JOURNAL OF ABDOMINAL WALL SURGERY
EUROPEAN HERNIA SOCIETY

TYPE Review
PUBLISHED 19 November 2026
DOI 10.3389/jaws.2026.17502

Check for updates

OPEN ACCESS

*CORRESPONDENCE
Andrea Balla,
andrea.balla@gmail.com

RECEIVED 31 July 2026
REVISED 03 September 2026
ACCEPTED 05 November 2026
PUBLISHED 19 November 2026

CITATION
Morales-Conde S, Balla A, Parra-Dávila E and Malcher F (2026) Prevention of midline and stoma site incisional hernia: implications for colorectal surgery. A narrative review.
J. Abdom. Wall Surg. 5:17502.
doi: 10.3389/jaws.2026.17502

COPYRIGHT
© 2026 Morales-Conde, Balla, Parra-Dávila and Malcher. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Prevention of midline and stoma site incisional hernia: implications for colorectal surgery. A narrative review

Salvador Morales-Conde [1,2], Andrea Balla [1,2]*, Eduardo Parra-Dávila [3] and Flavio Malcher [4,5]

[1]Department of General and Digestive Surgery, University Hospital Virgen Macarena, University of Sevilla, Sevilla, Spain, [2]Unit of General and Digestive Surgery, Hospital Quirónsalud Sagrado Corazón, Sevilla, Spain, [3]Good Samaritan Medical Center, TENET Palm Beach Health Network, Palm Beach, FL, United States, [4]Lenox Hill Hospital, New York, NY, United States, [5]Postgraduate Program in Medicine: Surgical Science, School of Medicine, Federal University of Rio Grande do Sul (UFRGS), Porto Alegre, Rio Grande do Sul, Brazil

Aim: Incisional hernia (IH) and stoma site incisional hernia (SSIH) represent some of the most frequent long-term complications after colorectal surgery, with reported incidences ranging from 14.5% to 39.9% and exceeding 50% in high-risk patients. This review aims to critically summarize current evidence on strategies for the prevention of IH and SSIH, focusing on surgical technique, biomaterials, and patient selection, with particular emphasis on their application in colorectal surgery.
Method: This narrative review is based on the synthesis of randomized controlled trials, meta-analyses, and international guideline recommendations. Although part of the available evidence derives from general abdominal surgery populations, its applicability to colorectal surgery was considered due to shared anatomical and technical principles.
Results: Continuous fascial closure using slowly absorbable sutures and the small-bites technique represents the most evidence-based strategy for midline laparotomy closure. Prophylactic mesh reinforcement reduces IH incidence, particularly in high-risk patients. Minimally invasive approaches and off-midline incisions further decrease hernia risk. In the context of stoma closure, prophylactic mesh—especially when placed in the retromuscular plane—has demonstrated a significant reduction in SSIH without increasing morbidity.
Conclusion: The prevention of IH and SSIH requires a multimodal and individualized approach. Despite the availability of high-quality evidence, implementation in clinical practice remains inconsistent, and further research is needed to optimize patient selection, standardize indications, and strengthen evidence in specific scenarios such as emergency surgery.

KEYWORDS
colorectal surgery, fascial closure, incisional hernia (IH), prophylactic mesh, stoma-site incisional hernia, parastomal hernia

Introduction

Incisional hernia (IH) continues to represent a major unresolved challenge in abdominal surgery and remains particularly prevalent following colorectal procedures, where disruption of the abdominal wall is inherent to the surgical approach [1–3]. Contemporary data indicate that the incidence of IH ranges from 14.5% to 39.9%, with

rates exceeding 50% in patients presenting with recognized risk factors such as obesity or comorbid conditions [1–3].

In parallel, stoma site incisional hernia (SSIH) has gained increasing attention as a clinically relevant complication that had historically been underestimated [4, 5]. Current evidence suggests that approximately one in three patients develops a hernia following stoma closure, and a substantial proportion of these cases ultimately require surgical repair [4, 5].

This growing burden has contributed to a paradigm shift in abdominal wall surgery, in which the focus is progressively moving from treatment to prevention [6, 7]. International scientific societies, including the European Hernia Society, have emphasized prevention as a priority area for research and clinical development [6, 7]. More recently, updated joint guidelines from the European and American Hernia Societies have further reinforced these concepts, highlighting the importance of standardized closure techniques, appropriate incision selection and the selective use of prophylactic mesh as key strategies in prevention [6, 7].

Despite this progress, considerable variability persists in clinical practice, and the adoption of preventive strategies remains inconsistent across institutions. The aim of the present review is therefore to provide a comprehensive and critical synthesis of the current evidence on the prevention of IH and SSIH in colorectal surgery, highlighting both established approaches and areas where further investigation is required.

Methods

This study was designed as a narrative review aimed at synthesizing the most relevant and high-quality evidence related to the prevention of incisional and stoma site hernias. The analysis was based on randomized controlled trials, systematic reviews, meta-analyses, and international guideline recommendations that represent the current standard of care in abdominal wall surgery [6, 7].

The review was structured around two main clinical scenarios: prevention of incisional hernia following midline laparotomy and prevention of hernia after stoma closure. Within these domains, particular attention was given to surgical technique, suture materials, the role of prophylactic mesh, and the impact of minimally invasive approaches.

Although a formal systematic search strategy or predefined inclusion criteria were not applied, the preparation and reporting of this narrative review were guided by the methodological principles proposed by the Scale for the Assessment of Narrative Review Articles (SANRA) [6]. The selected studies represent key contributions to the field and reflect contemporary evidence-based practice in abdominal wall surgery. Emphasis was placed on studies with higher levels of evidence, including randomized controlled trials and meta-analyses, as well as on recent guideline updates to ensure an up-to-date and clinically relevant synthesis of the available data [7, 8].

Although part of the available evidence derives from studies conducted in general abdominal surgery populations, its applicability to colorectal surgery was considered appropriate due to shared anatomical, physiological, and technical principles related to abdominal wall closure and stoma formation.

Particular attention was given in this review to the practical applicability of these preventive strategies in real-world colorectal surgery, where decisions are frequently influenced by patient risk profile, contamination, urgency, institutional protocols, and surgeon experience.

A narrative review methodology was considered appropriate given the broad and clinically heterogeneous nature of the topic, which encompasses different preventive strategies, surgical settings, techniques, and biomaterials. Rather than addressing a narrowly defined comparative question, the purpose of this review was to integrate evidence from different sources and levels of evidence and to provide a clinically oriented overview of current preventive strategies in colorectal surgery. This approach also allowed relevant evidence from general abdominal wall surgery to be contextualized within colorectal practice, while highlighting areas of uncertainty and priorities for future research.

Results

Prevention of incisional hernia in midline laparotomy

Fascial closure technique

The technique used for fascial closure has been consistently identified as one of the most important modifiable factors influencing the development of incisional hernia [9–14]. Early evidence derived from randomized controlled trials and meta-analyses demonstrated that continuous suturing is associated with a lower incidence of IH compared with interrupted closure, thereby establishing it as the preferred method for midline laparotomy closure [9].

More recently, the introduction of the small-bites technique has represented a significant advance in this field. This approach, characterized by the placement of closely spaced, small tissue bites with a high suture-to-wound length ratio, has been evaluated in landmark trials such as the STITCH and ESTOIH studies [10–12]. These investigations have consistently shown that the small-bites technique is associated with a reduced incidence of incisional hernia, as well as lower rates of surgical site infection and shorter hospital stay [10–12]. Meta-analyses of randomized trials further support these findings, demonstrating a significant reduction in hernia risk [13, 14]. However, longer-term follow-up data suggest that the incidence of incisional hernia continues to increase over time, and although the small-bites technique maintains lower absolute hernia rates, differences between techniques may attenuate beyond the first postoperative years, highlighting the importance of long-term evaluation in abdominal wall closure studies [13, 14].

In addition to the technique itself, the choice of suture material has also been explored as a potential determinant of postoperative outcomes [9]. Slowly absorbable monofilament sutures are currently recommended for fascial closure, as they provide prolonged support during the critical phases of wound healing while allowing a degree

of elasticity that may better accommodate physiological abdominal wall tension [9].

More recently, the use of barbed sutures has been proposed as an alternative that may facilitate continuous closure while reducing operative time [15–17]. Preliminary evidence suggests that these sutures are safe and may contribute to a reduction in surgical site infections, although long-term data remain limited [15–17]. Recent randomized evidence has provided a more nuanced perspective, suggesting that although barbed sutures are safe and facilitate closure, they may not significantly reduce the incidence of incisional hernia when compared with conventional sutures, indicating that their role remains adjunctive rather than definitive [17].

In addition, theoretical and experimental concerns have been raised regarding the potential for excessive localized tension generated by barbed sutures, which could impair tissue perfusion and lead to ischemia or necrosis at the fascial edges [15–17]. Although robust clinical evidence supporting this complication is limited, careful technique, avoiding over-tensioning and ensuring appropriate bite spacing, is recommended to minimize this risk [15–17]. Furthermore, the reduced elasticity associated with certain suture configurations may limit the physiological compliance of the abdominal wall, potentially influencing long-term functional outcomes [15–17].

Similarly, antimicrobial-coated sutures have been associated with a modest but statistically significant decrease in the incidence of surgical site infection, particularly in open surgical procedures [18–20]. Recent meta-analyses have confirmed this effect, demonstrating a modest but consistent reduction in surgical site infection rates associated with triclosan-coated sutures in abdominal surgery [18–20]. Given the well-established relationship between surgical site infection and incisional hernia development, the use of coated sutures may represent an additional preventive strategy within a multimodal approach [18–20].

Prophylactic mesh reinforcement

Beyond suture-based strategies, prophylactic mesh reinforcement has emerged as one of the most effective measures for preventing incisional hernia, particularly in patients at increased risk [21–26]. Multiple studies and meta-analyses have demonstrated that the use of mesh significantly reduces the incidence of IH and the need for reoperation [21–26]. Although an increased rate of seroma formation has been reported, this complication does not appear to translate into a clinically relevant increase in morbidity. Importantly, concerns regarding infection have not been consistently supported by the available evidence [21–26].

The optimal positioning of the mesh remains a subject of ongoing investigation [27–30]. Current data suggest that both retromuscular and onlay placement are effective in reducing hernia rates, while preperitoneal positioning has shown promising results but requires further validation [27–30]. As a consequence, current guidelines recommend considering prophylactic mesh in selected patients, although the strength of these recommendations remains limited by heterogeneity in study design and patient populations [8].

On the other hand, while most of the available evidence in this setting is based on permanent synthetic meshes, the role of biologic, biosynthetic, or hybrid materials remains poorly defined [31, 32]. These alternatives have been proposed in selected high-risk or contaminated scenarios; however, their routine use for prophylactic purposes in midline laparotomy is not currently supported by robust evidence [31, 32]. Furthermore, mesh materials should not be regarded as homogeneous categories [31, 32]. Even among polypropylene meshes, differences in pore size, effective porosity, mesh weight, and material burden may influence tissue integration and foreign-body response [33, 34]. Similarly, biosynthetic meshes differ in polymer composition and degradation profile, while reinforced tissue matrices (RTMs) combine an extracellular matrix scaffold with synthetic reinforcement [35]. These differences should be considered when interpreting outcomes across studies, although direct comparative evidence between different mesh technologies remains limited.

In colorectal surgery, the degree of surgical field contamination represents an additional consideration when prophylactic mesh is contemplated. Clean-contaminated procedures (CDC class II), including most elective colorectal resections, should be distinguished from contaminated or dirty/infected fields (CDC classes III-IV). In clean-contaminated procedures, randomized studies support prophylactic mesh reinforcement with both permanent synthetic and biosynthetic absorbable meshes, showing a reduction in incisional hernia without a significant increase in overall surgical site morbidity [36, 37]. As the degree of contamination increases, however, the evidence becomes substantially more limited. Mesh use in these settings should therefore be individualized according to the degree of contamination, patient risk profile, and clinical circumstances.

Surgical approach and incision type

Finally, the surgical approach and the location of the incision play a crucial role in the development of incisional hernia [38–40]. Minimally invasive surgery has been associated with lower hernia rates, largely due to the avoidance of large midline incisions [38–40]. In this context, the use of off-midline extraction sites, such as the Pfannenstiel incision, has been shown to significantly reduce the risk of hernia formation [38–40]. Conversely, midline extraction sites are strongly associated with an increased risk of IH and should be avoided whenever possible [38–40].

Recent systematic reviews and meta-analyses have further reinforced these findings, confirming that extraction-site incisional hernia is significantly influenced by incision location, with Pfannenstiel incisions consistently associated with lower hernia rates compared with midline extraction sites [38–40].

Emergency setting

Midline laparotomy is frequently used in emergency surgery, where patient-related and intraoperative factors significantly increase the risk of postoperative complications, including incisional hernia [41–43]. Emergency laparotomy is also associated with a higher incidence of abdominal wound dehiscence, which has been identified as a major risk factor for subsequent incisional hernia development [41–43]. In this context, evidence remains more limited than in elective surgery. However, available prospective data suggest that the use of the small-bites

technique may also reduce rates of wound dehiscence, surgical site infection and incisional hernia in emergency settings, although heterogeneity between studies and patient populations remains considerable [9–14].

Importantly, emergency procedures are often performed in physiologically compromised patients and under suboptimal conditions, including contamination, hemodynamic instability, and time constraints, all of which may adversely affect wound healing and the applicability of standardized closure techniques [41–43].

These findings should be interpreted with caution, as most of the available evidence supporting modern closure techniques derives from elective surgical populations, including landmark randomized trials such as STITCH and ESTOIH, and their applicability to emergency settings remains uncertain [11, 12]. In line with this, current international guidelines emphasize that the quality of evidence in emergency laparotomy is limited, and that recommendations regarding fascial closure techniques should be applied with caution in this context [8].

In clinical practice, however, adherence to fundamental principles of abdominal wall closure, such as tension-free approximation, appropriate suture-to-wound length ratio, and avoidance of excessive tissue trauma, remains essential and may help mitigate risk even in high-risk scenarios.

The role of prophylactic mesh in emergency surgery remains less clearly defined than in elective surgery. Randomized data suggest that mesh reinforcement may reduce the incidence of incisional hernia after emergency midline laparotomy, particularly in clean-contaminated procedures, without a significant increase in surgical site infection [21–32, 36, 44]. More recent meta-analytic evidence also supports a reduction in incisional hernia following prophylactic mesh reinforcement in emergency laparotomy; however, evidence specifically addressing contaminated and dirty/infected fields remains limited and of low to very low certainty [21–32, 36, 44]. Therefore, routine prophylactic mesh reinforcement cannot currently be recommended across the full spectrum of emergency surgery, and its use should be individualized according to the degree of contamination, patient risk, and clinical circumstances.

Prevention of stoma site incisional hernia

Stoma site incisional hernia represents a frequent and clinically relevant complication following stoma closure, with an incidence approaching one-third of patients, although considerable variability exists depending on patient characteristics and follow-up duration [4, 45–50]. The risk appears to be higher after colostomy closure compared with ileostomy closure, although the underlying mechanisms remain incompletely understood [4, 45–50].

The surgical approach to stoma reversal has evolved considerably over recent years, with increasing adoption of minimally invasive techniques [4, 45–50]. In particular, laparoscopic reversal of Hartmann's procedure has been associated in selected series with reduced postoperative morbidity, lower rates of surgical site infection, and shorter hospital stay compared with open surgery [43].

Among the various strategies proposed for the prevention of SSIH, prophylactic mesh reinforcement has emerged as the most promising intervention [4, 45–51]. A growing body of evidence indicates that the placement of mesh at the time of stoma closure significantly reduces the incidence of hernia without increasing the risk of postoperative complications [4, 45–51]. In addition, patients receiving mesh have been shown to experience an improvement in hernia-related quality of life [4, 45–51]. More recently, high-quality evidence from randomized controlled trials and meta-analyses has further confirmed the benefit of prophylactic mesh placement, demonstrating a significant reduction in stoma-site incisional hernia rates without increasing surgical site infection or anastomotic complications [4, 45–51]. However, heterogeneity in study design, mesh type, and patient selection continues to limit the generalizability of these findings [4, 45–51].

With regard to mesh positioning, the retromuscular plane appears to offer the most favourable balance between efficacy and safety [4, 45–51]. This approach allows for adequate reinforcement of the abdominal wall while minimizing the risk of contamination and mesh-related complications [4, 45–51]. Recent network meta-analysis data support this concept, suggesting that retromuscular mesh placement is associated with the lowest incidence of hernia recurrence without increasing postoperative morbidity [51].

The type of mesh used in this setting is another area of active investigation [48–50]. While permanent synthetic meshes remain the most widely studied option, biosynthetic materials have recently gained attention due to their favourable biological profile [48–50]. Early studies evaluating poly-4-hydroxybutyrate meshes have reported low rates of hernia recurrence and acceptable complication rates, suggesting that these materials may represent a valid alternative in selected patients [48–50].

Available comparative evidence does not currently demonstrate clear superiority of a specific mesh material. A systematic review and network meta-analysis comparing polypropylene, biosynthetic, and biologic meshes found no significant superiority of a specific mesh type [51]. More recently, an updated network meta-analysis confirmed the benefit of prophylactic mesh reinforcement but similarly found no statistically significant superiority between mesh types [52]. These findings should be interpreted cautiously given the limited direct head-to-head comparisons and the heterogeneous terminology used to classify mesh materials across studies.

It is important to recognize that not all absorbable or biologically derived meshes are equivalent [48–50]. Traditional biologic meshes, derived from human or animal collagen matrices, have shown variable performance, particularly in terms of long-term durability and cost-effectiveness, and their role in hernia prevention remains uncertain [48–50]. In contrast, reinforced tissue matrices (RTMs), combining a biologic scaffold with a permanent or slowly resorbable synthetic component, have been developed to enhance mechanical strength while preserving favourable biological integration [48–50].

Similarly, biosynthetic meshes represent a heterogeneous group of materials with different degradation profiles, mechanical properties, and host responses [48–50]. Polymers such as poly-4-hydroxybutyrate provide prolonged resorption times and gradual load transfer to native tissue, whereas other rapidly resorbable materials may offer less durable support [48–50]. These differences may have relevant clinical implications, particularly in prophylactic settings, where long-term reinforcement is desirable [48–50]. However, direct comparative evidence between biosynthetic

and biologic or hybrid meshes remains limited, and further research is required to define their optimal role in abdominal wall reinforcement.

Discussion

The prevention of incisional and stoma site hernias has become a central objective in modern colorectal and abdominal wall surgery. Over the past decade, substantial progress has been achieved in identifying modifiable factors that influence hernia development and in establishing evidence-based strategies to mitigate this risk. From a colorectal surgeon's perspective, prevention should not be regarded as an optional technical refinement, but as an integral component of the operation itself. In daily practice, the most difficult step is often not knowing what should be done, but ensuring that it is done consistently, even in complex or high-pressure scenarios.

One of the most significant advances has been the standardization of fascial closure techniques, particularly with the widespread recognition of the small-bites approach. Unlike previous technical refinements, this strategy is supported by high-level evidence and has demonstrated consistent benefits across multiple randomized trials and meta-analyses. Nevertheless, real-world data indicate that its adoption remains incomplete, highlighting a persistent gap between evidence and clinical practice [53]. This gap between evidence and implementation has been consistently documented in national surveys. In Spain, studies published in Cirugía Española and national surveys of colorectal surgeons have demonstrated significant variability in abdominal wall closure practices, with incomplete adoption of small-bites techniques and heterogeneous use of prophylactic measures [53]. Similarly, data from the European Society of Coloproctology and from the UK have shown wide variation in closure techniques and suture selection, further highlighting the challenges in translating evidence into routine clinical practice [54, 55]. In addition, longer-term follow-up data have shown that although the small-bites technique maintains lower absolute rates of incisional hernia, the incidence continues to increase over time, and differences between techniques may attenuate beyond the first postoperative years, underscoring the importance of long-term evaluation in abdominal wall closure [56, 57]. This point is particularly relevant because the small-bites technique is inexpensive, reproducible and independent of advanced technology. Therefore, its incomplete implementation probably reflects training gaps, established habits and local surgical culture rather than true resource limitations.

Similarly, the role of prophylactic mesh reinforcement has evolved from a controversial concept to a well-supported preventive measure in selected patients. Despite this, its use is still limited in routine practice, largely due to concerns regarding infection, cost, and technical complexity. Current evidence suggests that these concerns may be overstated, particularly when appropriate patient selection and surgical technique are applied. Recent high-quality evidence, including randomized controlled trials and meta-analyses, has reinforced the safety and effectiveness of prophylactic mesh both in midline laparotomy and stoma closure, particularly in high-risk patients [4, 48]. These findings are in line with contemporary international guidelines, which support the selective use of prophylactic mesh in high-risk patients while acknowledging the variability in clinical practice and the need for individualized decision-making [8]. In clinical practice, prophylactic mesh should not be interpreted as a universal solution, but as a selective tool for well-defined risk profiles. The real challenge is to avoid both extremes: underuse in patients who would clearly benefit from reinforcement and overuse in low-risk patients where the balance between benefit, cost, and potential morbidity is less favourable.

However, no universally accepted definition of a "high-risk" patient currently exists. Risk should therefore be considered cumulative, taking into account patient-related factors such as obesity, smoking, diabetes, chronic pulmonary disease, and previous abdominal surgery, together with procedure-related factors including open midline surgery, colorectal surgery, and emergency procedures [26]. Predictive tools such as the HERNIA score and the University of Pennsylvania incisional hernia risk model may assist risk stratification [58, 59], although no validated threshold currently defines the indication for prophylactic mesh.

Another important area of progress has been the recognition of the impact of surgical approach and incision type on hernia formation. The increasing use of minimally invasive techniques and off-midline incisions reflects a broader effort to preserve the structural and functional integrity of the abdominal wall. This concept of "abdominal wall preservation" represents a fundamental shift in surgical thinking and aligns with a broader move towards function-preserving surgical strategies. The concept is supported by contemporary evidence demonstrating lower hernia rates with non-midline extraction sites [38, 40]. For colorectal surgeons, this concept is especially important because the extraction site is often considered a secondary technical detail. However, available evidence suggests that this decision may have long-term consequences for the patient and should therefore be planned with the same attention as the oncological or reconstructive steps of the procedure.

In contrast, the prevention of stoma site incisional hernia remains a relatively underdeveloped field [4, 45–50, 52]. Although recent studies have demonstrated the effectiveness of prophylactic mesh in this context, the available evidence is still evolving. However, emerging high-quality data, including randomized trials and network meta-analyses, are rapidly strengthening the evidence base, particularly supporting retromuscular mesh placement as the most effective strategy [4, 45–50, 52]. Furthermore, recent studies have also highlighted improvements in patient-reported outcomes, reinforcing the clinical relevance of these preventive strategies beyond purely anatomical recurrence [49].

Cost is another relevant consideration when prophylactic mesh is contemplated at stoma closure. A recent budget impact analysis from the Italian healthcare perspective suggested that the higher initial cost of prophylactic biosynthetic mesh may potentially be offset by reductions in subsequent SSIH and related treatment costs [60]. However, these findings depend on local costs, reimbursement systems, and the assumptions underlying the economic model.

Several gaps in the current literature warrant further investigation. There is a clear need for high-quality randomized controlled trials evaluating prophylactic strategies in stoma closure, as well as studies comparing different mesh materials and positions.

TABLE 1 Main evidence-based strategies for prevention of midline and stoma-site incisional hernia in colorectal surgery.

Clinical scenario	Preventive strategy	Evidence/rationale	Practical recommendation	Evidence Level
Elective midline laparotomy	Continuous fascial closure	Lower incisional hernia rates than interrupted closure [9]	Continuous closure should be preferred	High
Elective midline laparotomy	Small-bites technique	RCTs and meta-analyses show reduced incisional hernia and SSI [10–14, 56, 57]	Use small, closely spaced bites and an adequate suture-to-wound length ratio	High
Elective midline laparotomy	Slowly absorbable monofilament sutures	Prolonged support during fascial healing with adequate tissue compliance [9]	Preferred suture material	Moderate
Elective midline laparotomy	Antimicrobial-coated sutures	Modest but consistent reduction in SSI, a recognized risk factor for incisional hernia [18–20]	May be considered within a multimodal strategy	Moderate
Patients at increased risk for elective midline closure	Prophylactic mesh reinforcement	Reduces incisional hernia and reoperation in selected patients; risk is cumulative and may be supported by predictive models [21–26, 58, 59]	Consider according to cumulative patient- and procedure-related risk	High
Mesh reinforcement for elective midline closure	Mesh characteristics/ material	Permanent synthetic, biosynthetic and RTM categories are heterogeneous; no overall superiority of one technology has been established [31–35]	Individualize material selection and interpret evidence according to the specific mesh	Low
Mesh placement for elective midline closure	Retromuscular, onlay or preperitoneal	Retromuscular and onlay positions are effective; preperitoneal placement is promising but less validated [27–30]	Individualize; retromuscular may be preferred when feasible	Moderate
Clean-contaminated surgery (CDC II)	Prophylactic mesh reinforcement	RCT evidence supports permanent synthetic and biosynthetic absorbable reinforcement, with lower IH and no clear increase in overall surgical-site morbidity [36, 37]	May be considered after individual risk assessment	Moderate
Contaminated or dirty/ infected surgery (CDC III-IV)	Prophylactic mesh reinforcement	Evidence for prophylactic mesh reinforcement remains limited, particularly in dirty/infected fields, and is of low or very low certainty [44]	Not routinely recommended; consider only in selected cases according to contamination, patient risk and clinical circumstances	Low/ very low
Minimally invasive colorectal surgery	Avoidance of midline extraction sites	Off-midline extraction, particularly Pfannenstiel, is associated with lower extraction-site hernia rates [38–40]	Avoid midline extraction whenever feasible	Moderate
Emergency surgery	Standardized fascial closure	Evidence is less robust than in elective surgery, but evidence-based closure principles remain relevant [8–14, 41–43]	Apply standardized closure principles whenever feasible	Low
Emergency surgery	Prophylactic mesh reinforcement	May reduce IH overall; evidence in CDC III-IV fields remains limited and of low or very low certainty [36, 44]	Selected cases only; not routine across all emergency settings	Low/ very low
Stoma closure	Prophylactic mesh reinforcement	Reduces SSIH without a clear increase in SSI or major postoperative morbidity [4, 45–52]	Consider, particularly in patients at increased risk	High
Stoma closure	Retromuscular mesh placement	Network meta-analysis suggests that retromuscular placement provides the most favorable efficacy profile among evaluated planes, without a significant increase in SSI [52]	Prefer when technically feasible	Moderate
Stoma closure	Mesh material	Comparative meta-analyses do not show statistically significant superiority of a specific mesh type; terminology and material classifications vary across studies [51, 52]	Individualize selection; avoid extrapolating one product's outcomes to an entire category	Moderate

Abbreviations: IH, incisional hernia; SSI, surgical site infection; SSIH, stoma-site incisional hernia; RTM, reinforced tissue matrix; CDC, Centers for Disease Control and Prevention wound classification. Reference numbers correspond to the final numbering of the manuscript bibliography. Evidence level reflects the overall strength and consistency of the evidence supporting each strategy as summarized in this narrative review and does not represent a formal GRADE assessment.

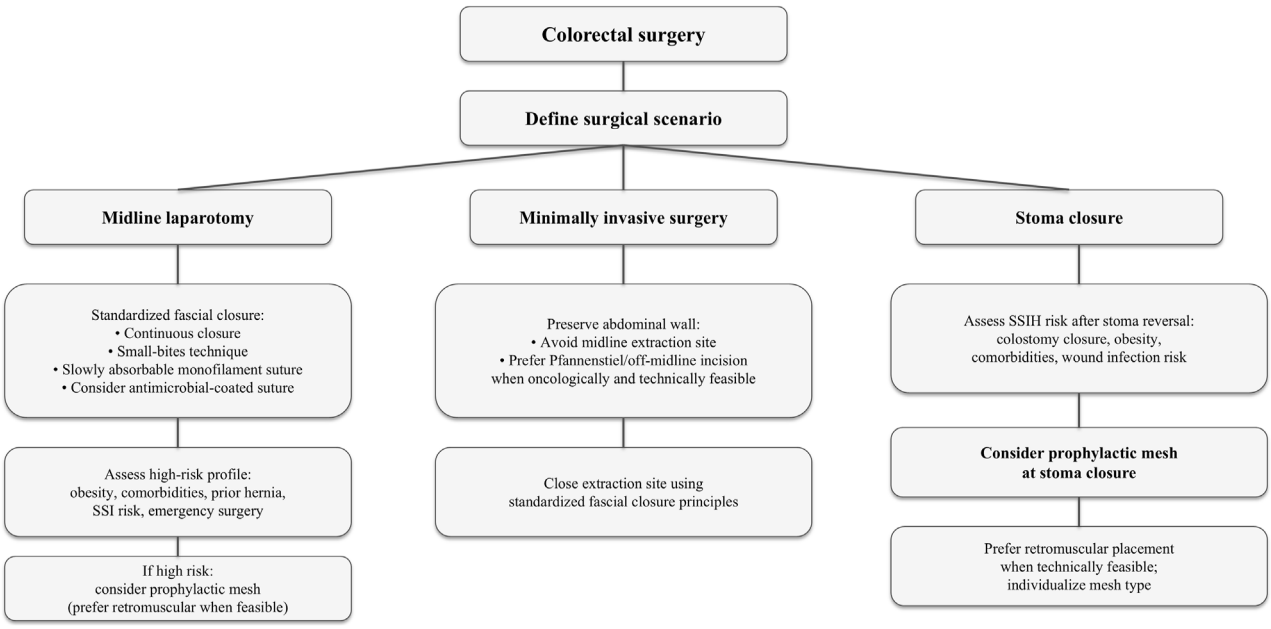


FIGURE 1
Proposed decision algorithm for prevention of incisional and stoma-site hernia in colorectal surgery. SSIH: stoma site incisional hernia.

In addition, data on non-midline incisions and emergency surgery remain scarce, and most available evidence derives from elective settings, limiting its generalizability [8]. This limitation is particularly relevant in emergency surgery, where patient instability, contamination, and time constraints further challenge the application of evidence-based preventive strategies. This heterogeneity has been highlighted in recent systematic reviews, which underline the difficulty in establishing universal recommendations and the need for more standardized study designs [13]. Long-term follow-up is also essential to assess recurrence rates, chronic pain, and cost-effectiveness.

Another relevant barrier is the absence of standardized institutional pathways. In many units, abdominal wall closure still depends more on individual preference than on standardised protocols. Periodic audit and structured training may therefore be as important as new trials in reducing the burden of incisional hernia.

Finally, beyond the generation of evidence, future efforts should focus on improving the implementation of proven strategies in clinical practice. Educational initiatives, standardized protocols, and multidisciplinary collaboration will be essential to bridge the gap between evidence and routine care.

Conclusions

The prevention of incisional and stoma site hernias requires a comprehensive and evidence-based approach that integrates surgical technique, biomaterials, and patient-specific factors. Continuous small-bites closure with slowly absorbable sutures represents the current standard for midline laparotomy, while prophylactic mesh should be considered in high-risk patients.

In the context of stoma closure, growing evidence supports the use of prophylactic mesh as a safe and effective strategy to reduce hernia incidence and improve patient outcomes, particularly when placed in the retromuscular plane.

These findings reflect a broader paradigm shift towards abdominal wall preservation as a key component of colorectal surgery. However, despite the availability of high-quality evidence, implementation in clinical practice remains inconsistent. The main preventive strategies are summarized in Table 1, and a proposed practical decision algorithm for the prevention of incisional and stoma-site hernias in colorectal surgery is presented in Figure 1.

Ultimately, prevention of IH and SSIH should be considered a quality indicator in colorectal surgery. Reducing these complications requires not only evidence, but also education, standardization, audit, and a cultural shift towards abdominal wall preservation.

Further research is required to optimize patient selection, define the most appropriate techniques and materials, and generate long-term data, particularly in underrepresented scenarios such as emergency surgery.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Funding

The author(s) declared that financial support was not received for this work and/or its publication.

Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declared that generative AI was not used in the creation of this manuscript.

Any alternative text (alt text) provided alongside figures in this article has been generated by Frontiers with the support of artificial intelligence and reasonable efforts have been made to ensure accuracy, including review by the authors wherever possible. If you identify any issues, please contact us.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

1. Claes K, Beckers R, Heindryckx E, Kyle-Leinhase I, Pletinckx P, Claeys D, et al. Retrospective observational study on the incidence of incisional hernias after colorectal carcinoma resection with follow-up CT scan. *Hernia* (2014) 18(6):797–802. doi: 10.1007/s10029-014-1214-z

2. Adell-Carceller R, Segarra-Soria MA, Pellicer-Castell V, Marcote-Valdivieso E, Gamón-Giner R, Martín-Franco MA, et al. Hernia incisional en cirugía de cáncer colorrectal. Factores de riesgo relacionados [Incisional hernia in colorectal cancer surgery. Associated risk factors]. *Cir Esp* (2006) 79(1):42–5. doi: 10.1016/s0009-739x(06)70812-0

3. Pereira JA, Pera M, Grande L. Elevada incidencia de hernia incisional tras resección abierta y laparoscópica por cáncer colorrectal [Incidence of incisional hernia after open and laparoscopic colorectal cancer resection]. *Cir Esp* (2013) 91(1):44–9. doi: 10.1016/j.ciresp.2012.05.004

4. Gosavi R, Tan R, McMurrick P, Teoh W, Narasimhan V. Prophylactic mesh at stoma reversal reduces incisional hernia without increasing early complications: a systematic review and meta-analysis of randomised trials. *Hernia* (2026) 30(1):76. doi: 10.1007/s10029-025-03532-3

5. Bruinsma J, Tharakan N, Clausen NA, Nikolenko R, Temperley HC, Mac Curtain BM, et al. Stoma-site specimen extraction in elective minimally invasive colorectal surgery: a systematic review and meta-analysis. *J Laparoendosc Adv Surg Tech A* (2026) 36(4):270–80. doi: 10.1177/10926429261418524

6. Baethge C, Goldbeck-Wood S, Mertens S. SANRA-a scale for the quality assessment of narrative review articles. *Res Integr Peer Rev* (2019) 4:5. doi: 10.1186/s41073-019-0064-8

7. Stabilini C, Muysoms FE, Tzanis AA, Rossi L, Koutsiouroumpa O, Mavridis D, et al. EHS rapid guideline: evidence-informed European recommendations on parastomal hernia prevention-with ESCP and EAES participation. *J Abdom Wall Surg* (2023) 2:11549. doi: 10.3389/jaws.2023.11549

8. Deerenberg EB, Henriksen NA, Antoniou GA, Antoniou SA, Bramer WM, Fischer JP, et al. Updated guideline for closure of abdominal wall incisions from the European and American hernia societies. *Br J Surg* (2022) 109(12):1239–50. doi: 10.1093/bjs/znac302

9. Diener MK, Voss S, Jensen K, Büchler MW, Seiler CM. Elective midline laparotomy closure: the INLINE systematic review and meta-analysis. *Ann Surg* (2010) 251(5):843–56. doi: 10.1097/SLA.0b013e3181d973e4

10. Dias Rasador AC, Mazzola Poli de Figueiredo S, Fernandez MG, Dias YJM, Martin RRH, da Silveira CAB, et al. Small bites versus large bites during fascial closure of midline laparotomies: a systematic review and meta-analysis. *Langenbecks Arch Surg* (2024) 409(1):104. doi: 10.1007/s00423-024-03293-0

11. Deerenberg EB, Harlaar JJ, Steyerberg EW, Lont HE, van Doorn HC, Heisterkamp J, et al. Small bites versus large bites for closure of abdominal midline incisions (STITCH): a double-blind, multicentre, randomised controlled trial. *Lancet* (2015) 386(10000):1254–60. doi: 10.1016/S0140-6736(15)60459-7

12. Albertsmeier M, Hofmann A, Baumann P, Riedl S, Reisensohn C, Kewer JL, et al. Effects of the short-stitch technique for midline abdominal closure: short-term results from the randomised-controlled ESTOIH trial. *Hernia* (2022) 26(1):87–95. doi: 10.1007/s10029-021-02410-y

13. Morarasu S, Lunca S, O'Brien L, Lynch P, Musina AM, Roata CE, et al. Small-bites versus large-bites closure of midline laparotomies: a systematic review and meta-analysis. *Colorectal Dis* (2025) 27(3):e70073. doi: 10.1111/codi.70073

14. Alrashidi A, Hageen AW, Rifai M, Sameh M, Elshaar AG, Alamri JA, et al. Small bites Versus large bites for closure of midline abdominal incisions: a systematic review and meta-analysis with trial sequential analysis of randomized controlled trials. *World J Surg* (2025) 49(6):1449–65. doi: 10.1002/wjs.12619

15. Pyo DH, Yun SH, Lee WY. A prospective single-arm clinical trial to assess the safety and efficacy of monofilament polydioxanone barbed suture, MONOFIX®, on abdominal fascial closure. *World J Surg* (2024) 48(7):1674–80. doi: 10.1002/wjs.12247

16. Matsuda A, Yamada T, Uehara K, Shinji S, Yokoyama Y, Takahashi G, et al. Comparison between barbed and non-barbed sutures for fascial closure in abdominal surgery: a systematic review and meta-analysis. *Surg Today* (2026) 56(2):165–73. doi: 10.1007/s00595-025-03118-7

17. Yamakawa Y, Takahashi H, Shiga K, Hirokawa T, Nakai N, Harata K, et al. HIBISCUS trial (hernia incidence with continuous barbed vs interrupted suturing in colorectal surgery with small incisions): a contemporary study protocol for a multicenter randomized controlled trial. *BMC Surg* (2026) 26(1):151. doi: 10.1186/s12893-026-03528-5

18. Depuydt M, Van Egmond S, Petersen SM, Muysoms F, Henriksen N, Deerenberg E. Systematic review and meta-analysis comparing surgical site infection in abdominal surgery between triclosan-coated and uncoated sutures. *Hernia* (2024) 28(4):1017–27. doi: 10.1007/s10029-024-03045-5

19. Kouzu K, Tsujimoto H, Ishinuki T, Shinji S, Shinkawa H, Tamura K, et al. The effectiveness of fascial closure with antimicrobial-coated sutures in preventing incisional surgical site infections in gastrointestinal surgery: a systematic review and meta-analysis. *J Hosp Infect* (2024) 146:174–82. doi: 10.1016/j.jhin.2023.09.006

20. Dilday J, McGillen P, Park S, Gallagher S, Lee H, Schellenberg M, et al. Is barbed better? Evaluation of triclosan-coated barbed suture on wound complications following emergency laparotomy. *J Trauma Acute Care Surg* (2024) 97(1):149–57. doi: 10.1097/TA.0000000000004341

21. van den Berg R, Den Hartog FPJ, Baart SJ, Bali C, Matsagkas M, Bevis PM, et al. European hernia society prophylactic mesh study group collaborators. A systematic review and independent patient data meta-analysis of prophylactic mesh augmentation for incisional hernia prevention after abdominal aortic aneurysm surgery (I-PREVENT-AAA) A collaborative European hernia society project. *Ann Surg* (2026) 283(1):82–91. doi: 10.1097/SLA.0000000000006684

22. Aiolfi A, Cavalli M, Gambero F, Mini E, Lombardo F, Gordini L, et al. Prophylactic mesh reinforcement for midline incisional hernia prevention: systematic review and updated meta-analysis of randomized controlled trials. *Hernia* (2023) 27(2):213–24. doi: 10.1007/s10029-022-02660-4

23. Abbas AW, Abo-Elsoad MF, Hindawi MD, Zeid MA, Kalmoush AE, Aboelkier MM, et al. Prophylactic mesh reinforcement in elective abdominal surgeries: a systematic review, meta-analysis, and GRADE evidence assessment. *Hernia* (2025) 29(1):230. doi: 10.1007/s10029-025-03421-9

24. Argudo N, Iskra MP, Pera M, Sancho JJ, Grande L, López-Cano M, et al. The use of an algorithm for prophylactic mesh use in high risk patients reduces the incidence of incisional hernia following laparotomy for colorectal cancer resection. *Cir Esp* (2017) 95(4):222–8. doi: 10.1016/j.ciresp.2017.03.010

25. Lozada Hernández EE, Maldonado Barrios IL, Amador Ramírez S, Rodríguez Casillas JL, Hinojosa Ugarte D, Smolinski Kurek RL, et al. Surgical site occurrence after prophylactic use of mesh for prevention of incisional hernia in midline laparotomy: systematic review and meta-analysis of randomized clinical trials. *Surg Endosc* (2024) 38(2):942–56. doi: 10.1007/s00464-023-10509-9

26. Pereira-Rodríguez JA, Bravo-Salva A, Argudo-Aguirre N, Amador-Gil S, Pera-Román M. Defining high-risk patients suitable for incisional hernia prevention. *J Abdom Wall Surg* (2023) 2:10899. doi: 10.3389/jaws.2023.10899

27. Tansawet A, Numthavaj P, Techapongsatorn S, Wilasrusmee C, Attia J, Thakkinstian A. Mesh position for hernia prophylaxis after midline laparotomy: a systematic review and network meta-analysis of randomized clinical trials. *Int J Surg* (2020) 83:144–51. doi: 10.1016/j.ijsu.2020.08.059

28. Aiolfi A, Bona D, Gambero F, Sozzi A, Bonitta G, Rausa E, et al. What is the ideal mesh location for incisional hernia prevention during elective laparotomy? A network meta-analysis of randomized trials. *Int J Surg* (2023) 109(5):1373–81. doi: 10.1097/JS9.0000000000000250

29. Lagger M, Raffaella S, Leo B, Michel A. Retromuscular prophylactic mesh reinforcement after midline laparotomy: a systematic review and meta-analysis. *Hernia* (2025) 30(1):45. doi: 10.1007/s10029-025-03533-2

30. Van den Dop LM, Sneiders D, Yurtkap Y, Werba A, van Klaveren D, Pierik REGJM, et al. Prevention of incisional hernia with prophylactic onlay and sublay mesh reinforcement vs. primary suture only in midline laparotomies (PRIMA): long-term outcomes of a multicentre, double-blind, randomised controlled trial. *Lancet Reg Health Eur* (2023) 36:100787. doi: 10.1016/j.lanepe.2023.100787

31. Van Den Dop LM, Molina-Villar JM, Mäkäräinen E, Torkington J, Weyhe D, Koncar I, et al. Prophylactic slowly resorbable mesh in midline laparotomy to limit incisional hernia incidence: the prospective 'Mesh Augmented Reinforcement of Abdominal Wall Suture Line (MARS)' cohort study protocol. *Int J Surg Protoc* (2024) 28(2):58–63. doi: 10.1097/SP9.0000000000000023

32. Coelho R, Anwoju O, Siddiqui A, Youssef A, Olavarria OA, Dhanani NH, et al. Prophylactic mesh reinforcement for non-midline incisions: a systematic review. *HCA Healthc J Med* (2024) 5(2):57–65. doi: 10.36518/2689-0216.1576

33. Brown CN, Finch JG. Which mesh for hernia repair? *Ann R Coll Surg Engl* (2010) 92(4):272–8. doi: 10.1308/003588410X12664192076296

34. Cobb WS, Kercher KW, Heniford BT. The argument for lightweight polypropylene mesh in hernia repair. *Surg Innov* (2005) 12(1):63–9. doi: 10.1177/155335060501200109

35. Lake SP, Deeken CR, Agarwal AK. Reinforced tissue matrix to strengthen the abdominal wall following reversal of temporary ostomies or to treat incisional hernias. *World J Gastrointest Surg* (2024) 16(3):823–32. doi: 10.4240/wjgs.v16.i3.823

36. Pizza F, D'Antonio D, Ronchi A, Lucido FS, Brusciano L, Marvaso A, et al. Prophylactic sublay non-absorbable mesh positioning following midline laparotomy in a clean-contaminated field: randomized clinical trial (PROMETHEUS). *Br J Surg* (2021) 108(6):638–43. doi: 10.1093/bjs/znab068

37. Pizza F, D'Antonio D, Arcopinto M, Dell'Isola C, Marvaso A. Safety and efficacy of prophylactic resorbable biosynthetic mesh following midline laparotomy in clean/contemned field: preliminary results of a randomized double blind prospective trial. *Hernia* (2020) 24(1):85–92. doi: 10.1007/s10029-019-02025-4

38. den Hartog FPJ, van Egmond S, Poelman MM, Menon AG, Kleinrensink GJ, Lange JF, et al. The incidence of extraction site incisional hernia after minimally invasive colorectal surgery: a systematic review and meta-analysis. *Colorectal Dis* (2023) 25(4):586–99. doi: 10.1111/codi.16455

39. Johnson JA, Mesiti A, Herre M, Farzaneh C, Li Y, Zambare W, et al. Effect of specimen extraction site on postoperative incisional hernia after minimally invasive right colectomy. *J Am Coll Surg* (2024) 239(2):107–12. doi: 10.1097/XCS.0000000000001060

40. Burgard M, Liot E, Meurette G, Poletti PA, Toso C, Ris F, et al. The choice of extraction site modulates the incidence of incisional hernia in colorectal surgery: a cohort analysis. *Updates Surg* (2025) 27:1581–7. doi: 10.1007/s13304-025-02272-4

41. Zhang Y, Liu C, Nistala KRY, Chong CS. Open *versus* laparoscopic Hartmann's procedure: a systematic review and meta-analysis. *Int J Colorectal Dis* (2022) 37(12):2421–30. doi: 10.1007/s00384-022-04285-6

42. Chavrier D, Alves A, Menahem B. Is laparoscopy a reliable alternative to laparotomy in Hartmann's reversal? An updated meta-analysis. *Tech Coloproctol* (2022) 26(4):239–52. doi: 10.1007/s10151-021-02560-2

43. Horesh N, Rudnicki Y, Dreznik Y, Zbar AP, Gutman M, Zmora O, et al. Reversal of Hartmann's procedure: still a complicated operation. *Tech Coloproctol* (2018) 22(2):81–7. doi: 10.1007/s10151-017-1735-4

44. Gonzalez Jaramillo RA, Avendaño LI, González AMB, Suárez BD, Becerra JLR, Garcia EJ, et al. Prophylactic mesh reinforcement at emergency midline laparotomy: a systematic review and meta-analysis with pre-specified subgroup analysis of contaminated and dirty abdominal wounds (CDC class III-IV). *Hernia* (2026) 30(1):307. doi: 10.1007/s10029-026-03807-3

45. López-Cano M, Pereira JA, Villanueva B, Vallribera F, Espin E, Armengol Carrasco M, et al. Abdominal wall closure after a stomal reversal procedure. *Cir Esp* (2014) 92(6):387–92. doi: 10.1016/j.ciresp.2014.01.003

46. Bhangu A, Nepogodiev D, Futaba K, West M. Research collaborative. Systematic review and meta-analysis of the incidence of incisional hernia at the site of stoma closure. *World J Surg* (2012) 36(5):973–83. doi: 10.1007/s00268-012-1474-7

47. Warren JA, Beffa LR, Carbonell AM, Cull J, Sinopoli B, Ewing JA, et al. Prophylactic placement of permanent synthetic mesh at the time of ostomy closure prevents formation of incisional hernias. *Surgery* (2018) 163(4):839–46. doi: 10.1016/j.surg.2017.09.041

48. Burghgraef TA, Amelung FJ, Kertzman BAJ, Draaisma WA, Verdaasdonk EGG, Verheijen PM, et al. Prevention of incisional hernias with prophylactic synthetic mesh placement during stoma reversal: a randomized clinical trial. *JAMA Surg* (2025) 160(11):1177–84. doi: 10.1001/jamasurg.2025.3445

49. Peltrini R, Rognoni C, Bellanova G, Caricato M, Carlini M, Cimbanassi S, et al. Prevention of incisional hernia with biosynthetic mesh at the site of temporary ileostomy closure (PRINCESS study): Preliminary results. *Hernia* (2025) 29(1):277. doi: 10.1007/s10029-025-03462-0

50. Drissi F, Jurczak F, Dabrowski A, Oberlin O, Khalil H, Gillion JF, et al. Long-term outcome of prophylactic biosynthetic mesh reinforcement at the time of loop ileostomy reversal for colorectal cancer-results of a case-matched study. *Hernia* (2025) 29(1):133. doi: 10.1007/s10029-025-03328-5

51. Peltrini R, Imperatore N, Altieri G, Castiglioni S, Di Nuzzo MM, Grimaldi L, et al. Prevention of incisional hernia at the site of stoma closure with different reinforcing mesh types: a systematic review and meta-analysis. *Hernia* (2021) 25(3):639–48. doi: 10.1007/s10029-021-02393-w

52. Ramírez-Giraldo C, Santamaría-Forero S, Van-Londoño I, Navarro-Alean J, Figueroa-Avendaño C, Rojas-López S, et al. Type of mesh and wall plane in prophylactic mesh after stoma closure: a network meta-analysis. *Hernia* (2025) 29(1):228. doi: 10.1007/s10029-025-03413-9

53. Pous-Serrano S, García-Pastor P, Bueno-Lledó J. National survey of colorectal surgery units on abdominal wall closure. *Cir Esp Engl Ed* (2023) 101(4):258–64. doi: 10.1016/j.cireng.2022.09.017

54. Messenger DE, Rajaretnam N, Slade DAJ. CLosure of abdominal MidlineS survey (CLAMSS) collaborative, abdominal wall subcommittees of the association of coloproctologists of Great Britain and Ireland (ACPGBI) and the british hernia society (BHS), the dukes' club. CLosure of abdominal MidlineS survey (CLAMSS): a national survey investigating current practice in the closure of abdominal midline incisions in UK surgical practice. *Colorectal Dis* (2024) 26(8):1617–31. doi: 10.1111/codi.17081

55. Chowdhury S, El-Hussuna A, Gallo G, Keatley J, Kelly ME, Minaya-Bravo A, et al. An international assessment of surgeon practices in abdominal wound closure and surgical site infection prevention by the european society for coloproctology. *Colorectal Dis* (2023) 25(5):1014–25. doi: 10.1111/codi.16500

56. Fortelny RH, Hofmann A, Baumann P, Riedl S, Kewer JL, Hoelderle J, et al. Three-year follow-up analysis of the short-stitch *versus* long-stitch technique for elective midline abdominal closure randomized-controlled (ESTOIH) trial. *Hernia* (2024) 28(4):1283–91. doi: 10.1007/s10029-024-03025-9

57. Fortelny RH, Baumann P, Hofmann A, Riedl S, Kewer JL, Hoelderle J, et al. 5-year clinical outcome of the ESTOIH trial comparing the short-bite versus large-bite technique for elective midline abdominal closure. *Hernia* (2025) 29(1):263. doi: 10.1007/s10029-025-03459-9

58. Goodenough CJ, Ko TC, Kao LS, Nguyen MT, Holihan JL, Alawadi Z, et al. Development and validation of a risk stratification score for ventral incisional hernia after abdominal surgery: hernia expectation rates in intra-abdominal surgery (the HERNIA project). *J Am Coll Surg* (2015) 220(4):405–13. doi: 10.1016/j.jamcollsurg.2014.12.027

59. Fischer JP, Basta MN, Mirzabeigi MN, Bauder AR, Fox JP, Drebin JA, et al. A risk model and cost analysis of incisional hernia after elective, abdominal surgery based upon 12,373 cases: the case for targeted prophylactic intervention. *Ann Surg* (2016) 263(5):1010–7. doi: 10.1097/SLA.0000000000001394

60. Rognoni C, Bracale U, Peltrini R, Tarricone R. Preventing incisional hernia after ileostomy closure: budget impact analysis of prophylactic biosynthetic mesh use in Italy. *Surgery* (2026) 194:110175. doi: 10.1016/j.surg.2026.110175