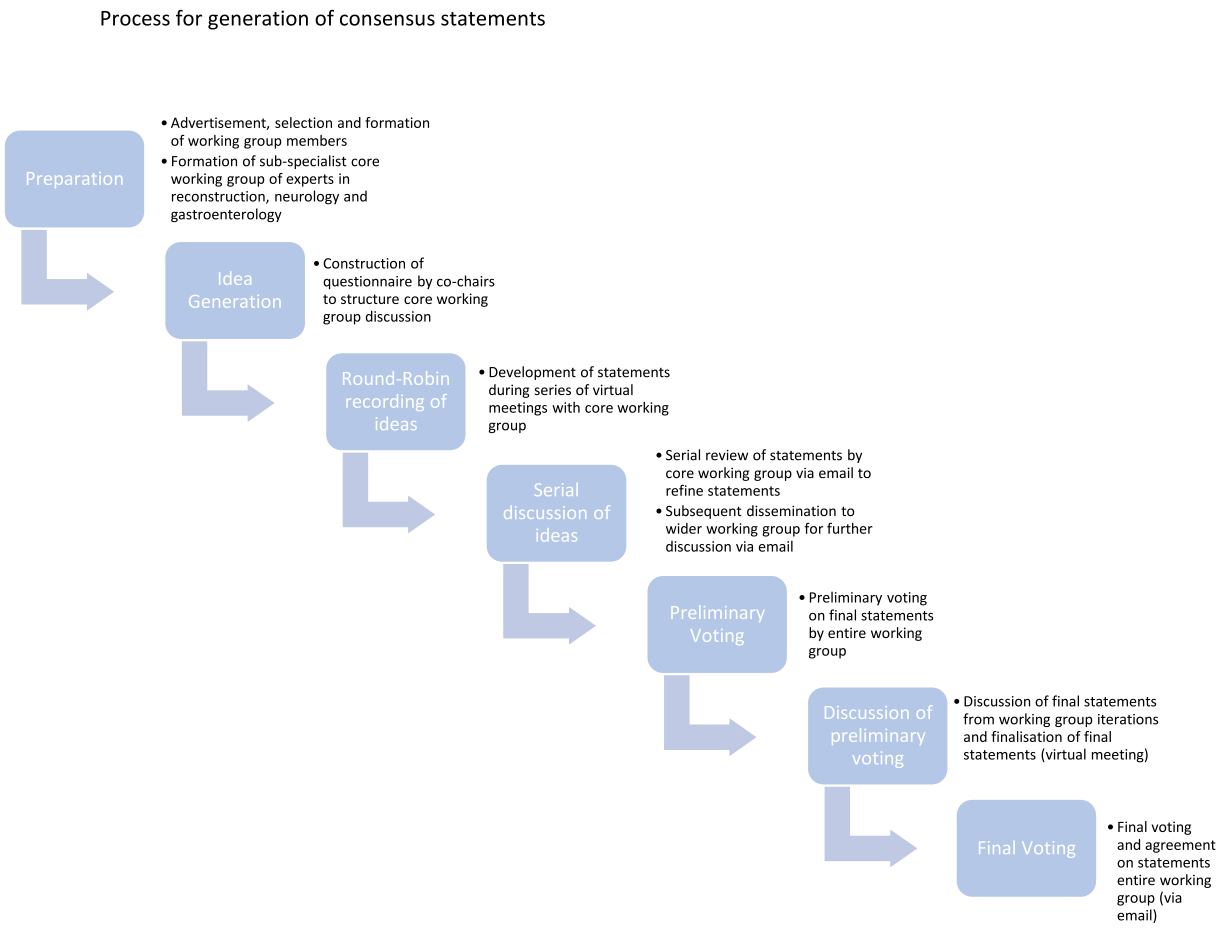

Fig. 1. Process for generation of consensus statements.

Alternative bowel segments may be preferred in certain neurological diseases, such as spina bifida, where the sigmoid colon may be preferred due to issues related to small bowel mesenteric length. Other indications for alternative bowel segment harvest (namely colonic segments) include concomitant bowel disease such as inflammatory bowel disease or previous radiotherapy [1] and also when performing reconstructive surgery for congenital anomalies.

3.2.1.2 When considering performing a reconstructive procedure that can alter stool consistency, a history of bowel symptoms should be taken and if reported, this should be evaluated by an appropriate specialist team.

3.2.1.3 Renal function may limit the patient's reconstructive surgical options. An appropriate method of renal function assessment should therefore be conducted before choosing which type of reconstruction is most appropriate for the patient.

Methods to test renal function include testing serum creatinine, eGFR and/or Cr-EDTA nuclear medicine imaging in select cases.

3.2.1.4 Routine pre-operative bowel assessment with specialist imaging or endoscopic evaluation is not required in the absence of known history of bowel disease or symptoms suggestive of undiagnosed bowel disease.

3.2.2. Pre-operative optimisation

3.2.2.1 A nutritional assessment should always be conducted and dietetic input must be sought pre-operatively in patients with extremes of body mass index or a recent history of rapid weight loss or weight gain.

A validated screening tool should be used to help identify malnutrition however if there is any concern, an expert opinion should be obtained. One example is the Malnutrition Universal Screening Tool (MUST) https://www.bapen.org.uk/pdfs/must/must_full.pdf.

3.2.2.2 Pre-operative correction of any underlying electrolyte abnormalities, anaemia, diabetic control, hypoalbuminaemia and coagulopathy should be performed.

3.2.2.3 Patients should be educated regarding smoking cessation and referred to available smoking cessation support services if necessary.

3.2.2.4 Infected pressure sores are an absolute contraindication to elective urinary tract reconstruction. Non-infected chronic pressure sores are a relative contraindication, which should be addressed pre-operatively to minimise peri-operative morbidity.

It is however important to recognise that some infected sores can be exacerbated by urinary and/or faecal incontinence and therefore in select cases diversion may be required as an initial measure to manage their sores prior to performing more complex reconstructive surgery.

3.2.2.5 All patients should undergo an anaesthetic assessment pre-operatively but additional cardiac or respiratory pre-operative assessment tests are not required unless the patient has additional risk factors.

Examples include concomitant cardiac or respiratory disease and also certain neuromuscular diseases, e.g. Duchenne Muscular Dystrophy or thoracic spinal cord injury with associated cardio-pulmonary involvement.

3.2.2.6 Abdominal wall hernias are more common in those deconditioned pre-operatively and therefore effort must be made to improve muscle mass pre-operatively through early involvement of physiotherapists.

3.3. Peri-operative considerations

3.3.1 Pre-operative overnight fasting should be avoided and an enhanced recovery after surgery (ERAS) protocol should be used instead.

Prolonged pre-operative fasting can exacerbate an insulin resistant state resulting in increased morbidity in the peri-operative period. Following the recommendations of the ERAS protocol, solid food should not be consumed beyond 6 hours pre-surgery. Clear fluids are permitted up to 2 hours pre-surgery. Carbohydrate loading drinks can also be administered at 2 hours pre-surgery to further minimise the morbidity associated with this transient insulin resistant state, potentially resulting in a quicker post-operative recovery.

3.3.2 Bowel preparation products should not be routinely administered pre-operatively, as per the ERAS protocol but should be considered in select cases; such as when colonic segments are harvested or in cases with known faecal loading of large bowel as a result of their neurogenic bowel dysfunction.

The role of pre-operative mechanical bowel preparation (MBP) remains controversial. The concern is that it can impact electrolyte homeostasis and bowel motility, as well as being practically difficult in terms of continence for patients with neurological disease.

There is limited evidence to support the role of MBP in reducing complications in patients undergoing cystectomy and ileal conduit or ileal neobladder urinary diversion. As there is emerging evidence to support the role of MBP in elective colorectal surgery, the working group have recommended that MBP could be considered in cases involving colonic harvest.

Additionally a faecally-loaded colon can pose a challenge during major pelvic surgery, particularly in patients with atypical anatomy (such as spina bifida) and therefore MBP could be considered in such cases.

3.3.3 Nasogastric tubes can be used intra-operatively but should be removed at the end of the surgery, unless there is a high risk of post-operative ileus.

Recent evidence suggests that routine nasogastric tube insertion does not significantly reduce the risk of peri-operative morbidity but instead can result in delayed recovery of gut motility.

The working group recommends that nasogastric tubes should be kept in post-operatively in patients with an increased risk of post-operative ileus to minimise risk of pulmonary aspiration and pneumonia. Risk factors for post-operative ileus include those with a prior history of delay in resolution of gut function, polypharmacy including anticholinergics and opiates, pre-existing electrolyte abnormalities and obesity. Retaining the nasogastric tube post-operatively should also be considered in those for whom the consequences of pulmonary aspiration are greater (e.g. immunocompromised states and restricted pulmonary reserve).

3.3.4 The risk of autonomic dysreflexia in spinal cord injury patients, at the level of T6 or above, should be recognised and special precautions undertaken peri-operatively. These patients may require additional spinal anaesthesia in addition to their standard general anaesthetic induction, with or without additional drug infusions.

All members of the anaesthetic, theatre and post-operative ward team should be aware of how to manage autonomic dysreflexia, with easy access to the necessary emergency drugs.

3.3.5 Additional precautions may be necessary in patients with ventriculoperitoneal (VP) shunts, baclofen pumps, deep brain stimulators, spinal cord stimulators and sacral nerve stimulators.

The presence of these implants should be highlighted in the patient's pre-operative assessment.

Spina bifida patients with VP shunts are at an increased risk of shunt infections and therefore require additional antibiotics with gram positive cover.

Those with simulator devices will need input from specialist teams to manage (turn off/on and/or interrogate) their devices. Diathermy choice is also influenced by the presence of these implants, whereby bipolar diathermy is safer than monopolar.

3.4. Post-operative considerations and follow-up:

3.4.1. General post-operative considerations applicable to all major urinary tract reconstruction

3.4.1.1 Bile salt malabsorption is likely to be encountered following reconstruction using bowel, especially when terminal ileum is harvested, resulting in chronic diarrhoea. Those with significant bowel disturbance after surgery need gastroenterology input, and the terminal ileum should be spared in any reconstructive procedure where possible.

Urinary tract reconstructive techniques will typically require a maximum of 40–60 cm of bowel harvest however those with previous bowel surgery and/or other bowel conditions which may require extensive bowel surgery are at greater risk of short bowel syndrome. Alternative reconstructive techniques should be considered in these patients, such as ureterosigmoidostomy.

Nonetheless if this occurs, it is best managed by gastroenterologists who would consider performing nuclear medicine SeHCAT testing and commencing titrated bile acid sequestrants and/or antidiarrhoeal medication.

With greater bowel lengths harvested (i.e. >100 cm) there is an added risk of fat malabsorption which may require a more tailored management plan.

3.4.1.2 Vitamin B12 levels should be monitored in all patients with annual blood tests and replacement therapy should be given as necessary. The terminal ileum should be spared in any reconstructive surgery where possible. Follow-up should be lifelong, as it can take several years for B12 deficiency to become evident.

Vitamin B12 is mainly absorbed in the terminal ileum and therefore malabsorption is expected in patients who have had >20 cm terminal ileum removed from the gastrointestinal tract but can also occur when the terminal ileum is spared. Another common aetiology of B12 deficiency is small intestinal bacterial overgrowth (SIBO) which is more common after ileo-caecal valve resection. If deficiency is detected, it needs to managed according to local practice (typically with intra-muscular hydroxocobalamin injections).

3.4.1.3 Folate should be monitored and replaced as necessary in those who have had extensive small bowel resection.

Severe folate deficiency can result in pancytopenia and megaloblastic anaemia. If deficiency is detected, it needs to managed according to local practice (typically with oral folic acid tablets and dietary advice). Although relevant to all patients, this is particularly important to women of child-bearing age.

3.4.1.4 A mild, subclinical hyperchloraemic metabolic acidosis is encountered in almost all patients undergoing urinary diversion using bowel segments. Monitoring of bicarbonate and chloride is recommended when there are concerns about clinical metabolic acidosis.

Symptoms of acute clinical metabolic acidosis include headache, fatigue, nausea and vomiting. Bicarbonate and chloride testing +/- replacement is required in such cases. Uncorrected hyperchloraemic metabolic acidosis can result in bone demineralisation and osteomalacia.

3.4.1.5 The presence of renal failure or liver derangement can increase the risk of anastomotic breakdown and therefore requires optimisation pre-operatively. This risk is considerably higher in patients requiring dialysis.

Both renal impairment and hepatic dysfunction (e.g. known liver disease and/or impaired liver function tests) are relative contraindications to performing urinary tract reconstruction using bowel. If urinary tract reconstruction is being considered in these patients, a consultation by a specialist is recommended.

3.4.1.6 The presence of bowel in a reconstructed urinary tract will often result in mucus production. In those with excessive mucus production and inadequate bladder emptying, there is a resultant increased risk of infection, stones and pyocystis.

Any intermittent self-catheterisation regimen (e.g. number of catheterisations, type of catheter) may need to be reviewed to cope with mucus production and poor bladder emptying, and to minimise the risk of complications such as rupture of the reconstructed bladder.

3.4.1.7 Although the risk of primary bowel malignancy in the reconstructed urinary tract is very low, there is a recognised small risk of malignant transformation. Patients should be counselled accordingly and followed up as per local unit surveillance policies pertaining to the type of urinary reconstruction performed.

There is no clear consensus on the frequency and duration of surveillance following urinary tract reconstruction with bowel, but it is recommended due to the small risk of developing adenocarcinoma. More pertinent is the segment of gut used in the reconstruction (those at greatest risk include ureterosigmoidostomy and gastric conduits).

All patients must be counselled about the importance of seeking urgent medical advice if they were to develop any red flag symptoms (haematuria and/or recurrent urinary tract infections).

3.4.1.8 There is no strong evidence to support the need for extended venous thromboembolism (VTE) prophylaxis in this patient group post-operatively. In the absence of any contraindications, all patients should receive VTE prophylaxis for the duration of their hospital admission. *Extended prophylaxis (duration guided by local protocol) should be considered in those with additional risk factors for VTE and/or if undergoing extensive concomitant pelvic surgery, such as cystectomy.*

3.4.2. Post-operative considerations specific to patients with neurological disease undergoing major urinary tract reconstruction

3.4.2.1 In patients at risk of autonomic dysreflexia, it is imperative to minimise the risk of exposing the patient to potential precipitants that could provoke a dysreflexia episode, including the detection and management of any infection or pressure sore, ensuring adequate bladder emptying and reducing the risk of blocked catheters.

3.4.2.2 Additional care must be taken to minimise the risk of acquiring pressure sores in the post-operative recovery period with early mobilisation (if able), the use of pressure relief mattresses and physiotherapy involvement.

3.4.2.3 Additional post-operative antibiotic prophylaxis may be necessary in patients with VP shunts in situ due to the increased risk of shunt infection and morbidity.

Symptoms commonly suggestive of a VP shunt infection include erythema and tenderness along the line of the shunt, fevers, headache, neck stiffness, vomiting and abdominal pain.

3.4.2.4 All patients with diarrhoea persisting for more than six weeks following their surgery should be referred for a gastroenterology review. There is an increased risk of chronic diarrhoea if large lengths of bowel are harvested and/or the ileo-caecal valve is resected.

A stool culture is required as an initial test to exclude bacterial colitis, e.g. Clostridium difficile infection. Persistent, non-infective diarrhoea is best managed by a gastroenterologist. Treatment involves bile acid sequestrants (e.g. cholestyramine), pancreatic enzyme replacement, dietary changes and judicious use of anti-diarrhoeals. Additional intra-operative means to minimise this risk include limiting the extent of bowel resection and sparing of the ileo-caecal valve.

4. Discussion

Patients with neurogenic lower urinary tract dysfunction, with concurrent bowel dysfunction, can be a challenging group to manage. Although complications following urinary tract reconstruction in the neurogenic population are relatively well reported over the years the majority of evidence is based on retrospective data and expert opinion. Neurogenic bowel dysfunction is less extensively studied than neurogenic bladder dysfunction and it is unclear if this cohort of patients are at a higher risk of overall and bowel specific morbidity when compared with the non-neurogenic population.

In general, patients with neurogenic bowel dysfunction have a greater number of hospitalisations for bowel pathology (including impaction, megacolon, constipation and volvulus) [4], which would suggest that they would be at higher risk of complications following major reconstructive bowel surgery. However, a cohort study found that although complications following colostomy formation in spinal cord injury patients were common, they were no greater than in the non-neurogenic stoma population [5].

The current consensus report, developed using rigorous qualitative methodology, provides a framework for clinicians potentially considering urinary tract reconstruction in this cohort. It is applicable to open surgery and, in appropriate cases and with sufficient experience, may also be appropriate for minimally invasive approaches (laparoscopic and robot-assisted laparoscopic surgery).

The consensus opinion indicates that urinary tract reconstruction using bowel segments is feasible in carefully selected and optimised patients with neurological disease lacking alternative management options. Close surveillance of bladder dysfunction should be conducted in accordance with the EAU guidelines [6], and once surgery is felt to be indicated, a thorough assessment including cognition and dexterity, and inter-disciplinary specialist input is required to ensure both suitability and feasibility of surgery. The primary neurological disease needs to be understood in terms of prognosis and potential for progression, as this may influence the surgical options available to the patient. Once a decision has been made about appropriateness for surgery, a decision needs to be made on selection of the segment of bowel harvest. The primary neurological disease dictates the pattern of neurogenic bowel dysfunction which can help to guide the most appropriate segment of bowel to harvest.

Patients should be maximally optimised pre-operatively to improve overall performance status and to establish if there are any pre-existing bowel symptoms which may warrant further specialist input. Many of these patients will have co-existing bowel symptoms and so need to be counselled that their symptoms may worsen.

Additional consideration must be taken to account for the risk of autonomic dysreflexia depending on their underlying neurological condition and to also be mindful of other complexities such as the presence of VP shunts, baclofen pumps and sacral or spinal cord stimulators, which may require additional antibiotic prophylaxis and/or programming.

Relevant intra-operative considerations include potential difficulty with using small bowel (e.g. a short ileal mesentery secondary to previous bowel surgery or the presence of a VP shunt).

Post-operative considerations include the risk of ileus, especially with anti-cholinergic and opiate use, venous thrombo-embolism, hospital-acquired pneumonia and long-term bowel disturbance. We recognise that this cohort of patients are at a higher risk of pressure sore formation and may even have pre-existing pressure sores. Consequently, early physiotherapy and the use of pressure relief mattresses needs to be considered alongside consideration of extended VTE prophylaxis in select cases.

In order to optimise post-operative recovery, ERAS protocols are recommended for most patients, including avoidance of pre-operative fasting, avoiding bowel preparation products and early removal of nasogastric tubes; however, we appreciate that this may not always be

suitable for all patients in this setting, and regimens may need to be tailored to the individual.

In conclusion, bowel use for urinary tract reconstruction in patients with neurogenic bladder and bowel dysfunction is feasible, provided the potential implications for serious adverse events are carefully considered.

Complex reconstructive surgery should be performed in specialist centres where expertise in urological reconstruction, neurology and gastro-enterology are available.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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