Outcomes Of Robotic Versus Open Parastomal Hernia Repair: A Propensity Score-matched Analysis

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Background

- **Parastomal hernia (PSH**) is a common complication following stoma formation, with an **incidences of 30–50%**, and is associated with significant morbidity, including **pain**, **appliance difficulties**, and **impaired quality of life**.
- In the emergency setting, PSH may present with obstruction, incarceration, or ischemia, often **requiring urgent surgical intervention**.
- Open repair is the standard approach but is associated with **high morbidity**, **prolonged length of stay**, and **recurrence rates of up to 45%**
- Minimally invasive approaches have been increasingly adopted to improve outcomes

Objectives

To evaluate and compare **outcomes of open versus minimally invasive (laparoscopic and robotic) approaches** in emergency parastomal hernia repair, addressing the limited existing evidence

Methods

- **Study design:** Retrospective cohort study using ACS-NSQIP database
- **Case identification:**
 - ICD-10: K43.3, K43.5 (parastomal hernia without gangrene).
 - Emergent cases were identified using NSQIP "acuity" variable including cases coded as "emergent".
 - CPT codes 49621, 49622, and 44346 parastomal hernia repairs.
- **Cohort definition:**
 - Open repair
 - Minimally invasive (laparoscopic and robot) repair
- **Outcomes:**
 - 30-day morbidity and complication rates
- **Analysis:**
 - Multivariate logistic regression to identify risk factors for complications

Results

Table 1. ***Clinicopathological and surgical characteristics of patients who underwent parastomal hernia repair in an emergency setting from 2022 to 2023 according to the surgical approach in an emergency setting after propensity score matching.***

Characteristics	After propensity matching			
	N=144	Open N=144	Minimally invasive (Laparoscopic / Robotic)=192	
Age – years ± SD	67.53±14.65	66.94±14.59	67.39±14.60	0.807[a]
Age >65 years	90 (62.5)	32 (66.7)	122 (63.5)	0.603[b]
Sex				
Female	82 (56.9)	27 (56.3)	109 (56.8)	0.933[b]
Male	62 (43.1)	21 (43.8)	83 (43.2)	
Race				
White	100 (69.4)	41 (85.4)	141 (73.4)	0.030[b]
African-American and others	44 (30.6)	7 (14.6)	51 (26.6)	
Hispanic ethnicity	7 (6.4)	2 (5.0)	9 (6.0)	0.756[b]
BMI – kg/m²	32.62±7.43	33.99±9.51	32.96±8.00	
BMI classification				0.308[a]
<30	55 (38.5)	18 (37.5)	73 (38.0)	0.932[b]
≥30	89 (61.8)	30 (62.5)	119 (62.0)	
Smoking	17 (11.8)	5 (10.4)	22 (11.5)	0.794[b]
Diabetes Mellitus	26 (18.1)	9 (18.8)	35 (18.2)	0.914[b]
COPD	16 (11.1)	3 (6.3)	19 (9.9)	0.329[b]
CHF	11 (7.6)	7 (14.6)	18 (9.4)	0.153[b]
Hypertension	89 (61.8)	30 (62.5)	119 (62.0)	0.932[b]
Metastatic cancer	8 (5.6)	4 (8.3)	12 (6.3)	0.491[b]
Immunosuppression	17 (11.8)	4 (8.3)	21 (10.9)	0.504[b]
Bleeding disorder	22 (15.3)	5 (10.4)	27 (14.1)	0.401[b]
Acute kidney injury	3 (2.1)	2 (4.2)	5 (2.6)	0.600[c]
Sepsis	44 (30.6)	9 (18.8)	53 (27.6)	0.113[b]
ASA – ASA classification ± SD	3.02±0.51	3.08±0.50	3.04±0.51	0.462[a]
Hematocrit – % ± SD	39.59±6.30	37.88±574	39.16±6.19	0.098[a]
Platelets – platelets/mcL ± SD	265.48±100.06	211.52±45.80	251.17±92.37	0.001[a]
Albumin – g/dL	3.84±0.63	3.61±0.63	3.79±0.63	0.049[a]
Creatinine – mg/dL ± SD	1.13±0.79	1.03±0.38	1.10±0.72	0.407[a]
Operative time – min ± SD	135±0.75	141.35±0.87	137.02±77.98	0.657[a]

[a] Student's t-test (Mean ± standard deviation)
[b] Chi-squared analysis
[c] Fisher's exact test

Figure 1. ***Covariate balance after propensity score matching for key preoperative variables***

Characteristics				
Surgical approach	Open N=404 N (%)	Robotic N=404 N (%)	Total N=808 N (%)	P value
Overall complications	101 (25.0%)	50 (12.4%)	151 (18.7)	<0.001[a]
Surgical complications	45 (11.1%)	22 (5.4%)	67 (8.3)	0.003[a]
Wound complications	57 (14.1%)	21 (5.2%)	78 (9.7)	<0.001[a]
Medical complications	66 (16.3%)	36 (3.9%)	102 (12.6%)	<0.001[a]
Superficial SSI	26 (0.4%)	8 (2.0%)	34 (4.2%)	0.002[a]
Deep SSI	11 (2.7%)	3 (0.7%)	14 (1.7%)	0.031[a]
Organ/space SSI	19 (4.7%)	10 (2.5%)	29 (3.6%)	0.089[a]
Wound dehiscence	5 (1.2%)	0 (0.0)	5 (0.6%)	0.025[a]
Pneumonia	14 (3.5%)	6 (1.5%)	26 (2.5%)	0.070[a]
Reintubation	6 (1.5%)	5 (1.2%)	11 (1.4%)	0.412[a]
Pulmonary embolism	4 (1.0%)	2 (0.5%)	6 (0.7%)	0.255[a]
Deep vein thrombosis	5 (1.2%)	2 (0.5%)	7 (0.9%)	0.255[a]
>48 on the ventilator	21 (5.2%)	14 (3.5%)	35 (4.3%)	0.226[a]
Renal insufficiency	1 (0.2%)	1 (0.2)	2 (0.2%)	1.000[b]
Dialysis	9 (2.2%)	7 (1.7%)	16 (2.0%)	0.614[a]
Urinary tract infection	3 (0.7)	3 (0.4%)	3 (0.4%)	0.024[a]
Stroke	2 (0.3%)	1 (0.9)%)	3 (0.4%)	-
Cardiac arrest	13 (3.2%)	2 (0.5%)	15 (1.9%)	0.004[a]
Myocardial infarction	11 (2.7%)	9 (2.2%)	20 (2.5%)	0.651[a]
Bleeding requiring blood transfusion	6.08±5.53	3.26±4.06	4.67±5.04	<0.001[c]
Post operative sepsis	6.08±5.53	22±5.4	57 (7.1)	0.074[a]
Septic shock	35 (8.7%)	22 (5.4%)	125 (15.5)	0.004[a]
Length of stay, days – mean ± SD				
70 (17.3%)	20 (17.3)	55 (13.6)	25 (3.1%)	0.002[a]
Return to the operating room	19 (4.7)	6 (20.7)	25 (3.1)	0.002[a]
Readmission	17 (4.2%)	23 (7.9%)	40 (5.0%)	0.040[a]
Wound infection or, dehiscence	19 (4.7)	6 (20.7)	25 (3.1)	0.002[a]
Ileus/bowel obstruction	17 (4.2%)	23 (7.9%)	40 (5.0%)	0.040[a]

SSI, surgical site infection.
[a] p-value calculated using chi-square test.
[b] p-value calculated using Fisher's exact test
[c] p-value calculated using ANOVA test
[d] p-value calculated using Students T test

After matching (n=5,259), robotic repair was associated **with lower overall complications** (4.8% vs 19.6%, aOR 0.19, p<0.001), including wound (2.2% vs 10.2%, aOR 0.16), surgical (2.9% vs 10.0%, aOR 0.27), and medical complications (2.0% vs 7.0%, aOR 0.23). **Robotic cases also had shorter LOS** (1.34 vs 3.86 days) and fewer readmissions (4.4% vs 9.1%) (all p<0.001)

Discussion

- After propensity score matching, robotic repair was associated with significantly lower rates of overall, surgical, wound related, and medical complications compared to open surgery.
- Patients undergoing robotic repair experienced shorter LOS, fewer wound infections and reduced transfusion requirements.
- Open repair patients had lower preoperative albumin, this may reflect selection bias, where more fragile patients are assigned to open surgery. Low albumin levels could partly explain differences in postoperative outcomes, including poorer wound healing and higher risk of infections.
- Robotic approach allows precise, tension-free mesh placement and facilitate complex reconstructive maneuvers such as intracorporeal closure.
- Minimizing operative time may reduce postoperative morbidity.
- These collective findings corroborate our observation that robotic repair not only improves perioperative morbidity but also promotes faster recovery

Conclusion

- Robotic-assisted PSH repair is associated with significantly lower complication rates and shorter length of stay compared to open surgery
- These findings support the role of robotic surgery in improving patient outcomes and recovery
- Further prospective studies are needed to validate these results and refine patient selection

References

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