When is a Robotic Approach Valuable in Ventral Hernia Repair?

Abstract ID: 2140193 | Authors: Rory Carroll MD, Bruce Ramshaw MD, Eric Heidel PhD, John Cromwell MD, Mallory Kallish, Elle McCormick, Haley Steffen MD, Peter Nau MD, MS, FACS

PURPOSE

Traditional research often oversimplifies surgical innovation, asking whether a technology like robotic surgery is universally "good" or "bad" for all patients. This project challenges that binary approach, applying systems science principles and non-linear data analytics to explore where robotic ventral hernia repair (VHR) delivers the most value.

By analyzing five years of real-world data from a Clinical Quality Improvement (CQI) initiative, this project seeks to identify specific patient subgroups and procedural scenarios where robotic VHR outperforms other approaches—thereby promoting smarter, more sustainable use of advanced surgical technologies across health systems.

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MATERIALS AND METHODS

- **Study Type:** Clinical Quality Improvement (CQI) initiative
- **Setting:** Single academic medical center
- **Timeframe:** 2019 – 2023
- **Sample:** 485 consecutive VHR patients treated with open, laparoscopic or robotic approaches

Approach:

- Compared robotic, open, and laparoscopic VHR techniques
- Applied non-linear data science tools to identify value patterns
- Evaluated outcomes across surgical complexity, patient comorbidities, and hernia characteristics

Key Variables:

- Surgical approach
- Hernia size (3–10 cm focus)
- Recurrence history and prior abdominal operations
- Patient age and health status
- Clinical outcomes: complications, length of stay, hospital margin

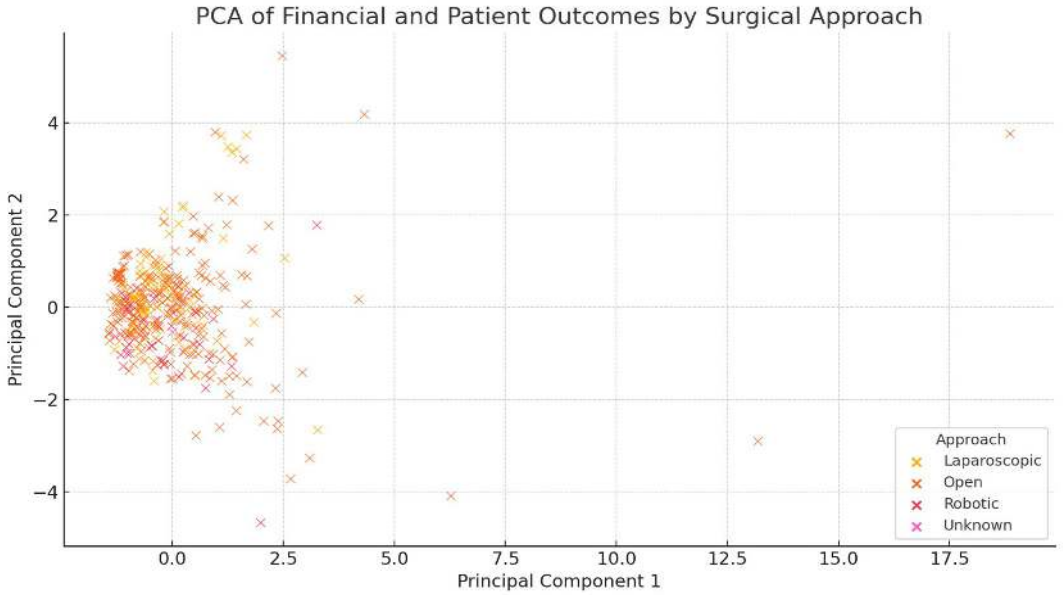
485 Patients

Female 244 / Male 241

5 Years

2019 - 2023

Open / Laparoscopic / Robotic



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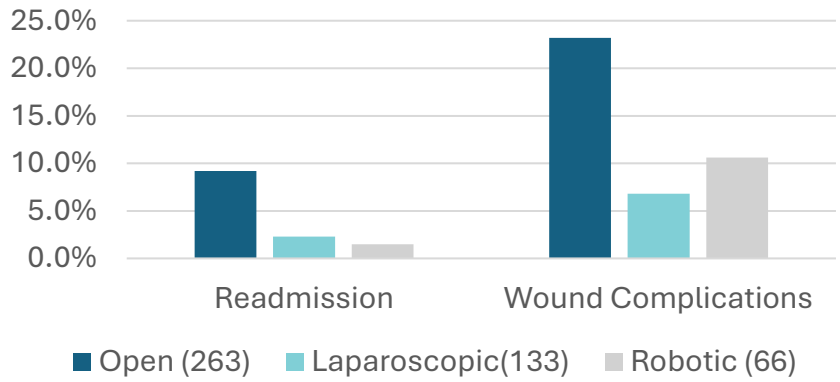
	OPEN (263)	ROBOTIC (66)	LAPAROSCOPIC (133)	P-VALUE
Female (%) / Male (%)	138 (52.5%) / 125 (47.5%)	30 (45.5% / 36 (54.5%)	68 (51.1%) / 65 (48.9%)	p = 0.60
Prior Hernia Repair (%)	112 / 263 (42.6)	28 / 66 (42.4%)	53 / 133 (39.8%)	p = 0.87
Age, Years (SD)	57.2 (+/- 13.0)	58.2 (+/- 11.7)	56.5 (+/- 13.5)	p = 0.69
BMI (SD)	32.32 (+/- 7.38)	32.16 (+/- 6.04)	32.26 (+/- 6.16)	p =0.99
Smoking (%)	20 / 263 (7.6%)	3/66 (4.5%)	6/133 (4.5%)	p = 0.40
OR Time, Minutes (SD)	158.7 (+/- 103.8)	**208.2 (+/- 90.7)**	165.3 (+/- 73.3)	**p = 0.0004**
Length of Stay, Days (SD)	**3.9 (+/- 4.6)**	1.7 (+/- 1.9)	1.8 (+/- 1,7)	**p < 0.00001**
Hospital Readmission (%)	**24 / 263 (9.2%)**	1/66 (1.5%)	3 / 133 (2.3%)	**p = 0.006**
Wound Complications (%)	**61 / 263 (23.2%)**	7/66 (10.6%)	9 / 133 (6.8%)	**p < 0.001**
Total Cost, Dollars (SD)	14,980 (+/- 15,732)	14,988 (+/- 6,980)	**11,383 (+/- 4,930)**	**p = 0.0166**
Hospital Profit/Loss (SD)	1,031 (+/- 8,992)	**-4,149 (+/- 6,423)**	1,428 (+/- 7,289)	**p = 0.000004**

RESULTS

Linear analysis showed robotic VHR had higher costs, longer OR times, and similar clinical outcomes compared to laparoscopic surgery. However, non-linear analysis identified a specific subpopulation—younger, medically low-risk patients with moderate (3–10 cm), and complex hernias with a higher rate of prior abdominal surgery and recurrent hernias—where robotic VHR provided clear value. In these cases, the approach improved outcomes and justified higher resource use.



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CONCLUSION

Robotic ventral hernia repair is not universally superior, however offers distinct value for specific patient profiles. This study shows that younger, healthier patients with complex, moderate-sized hernias benefit most from a robotic approach. By using systems and data science tools to match surgical method to patient need, we can improve outcomes, optimize resource use, and move toward a more sustainable, value-based healthcare model.