Adhesions and Colorectal Surgery – Call for Action

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Abstract

Mounting evidence highlights that adhesions are now the most frequent complication of abdominopelvic surgery, yet many surgeons are still not aware of the extent of the problem and its serious consequences. While many patients go through life without apparent problems, adhesions are the major cause of small bowel obstruction and a leading cause of infertility and chronic pelvic pain in women. Moreover, adhesions complicate future abdominal surgery with important associated morbidity and expense and a considerable risk of mortality. Studies have shown that despite advances in surgical techniques in recent years, the burden of adhesion-related complications has not changed. Adhesiolysis remains the main treatment even though adhesions reform in most patients. Recent developments in adhesion-reduction strategies and new anti-adhesion agents do, however, offer a realistic possibility of reducing the risk of adhesions forming and potentially improving the clinical outcomes for patients and reducing the associated onward burden to healthcare systems. This paper provides a synopsis of the impact and extent of the problem of adhesions with reference to the wider literature and also consideration of the key note papers presented in this special supplement to Colorectal Disease. It considers the evidence of the risk of adhesions in colorectal surgery and the opportunities and strategies for improvement. The paper acts as a ‘call for action’ to colorectal surgeons to make prevention of adhesions more of a priority and importantly to inform patients of the risks associated with adhesion-related complications during the consent process.

Keywords Adhesions, reduction, consent, colorectal, surgery

Introduction

Considering the mounting evidence, adhesions are now the most frequent complication of abdominal surgery and represent one of the greatest unresolved problems in colorectal surgery today.

Ten years ago colleagues highlighted that ‘for years the clinical consequences of postoperative adhesions and their complications had been poorly understood and underappreciated. Consequently, measures to prevent or reduce adhesion formation in daily surgical practice had been neglected’ [1]. They called for surgeons to become more aware of the potential for adhesive complications in certain procedures and defined surgical techniques to minimize adhesions. They also highlighted the availability of a number of anti-adhesion adjuvants to assist surgeons in reducing adhesion-related complications [1]. Ellis, who has done so much in helping to focus attention on this serious problem [2], notes, however, that there seems to be a sense of fatalism affecting the surgical community in relation to adhesions, describing it as something like the attitude of surgeons to wound infection in the days before Lister [3].

Since then the body of evidence of the extent of the problems posed by adhesions and their associated costs to healthcare systems has increased. Also, there have been significant advances in surgery, particularly laparoscopy and the development of new anti-adhesion agents. Despite this, the burden of disease associated with
Adhesions are widespread problem with over 93% of patients undergoing laparotomy subsequently developing adhesions [5].

While the majority of studies indicate that laparoscopy may result in a reduction in postoperative adhesion formation relative to laparotomy, the definitive answer to this hypothesis has not been determined [6]. Importantly, after laparoscopic adhesiolysis, which is fast becoming the preferred method of treatment of adhesions, 97% of patients developed postoperative adhesions within 3 months at the same sites for which they underwent adhesiolysis – although de novo adhesions were only reported in 12% [7]. While a meta-analysis revealed comparable results for open vs laparoscopic surgery for both formation of de novo adhesions and reformation following adhesiolysis [8], it is generally considered from the extensive work by gynaecologists that the benefits of laparoscopic surgery, including reduced postoperative pain, reduced morbidity and decreased length of stay, have consolidated the role of laparoscopy in clinical surgery [6]. It is postulated that importantly the environment of the pneumoperitoneum [9] as well as the surgeon’s training may play an important role in the incidence of adhesions – matters which are of key importance to colorectal surgeons as we adopt minimal access surgical techniques to our practices.

The important point is that adhesions develop after all types of surgery and despite the fact that most surgeons will not see the adhesions that form as a result of their surgery, no colorectal surgeon at this time is undertaking adhesion-free surgery.

The extent of the problem

Although many patients may have no apparent signs of adhesion-related disease, the actual burden of disease associated with adhesions is considerable and underestimated by many surgeons.

Using a conservative interpretation of adhesion-related disease, in a 10-year period following initial incident laparotomy, one in three patients undergoing lower abdominal surgery is readmitted to hospital on average twice for problems related to adhesions or further surgery that would be complicated by pre-existing adhesions [10]. This initial work by the Surgical and Clinical Adhesions Research (SCAR) group was considered to provide a cornerstone in delineating the problem of adhesions [11]. It confirmed that adhesions bring many patients back into hospital and that surgery on the colon, rectum and small intestine has the greatest relative risk and greatest impact on surgical workload. The SCAR group subsequently re-examined the burden of adhesion-related disease more recently, to assess if the increasing evidence and mounting knowledge of the extent of the problem of adhesions has reduced the adhesion burden [4]. The analysis demonstrated that adhesion-related problems remain a significant problem following colorectal surgery. There was no change in the rate of adhesion-related readmissions when they looked at three different cohorts of patients undergoing colorectal surgery (1996–1997, 1997–1998 and 1998–1999) and in the 5 years since their original research [10], adhesion-related readmissions remained a problem despite advances in surgery. Indeed, considering the uptake of laparoscopic surgery by gynaecologists, the SCAR group reported that for therapeutic and diagnostic laparoscopic procedures, the risk of adhesion-related readmissions was comparable to that of gynaecological laparotomy [12].

Adhesions have serious consequences

The most frequent manifestation of adhesion-related disease is small bowel obstruction (SBO) (74% of cases are adhesion-related [13]), secondary infertility in women (20–40% of cases are caused by adhesions [14,15]) and, albeit a multifactorial issue, adhesions are also a leading cause of chronic pain [16,17].

The morbidity and mortality of adhesion-related disease are often underestimated. Detailed reviews of hospital admissions for adhesional SBO have identified a mortality rate of almost 10% [18,19], rising to 15% in patients undergoing small bowel resection [19]. The importance of early diagnosis and optimal treatment in the hands of experienced surgeons is, as Moran highlights, of key importance [20]. Van Goor notes [21] that there is a 33% risk of inadvertent enterotomy during surgery for SBO [22] in the hands of experienced surgeons, with an important associated morbidity. Moreover, in patients with undetected bowel injury there is an increased mortality rate of 20–50% [21]. The risk of adhesion-related SBO is life-long and all efforts
should be focussed at reducing this through action on adhesions.

For patients undergoing subsequent surgery, whether or not they have signs of adhesion-related disease, adhesions pose an important complicating factor. Adhesions from previous surgery increase operating time significantly [23,24] and, even in the hands of highly experienced surgeons, there is a 19% risk of inadvertent enterotomy at reoperative laparotomy [22] and a 10–25% risk of bowel injury in laparoscopic adhesiolyis [25]. In medicolegal terms, tissue damage to underlying structures is the most common factor in successful surgical negligence suits [26].

Adhesiolysis remains the main treatment for adhesions, despite the fact that adhesions reform in most patients (~85%) regardless of the method of adhesiolysis used or the type of adhesion being lysed [27]. As Jobanputra and Wexner discuss [28], adhesions can convert any simple procedure into a complex one riddled with potential pitfalls and severe adverse sequelae for the patient. Managing patients with severe adhesions is problematic posing a tremendous burden to the patient and surgeon and requires meticulous, carefully planned surgery and all available techniques to avoid the serious consequences.

**Adhesions need to be considered a priority**

In Stanciu and Menzies’ outline [29] and Bhardwaj and Parker’s review [30], the third piece of work from the SCAR trilogy of studies sought to quantify the risk associated with lower abdominal surgery [31]. It demonstrated that the overall direct adhesion-related readmission risk following colorectal surgery was 5% within 5 years after surgery. This was even higher for specific surgical procedures, eg panproctocolectomy 15.4%. Furthermore it showed that in patients who had undergone previous abdominopelvic surgery within 5 years of their colorectal surgery, the risk doubled. It also demonstrated that for women less than 60 years of age who had previous abdominal surgery there is a 10% risk of hospital readmission for a directly adhesion-related problem in a 5-year period following a further laparotomy [31].

With this level of demonstrated risk and the knowledge of the consequences of adhesions, there is no place for complacency and action on adhesions needs to become a priority. Adhesions need to be seen by all surgeons as the most frequent complication of abdominal surgery and methods to reduce the incidence and risks should be considered. Moreover, the level of risks as Bhardwaj and Parker outline [30] is one of which patients should be made aware. Wilson [32] observes that, legal precedent in the UK, has identified a risk of > 1–2% sufficient to warrant inclusion in the consent process and that failure to do so could be considered negligent [33]. However, the frequency of including discussion on adhesions in the consenting process is currently low (< 15%) [34]. Recognising that adhesions can be dangerous and that patients can die from adhesional SBO it is important to tell a patient of the potential risks in colorectal surgery and as part of surgical duty of care, to take active steps that may reduce adhesions. Wilson states that to fail to do so could have major financial consequences on healthcare systems [32].

**Adhesions are costly**

The associated costs of adhesions to health services, patients and society are significant and continue to increase. In 1994, the cost of adhesiolysis alone in the US was estimated at $1.3 billion (€0.98 billion) in hospitalisation and surgeon expenditures and this did not include other costs associated with treating adhesion-related disease or dealing with the surgical complications of adhesions [35]. In Europe, adhesion admissions (surgical and medical) in one centre in the Netherlands amounted to over €542 000 with an operative mortality rate of some 13% [36]. In Sweden, Holmdahl and colleagues estimated that the total care of adhesive small bowel obstruction, including costs of sick leave amounted to at least €18 million [1,37]. More recently, Kossi estimated the annual direct hospital costs for postoperative adhesive small bowel obstruction in Finland to be in the order of €3 million, comparable to the costs associated with the treatment of gastric carcinoma and rectal carcinoma [38].

In Wilson’s review [32], the SCAR data imported into a hypothetical model show the direct economic impact of adhesion-related hospital readmissions following lower abdominal surgery for a given year. This demonstrates that the total costs in the UK will be in excess of €152 million within 10 years. The cumulative, year-on-year, direct costs of adhesion-related readmissions due to lower abdominal surgery are estimated to be over €908 million for a 10-year period in a population of some 60 million people [39].

In a study of medical and surgical admissions for small bowel obstruction in two UK general hospitals, the associated workload and costs equated to the equivalent of one surgical bed per year and at least 2 days per year theatre time [18]. This affects surgical capacity making planning difficult and potentially delays operating waiting times. Stanciu and Menzies emphasise that the impact of adhesions begins immediately after surgery and continues for the life of the patient [29]. The associated costs are
cumulative and as well as costs to the health system, readmissions and re-operations result in lost working days as well as reduced quality of life. Until surgeons, healthcare providers and planners recognise this and institute wide-scale adhesion reduction strategies, the burden will remain.

**Adhesion reduction strategies**

Duron notes that a better understanding of the pathological and physiological events and the medical and surgical factors involved in adhesion formation is pivotal in any attempt to reduce adhesions and their serious consequences [40]. Jeekel and van der Wal highlight that the rate of surgical injury to the peritoneum determines the rate and extent of the inflammatory response to that injury; this response determining the extent of adhesion formation [41]. The inflammatory processes and subsequent cascade of cellular, biochemical, immunological and biomechanical factors is complex and as yet not fully understood. What is clear however is that the processes by which adhesions form commences during surgery and the incidence of an adhesion, whether it develops at all, occurs in the first 3–5 days after peritoneal trauma takes place, i.e. after surgery has been carried out [42]. Thereafter the severity and extent of adhesions may then change over time.

This has important ramifications and means that good surgical practice is fundamental to any adhesions reduction strategy. As surgeons we need to:

- Handle tissue carefully with field enhancement (magnification) techniques
- Focus on planned surgery and if any secondary pathology is identified question the risk benefit of surgical treatment before proceeding
- Perform diligent haemostasis but ensure judicious use of cautery
- Reduce cautery time and frequency and aspirate aerosolised tissue following cautery
- Excise tissue - reduce fulguration
- Reduce duration of surgery
- Reduce pressure and duration of pneumoperitoneum in laparoscopic surgery
- Reduce risk of infection
- Avoid GI contamination
- Reduce drying of tissues (limit heat and light)
- Use frequent irrigation and aspiration in laparoscopic and open surgery
- Limit use of sutures and choose fine nonreactive sutures
- Avoid foreign bodies such as materials with loose fibres
- Minimize use of dry towels or sponges in laparotomy
- Use starch and latex-free gloves in laparotomy.

Patients who have undergone previous abdominopelvic surgery (whether by laparotomy or laparoscopy), or who have inflammatory bowel disease, endometriosis or pelvic inflammatory disease, require special consideration. The likelihood of pre-existing adhesions in such patients and their impact on surgical outcome [21,28] needs to be borne in mind and appropriate measures taken.

Certain surgical procedures carry a known higher risk [31] and include:

- Adhesiolysis
- Small bowel resection
- Formation and closure of ileostomy
- Hartmann’s procedure
- Anterior resection +/- stoma
- Low anterior resection
- Abdomino-perineal excision
- Hemi-colectomy – right/ left
- Colectomy – Sigmoid/ total
- Formation/closure of colostomy

As well as advising patients of the risks and consequences of adhesions and taking all steps during surgery to reduce the possibility of adhesions forming, it may be timely to consider the use of adhesion reduction agents.

More agents are now available and in considering their use, the selection should be based on safety, efficacy (reducing adhesions) cost and ease of use [30]. If an agent does not have a body of evidence for its safety in abdominopelvic surgery then it should not be used. While there is increasing clinical evidence that many available anti-adhesion agents will reduce adhesions, this is not the case for all agents being marketed and the quality of studies is not always high. Performing clinical studies to assess the efficacy of an agent in reducing adhesions is becoming more difficult. The ethical aspects of the clinical value of putting a patient through a second look laparoscopy to allow adhesion scoring using a validated scoring system is a matter for review when planning any study. We may have to accept that this will only be possible for some ‘model procedures’ and that we will have to extrapolate from that setting to routine practice. While assessing a reduction in adhesions at the site of an incisional scar may be a valid model for a site specific agent [43,44] it may not be the optimal model for an agent that has a wider broad coverage application [45].

Moreover whether or not by reducing adhesions there is a reduction in the consequences and associated burden of disease is still uncertain. As Wilson overviews [32] undertaking robust randomised controlled trials (RCT) to look at the effects of an anti-adhesion agent on an adhesion-related outcome is very difficult. Some outcomes such as successful pregnancy, following tubal...
adhesion division are multifactorial and the powering and conduct of studies to show reductions in small bowel obstruction requires huge numbers of patients and collaborating centres [39], making the studies very complex to undertake. Where work has been performed to look at clinical outcomes (reduction in SBO or increase in pregnancy rates), the definitive findings, not surprisingly given the difficulties in such research, have been restricted to subset analysis [46–48]. Whether or not other end points such as reduction in time taken to perform second surgical procedures would be an acceptable outcome measure is a matter of some discussion, but as recent work has shown, even the conduct of these studies is problematic given the numbers of centres and surgeons required for adequate statistical powering [49].

As noted by Wilson given these practical difficulties, the decision to use an adhesion reduction product will remain at this time with surgeons who will need to make individual judgements based on a balance between safety, perceived patient and surgeon benefit and whether the cost of an agent will be affordable to adopt for routine practice [32,39].

For the future there is a need to better understand the utility of adhesion reduction agents in improving outcomes and reducing the burden of disease. How to realistically achieve this remains uncertain but is a matter of onward discussion. Randomised controlled prospective clinical trials are desperately needed but they are expensive to run since huge numbers of patients are required to achieve meaningful data. Nevertheless they are likely to be required to influence national governing agents such as the UK advisory body National Institute for Health and Clinical Excellence (NICE) who regulate the introduction of innovative medical treatment regimes. There is also a need for a better understanding of the pathophysiological processes resulting in adhesions in order to allow for development of strategies, including potential combinations of agents and actions that allow for greater reduction in adhesions.

In the meantime, taking no action to reduce adhesions now is not an option. The burden of disease to healthcare systems and the risk to individual patients is considerable. Wilson has shown that the present lack of a long-term policy to tackle the long-term complications of adhesion-related hospital readmissions alone is estimated to cost the UK health system more than €900 million in the next 10 years [32]. Using a low-cost adhesion-reduction product today could result in savings of up to €42 million, if it were to reduce the current burden of adhesion-related readmissions by 25%.

Patients need to be advised of the risks and consequences of adhesions before they undergo surgery. Failure to do so could result in claims of medical negligence. Surgeons have a duty of care to protect patients by providing the best possible standard of care in order to reduce the risks of adhesion formation – this may now need to include the use of anti-adhesion agents at least in high-risk surgery. The choice of the agent to use remains with the individual surgeon.

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