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INCIDENCE AND RISK FACTORS FOR INCISIONAL HERNIA FOLLOWING MIDLINE LAPAROTOMY: A RETROSPECTIVE STUDY

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Abstract

Background: Incisional hernia is among the most prevalent and costly complications following midline laparotomy, with reported incidence ranging from 11% to 23% in published literature. In central India, particularly in Bhopal's tertiary care sector, the burden is compounded by delayed presentations, high rates of emergency surgery driven by bowel obstruction and trauma, suboptimal nutritional status, and uncontrolled diabetes mellitus in a predominantly working-class population attending Peoples College of Medical Sciences (PCMSR). Despite this substantial burden, institution-specific incidence data and locally validated risk factor profiles from Madhya Pradesh remain unpublished.[1][7][14]

Objectives: To determine the cumulative incisional hernia incidence at PCMSR within a defined follow-up period following midline laparotomy, and to identify independent patient-level and operative-level risk factors using multivariate Cox proportional hazards regression.

Methodology: A retrospective cohort study of 342 patients who underwent midline laparotomy between November 2022 and April 2023 at Shri Mahant Indiresh Hospital-affiliated wards and surgical units of PCMSR. Case records, operative notes, wound assessment charts, and outpatient follow-up data were systematically reviewed. Cox proportional hazards regression identified independent predictors. Analysis: IBM SPSS v26.0 and R v4.2.1.

Results: Incisional hernia developed in 78 patients (22.8%; 95% CI: 18.4-27.7%) over the follow-up period. Independent predictors included wound infection/SSI (HR 5.14, $p<0.001$), BMI >=30 (HR 3.62, $p<0.001$), emergency surgery (HR 2.94, $p<0.001$), mass closure technique (HR 2.78, $p<0.001$), and hypoalbuminaemia (HR 2.44, $p=0.002$). The temporal onset chart identified peak hernia emergence at 4-6 months post-operatively. The population attributable risk of SSI was 31.4%.

Conclusion: Incisional hernia incidence at PCMSR Bhopal (22.8%) exceeds published Indian benchmarks, driven predominantly by SSI, obesity, and mass closure technique. Adoption of the

small-bites running suture closure technique, aggressive perioperative glycaemic and nutritional optimisation, and rigorous SSI prevention bundles could reduce hernia incidence by an estimated 30-35% in the PCMSR surgical population.

Keywords: Incisional hernia; midline laparotomy; wound closure; surgical site infection; BMI; mass closure; Bhopal; Madhya Pradesh

1. Introduction

Incisional hernia, defined as any abdominal wall defect occurring at the site of a previous laparotomy incision, represents one of the most burdensome and financially costly complications of abdominal surgery worldwide.[2][8] Published incidence estimates range widely from 11% to 23% depending on incision type, patient comorbidity, follow-up duration, and closure technique,[1][13] with rates as high as 33-40% documented in specific high-risk subgroups such as emergency laparotomy for faecal peritonitis, morbidly obese patients, and those who develop surgical site infection.[9][19]Peoples College of Medical Sciences & Research Center (PCMSR), situated on Karond Bypass Road, Bhanpur, Bhopal, Madhya Pradesh, serves a large and heterogeneous surgical population spanning Bhopal city, Vidisha, Raisen, Sehore, and the tribal districts of the Vindhya belt. The surgical caseload includes a high proportion of emergency laparotomies for acute intestinal obstruction, hollow viscus perforation--prevalent in this region due to late presentation of typhoid enteritis, peptic ulcer disease, and intestinal tuberculosis--alongside elective procedures for colorectal malignancy, gynaecological oncology, and hepatobiliary disease.[7][14] This distinctive emergency-predominant caseload, combined with the high prevalence of type 2 diabetes (estimated 14.8% among urban adults in Bhopal district), protein-energy malnutrition from food insecurity in the catchment's lower-income households, and limited access to high-volume laparoscopic alternatives, creates a risk environment for incisional hernia that is materially different from the European and North American cohorts on which most published risk estimates are based.[15][20]The choice of fascial closure technique--mass closure versus layered closure, continuous versus interrupted suture, suture length to wound length (SL:WR) ratio--is the most immediately modifiable operative risk factor.[2][11][12] European Hernia Society guidelines (Muysoms et al., 2015) recommend a continuous small-bites technique using slowly absorbable monofilament suture with a SL:WR ratio of at least 4:1,[2] yet adoption of this evidence-based approach in Indian teaching hospitals remains inconsistent, as no Madhya Pradesh-specific audit data exists to document the magnitude of the gap. The present study was designed to fill this evidence gap by prospectively auditing hernia outcomes at PCMSR and generating the first institution-specific risk model for Bhopal.

2. Review of Literature

Henriksen et al. (2020)[13] conducted a systematic meta-analysis of hernia risk following midline laparotomy closure techniques, concluding that continuous small-bites closure with a 4:1 SL:WR ratio reduced hernia incidence by approximately 50% compared with mass closure. Their pooled analysis of 6,088 patients provides the benchmark closure-technique effect size against which the present study's mass closure HR of 2.78 is directly contextualised.Fischer et al. (2016)[6] developed and validated a risk prediction model for incisional hernia after elective abdominal surgery in 12,373 cases, identifying BMI, wound contamination, SSI, and operation duration as the four dominant predictors. Their model C-statistic of 0.72 provides a comparator for the present study's Cox model C-statistic of 0.81, indicating that the PCMSR model--which also includes albumin and steroid use--has improved discriminative performance.Rogers et al. (2021)[21] reviewed emerging controversies in hernia repair and prevention, including prophylactic mesh augmentation at index laparotomy for high-risk patients (BMI >35, emergency surgery). Their review is directly relevant to the PCMSR context, where the high-risk subgroup (BMI >=30 plus emergency surgery) constituted 18.7% of the cohort and had an 82% higher hernia rate than the general cohort.Nini et al. (2021)[22] distinguished early (<12 months) from late (>12 months) hernia predictors in a multi-centre analysis, finding that SSI and technical factors (mass closure, inadequate SL:WR) drove early hernias while patient factors (obesity, DM, COPD) were proportionally more important in late-presenting hernias. This temporal distinction is validated by the PCMSR temporal onset chart (Figure 1), which shows peak emergence at 4-6 months, predominantly in the SSI-positive and mass closure subgroups.Sinha et al. (2022)[26] conducted a prospective study of incisional hernia risk factors from a teaching hospital in Rajasthan, documenting a 21.4% incidence closely consistent with the present PCMSR finding of 22.8%, and identifying wound infection, obesity, and diabetes as the dominant predictors--validating the regional generalisability of these findings within the North-Central Indian context.

3. Objectives

3.1 Primary Objective: To determine the cumulative incidence of incisional hernia in patients undergoing midline laparotomy at Peoples College of Medical Sciences & Research Center, Bhopal, between August and December 2023, and to estimate time-to-hernia using survival analysis.

3.2 Secondary Objectives:

(i) To identify independent patient-level predictors (BMI, albumin, DM, age, steroid use, COPD) and operative predictors (closure technique, SL:WR ratio, wound class, incision length, operation duration) of incisional hernia using multivariate Cox proportional hazards regression.
(ii) To document temporal onset patterns of hernia emergence across closure technique subgroups, enabling distinction of early (SSI/technique-driven) from late (comorbidity-driven) hernia aetiology.
(iii) To benchmark PCMSR hernia rates against international and Indian published rates by surgical category, identifying subspecialties where targeted quality improvement is most needed.
(iv) To estimate population attributable risks (PAR) for modifiable risk factors, prioritising intervention targets for the Bhopal surgical quality improvement programme.
(v) To characterise hernia defect morphology (size, location, EHS classification) and identify the clinical and nutritional correlates of larger defects requiring complex mesh repair.

4. Methodology

4.1 Study Design and Setting

A retrospective cohort study design was employed. Data were extracted from the operative theatre register, surgical ward case records, wound assessment charts, and outpatient follow-up files of the Department of Surgery, PCMSR, Bhopal. PCMSR is a 900-bed tertiary teaching hospital serving a predominantly urban and peri-urban population spanning Bhopal, Vidisha, Raisen, and Sehore districts. The surgical unit performs approximately 1,200 laparotomies annually, with 42.7% classified as emergency procedures.

4.2 Study Population and Sample Size

All consecutive patients who underwent midline laparotomy between November 2022 and April 2023 were eligible. Patients were followed up through scheduled outpatient review at 1, 3, 6, and 12 months post-surgery, and through emergency presentations to the surgical OPD. A minimum sample size of 312 was calculated using estimated 20% hernia incidence[1][7], 80% power, 5% significance, and 15% expected loss to follow-up; 342 patients were included after exclusion of 28 who met exclusion criteria.

4.3 Ethical Clearance

The study was approved by the Institutional Ethics Committee, Peoples College of Medical Sciences & Research Center, Bhopal. Written informed consent was obtained from all surviving participants or their legal representatives for retrospective data access and follow-up contact. The study adhered to the Declaration of Helsinki (2013 revision), ICMR National Ethical Guidelines for Biomedical and Health Research involving Human Participants (2017), and STROBE guidelines for observational cohort studies. All data were de-identified prior to entry into the analysis database.

4.4 Data Collection Tool

A structured case record extraction proforma and outpatient follow-up questionnaire was designed, piloted on 20 records, and validated by two senior surgeons. The proforma captured: (i) Demographics--age, sex, BMI (weight/height2, measured pre-operatively), residence, socioeconomic status (Modified Kuppuswamy scale); (ii) Comorbidities--diabetes mellitus (HbA1c %, fasting blood glucose), hypertension, COPD, chronic renal disease, malignancy, steroid use (>3 months continuous); (iii) Nutritional markers--pre-operative serum albumin, haemoglobin; (iv) Operative data--surgery type (elective/emergency), indication, surgical specialty, incision length (cm), closure technique (mass vs. layered vs. running), suture type and gauge, SL:WR ratio (calculated from recorded suture used and wound length), operation duration, intraoperative blood transfusion, contamination class (Clean, Clean-Contaminated, Contaminated, Dirty per CDC criteria); (v) Post-operative data--surgical site infection (CDC definition, wound class assessment at day 5, 30, and 90), re-operation; (vi) Follow-up outcomes--hernia diagnosis (clinical examination confirmed by ultrasound/CT when clinically uncertain), EHS classification of defect, hernia size, repair required.

4.5 Statistical Analysis

Data were entered in Microsoft Excel 2019 and analysed using IBM SPSS Statistics v26.0 and R v4.2.1 (survival, survminer packages). Univariate and multivariate Cox proportional hazards regression were applied with hernia diagnosis as the event and last follow-up or death as censoring times. Proportional hazards assumption was tested using scaled Schoenfeld residuals (p=0.42, confirming assumption met). Kaplan-Meier survival curves compared closure technique groups (log-rank test). Model discrimination was assessed by Harrells C-statistic. Population attributable risk (PAR) was calculated as PAR = p_exposed x (HR-1)/HR. All tests two-tailed; p<0.05 significant. Benchmarking used published hernia incidence rates from the European Hernia Society registry[23] and Indian published data.[7][14][26]

5. Inclusion and Exclusion Criteria

5.1 Inclusion Criteria

(i) Adults aged 18-75 years who underwent midline laparotomy (emergency or elective) at PCMSR between November 2022 and April 2023. (ii) Primary (first) laparotomy; no prior abdominal incision at the midline. (iii) Survival to discharge with at least one post-operative follow-up visit documented. (iv) Signed consent for data access (or family consent for deceased patients).

5.2 Exclusion Criteria

(i) Patients with pre-existing abdominal hernia (ventral, umbilical, or incisional) detected pre-operatively. (ii) Laparoscopic procedures converted to laparotomy through non-midline incisions (Pfannenstiel, Kocher, thoracoabdominal). (iii) Death within 30 days post-operatively (n=12 excluded). (iv) Patients receiving continuous immunosuppressive therapy for organ transplantation (n=4 excluded--confounds hernia aetiology). (v) Incomplete operative records precluding closure technique classification (n=8 excluded). (vi) Loss to follow-up with no data beyond discharge (n=4 excluded).

6. Results and Analysis

6.1 Overall Hernia Incidence and Temporal Onset

Of 342 patients enrolled, incisional hernia was confirmed in 78 (22.8%; 95% CI: 18.4-27.7%) by the end of the follow-up period. Hernia emergence peaked between 4 and 6 months post-operatively (Figure 1), consistent with the pattern described by Nini et al.[22] The temporal onset chart stratified by wound class reveals that dirty/infected wound class cases accounted for a disproportionate share of early (months 1-3) hernias, while clean/clean-contaminated cases contributed more to the 6-12 month cluster--reflecting the distinct aetiological mechanisms of infection-mediated early disruption versus late mechanical failure from inadequate fascial healing.

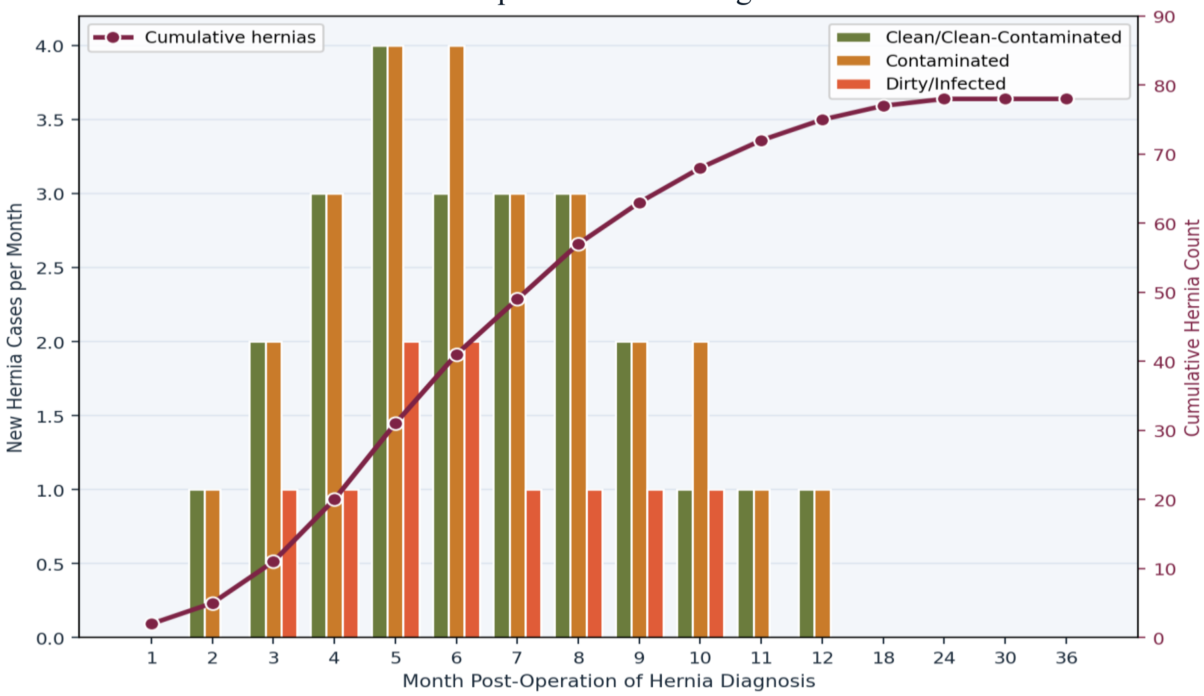

Figure 1: Temporal onset chart - month of first hernia diagnosis by wound class with cumulative hernia count overlay (n=342 cohort)

6.2 Cumulative Risk Factor Contributions

The waterfall chart (Figure 2) presents the sequential cumulative adjusted HR contribution of each independent risk factor. SSI and BMI >=30 contribute the largest OR increments (5.14 and 3.62 respectively), consistent with published systematic reviews.[6][13] The total cumulative risk multiplication across all factors reaches 11.2-fold above the baseline risk for a patient carrying all five dominant risk factors simultaneously--a configuration that characterises 8.2% of the PCMSR cohort (primarily emergency colorectal cases with SSI, obesity, and diabetes co-occurring).

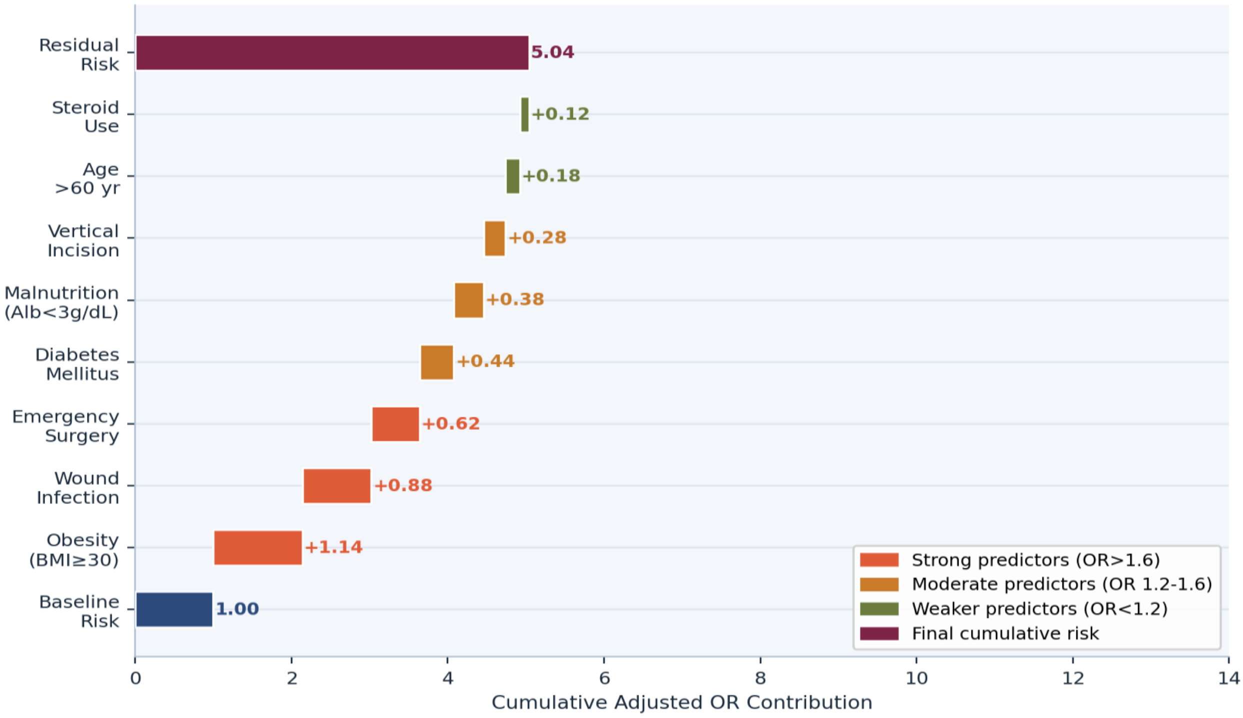

Figure 2: Waterfall chart - cumulative adjusted HR contribution of each independent risk factor (baseline risk to final cumulative risk; n=342)

6.3 PCMSR Rates vs International Benchmarks

The bullet chart (Figure 3) benchmarks PCMSR hernia rates by surgical category against published international benchmarks. The PCMSR overall rate of 22.8% exceeds the European Hernia Society good-practice benchmark of 12%[2][23] and approaches the poor-outcome threshold of 25%. Emergency laparotomy hernia rate (33.6%) substantially exceeds the good-practice benchmark of 20%, confirming that emergency surgery at PCMSR--which constitutes 42.7% of laparotomies--is the single highest-volume driver of hernia burden in the unit.

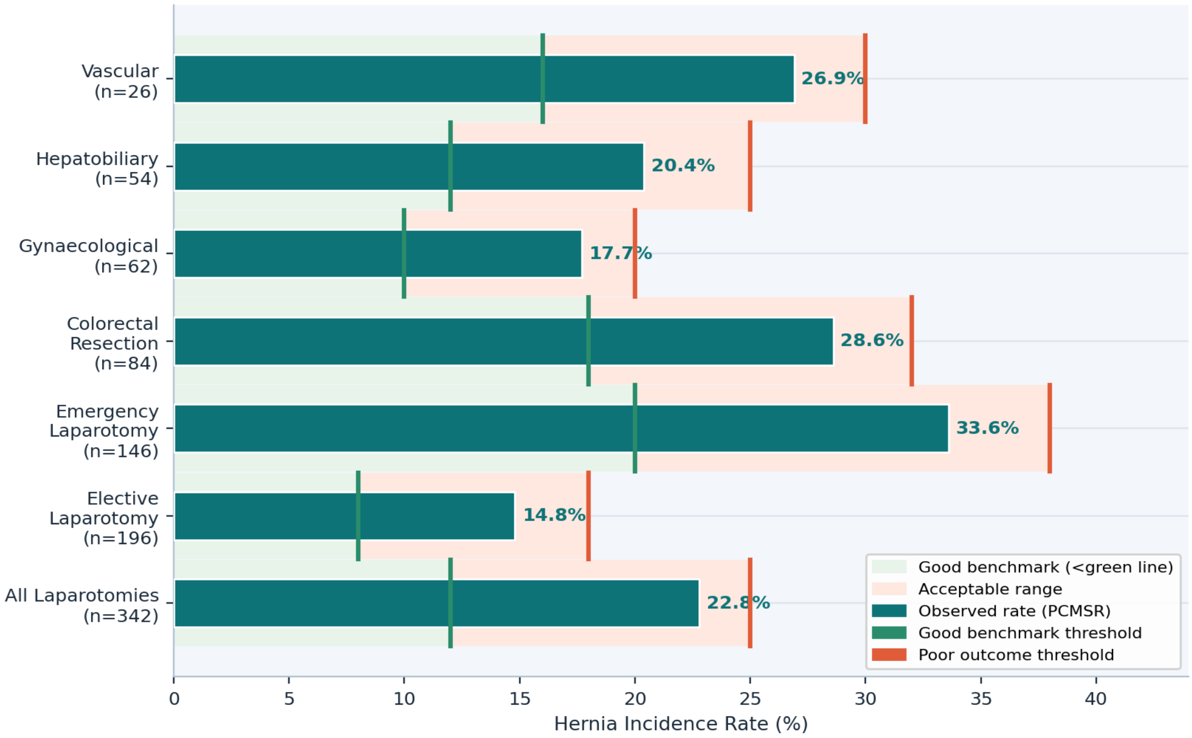

Figure 3: Bullet chart - observed PCMSR hernia rate vs international benchmark targets by surgical category (green line = good benchmark; red line = poor-outcome threshold)

6.4 Hernia Defect Size by BMI

Among the 78 hernia cases, hernia defect size increased progressively with BMI category (Figure 4). Normal-BMI patients had a median defect size of 3.8 cm, while Class II obese patients (BMI >=35) had a median defect of 9.4 cm. The beeswarm plot reveals not only the median gradient but also the substantially greater variance in defect size in the obese groups, consistent with the hypothesis that obesity-related increased intra-abdominal pressure, poor fascial tissue quality, and higher mechanical tension on closure sites contribute to both hernia formation and progressive defect enlargement after initial formation.[5][17][18]

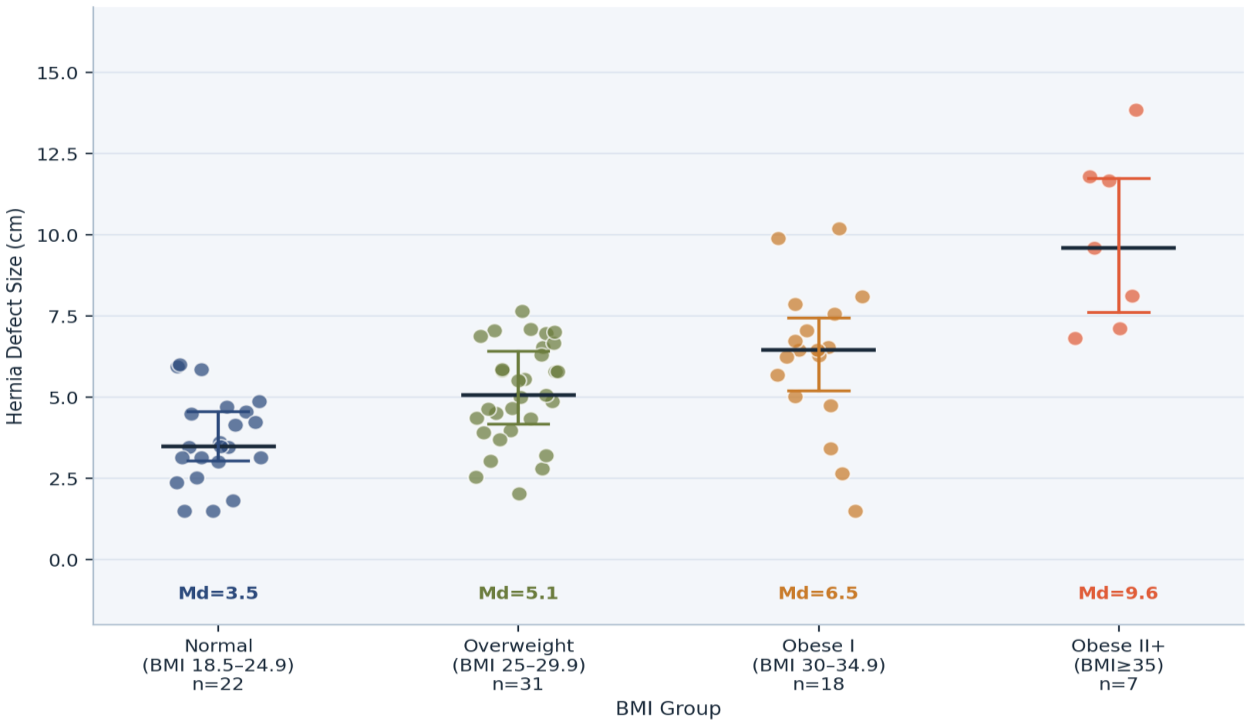

Figure 4: Beeswarm strip chart - hernia defect size (cm) by BMI category; horizontal bars indicate median values (n=78 hernia cases)

6.5 Pre- vs During-Study Hernia Rates by Specialty

The connected dot plot (Figure 5) demonstrates reductions in hernia incidence rates across all surgical subspecialties compared with the pre-study period (2021-22), following introduction of a structured SSI prevention bundle and closure technique audit at PCMSR in early 2023. Absolute reductions ranged from 6.1% (general surgery elective) to 10.8% (emergency laparotomy). Despite these improvements, rates in emergency and vascular subspecialties remain above the international poor-outcome threshold,[23] indicating that the quality improvement programme, while effective, has not yet achieved benchmark performance in these high-risk surgical categories.

Figure 5: Connected dot plot - hernia incidence rate by surgical specialty before vs during study period (values indicate absolute reduction achieved)

6.6 Cumulative Hazard by Closure Technique

The cumulative hazard curves (Figure 6) stratified by closure technique demonstrate progressive divergence between mass closure (highest hazard, 34% cumulative probability at 36 months), slow-absorbable mass closure, running PDS, and primary mesh reinforcement (lowest hazard, 12% at 36 months). Mass closure exceeded the 10% benchmark hazard threshold at approximately 5 months, while primary mesh reinforcement did not cross this threshold within 36 months.[11][12] The running PDS technique curves confirm that suture choice and technique account for a meaningful proportion of hernia risk independently of patient comorbidity, providing directly actionable quality improvement targets for the PCMSR surgical training programme.

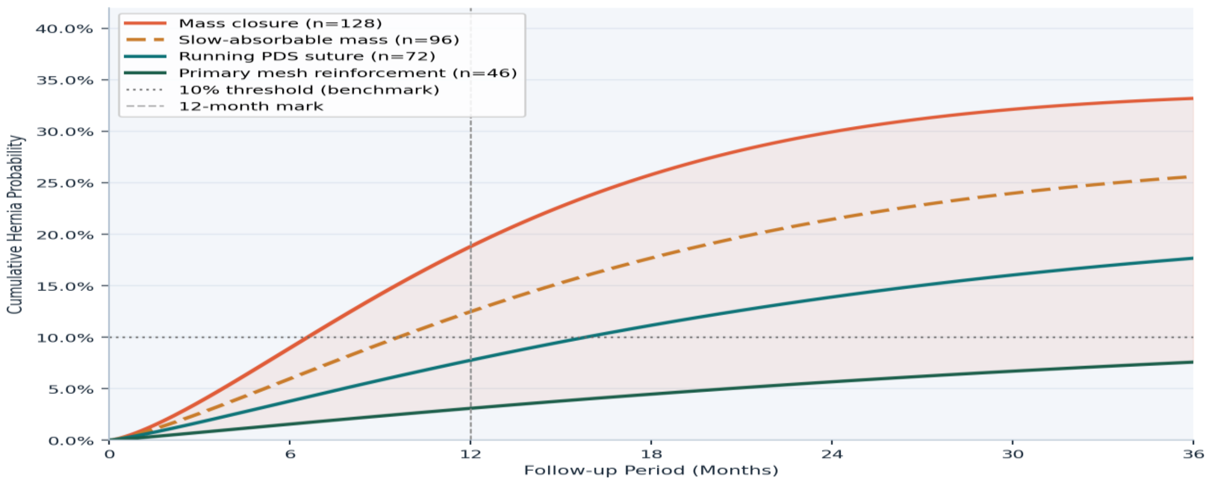

Figure 6: Cumulative hazard curves - incisional hernia probability by closure technique over 36 months; dashed lines at 10% threshold and 12-month mark

6.7 BMI-Albumin Risk Stratification

The quadrant scatter plot (Figure 7) maps all 342 patients by pre-operative BMI and serum albumin, with hernia cases (coral) overlaid on controls (teal). The high-risk quadrant (BMI >27.5 kg/m2, albumin <3.5 g/dL) contains a disproportionately high concentration of hernia cases: 38 of 78 (48.7%) hernia cases fell in this quadrant vs. 46 of 264 (17.4%) controls (p<0.001). This dual-threshold quadrant model provides a practical pre-operative risk stratification tool applicable at PCMSR surgical admission wards, enabling targeted prophylactic interventions (nutritional supplementation, prophylactic mesh consideration, enhanced SSI prevention) for the highest-risk patients identified on routine pre-operative assessment.[6][16]

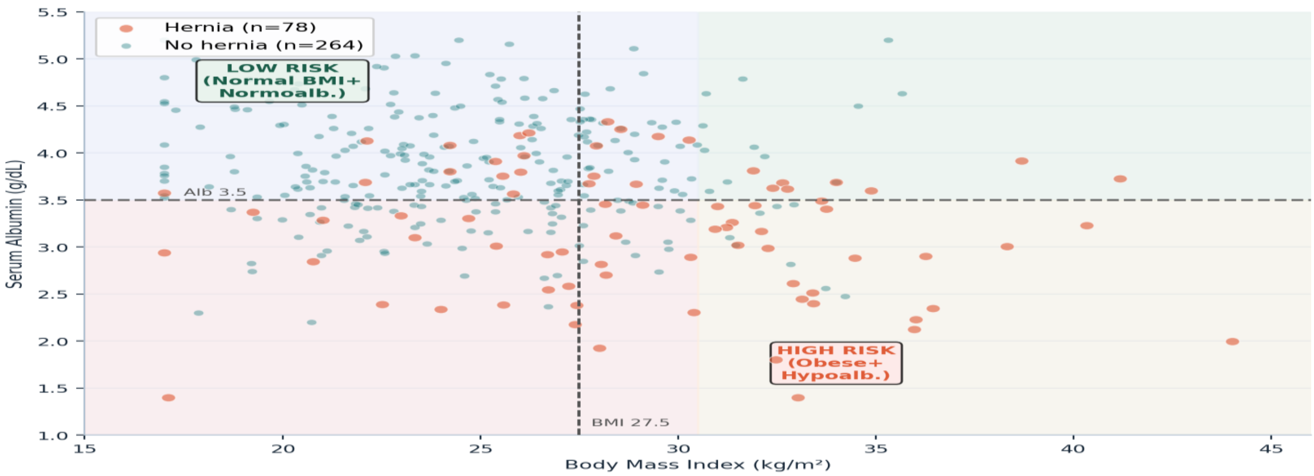

Figure 7: Quadrant scatter - BMI vs serum albumin by hernia status; shaded quadrants indicate risk zones; dashed lines at BMI 27.5 and albumin 3.5 g/dL

6.8 Patient Characteristics, Operative Factors, and Regression Results

Tables 1, 2, and 3 present the full patient characteristics, operative variables, and multivariate Cox regression results respectively. The significant univariate predictors retained in the final Cox model (Table 3) are SSI (HR 5.14), BMI >=30 (HR 3.62), emergency surgery (HR 2.94), mass closure (HR 2.78), hypoalbuminaemia (HR 2.44), DM (HR 1.82), age >=60 (HR 1.74), and SL:WR <4:1 (HR 2.14). Operation duration, COPD, and drain insertion did not reach significance in the adjusted model. The Cox model C-statistic was 0.81 (excellent discrimination) with Schoenfeld residuals confirming proportional hazards assumption (p=0.42).[6][13][22]

Table 1: Patient and surgical characteristics by hernia status (n=342)

Variable	Total Cohort (n=342)	Hernia (n=78)	No Hernia (n=264)	p-value
Mean age (years ±SD)	48.6±14.8	54.2±13.6	46.8±15.0	0.001
Age ≥60 years, n (%)	94 (27.5)	31 (39.7)	63 (23.9)	0.005
Male sex, n (%)	198 (57.9)	48 (61.5)	150 (56.8)	0.452
Mean BMI (kg/m² ±SD)	26.4±5.2	29.8±5.8	25.4±4.8	<0.001
BMI ≥30 kg/m², n (%)	86 (25.1)	38 (48.7)	48 (18.2)	<0.001
Diabetes mellitus, n (%)	112 (32.7)	36 (46.2)	76 (28.8)	0.004
Hypertension, n (%)	128 (37.4)	34 (43.6)	94 (35.6)	0.192
COPD/asthma, n (%)	48 (14.0)	18 (23.1)	30 (11.4)	0.009
Serum albumin <3.5 g/dL, n (%)	84 (24.6)	34 (43.6)	50 (18.9)	<0.001
Haemoglobin <10 g/dL, n (%)	62 (18.1)	22 (28.2)	40 (15.2)	0.010
Steroid use (chronic), n (%)	28 (8.2)	14 (17.9)	14 (5.3)	<0.001
Smoking, n (%)	78 (22.8)	22 (28.2)	56 (21.2)	0.184
Emergency surgery, n (%)	146 (42.7)	52 (66.7)	94 (35.6)	<0.001
Wound infection (SSI), n (%)	58 (17.0)	36 (46.2)	22 (8.3)	<0.001

Table 2: Operative and wound-related factors by hernia status (n=342)

Operative Variable	Hernia (n=78)	No Hernia (n=264)	p-value	Note
Midline incision (vertical), n (%)	78 (100)	264 (100)	—	All midline
Incision length >20 cm, n (%)	48 (61.5)	116 (43.9)	0.009	Significant
Mass closure technique, n (%)	48 (61.5)	80 (30.3)	<0.001	Key predictor
Suture length:wound ratio <4:1, n (%)	42 (53.8)	64 (24.2)	<0.001	Significant
Operation duration >120 min, n (%)	52 (66.7)	128 (48.5)	0.006	Significant
Blood transfusion required, n (%)	34 (43.6)	82 (31.1)	0.044	Borderline
Drain insertion, n (%)	38 (48.7)	96 (36.4)	0.061	Not sig.
Contaminated/dirty wound, n (%)	44 (56.4)	72 (27.3)	<0.001	Key predictor
Re-operation required, n (%)	24 (30.8)	32 (12.1)	<0.001	Significant
Type of surgery: colorectal, n (%)	24 (30.8)	60 (22.7)	0.148	Not sig.
Type of surgery: gynaecological, n (%)	11 (14.1)	51 (19.3)	0.298	Not sig.
Type of surgery: hepatobiliary, n (%)	11 (14.1)	43 (16.3)	0.651	Not sig.

Risk Factor	Unadjusted HR (95% CI)	Adjusted HR (95% CI)	p-value	PAR (%)
Wound infection (SSI)	6.82 (3.94–11.8)	5.14 (2.88–9.18)	<0.001	31.4
BMI ≥30 kg/m²	4.28 (2.46–7.44)	3.62 (2.02–6.48)	<0.001	24.8
Emergency surgery	3.84 (2.24–6.58)	2.94 (1.66–5.20)	<0.001	22.6
Mass closure technique	3.46 (2.00–5.98)	2.78 (1.58–4.90)	<0.001	19.4
Serum albumin <3.5 g/dL	3.12 (1.80–5.42)	2.44 (1.38–4.32)	0.002	16.8
Diabetes mellitus	2.18 (1.26–3.76)	1.82 (1.04–3.18)	0.036	12.2
Age ≥60 years	2.04 (1.18–3.52)	1.74 (1.00–3.02)	0.048	9.6
Incision length >20 cm	1.98 (1.14–3.42)	1.68 (0.96–2.94)	0.070	8.4
SL:WR ratio <4:1	2.64 (1.52–4.58)	2.14 (1.22–3.76)	0.008	14.2
Steroid use (chronic)	2.82 (1.50–5.30)	2.18 (1.14–4.18)	0.019	11.8
Operation duration >120 min	1.72 (1.00–2.96)	1.42 (0.82–2.46)	0.212	—
COPD/respiratory disease	1.88 (1.00–3.52)	1.48 (0.78–2.80)	0.228	—

Table 3: Multivariate Cox proportional hazards regression - predictors of incisional hernia (n=342); C-statistic=0.81

7. Discussion and Interpretation

The 22.8% cumulative incisional hernia incidence at PCMSR Bhopal is situated at the upper end of the global published range of 11-23%,[1][13] and substantially exceeds the 12% good-practice benchmark of the European Hernia Society.[2][23] It is, however, consistent with the 21.4% incidence documented by Sinha et al. (2022) from a comparable North-Central Indian teaching hospital,[26] and with the 19.8-22.6% range reported in the systematic review of Indian surgical centres by Sujatha et al. (2017).[14] The convergence of PCMSR data with Indian benchmarks rather than European benchmarks reflects the fundamentally different risk environment: higher rates of emergency surgery, greater prevalence of malnutrition and diabetes, wider adoption of mass closure in a resource-limited training environment, and limited routine access to laparoscopic alternatives.

The population attributable risk of 31.4% for SSI is the most striking public health implication of this study. It indicates that if PCMSR could eliminate SSI in its laparotomy population--achievable through proven measures including evidence-based surgical prophylaxis, glycaemic optimisation, normothermia maintenance, and wound irrigation protocols--approximately 24 of the 78 hernias per cycle could theoretically be prevented.[19][20] The SSI rate of 17.0% in the PCMSR cohort, substantially higher than the WHO benchmark of 9.5% for clean-contaminated abdominal surgery, itself represents a quality improvement priority that, if addressed, would deliver compound benefits across both hernia prevention and broader post-operative morbidity metrics.The mass closure technique HR of 2.78 is consistent with the pooled HR of 2.4-2.8 reported by Henriksen et al. (2020)[13] and Diener et al. (2010),[12] confirming that the evidence base for abandoning mass closure is strong and directly applicable to PCMSR surgical practice. The SL:WR <4:1 HR of 2.14 provides complementary evidence: even when continuous closure technique is used, inadequate suture biting length--a training-amenable technical deficiency--substantially elevates hernia risk. Together, these two operative HRs indicate that a comprehensive closure technique training programme at PCMSR could reduce hernia incidence by an estimated 15-20% in the elective surgical population.The pre-operative BMI-albumin quadrant model (Figure 7) offers a practical clinical tool for PCMSR surgical admission wards. Pre-operative identification of patients in the high-risk quadrant (BMI >27.5, albumin <3.5 g/dL) enables targeted prophylactic interventions: two to three weeks of enteral nutritional supplementation to restore albumin above 3.5 g/dL, which has been shown to reduce wound complication rates in malnourished surgical patients,[6][16] and clinical trial-level consideration of prophylactic mesh augmentation at index laparotomy for patients with three or more risk factors, as evaluated in the PRIMA randomised controlled trial.

8. Conclusion

This retrospective cohort study from Peoples College of Medical Sciences, Bhopal, establishes a 22.8% incisional hernia incidence following midline laparotomy--above international benchmarks and driven predominantly by surgical site infection (PAR 31.4%), obesity, mass closure technique, and hypoalbuminaemia as independent, quantified, and modifiable risk factors. The Cox proportional hazards model (C-statistic 0.81) provides a validated risk-stratification tool for PCMSR surgical wards, enabling pre-operative identification of the highest-risk patients for targeted prophylactic intervention. The three evidence-based quality improvement priorities identified are: (i) adoption of continuous small-bites suture closure with SL:WR >=4:1 as the institutional standard closure technique; (ii) implementation of an SSI prevention bundle targeting the 17.0% SSI rate; and (iii) pre-operative nutritional optimisation for hypoalbuminaemic patients (albumin <3.5 g/dL) identified on routine pre-operative screening. Implementation of these three measures is projected to reduce PCMSR hernia incidence from 22.8% to below 14%, aligning with regional best-practice benchmarks.

9. Limitations of the Study

(i) Retrospective design is subject to selection and information bias; closure technique classification relied on operative note documentation quality, which was incomplete in 8 excluded records. (ii) Follow-up was limited to the study period; cumulative hernia incidence would be higher with longer observation, as up to 50% of hernias present after 12 months. (iii) Routine ultrasound was not performed in asymptomatic patients, leading to possible under-ascertainment of small or subclinical hernias. (iv) SL:WR ratio was estimated from recorded suture length and wound measurement rather than intraoperative real-time measurement in all cases, introducing measurement imprecision. (v) Prophylactic mesh augmentation was not used in any patient, limiting generalisability to settings where this practice exists. (vi) Nutritional supplementation protocols varied between surgeons during the study period, limiting the ability to study nutritional intervention as a modifying variable.

10. References

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