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# Permanent prophylactic mesh reinforcement in elective and emergency midline laparotomy: a registry-based comparative analysis

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**Background:** Prophylactic mesh reinforcement reduces the incidence of incisional hernia (IH) after midline laparotomy and is recommended for high-risk patients. However, concerns regarding contamination, mesh infection, and prosthetic-related morbidity have limited its implementation in emergency surgery. Whether emergency indication is associated with worse outcomes among mesh-treated patients remains uncertain.

**Methods:** A retrospective registry-based cohort study used data from the Spanish National Incisional Hernia Registry (EVEREG) from 2020 to 2025 (17 hospitals). Adults undergoing midline laparotomy with permanent prophylactic mesh reinforcement were stratified by elective or emergency indication. In-hospital outcomes included overall and general complications (cardiac, respiratory or renal failure), surgical-site occurrence (SSO), mesh infection, mesh removal, abdominal complications during the index stay and mortality at 30 days. Analyses used 204 patients with completed in-hospital data and clinically specified multivariable logistic regression models.

**Results:** The registered cohort included 234 patients: 104 elective and 130 emergency procedures. Among 204 patients with completed in-hospital modules (85 elective, 119 emergency), overall complications occurred in 38.8% versus 62.2% and general complications in 21.2% versus 48.7%, respectively; both remained significant after multiplicity correction. No statistically detectable differences were observed in SSO, mesh infection, mesh removal, abdominal complications or mortality (10.6% versus 11.8%). Recorded Clavien–Dindo categories were higher after emergency surgery (P = 0.006). After adjustment, emergency indication was associated with general complications (OR 2.13, 95% CI 1.01–4.47), but not mortality (OR 1.00, 95% CI 0.39–2.57). Renal disease and contamination were associated with overall complications, and contamination with abdominal complications. Older age and higher body mass index (BMI) were associated with mortality (BMI: OR 1.64 per 5 kg/m$^2$, 95% CI 1.06–2.53).

**Conclusion:** In this selected registry cohort, emergency indication was associated with greater early general morbidity, whereas no statistically detectable increase in short-term wound- or mesh-related events was observed, with considerable uncertainty. As a cautious implication requiring confirmation, emergency indication *per se* might not be an absolute contraindication to prophylactic

mesh in selected patients. The small number of mesh-related events, the absence of a non-mesh control group and the loss to follow-up preclude conclusions on equivalent safety or effectiveness in preventing incisional hernia.

KEYWORDS

emergency laparotomy, incisional hernia, prophylactic mesh, registry, surgical-site occurrence

# Introduction

Current recommendations from the European Hernia Society (EHS) and the American Hernia Society (AHS) emphasize standardised fascial closure techniques with the use of a continuous slowly absorbable suture and an adequate suture-length-to-wound-length (SL/WL) ratio [1, 2]. On the other hand, randomised controlled trials and meta-analyses have shown that prophylactic mesh can reduce postoperative incisional hernia (IH) compared with primary suture closure alone, particularly in patients with risk factors (obesity, smoking history and diabetes mellitus among others) [3–5].

Although evidence supporting prophylactic mesh in elective surgery is growing, its use in emergency surgery remains controversial. Emergency laparotomy frequently involves bowel obstruction, perforation, ischaemia, haemorrhage or peritonitis, all of them associated with contamination, physiological instability and increased postoperative morbidity. Consequently, many surgeons remain reluctant to implant permanent prosthetic material because of concerns regarding surgical-site occurrences (SSOs), mesh infection, chronic mesh-related complications and the potential need for mesh removal [6–10].

Paradoxically, emergency laparotomy patients may be among those most likely to benefit from preventive strategies. Emergency surgery is associated with a higher incidence of fascial dehiscence and subsequent IH than elective procedures, while opportunities for delayed abdominal wall reconstruction are often limited by advanced age, frailty, malignancy or multiple comorbidities [6–8]. Therefore, preventing IH during the index operation may be particularly valuable in this population.

Recent observational and randomised studies have challenged the traditional view that emergency surgery represents a contraindication to prophylaxis with synthetic permanent onlay mesh reinforcement [6–8]. Similarly, the PROMETHEUS trial demonstrated that sublay non-absorbable mesh reinforcement significantly reduced IH following urgent clean-contaminated laparotomy [9]. More recently, meta-analyses have suggested that the benefits of prophylactic permanent mesh may extend to both elective and emergency surgery without a clinically relevant increase in severe mesh-related morbidity [4, 10].

Despite these advances, real-world comparative data evaluating whether emergency surgery adversely affects the safety or effectiveness of prophylactic permanent mesh remain limited. Most available studies have focused on comparisons between mesh and primary closure rather than on differences between elective and emergency settings. Consequently, uncertainty persists regarding whether surgical emergency itself influences abdominal wall outcomes after prophylactic mesh implantation.

The present study was designed to evaluate outcomes among patients receiving permanent prophylactic mesh reinforcement within the Spanish Incisional Hernia Registry (EVEREG) [11]. The primary exposure was emergency versus elective surgical indication. The principal safety outcomes were in-hospital SSO and recorded mesh-related complications. Overall and general complications, abdominal complications and 30-day mortality were secondary outcomes. We hypothesised that although emergency surgery would be associated with greater systemic postoperative morbidity, abdominal wall and mesh-related outcomes would not be adversely affected by surgical emergency.

# Methods

## Registry and study design

The National Incisional Hernia Registry (EVEREG) is based on a computerised web-based data-entry platform, OpenClinica, accessible through the EVEREG website [11]. Data are collected anonymously. The registry protocol has undergone ethical review by the EVEREG Registry Committee and follows Spanish recommendations on data protection and patient autonomy. The registry records patient characteristics, operative details, abdominal wall closure and mesh-related variables, postoperative complications and short term follow-up.

The prophylactic mesh module is a newly opened line of the registry: 17 hospitals contributed patients during the study period, whereas more than 200 centres participate in other EVEREG lines. Inclusion of patients depends on each participating centre, so consecutive inclusion of all eligible cases cannot be guaranteed. The registry also collects follow-up information, but the present revised analysis was restricted to short-term outcomes.

We performed a retrospective observational cohort study using EVEREG data from 2020 to 2025. The study population included patients aged 18 years or older undergoing midline laparotomy in whom permanent prophylactic synthetic mesh placement was recorded. Non-midline laparotomies and the use of absorbable mesh were excluded. Procedures initiated laparoscopically and subsequently converted to laparotomy were included because a midline laparotomy, abdominal wall closure and prophylactic mesh placement were recorded. Patients considered unsuitable for mesh placement are not represented in the cohort. Indications for mesh placement were determined by the treating teams, and the aim of the study was not to define which patients should receive prophylactic mesh. Outcome analyses were restricted to patients with completed in-hospital modules. Three elective patients with known early deaths but no in-hospital complication data were excluded from this restriction; the supplied outcome file contained 231 patients, of whom 204 had the required information.

TABLE 1 Baseline and operative characteristics according to surgical indication.

| Variable | Elective (n = 85) | Emergency (n = 119) | Difference, emergency minus elective (95% CI) | P value |
|---|---|---|---|---|
| Age, years | 66.7 ± 12.7 | 69.2 ± 13.6 | 2.5 (−1.2–6.1) | 0.234 |
| Male sex | 63.5% | 56.3% | −7.2 (−20.3 to 6.4) | 0.300 |
| Body mass index, kg/m$^2$ | 27.6 ± 4.8 | 26.0 ± 5.6 | −1.6 (−3.0 to −0.2) | 0.019 |
| Diabetes mellitus | 23.5% | 23.5% | 0.0 (−12.1 to 11.4) | 1.000 |
| Hypertension | 50.6% | 55.5% | 4.9 (−8.8–18.4) | 0.491 |
| Cardiovascular disease | 18.8% | 23.5% | 4.7 (−7.0–15.6) | 0.420 |
| Chronic obstructive pulmonary disease | 12.9% | 15.1% | 2.2 (−8.1–11.5) | 0.660 |
| Liver disease | 2.4% | 5.9% | 3.5 (−3.0–9.5) | 0.310 |
| Renal disease | 9.4% | 17.6% | 8.2 (−1.7–17.3) | 0.097 |
| History of malignancy | 57.6% | 36.1% | −21.5 (−34.3 to −7.6) | 0.002 |
| Former smoker | 35.3% | 24.4% | −10.9 (−23.5 to 1.6) | 0.090 |
| Current smoker | 12.9% | 21.0% | 8.1 (−2.8–17.9) | 0.136 |
| Previous laparotomy | 7.1% | 42.0% | 35.0 (23.6–44.7) | <0.001 |
| ASA class III–IV | 49.4% | 65.5% | 16.1 (2.4–29.2) | 0.021 |
| Abdominal wall specialist involved | 48.2% | 28.6% | −19.7 (−32.5 to −6.2) | 0.004 |
| Colorectal surgery | 49.4% | 42.0% | −7.4 (−20.8 to 6.3) | 0.295 |
| Contaminated or dirty surgery | 16.5% | 56.3% | 39.8 (26.9–50.5) | <0.001 |
| Operative duration, min | 180.0 [140.0–280.0] | 150.0 [102.5–185.0] | −30.0 (−80.0 to 0.0) | <0.001 |
| SL/WL ratio ≥4:1 | 98.8% | 98.3% | −0.5 (−4.9 to 4.8) | 1.000 |
| Onlay mesh position | 97.6% | 94.1% | −3.5 (−9.5 to 3.0) | 0.310 |
| Mesh fixation recorded | 74.1% | 99.2% | 25.0 (16.1–35.3) | <0.001 |
| Suture fixation | 71.8% | 97.5% | 25.7 (16.1–36.2) | <0.001 |
| Intraoperative complication | 3.5% | 11.8% | 8.2 (0.4–15.6) | 0.036 |

Values are percentages. Continuous variables are mean ± SD or median [IQR]. Differences are emergency minus elective. CI, confidence interval; ASA, American Society of Anesthesiologists; SL/WL, suture-length-to-wound-length ratio.

## Preoperative variables

Preoperative variables included sex, age, body mass index (BMI), diabetes mellitus, arterial hypertension, cardiovascular disease, chronic obstructive pulmonary disease (COPD), liver disease, renal disease, history of malignancy, smoking status, alcohol consumption and previous laparotomy (any laparotomy performed before the index operation) when recorded.

## Operative variables

Operative variables included surgical procedure, elective or emergency indication, American Society of Anesthesiologists (ASA) class, participation of an abdominal wall specialist (self-defined by the user at the time of data entry), anaesthesia, antibiotic prophylaxis, Centers for Disease Control and Prevention wound classification (CDC), incision length, recorded suture-length-to-wound-length ratio, mesh dimensions, mesh position onlay and subfascial (retromuscular or intraperitoneal), fixation and intraoperative complications (including intestinal injury, either serosal tear or perforation) [12, 13]. Because only nine meshes were recorded outside the onlay plane, analyses by mesh position were descriptive.

## Postoperative variables

All outcomes except 30-day mortality were assessed during the index hospital stay. Mortality was recorded at 30 days. Postoperative variables included overall in-hospital complications (yes or no), general complications (cardiac, respiratory or renal failure), surgical-site occurrences (SSO, comprising wound infection, seroma and haematoma), mesh infection, mesh removal, abdominal complications (comprising occlusion, ileus and organ injury/intestinal perforation), Clavien–Dindo grade (0, no

10.3389/jaws.2026.17764

TABLE 2 Outcomes according to elective or emergency surgical indication.

| Outcome | Elective (n = 85) | Emergency (n = 119) | Risk difference, pp (95% CI) | Raw P | BH-adjusted P |
|---|---|---|---|---|---|
| Overall in-hospital complications | 38.8% | 62.2% | 23.4 (9.5–36.0) | 0.001 | 0.005 |
| In-hospital general complications | 21.2% | 48.7% | 27.6 (14.4–39.1) | <0.001 | <0.001 |
| In-hospital surgical-site occurrence | 18.8% | 21.8% | 3.0 (−8.5–13.8) | 0.726 | 0.816 |
| In-hospital mesh infection | 3.5% | 2.5% | −1.0 (−7.6 to 4.2) | 0.695 | 0.816 |
| In-hospital mesh removal | 2.4% | 0.0% | −2.4 (−8.2 to 1.2) | 0.172 | 0.310 |
| In-hospital abdominal complication | 5.9% | 10.1% | 4.2 (−4.1–11.7) | 0.317 | 0.476 |
| 30-day mortality | 10.6% | 11.8% | 1.2 (−8.3–9.7) | 0.827 | 0.827 |
| Clavien–Dindo category (0–V) | 0:52; 1:5; 2:13; 3:11; 4:3; 5:1 | 0:45; 1:13; 2:27; 3:22; 4:6; 5:6 | — | 0.002 | 0.006 |
| Length of hospital stay, days | 8.0 [6.0–16.0] | 12.0 [7.0–25.0] | — | 0.013 | 0.029 |

Binary outcomes are shown as n/N valid (%). Risk differences are emergency minus elective and use Newcombe–Wilson 95% confidence intervals; pp, percentage points; CI, confidence interval; BH, Benjamini–Hochberg procedure.

complication; I–V), length of stay and 30-day mortality [13, 14]. Outcomes were recorded by the surgeon entering each patient according to local clinical practice and CDC criteria [12, 13], and were not independently verified. Mesh infection was recorded as a yes/no variable without further diagnostic criteria; wound infection was categorised as superficial, deep or intra-abdominal. SSO, mesh infection and mesh removal were recorded as separate, potentially overlapping fields and were not treated as additive event counts.

## Statistical analysis

Descriptive analyses used available observations. Continuous variables are reported as mean and standard deviation (SD) or median and interquartile range (IQR), as appropriate; observed minima and maxima are explicitly described as ranges. Categorical variables are reported as percentages (Table 1; Table 2). Table 1 describes the 204-patient complication-analysis cohort; the original registered cohort is described separately in Study population. Missing values were not imputed. Baseline characteristics were compared descriptively between elective and emergency groups; differences are presented with 95% confidence intervals (CIs) (Newcombe–Wilson for proportions, Welch for means).

Bivariable comparisons used the Mann–Whitney U test for continuou s variables and the chi-squared or Fisher exact test for categorical variables; binary outcomes were compared with the Fisher exact test and ordered Clavien–Dindo categories (0–V) with the two-sided Mann–Whitney U test, with tie correction. Binary outcomes are presented with absolute risk differences and Newcombe–Wilson 95% confidence intervals. The Benjamini–Hochberg (BH) procedure, used to correct for multiple comparisons, was applied to a family of nine comparisons between surgical indication and the following outcomes: overall complications, general complications, SSO, mesh infection, mesh removal, abdominal complications, 30-day mortality, Clavien–Dindo category and hospital stay. Regression analyses were not part of this correction.

Outcome-specific multivariable logistic regression models were specified according to clinical relevance and the number of observed events rather than bivariable screening or automated stepwise selection. Emergency indication was forced into every model. Models for overall and general in-hospital complications included emergency indication, age per 10 years, BMI per 5 kg/m$^2$, sex, ASA class III–IV, renal disease, history of malignancy, smoking status and contaminated or dirty surgery. The SSO model included emergency indication, age per 10 years, BMI per 5 kg/m$^2$, ASA class III–IV and contaminated or dirty surgery. The abdominal-complication model included emergency indication and contaminated or dirty surgery. The 30-day mortality model included emergency indication, age per 10 years and BMI per 5 kg/m$^2$. Variables potentially occurring after or downstream of surgical indication (for example, operative duration, fixation technique or intraoperative complications) were not treated as confounders. Mesh infection and mesh removal were not entered into multivariable models because their event counts were too small; descriptive comparisons were nevertheless performed. The number of events (or non-events, whichever was smaller) per estimated parameter ranged from 7.6 to 9.7. We report adjusted odds ratios (ORs), 95% confidence intervals (CIs), complete-case sample sizes, event counts and apparent areas under the receiver operating characteristic curve (AUCs). Statistical analyses were performed using jamovi version 2.3.21.0.

# Results

## Study population and operative characteristics

A total of 234 patients undergoing permanent prophylactic mesh reinforcement after midline laparotomy were registered: 104 (44.4%) elective and 130 (55.6%) emergency procedures. Mean age was 68.0 years (SD 13.3; observed range 29–93),

142 patients (60.7%) were male and mean BMI was 26.7 kg/m$^2$ (SD 5.2; observed range 15.2–43.2). 60.3% of patients were classified as ASA III–IV and 89 procedures (38.0%) were classified as contaminated or dirty and colorectal surgery represented the most frequent indication. Most meshes were placed onlay (225/234, 96.2%). A recorded SL/WL ratio of at least 4:1 was present in 231/234 patients (98.7%); three records were coded as not applicable. Patients came from 17 hospitals. In-hospital outcome data were available for 204 of the 234 patients (85 elective and 119 emergency; 19 elective and 11 emergency patients had no data). Of the 30 patients without in-hospital data, 27 had no postoperative information entered in the registry and 3 died within the first hours after surgery. These figures describe the registered cohort before restricting the outcome analyses.

## Elective versus emergency surgery

In the 204-patient analytic cohort, contaminated or dirty surgery occurred in elective 16.5% versus emergency 56.3% of cases (difference, emergency minus elective, 39.8 percentage points (pp), 95% CI 26.9–50.5), previous laparotomy in 7.1% versus 42.0% (difference 35.0 pp, 95% CI 23.6–44.7) and suture fixation in 71.8% versus 97.5% (difference 25.7 pp, 95% CI 16.1–36.2). Malignancy occurred in elective 57.6% versus emergency 36.1% (difference −21.5 pp, 95% CI −34.3 to −7.6), and abdominal wall specialist involvement in 48.2% versus 28.6% (difference −19.7 pp, 95% CI −32.5 to −6.2). Baseline and operative characteristics are shown in Table 1.

Overall in-hospital complications occurred in 33/85 elective cases (38.8%) and 74/119 emergency cases (62.2%), corresponding to an absolute risk difference of 23.4 percentage points (95% CI 9.5–36.0). General complications occurred in 18/85 elective cases (21.2%) and 58/119 emergency cases (48.7%), with a risk difference of 27.6 percentage points (95% CI 14.4–39.1). Both comparisons remained significant after Benjamini–Hochberg correction (adjusted P = 0.005 and P < 0.001, respectively).

No statistically detectable differences were observed for in-hospital SSO, mesh infection, mesh removal, abdominal complications or 30-day mortality. Mortality in the cohort was elective 9/85 (10.6%) versus emergency 14/119 (11.8%) (difference, emergency minus elective, 1.2 pp, 95% CI −8.3 to 9.7; raw and BH-adjusted P = 0.827). Median hospital stay was 8.0 days [IQR 6.0–16.0] after elective surgery and 12.0 days [IQR 7.0–25.0] after emergency surgery.

Clavien–Dindo categories were higher after emergency surgery: elective median 0 [IQR 0–2] versus emergency median 2 [IQR 0–3]. The Mann–Whitney comparison gave raw P = 0.002 and BH-adjusted P = 0.006; the rank-biserial effect was 0.237 towards higher emergency ranks. Category 0 was included, so the comparison reflects both the occurrence and recorded severity of complications. Hospital stay was longer after emergency surgery (raw P = 0.013; BH-adjusted P = 0.029). Outcomes according to elective or emergency surgical indication are presented in Table 2.

## Sparse outcomes

Because mesh infection occurred in only six patients and mesh removal in two, multivariable models for these outcomes were not considered reliable. All six infections and both removals were among the 42 patients with SSO; their union would identify no additional patient.

## Multivariable analysis

After clinically specified adjustment, emergency indication was not associated with overall in-hospital complications (adjusted OR 1.53, 95% CI 0.77–3.06; P = 0.225). Renal disease (adjusted OR 3.71, 95% CI 1.29–10.63; P = 0.015) and contaminated or dirty surgery (adjusted OR 2.44, 95% CI 1.23–4.87; P = 0.011) were associated with the outcome. The model included 204 patients and 107 events and had an apparent AUC of 0.740.

Emergency indication remained associated with in-hospital general complications after adjustment (adjusted OR 2.13, 95% CI 1.01–4.47; P = 0.046). Renal disease was also associated with general complications (adjusted OR 2.63, 95% CI 1.03–6.75; P = 0.044). The model included 204 patients and 76 events and had an apparent AUC of 0.745. These borderline estimates should be interpreted cautiously because residual confounding and model uncertainty cannot be excluded.

Emergency indication was not associated with in-hospital SSO (adjusted OR 0.98, 95% CI 0.44–2.19; P = 0.955) or abdominal complications (adjusted OR 0.99, 95% CI 0.29–3.29; P = 0.980). The respective apparent AUCs were 0.632 and 0.676. The adjusted estimate for SSO was imprecise and moderate differences could not be assessed reliably. Contaminated or dirty surgery remained associated with abdominal complications.

Emergency indication was not associated with 30-day mortality after adjustment for age and BMI (adjusted OR 1.00, 95% CI 0.39–2.57; P = 0.997). The model included 204 patients and 23 deaths and had an apparent AUC of 0.747. Older age (adjusted OR 2.18 per 10 years, 95% CI 1.37–3.44; P < 0.001) and higher BMI (adjusted OR 1.64 per 5 kg/m$^2$, 95% CI 1.06–2.53; P = 0.027) were associated with higher odds of mortality. Detailed adjusted estimates are shown in Table 3 and Figure 1.

# Discussion

In this selected EVEREG cohort, emergency surgical indication was associated with greater early general morbidity but not with a statistically detectable increase in SSO, mesh infection, mesh removal, abdominal complications or 30-day mortality. However, the confidence intervals were wide and the study cannot establish equivalent safety between elective and emergency settings. The findings apply to the selected patients who received mesh and should not be generalised to emergency laparotomy as a whole. In addition, the absence of a non-mesh control group precludes conclusions regarding mesh effectiveness.

Historically, emergency surgery has been regarded as a hostile environment for prosthetic implantation because of contamination, tissue edema, physiological instability and concerns regarding mesh infection or mesh removal [6–10]. As a result, many surgeons have traditionally reserved prophylactic permanent mesh for elective procedures despite the fact that emergency laparotomy patients are among those at highest risk of fascial dehiscence and subsequent IH. These observations provide short-term data from selected mesh

TABLE 3 Clinically specified multivariable logistic regression models.

| Outcome and model information | Variable | Adjusted OR (95% CI) | P value |
|---|---|---|---|
| Overall in-hospital complications (n = 204; 107 events; AUC 0.740) | Emergency vs. elective surgery | 1.53 (0.77–3.06) | 0.225 |
| | Age, per 10 years | 1.19 (0.93–1.53) | 0.175 |
| | BMI, per 5 kg/m$^2$ | 1.21 (0.89–1.65) | 0.215 |
| | Male vs. female | 1.24 (0.63–2.41) | 0.533 |
| | ASA III–IV vs. I–II | 1.13 (0.58–2.21) | 0.725 |
| | Renal disease, yes vs. no | 3.71 (1.29–10.63) | 0.015 |
| | History of malignancy, yes vs. no | 0.65 (0.35–1.20) | 0.166 |
| | Former vs. never smoker | 0.51 (0.24–1.07) | 0.075 |
| | Current vs. never smoker | 1.64 (0.68–3.96) | 0.270 |
| | Contaminated/dirty vs. clean/clean-contaminated surgery | 2.44 (1.23–4.87) | 0.011 |
| In-hospital general complications (n = 204; 76 events; AUC 0.745) | Emergency vs. elective surgery | 2.13 (1.01–4.47) | 0.046 |
| | Age, per 10 years | 1.19 (0.91–1.56) | 0.196 |
| | BMI, per 5 kg/m$^2$ | 1.02 (0.75–1.40) | 0.880 |
| | Male vs. female | 1.26 (0.63–2.52) | 0.505 |
| | ASA III–IV vs. I–II | 1.45 (0.71–2.98) | 0.307 |
| | Renal disease, yes vs. no | 2.63 (1.03–6.75) | 0.044 |
| | History of malignancy, yes vs. no | 0.63 (0.33–1.19) | 0.155 |
| | Former vs. never smoker | 0.57 (0.26–1.24) | 0.157 |
| | Current vs. never smoker | 1.53 (0.65–3.62) | 0.333 |
| | Contaminated/dirty vs. clean/clean-contaminated surgery | 1.90 (0.95–3.79) | 0.068 |
| In-hospital surgical-site occurrence (n = 204; 42 events; AUC 0.632) | Emergency vs. elective surgery | 0.98 (0.44–2.19) | 0.955 |
| | Age, per 10 years | 0.96 (0.73–1.28) | 0.800 |
| | BMI, per 5 kg/m$^2$ | 1.26 (0.92–1.74) | 0.155 |
| | ASA III–IV vs. I–II | 1.52 (0.70–3.29) | 0.290 |
| | Contaminated/dirty vs. clean/clean-contaminated surgery | 1.69 (0.78–3.68) | 0.185 |
| In-hospital abdominal complication (n = 204; 17 events; AUC 0.676) | Emergency vs. elective surgery | 0.99 (0.29–3.29) | 0.980 |
| | Contaminated/dirty vs. clean/clean-contaminated surgery | 4.13 (1.26–13.58) | 0.020 |
| 30-day mortality (n = 204; 23 events; AUC 0.747) | Emergency vs. elective surgery | 1.00 (0.39–2.57) | 0.997 |
| | Age, per 10 years | 2.18 (1.37–3.44) | <0.001 |
| | BMI, per 5 kg/m$^2$ | 1.64 (1.06–2.53) | 0.027 |

N and event counts refer to complete cases; AUC, area under the receiver operating characteristic curve; CI, confidence interval; OR, odds ratio.

recipients but do not establish that additional risk is expressed primarily through systemic rather than mesh-related complications.

No statistically detectable differences in mesh infection, mesh removal or SSO were observed. These outcomes were assessed only during the index admission, so the data cannot quantify infection or removal after discharge. The separate fields distinguish wound morbidity from prosthetic involvement and removal; in this cohort their union added no events. These observations do not establish equivalence and considerable uncertainty persists.

Because all patients received prophylactic mesh reinforcement, the present study cannot directly compare mesh with primary closure.

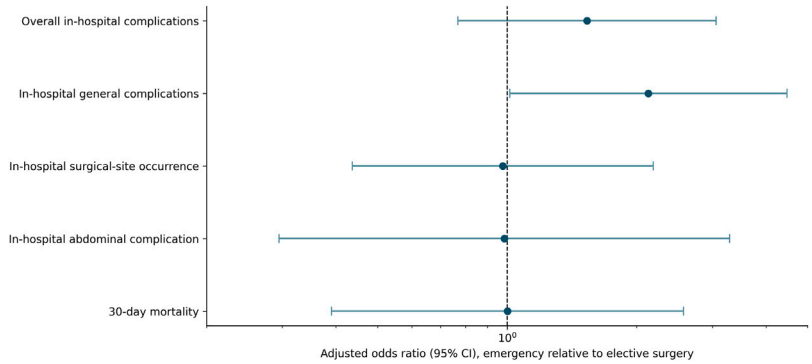



FIGURE 1
Association of emergency versus elective surgical indication with principal outcomes.

Two findings deserve comment. First, adjustment for patient characteristics and operative case mix attenuated the crude association between surgical setting and overall complications; the adjusted estimate was imprecise and moderate differences could not be assessed reliably. Second, the mortality comparison concerns only patients with completed in-hospital modules and excludes known early deaths without those data. It should not be interpreted as mortality in all registered patients or as evidence of comparable risk in unselected emergency laparotomies.

Our findings are consistent with literature supporting prophylactic mesh use beyond elective surgery. Argudo et al. demonstrated that synthetic mesh could be safely used during emergency laparotomy, including cases involving generalised peritonitis, without chronic mesh infection requiring removal [6]. Similarly, Lima et al. reported a reduction in fascial dehiscence from 13.5% to 0% following onlay prophylactic mesh placement during emergency surgery [7]. Ulutas et al. subsequently observed a reduction in IH incidence from 27.4% to 4% after emergency laparotomy with prophylactic mesh reinforcement [8]. The PROMETHEUS trial further demonstrated a significant reduction in IH following urgent clean-contaminated surgery using sublay mesh reinforcement [9].

More recently, the meta-analysis by Marcolin et al. confirmed that prophylactic mesh augmentation during emergency laparotomy significantly reduces IH without increasing major postoperative morbidity [10]. Likewise, the systematic review and meta-analysis by Valério-Alves et al., which included both elective and emergency procedures, demonstrated that permanent prophylactic mesh significantly decreases IH incidence, with a similar magnitude of benefit across surgical settings [4]. Taken together, these studies support the concept that prophylactic mesh may represent a preventive strategy whose potential application is not restricted to elective surgery.

Patient-related and procedural characteristics were also associated with postoperative morbidity. These associations are exploratory and do not demonstrate that these factors are more important determinants of outcome than emergency indication itself; they are nevertheless consistent with previous evidence indicating that physiological reserve, surgical complexity and contamination influence postoperative outcomes [1, 5].

Several limitations should be acknowledged. First, the observational design precludes causal inference and residual confounding remains possible. Second, inclusion was restricted to selected patients who received prophylactic mesh, creating potential selection and confounding-by-indication biases, and the findings should not be generalised to emergency laparotomy as a whole. Third, the absence of a non-mesh control group prevents direct assessment of mesh effectiveness. Fourth, several outcomes were infrequent, precluding reliable multivariable modelling of mesh infection and removal, and models had few events relative to their parameter counts, so their estimates may be unstable. Fifth, outcomes were recorded by the surgeons entering each case according to local practice and were not independently verified. Sixth, in-hospital data were missing for 30 patients (12.8%), mostly because the registry form had not been completed, and complete-case analyses may be biased. The three known early deaths without in-hospital modules were excluded from the restricted mortality comparison, which therefore does not estimate mortality in the whole registered cohort. No hospital-level clustering analysis was possible. Finally, incomplete follow-up precluded assessment of long-term incisional-hernia outcomes.

The study also has strengths. It describes real-world practice in a contemporary registry, includes emergency procedures across a broad spectrum of contamination and reports outcomes directly relevant to surgeons considering prophylactic mesh. Furthermore, registry-based analyses provide complementary evidence to randomised trials by capturing everyday decision-making and heterogeneous patient populations.

Overall, the present findings are descriptive and exploratory and support only a cautious interpretation of permanent prophylactic mesh reinforcement in selected elective and emergency surgery patients. Emergency laparotomy remained associated with increased general postoperative morbidity, whereas no statistically detectable increase in recorded short-term SSO or other mesh-related events was identified, with considerable uncertainty. As a cautious clinical implication requiring confirmation, these findings suggest that emergency indication *per se* might not constitute an absolute contraindication to permanent prophylactic mesh

placement in appropriately selected patients. Decisions should remain individualised according to contamination, physiological status, tissue quality, expected survival, operative complexity and surgical expertise together with standardised closure technique, appropriate mesh selection, meticulous fixation.

## Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

## Ethics statement

The studies involving humans were approved by the EVEREG Registry Committee. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin because the study involving human participants was approved by the EVEREG Registry Committee. The study was conducted in accordance with local legislation and institutional requirements. Written informed consent for participation was not required from the participants or their legal guardians or next of kin in accordance with national legislation and institutional requirements.

## Author contributions

Conceptualization: ML-C, PM-L, VR-G, and MV-T; Data curation: M-LC and PM-L; Formal analysis: ML-C and PM-L; Writing – original draft: M-LC and PM-L; Writing – review and editing: all authors. All authors contributed to the article and approved the submitted version.

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## 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 used in the creation of this manuscript. During manuscript preparation, Julius AI was used as an artificial intelligence-assisted tool for language editing, stylistic refinement and improvement of readability. The authors critically reviewed, edited, and approved all AI-assisted outputs and take full responsibility for the final content of the manuscript.

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