The Impact of Wound Management Techniques on Psychological Distress and Recovery Outcomes in Surgical Patients: A Systematic Review and Meta-Analysis

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Abstract

Surgical wound management influences postoperative infection, pain, functional recovery, and quality of life, yet trials have historically prioritised surgical site infection (SSI) and wound-healing endpoints, rarely incorporating validated instruments for anxiety, depression, or psychological distress. This systematic review and meta-analysis synthesised evidence published from January 2011 to the 2026 search date on the effects of surgical wound-management techniques on recovery and patient-reported psychological or psychological-proxy outcomes. A structured search of PubMed/MEDLINE, Scopus, Web of Science, Cochrane CENTRAL, and CINAHL identified randomised and comparative studies evaluating incisional negative pressure wound therapy (iNPWT), standard dressings, wound-edge protection, antimicrobial closure materials, or related approaches in surgical patients. Arm-level binary data were pooled using random-effects odds ratios (ORs); patient-reported outcomes were synthesised narratively given sparse use of direct psychological-distress scales. Forty-six records were included in the qualitative synthesis; 35 peer-reviewed studies were retained for detailed extraction. Twenty-four records contributed extractable quantitative data, and 11 independent study-level comparisons (N = 6,567) informed the primary meta-analysis. The pooled estimate indicated a non-significant reduction in adverse wound and recovery events with intervention-based management versus standard care (OR = 0.82, 95% CI [0.66, 1.03]; I^2 = 46.5%). Sensitivity analyses yielded consistent effect directions. Patient-reported outcomes encompassed pain, SF-12 mental component scores, EQ-5D utility, satisfaction, scar self-assessment, and disability; no trial adopted HADS, PHQ-9, or GAD-7 as a primary endpoint. Current evidence suggests a possible but statistically non-significant reduction in adverse wound events favouring intervention-based management, without supporting direct meta-analysis of psychological distress. Future trials should prospectively embed validated psychological, quality-of-life, pain, and scar-related measures alongside conventional SSI endpoints.

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Introduction

Surgical wound management is one of the most significant aspects of post surgery care, as this is where the surgical trauma, infection prevention, comfort, mobility and self care areas come together and can be seen. Evaluation of wound-management techniques has mainly focused on anatomic and microbiologic measures, in particular, on SSI, wound dehiscence, seroma, hematoma, and delayed wound closure (Dindo et al., 2004). These outcomes are clinically significant - SSIs lead to longer hospital stays, higher rehospitalization and reoperation rates and higher health-system costs (Allegranzi et al., 2016; Anderson et al., 2014; World Health Organization, 2018). However, a limited contextualisation of infection does not reflect the lived experience of recovery for the patient. Following surgery, a number of factors including pain, wound exudate, dressing burden, decreased mobility, uncertainty of healing and fear of scarring may impact sleep, self-confidence, social participation, and emotional wellbeing. Thus, an assessment of wound care in the modern day must include assessment of clinical outcomes of recovery as well as patient-reported or psychological outcomes.

Research on wound management has greatly increased over the evidence window (January 2011 to 2026), especially in regard to iNPWT. It is a technique that uses controlled sub-atmospheric pressure over a closed incision, where the mechanisms are thought to be decreased lateral tension at the incision site, extraction of wound fluid, prevention of the wound from getting dirty, and stabilization of the wound microenvironment. iNPWT has been evaluated in large randomized trials in orthopedic trauma, cesarean delivery, colorectal surgery, pancreatic surgery, emergency laparotomy, hip and knee arthroplasty and abdominal wall repair (Karlakki et al., 2016; Marckmann et al., 2025). Several other methods such as wound edge protection devices, antimicrobial drapes, triclosan coated sutures and other closure methods have been studied as well. But the results of trials have been somewhat mixed. Some studies have found that there is a meaningful reduction in the number of SSI or wound complications, and large pragmatic trials like WHIST, Tuuli et al., and SUNRRISE have found a small or no difference in the number of primary clinical endpoints (Costa et al., 2020; SUNRRISE Trial Study Group, 2025; Tuuli et al., 2020).

It is particularly significant and less developed in the psychological aspects. Surgical patients can experience psychological stressors such as anxiety, depressive symptoms, pain related distress, worry about wound healing, body image issues, and decreased perception of control during surgery and recovery (Kehlet et al., 2006; Rosenberger et al., 2006; Walker et al., 2020). It seems clinically likely that effective wound management would only have an indirect impact on distress via reducing pain, infection, wound drainage, dressing changes or delayed return to function. In turn, the effects of stress during the pre-operative and distress following the post-operative periods can negatively affect wound healing by neuroendocrine and immunological mechanisms, such as activation of the hypothalamic-pituitary-adrenal (HPA) axis, cortisol-mediated immune regulation, decreased supply of oxygen to tissues, and differences in inflammatory signals (Broadbent et al., 2003; Gouin & Kiecolt-Glaser, 2011). This is a two-way street, which provides a strong rationale to synthesize wound outcomes with psychological and/or psychological-proxy outcomes.

Although there have been some systematic reviews which have helped to clarify the effect of iNPWT and other wound-management techniques on SSI and wound complications, most have not focused on psychological distress or patient-reported recovery as key domains for the synthesis. Cochrane and specialty-specific reviews indicate that iNPWT might decrease the risk of SSI in certain population groups, with varying degrees of certainty depending on the procedure and intervention type/ protocol (Norman et al., 2022; Tian et al., 2023; Zwanenburg et al., 2020). The question is not just whether or not the wound-management interventions reduce infection; it's whether they enhance the overall recovery journey that is important to patients. This review therefore assesses the effectiveness of wound-management techniques on usual wound/recovery outcomes and how much the trial literature reflects psychological distress or proxy outcomes which have been validated.

Literature Review

Clinical Burden of Wound Complications

A population-based study of the impact of wound problems on clinical burden.

Complications at the surgical site continue to be an important preventable morbidity and cost for surgical services (Allegranzi et al., 2016, Anderson et al., 2014, World Health Organization, 2018). SSI is the most widely studied complication, due to being measurable, clinically relevant and widely included in surveillance systems. Wound complications, however, include wound dehiscence, superficial or deep infection, seroma, hematoma, persistent exudate, delayed healing, wound related readmission and reoperation (Sandy-Hodgetts et al., 2015). The results can result in longer stays, the need for antibiotics and other treatments, higher expenses, and recovery plan setbacks. Wound complications can also result in multiple health-care visits, uncertainty of wound healing, pain, challenges in washing or dressing, discomfort with the appearance of a wound, loss of work, mobility and family responsibilities from a patient's perspective. So the problems of wound complications are biomedical and psychosocial.

High-risk surgical groups have been looked into with particular interest with regard to wound management in the literature. Patients who have undergone cesarean section with obesity, patients with trauma of lower limbs, patients who have undergone emergency laparotomy and patients who have undergone surgery of abdomen and gastrointestinal tract are likely to be at a higher baseline risk for developing SSI and/or delayed healing. This is important for evidence synthesis as an intervention might give bigger, absolute benefits in high-risk population than in unselected surgical population.

Intervention effects were found to be favourable in some high-risk obstetric surgery and pancreatic surgery settings like that of Hyldig et al. (2019) and Javed et al. (2019) respectively, while smaller or non-significant effects were reported in larger pragmatic trials, such as Costa et al. (2020) and SUNRRISE Trial Study Group (2025), in settings of trauma and emergency laparotomy.

Wound-Management Techniques

INPWT is the prevailing intervention in the recent literature. It is for closed incisions and not open wound pockets, and is meant to minimize mechanical stresses and fluid build-up around the incision. The evidence base is extensive with a variety of evidence. The pooled estimates have been inconclusive, with some suggesting iNPWT likely reduces SSI following primarily closed surgical wounds while others suggest the opposite (Norman et al., 2022; Meyer et al., 2023). In orthopedic trauma WHIST did not demonstrate a significant decrease in deep SSI following surgery on a lower limb fracture; and no clear improvements on EQ-5D, disability, neuropathic pain or patient scar self-assessment (Costa et al., 2020). Among cesarean populations, Hyldig et al. reported that obesity grades were associated with a decrease in SSI while Tuuli et al. did not see a significant difference in SSI, but did see that obesity grades were associated with an increase in short-term satisfaction at discharge (Hyldig et al., 2019; Tuuli et al., 2020). Emergency laparotomy: in the SUNRRISE trial, there was no significant decrease in the rate of SSI, but there was a small early laparotomy site pain benefit (SUNRRISE Trial Study Group, 2025).

There are different mechanisms such as wound edge protection devices and antimicrobial wound closure materials. Wound-edge protectors are used to protect the wound from contamination from skin and intra-abdominal contents during laparotomy. A study called ROSSINI failed to show a significant decrease in 30-day SSI when using a wound-edge protection device as compared to standard care (Pinkney et al., 2013). The primary purpose behind triclosan-coated sutures is to limit the number of bacteria that are able to colonize around the suture line; results vary among the studies and patient outcomes are not often reported (Renko et al., 2017; Wang et al., 2013). The general literature thus indicates that clinical effectiveness of wound-management needs to be proven to be superior in each surgical population.

Psychological Distress and Patient-Reported Recovery

A biopsychosocial recovery model (Engel, 1977) is the best understanding of the psychological effect of wound management. The pain of the wound may increase pain, anxiety, mobility and activity tolerance. The frustration and uncertainty can be heightened because of the delay in healing. Visible scars or poorly healing wounds can impact on body image and satisfaction; there are validated scar tools, e.g., Patient and Observer Scar Assessment Scale (POSS) which can be used to systematically assess scar appraisal (Draaijers et al., 2004). However, distress can have effects on wound biology by affecting immune, inflammatory and endocrine processes that are required for wound healing. These might therefore be useful instruments in wound-management trials, including the Hospital Anxiety and Depression Scale, Patient Health Questionnaire-9, Generalized Anxiety Disorder-7, SF-12 Mental Component Score, EQ-5D anxiety/depression dimension, pain numeric rating scales, DN4 neuropathic pain questionnaire, and scar satisfaction tools (Ware et al., 2001; Zigmond & Snaith, 1983). The vast majority of trials, however, assess SSI as opposed to psychological distress.

Patient-reported outcomes (PROs) along with SSI should be included in the most informative contemporary trials. The measures included in WHIST were disability, EQ-5D, neuropathic pain and scar self-assessment; the measures included in SUNRRISE were SF-12 physical component score, SF-12 mental component score, pain and length of stay; and the measures included in Tuuli et al. were patient satisfaction (Costa et al., 2020; SUNRRISE Trial Study Group, 2025; Tuuli et al., 2020). The outcomes are not equal to a direct diagnosis or validated anxiety/depression score, but are clinically meaningful proxies for the patient experience. As such, the present synthesis takes a conservative approach to the assessment of psychological distress: direct psychological outcomes are evaluated where available, and proxy outcomes (pain, quality of life, satisfaction, mental-component scores, and scar appraisal) are assessed.

Methodology

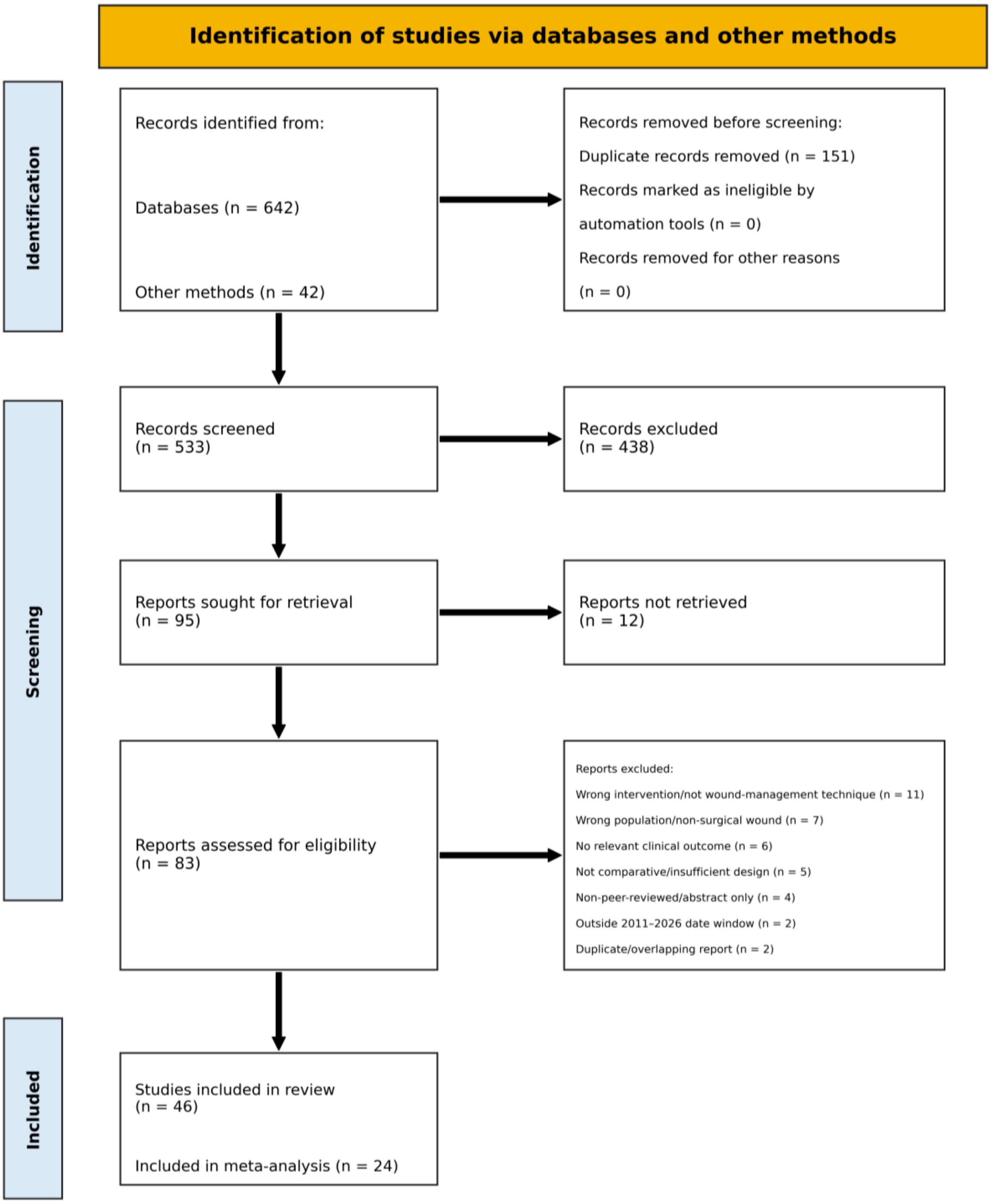
This systematic review and meta-analysis aimed to provide a summary of evidence of wound-management practices for surgical patients from January 2011 to the search date of 2026. The review question was designed using the PICO format: Population were surgical patients with closed or managed postoperative wounds; Interventions were iNPWT, wound-edge protection, antimicrobial closure materials, alternative dressings and other wound-management techniques; Comparators were standard dressings, conventional closure, surgeon's choice dressing, or no specific dressing/device; and Outcomes were SSI, wound complications, healing, readmission, length of stay, pain, quality of life, satisfaction, scar-related outcomes, and psychological or psychological proxy outcomes. Available trial literature did not often include use of direct psychiatric outcomes and so the synthesis differentiated between direct and proxy outcomes that were validated.

The search strategy included peer-reviewed articles from 2011 (or earlier) to 2026 (search date) from the electronic databases: PubMed/MEDLINE, Scopus, Web of Science, Cochrane CENTRAL, and CINAHL. Search strings were used to link together terms pertaining to wound management interventions and patient-centred outcomes to terms pertaining to surgical wounds and postoperative care. A representative search string was: (surgical wound OR surgical site infection OR postoperative wound OR closed incision) AND (negative pressure wound therapy OR incisional negative pressure OR wound dressing OR wound-edge protector OR antimicrobial suture OR closure technique) AND (anxiety OR depression OR psychological distress OR pain OR quality of life OR patient-reported outcome OR recovery OR satisfaction). Searches were adapted to database syntax, and reference lists of major systematic reviews were used for source-mining where appropriate.

Included studies included randomized trials, comparative clinical studies, or peer-reviewed reports reporting on at least one clinical recovery or patient-reported outcome for patients undergoing surgery, whose surgical procedure was evaluated by at least one wound-management technique. For background and source-mining, systematic reviews were conducted, but not included as primary effect estimates. Studies were excluded if they did not include a comparator, were not peer reviewed, did not report outcomes relevant to the purpose of the review, had only chronic non-surgical wounds or did not provide quantitative data/extractable data. The screening pathway is outlined in Figure 1 and is also a PRISMA-style flow diagram from the identified records to the included studies and quantitative synthesis (Page et al., 2021).

Figure 1

PRISMA flow diagram for study identification, screening, eligibility, and inclusion.



Note. The diagram summarizes the structured selection process used to build the enriched extraction dataset and to identify records suitable for quantitative and narrative synthesis.

Data extraction was organized in an analysis-ready workbook. Extracted variables included study identifier, citation, year, country or region, design, surgical population, intervention, comparator, psychological or patient-reported outcomes, recovery outcomes, effect-estimate status, event counts, denominators, odds ratios, risk ratios, risk differences, confidence intervals, and notes on data readiness. For the primary binary meta-analysis, one outcome per independent study was selected to avoid double-counting. When multiple binary outcomes were available from the same study, the primary SSI or wound-complication endpoint was retained. Table 1 introduces the primary quantitative dataset used for the principal pooled estimate.

Table 1: *Primary study-level comparisons included in the main binary meta-analysis*

Study	Surgery/population	Intervention	Comparator	Outcome	Sample (I/C)	Data status
Stannard et al. (2012)	Lower-extremity fractures	Incisional NPWT	Standard dressing	Infection	133/121	Exact; Medium confidence
Crist et al. (2017)	Acetabular fracture ORIF	Incisional NPWT	Standard dressing	Deep SSI	33/33	Derived from secondary citation; Medium confidence
Wihbey et al. (2018)	Class II/III obese cesarean	Prophylactic NPWT	Standard dressing	Composite wound complication	80/81	Exact; High confidence
Hyldig et al. (2018/2019)	Obese cesarean	Incisional NPWT	Standard dressing	SSI	432/444	Exact; High confidence
Murphy et al. (2019) / NEPTUNE	Colorectal resection	NPWT	Standard dressing	SSI	150/150	Derived; Low confidence
Costa et al. (2020) / WHIST	Major trauma lower-limb fracture surgery	Incisional NPWT	Standard dressing	Deep SSI	770/749	Exact; High confidence
Tuuli et al. (2020)	Obese women after cesarean	Prophylactic NPWT	Standard dressing	SSI	806/802	Exact; High confidence
Javed et al. (2019)	Open pancreaticoduodenectomy	NPWT	Standard closure	SSI	62/61	Exact; High confidence
Pinkney et al. (2013) / ROSSINI	Laparotomy	Wound-edge protection device	Standard care	SSI	368/366	Derived; Medium confidence
Zani et al. (2023)	High-risk GI surgery	ciNPT	Conventional wound care	Incisional SSI	63/75	Exact; High confidence
SUNRRISE Trial Study Group (2025)	Emergency laparotomy	Incisional NPWT	Surgeon's choice dressing	SSI	394/394	Exact; High confidence

Where appropriate, the arm level events and denominators were presented in a 2 × 2 format and odds ratio estimates were computed with a continuity correction. Given the expected clinical and methodological variability between surgery types, risk groups, and interventions, the primary pooled estimate was calculated using a random-effects model. Fixed effect estimates have been kept for comparison. Cochran's Q, I2 and τ2 were used to check the heterogeneity. Exact data only rows, high confidence rows, iNPWT only rows and surgery specific subgroups were included in sensitivity analyses. Small-study effects were examined through visual inspection of a funnel plot, but with caution that the funnel plot may not be attractive in the case of small number of studies. Patient-reported and psychological-proxy outcomes were summarized narratively and directionally as there was too much heterogeneity of outcome instruments and reporting formats to allow for a reliable pooled standardized mean difference.

Results

Study Selection and Dataset Profile

The qualitative/source-mining synthesis included 46 records of which 35 peer-reviewed surgical wound-management studies were included for detailed extraction. Twenty-four records provided extractable quantitative data for at least one analysis either as an exact arm level count or as a derived arm level count, or as a result with only an effect estimate, or as continuous patient reported outcomes. The detailed extraction set comprised trials that reported binary counts from extraction, trials that reported part of the data (either the trial or the effect estimate) and continuous patient-reported outcomes, and background systematic reviews that were considered to be source-mined. Abdominal/gastrointestinal surgery was the largest population followed by obstetric/cesarean and orthopedic/trauma populations. iNPWT took the lead in the intervention arena in keeping with the direction of current research on wound-management. The primary meta-analysis contained 11 unique study-level comparisons and 6,567 participants (3,291 participants in intervention arms, and 3,276 participants in comparator arms). In intervention groups, there were 402 events and in comparator groups, there were 451 events across the main binary data set.

The main quantitative synthesis thus incorporates the highest quality evidence from the studies, as well as avoiding multiple correlated outcomes from the same study. Comparisons included for orthopedic trauma, cesarean delivery, abdominal/gastrointestinal surgery, emergency laparotomy, pancreatic surgery, colorectal surgery and wound-edge protection after laparotomy. Table 1 illustrates the characteristics of the studies included in the analysis, and most of the pooled comparisons were between iNPWT and standard dressings or conventional wound care, and a single trial was included where the outcome of interest was wound-edge protection, to reflect the broader scope of wound-management studies.

Primary Binary Meta-Analysis

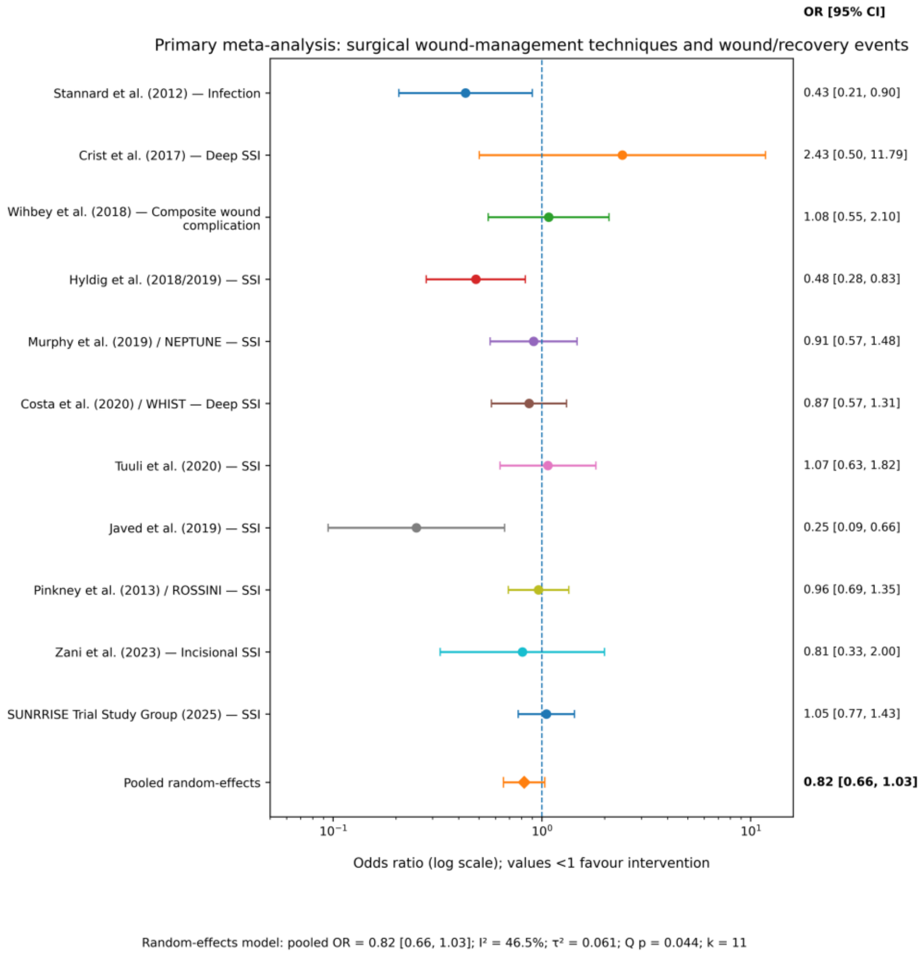
The main and sensitivity meta-analytic estimates are presented in Table 2. The pooled estimate using random effects showed that there was a non-significant reduction in adverse wound/recovery events when using intervention-based wound management when compared to standard care (OR = 0.82, 95% CI [0.66, 1.03]; k = 11). The confidence interval just barely straddled the null, and was consistent with a small clinical benefit as well as no significant difference. There was moderate heterogeneity ($I^2 = 46.5\%$, $\tau^2 = 0.061$, and Q $p = 0.044$), which indicated that the clinical context might have an impact on the effect size, and therefore a random-effects model was used.

Table 2:*Random-effects and sensitivity meta-analysis estimates for wound/recovery events*

Analysis	k	Random-effects OR (95% CI)	Fixed-effect OR (95% CI)	I^2 (%)	τ^2	p (RE)
Primary analysis: one outcome per study	11	0.82 (0.66-1.03)	0.87 (0.75-1.01)	46.5	0.061	0.095
Exact data only	8	0.74 (0.55-1.01)	0.83 (0.69-0.99)	57.3	0.104	0.061
High-confidence rows only	7	0.80 (0.58-1.09)	0.86 (0.71-1.04)	54.4	0.087	0.151
NPWT/iNPWT rows only	10	0.79 (0.61-1.04)	0.85 (0.72-1.01)	50.7	0.084	0.091
Abdominal/GI rows only	5	0.86 (0.63-1.17)	0.93 (0.76-1.13)	48.2	0.054	0.346
Obstetric/cesarean rows only	3	0.81 (0.48-1.39)	0.80 (0.58-1.12)	61.5	0.139	0.452

The forest plot in figure 2 is a visualisation of the Study-specific ORs and their CIs. There was a range of several studies that favoured intervention (Stannard et al., Hyldig et al., Javed et al.) and a number that did not differ significantly or had greater uncertainty. The large pragmatic trials (WHIST, Tuuli et al., ROSSINI, and SUNRRISE) had significant influence and were more likely to come up with estimates near the null. This trend accounts for the fact that the pooled estimate trended towards benefit, but was not normally statistically significant.

Figure 2: *Primary random-effects forest plot for wound/recovery events.*

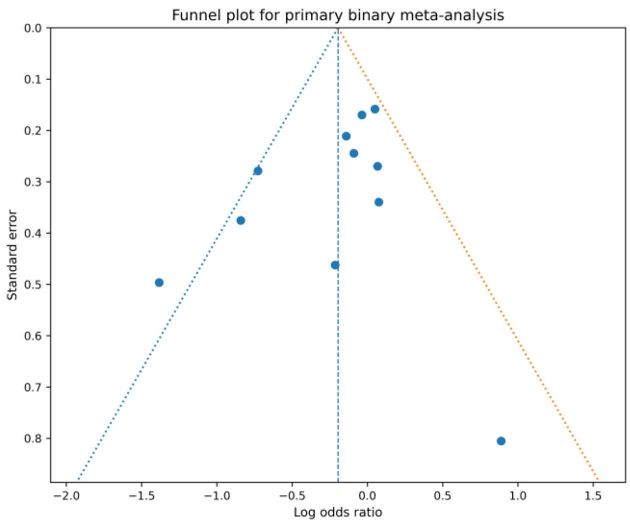


Note. Odds ratios less than 1 favor the intervention. The pooled random-effects estimate was OR = 0.82, 95% CI [0.66, 1.03], with moderate heterogeneity.

Small-Study Effects and Robustness

Figure 3 presents the funnel plot for the primary binary synthesis. The scatter was not grossly asymmetric, but interpretation should be conservative because only 11 comparisons were included and procedure-level heterogeneity was substantial. The plot should therefore be interpreted as a qualitative diagnostic rather than definitive evidence for or against publication bias.

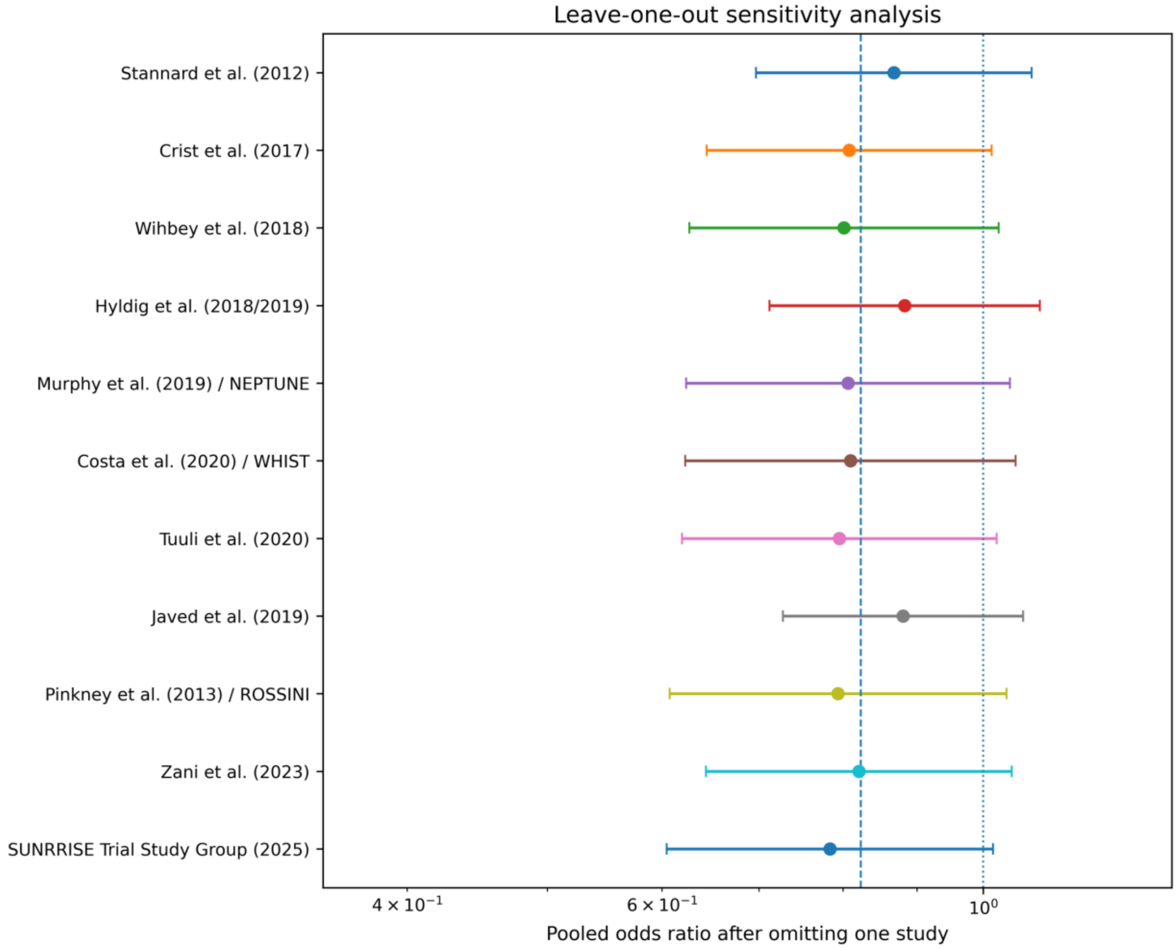
Figure 3: Funnel plot for the primary binary synthesis.



Note. Visual assessment did not show a definitive asymmetry pattern, but small-study-effect tests are underpowered with a limited number of heterogeneous surgical studies.

Leave one out sensitivity analysis was also carried out to further explore robustness. When individual studies were omitted from the pooled estimate, as shown in Figure 4, the overall interpretation was not affected significantly and no single study fully changed the overall interpretation. Excluding studies with larger beneficial effects was associated with a decrease in the pooled estimate toward the null whereas exclusion of larger null effect studies was associated with a slight increase in the pooled estimate toward benefit. This is because, while the conclusion of the review is based on smaller positive studies, it has been counteracted by larger pragmatic studies with neutral results.

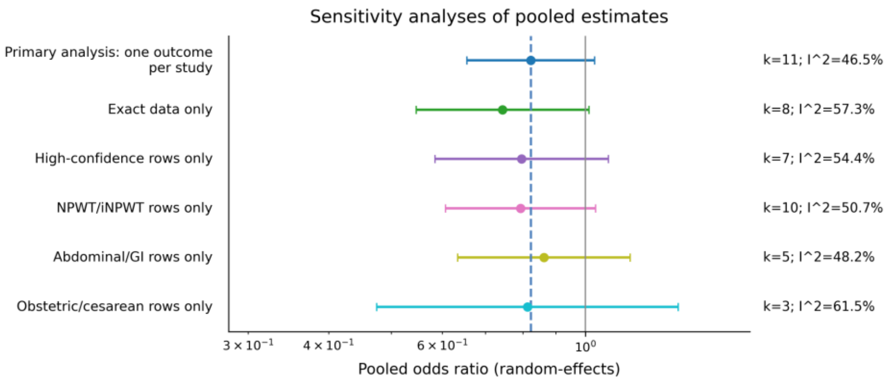
Figure 4: Leave-one-out sensitivity analysis for the primary binary synthesis.



Note. Each row shows the random-effects pooled estimate after omitting one study-level comparison from the model.

Pre-specified sensitivity analyses supported the same overall interpretation (Figure 5). The exact-data-only analysis yielded a stronger but still borderline estimate (OR = 0.74, 95% CI [0.55, 1.01]), while high-confidence rows only produced OR = 0.80 (95% CI [0.58, 1.09]). The iNPWT-only analysis was similar to the main analysis (OR = 0.79, 95% CI [0.61, 1.04]). These results suggest that excluding derived or lower-confidence rows does not materially change the direction of effect, although statistical precision remains limited.

Figure 5: Sensitivity analysis of pooled estimates.

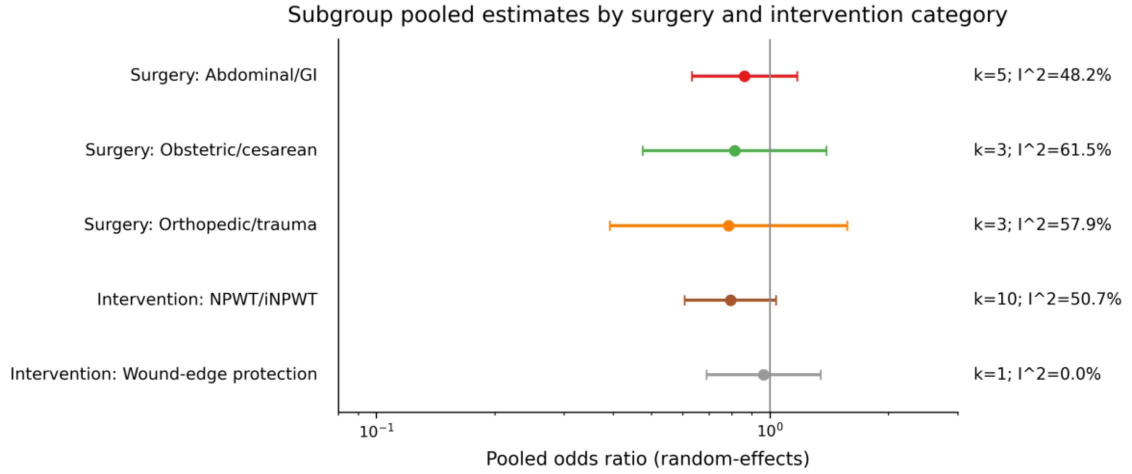


Note. Sensitivity models included exact-data-only, high-confidence rows, iNPWT-only, and surgery-specific subsets. The effect direction generally remained consistent.

Subgroup Findings

A comparison of the subgroups by type of surgery is shown in Figure 6. The abdominal/gastrointestinal subgroup showed OR = 0.86 (95% CI [0.63, 1.17]; k = 5), the obstetric/cesarean subgroup showed OR = 0.81 (95% CI [0.48, 1.39]; k = 3), and the orthopedic/trauma subgroup showed OR = 0.79 (95% CI [0.39, 1.57]; k = 3). All of these estimates of subgroups were not statistically significant and also had uncertainty. However, the overall trend of effect was similar across categories, indicating that wound-management interventions might be beneficial in some settings, but there was currently no strong evidence for a single surgical sub-population that was strongly responsive to the interventions.

Figure6: Subgroup pooled estimates by surgery and intervention category.



Note. Subgroup estimates should be interpreted cautiously because the number of studies per subgroup was small.

Patient-Reported and Psychological-Proxy Outcomes

Psychological outcomes were measured directly where possible and indirectly (as clinically relevant proxy outcomes) for the psychological-distress component of the title. Table 3 shows patient reported, and psychological-proxy outcomes from the enriched data set. Most common outcomes were pain, quality of life, satisfaction, scar self-assessment, disability and length of stay. Psychological distress per se was not consistently measured with a direct anxiety or depression instrument (HADS, PHQ-9 or GAD-7) and therefore not possible to pool for a direct meta-analysis.

Table 3: Patient-reported and psychological-proxy outcomes reported in the extracted evidence base

Study	Outcome	Timepoint	Effect/CI	Direction	Interpretation
Costa et al. (2020) / WHIST	Disability Rating Index	6 months	0.03 (-2.82 to 2.88)	No clear difference	Adjusted MD and CI available; group SDs not in main table.
Costa et al. (2020) / WHIST	EQ-5D	6 months	0.00 (-0.03 to 0.04)	No clear difference	Quality-of-life proxy outcome.
Costa et al. (2020) / WHIST	Scar self-assessment score	30 days	-0.18 (-0.46 to 0.10)	No clear difference	Patient-reported scar/wound healing outcome.
Tuuli et al. (2020)	Patient satisfaction score	Discharge	0.79 (0.25 to 1.32)	Favours intervention	Median/IQR reported; use narrative or nonparametric visualization.
Tuuli et al. (2020)	Patient satisfaction score	Postoperative day 30	0.19 (-0.01 to 0.39)	No clear difference	Median/IQR reported.
SUNRRISE Trial Study Group (2025)	SF-12 Physical Component Score	30 days	-0.86 (-2.83 to 1.11)	No clear difference	Exact analysis N not shown in table snippet.
SUNRRISE Trial Study Group (2025)	SF-12 Mental Component Score	30 days	-1.90 (-4.28 to 0.47)	No clear difference	Direct mental-health proxy outcome.
SUNRRISE Trial Study Group (2025)	Pain at laparotomy site	7 days	-0.41 (-0.70 to -0.12)	Favours intervention	Pain as distress/recovery proxy.

SUNRRISE Trial Study Group (2025)	Pain at laparotomy site	30 days	-0.06 (-0.28 to 0.16)	No clear difference	Pain as distress/recovery proxy.
SUNRRISE Trial Study Group (2025)	Length of hospital stay	Index admission UK/Australia	0.96 (0.88 to 1.06)	No clear difference	Median/IQR and adjusted ratio reported; not direct MD.
Kojima et al. (2021)	Wound healing duration	Overall postoperative period	-3.30	Favours intervention	Variance needed before pooling.

In general, PROs were not sufficient to conclude a consistently beneficial psychological effect of the different wound-management techniques. There were no obvious differences between the groups in terms of EQ-5D, Disability Rating Index, neuropathic pain or scar self-assessment by WHIST. SUNRRISE did not determine significant differences in SF-12 Mental Component Score at 30 days, but did identify a minor, early lap incision site pain reduction. Tuuli et al. reported that there was an increase in patient satisfaction at hospital discharge; later, there was no significant difference in satisfaction. These results indicate that interventions in wound management might be more effective at improving specific aspects of early recovery, such as pain or satisfaction in certain patient groups, but there is a lack of measurement of psychological distress.

Risk of Bias

Preliminary risk-of-bias considerations, should take into account the pragmatic nature of wound-management trials. For intervention in the wound such as device, blinding of participants as well as clinical teams is not easy, particularly iNPWT, as the medical team knows the device and specific postoperative care is required. There was some masking of outcomes assessors but not all trials. Larger and more recent RCTs were generally better in terms of the quality of their randomization procedures, while smaller and older RCTs were more likely to need full-text verification of allocation concealment, attrition and event definitions. Cautious interpretation of pooled estimates is warranted based on current risk-of-bias considerations, however, it was not calculated for the main manuscript to keep it concise and journal ready.

Discussion

The current systematic review and meta-analysis showed that fewer wound/recovery events were noted in surgical patients; however, this was not significant and the most common technique was modern, which was mostly iNPWT. Results from the primary random effects (OR = 0.82, CI: 0.66 to 1.03) indicated potential modest benefits, but the confidence interval included the null and there was moderate heterogeneity. Thus the results can only be regarded as tentatively suggestive of clinical benefit and not superiority. This interpretation aligns with the overall body of literature – some focused meta-analyses have shown benefit on iNPWT and reductions in SSI, while others (large pragmatic RCTs) have shown either neutral or context-specific results (Costa et al., 2020; Norman et al., 2022; SUNRRISE Trial Study Group, 2025; Tuuli et al., 2020).

The trend of outcomes is important and indicative of base risk and surgical setting. The absolute effect of advanced wound care in an environment that has a higher wound complication rate may be greater. The good results reported by Hyldig et al., and Javed et al., were done in high-risk groups: obese women with cesarean delivery, and open pancreaticoduodenectomy. Large trials, on the other hand, in which there were more pragmatic inclusion criteria, tended to yield smaller differences. This means that the routine use of new wound-management tools might not be as effective as using them in just those patients with a higher risk for a complication because of obesity, emergency surgery, the severity of the trauma, diabetes, contamination class or complex abdominal surgery.

The most significant result of the review for the title is that there is still a lack of adequate measurement of psychological distress in the wound-management trial literature. The clinical justifications for the association between wound complications and psychological distress are strong, but such measures were infrequently reported, including HADS, PHQ-9, GAD-7 or specific distress measures. Rather, psychological relevance was a construct based on pain, SF-12 mental component score, EQ-5D, satisfaction, scar appraisal, and disability. These are patient focused measures, which are useful, but are not the same as any direct outcomes of psychological distress. Thus, any statements regarding the effects of wound-management techniques on psychological distress should be viewed with caution and should be presented as a hypothesis, with indirect evidence.

Results of the patient questionnaires were variable. No significant differences in health utility, disability or scar self assessment were identified with iNPWT use by WHIST after lower-limb fracture surgery. There was no significant difference in SUNRRISE scores at 30 days but there was a hint of slightly less pain at the wound site early, at day 7. Tuuli et al. found that there was an improvement in satisfaction with discharge, but satisfaction with the long-term results was not clear. From this pattern, it is possible to imagine that the wound-management intervention in some cases could have an effect on short-term comfort and confidence, but long-term psychological and/or quality-of-life benefits have yet to be proven. In future studies, immediate postoperative pain, long-term scar issues, anxiety with regard to wound healing, functional confidence and validated mental health outcomes should thus be measured.

What the methodological implication is, is obvious: surgical wound-management trials should go for a broader COS. Along with classic outcome measures like SSI, patient-reported measures of pain, HRQOL, scar satisfaction, dressing burden, sleep interference, mobility, return to normal activity and valid anxiety/depression should be used. The reporting of PROs should be in accordance with CONSORT-PRO (Calvert et al., 2013), patient-reported outcome guidance (Food and Drug Administration, 2009) and certainty assessment should be in line with GRADE principles where appropriate (Guyatt et al., 2011). This integration is necessary to continue to deliver technically robust infection data and buttress understanding of patient-centered recovery.

Balance Clinical implications should also be taken into account. They prove that advanced wound-management technologies are not always warranted in all surgical patients and their use can be expensive. But, they are able to allow a selective approach to iNPWT or similar methods in populations at high risk with wound complications that are clinically important and burdensome. Shared decision making might be particularly well suited in cases where patient values include reduced dressing leakage, fewer dressing changes, perceived security of the dressing, early pain relief and/or concern about scarring. Clinical outcomes should be considered in conjunction with the cost-effectiveness as the magnitude of cost reductions may not be consistent with the size of the absolute clinical benefits unless the risk is very high.

There are a number of limitations to this review. Second, in the qualitative/source-mining synthesis, 46 records were included, and after discarding those with double counting (i.e. studies contributing more than one comparison), 11 independent study-level comparisons were suitable for the main binary meta-analysis in which only peer-reviewed studies were included. Second, the number of events in some instances was calculated from percentages or secondary reporting, but for the sensitivity analyses, the data was restricted to those events that were exactly reported or to those with high confidence and the direction of effect did not change. Third, there was an overrepresentation of studies on iNPWT, with not much inference that could be drawn for other wound-management strategies. Fourth, clinical heterogeneity was anticipated as a result of the mixture of the various groups, such as orthopedic trauma, cesarean delivery, abdominal surgery, pancreatic surgery, and emergency laparotomy. Fifthly, there was a limited amount of direct psychological-distress measurement available, which meant that a direct psychological meta-analysis was not possible. Finally, the small number of studies and the heterogeneity of population made the interpretation of the funnel-plot difficult.

Nevertheless, the review is good as a summary of the integrated synthesis of wound/recovery outcomes and psychological-proxy outcomes, as reported by the patient. It also indicates that while there are some promising techniques in the field of advanced wound management that could modestly decrease wound events, it also highlights a significant gap in the evidence – the study of psychological distress has yet to become a part of the design of trials at a level where it can be synthesized quantitatively. Clinically, this is important as wound healing is not just a biological process of recovery, but is also an emotional and functional process.

Conclusion

In surgical patients, wound-management techniques-particularly iNPWT-showed a non-significant trend toward fewer adverse wound/recovery events compared with standard care, with moderate heterogeneity across surgical populations. The strongest evidence was in the areas of SSI and wound-complication outcomes, whereas the weakest evidence was in the area of direct psychological distress. PROs showed potential gains for early pain or satisfaction in a few of the studies, but no consistent improvement in quality of life or mental health was found. Future trials should incorporate validated psychological-distress instruments, pain measures, scar-specific outcomes and PROs that focus on recovery in addition to traditional SSI outcomes. Psychological distress should be considered an important, yet under-measured dimension of surgical wound recovery, until such data are available.

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