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Laparoscopic Colectomy in a Rural Australian Centre: A 10-Year Retrospective Audit of Safety and Operative Outcomes

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Abstract

Background:

Laparoscopic colectomy is the gold-standard approach for elective colonic resection, demonstrating reduced morbidity and improved postoperative recovery compared with open surgery. Although well supported in metropolitan centres, outcomes from rural hospitals remain underreported. This study evaluates the safety, oncological adequacy, and sustainability of a laparoscopic colectomy service delivered over a decade at a rural Australian centre.

Methods:

A retrospective audit was performed on all planned laparoscopic colectomies undertaken at Armidale Rural Referral Hospital, New South Wales, between August 2015 and September 2025. Data points included demographic variables, operative details, complications, length of stay, pathology results, oncological indicators, and 30-day outcomes. Results were compared with national benchmarks from the Australia and New Zealand Bowel Cancer Outcomes Registry.

Results:

A total of 107 patients were included (mean age 69.5 years; 49.5% female). A laparoscopic or hybrid approach was completed in 78.5% of cases. Mean length of stay was 8.3 days. Surgical complications occurred in 12.1% of patients, including a 3.7% anastomotic leak rate. Thirty-day representation and readmission rates were 11.2% and 7.5%, respectively. 30-day mortality was 0.9%. The mean lymph node yield was 18.1, exceeding accepted oncological standards, and clear margins were achieved in 93.5% of malignant cases. Results all aligned closely with national registry outcomes.

Conclusion:

This 10-year audit demonstrates that laparoscopic colectomy can be delivered safely and sustainably in a rural Australian centre. Outcomes were consistent with national benchmarks, supporting the capacity of rural hospitals to provide high-quality minimally invasive colorectal surgery close to home for rural patients.

Introduction

Laparoscopic colectomy has gained widespread recognition and adoption in colorectal surgery. Since first described in 1991 by Jacobs et al., numerous studies have confirmed feasibility, safety and oncological efficacy of this technique.[1–12] The laparoscopic approach has been strongly associated with reduction in length of stay, mortality, complication rate, ICU admission and blood loss.[5–8, 10–12] Additionally, patients who undergo laparoscopic colectomy report improved quality-of-life outcomes when compared to those who have received open surgery.[13–14] This technique has become the

established gold standard of care in surgical management of patients requiring elective colonic resection.

Armidale is a rural centre located in the Northern Tablelands of New South Wales, Australia. Most recent census data estimate a population of approximately 24,000 residents, with a median age of around 35 years.[15] The region serves as a service hub for a much wider rural catchment area and has growing healthcare infrastructure requirements to meet the needs of this population.

Laparoscopic colectomy was initiated in Armidale Rural Referral Hospital (ARRH) in August 2015. Initial feasibility was demonstrated through outcomes recorded at inception. Longer term sustainability, safety and quality of a laparoscopic colectomy program in this rural setting has awaited validation. Here we present a retrospective analysis of outcomes for 107 cases completed during this 10-year period.

Primary Aim:

This study presents a 10-year retrospective audit of laparoscopic colectomy outcomes at a single rural Australian centre, with the primary aim being to demonstrate long-term safety, oncological adequacy, and sustainability of the service.

Methods

This was a single-centre, retrospective audit of all consecutive patients undergoing planned laparoscopic colectomy at Armidale Hospital, a rural referral centre in New South Wales, Australia, between August 2015 and September 2025. Data were collected from a prospectively maintained operative log.

All patients who were booked for planned laparoscopic colectomy at ARRH during the study period were included in the analysis. Informed consent was not obtained because the project was classified as a quality improvement audit of standard care, with approval and institutional oversight granted by the relevant line manager within the Hunter New England Human Research Ethics Committee. Patients were identified based on their elective operating theatre booking on the electronic hospital database. A laparoscopic approach was planned for all elective colonic resections unless contraindicated. General exclusion criteria for a laparoscopic approach were consistent with those used in clinical guidelines and major trials[16, 17] and included: tumours with clinical or radiological evidence of invasion into adjacent structures (T4b), body mass index (BMI) > 45, patients with previous major abdominal surgery precluding safe laparoscopic access, and emergency presentations. Armidale Hospital's capacity to manage high-risk patients is limited by its infrastructure. The highest level of care available is the nurse-led Close Observation Unit, as the facility does not have a dedicated Intensive Care Unit. Furthermore, after-hours anaesthetic support is provided on an on-call basis, which may not be immediately available for critical, time-sensitive situations. For this reason, ASA Grade IV (American Society of Anaesthesiologists) patients are deemed too high risk for elective surgery at ARRH.

Data points collected in this analysis included age, gender, procedure type, conversion to open/hybrid approach, duration of procedure, length of stay, inpatient complication rate, anastomotic leak rate, representation rate, readmission rate, pathology result, lymph node yield, resection margin status (R0 rate) and inpatient/ 30-day mortality. Data points are listed with standard deviations and 95% confidence intervals where possible.

Results

Patient demographics are displayed below in Table 1, hospital and oncological outcomes are displayed in Table 2.

Table 1
Patient Demographics Clinical demographic data of included patients from recorded operative log.

Category	Variable	Value (mean, 95% CI)
Demographics	Total patients	107
	Female	53 (49.5%)
	Male	54 (50.5%)
	Age, mean ± SD	69.5 ± 12.6 years
	Age, median (range)	72 (26–90) years
Procedure Type	Laparoscopic	74 (69.2%)
	Open	23 (21.5%)
	Hybrid	10 (9.3%)
	Conversion rate (lap to open)	23.7%
	Conversion including hybrid/partial	30.8%
Procedure	Right Hemicolectomy	45 (42%)
	Extended Right Hemicolectomy	7 (6.5%)
	Left Hemicolectomy	11 (10.2%)
	Sigmoid Colectomy	15 (14%)
	Anterior Resection	24 (22.4%)
	Loop Colostomy	3 (2.8%)
	Rectosigmoid Colectomy	1 (0.9%)
	Transverse Colectomy	1 (0.9%)

Table 2
Patient Outcomes Surgical, hospital and oncological outcomes. Data collected from hospital clinical software system database.

Duration of Surgery	**Mean ± SD**	**270.6 ± 89.9 mins**
	Median (range)	**257 (100–555) mins**
Pathology	Benign	27 (25.2%, 95% CI 17.0–33.5%)
	Malignant	80 (74.8%, 95% CI 65.6–82.3%)
Lymph Nodes	Total collected	1,519
	Malignant nodes	94 (6.2%, 95% CI 5.0–7.5%)
	Mean ± SD	18.1 ± 8.5 (95% CI 16.5–19.7)
	Median (range)	17 (7–50)
Margins	Clear	100 (93.5%, 95% CI 87.7–97.1%)
	Positive	5 (4.7%, 95% CI 0.7–8.7%)
Complications	Any inpatient complication	31 (29.0%, 95% CI 20.6–38.7%)
	Surgical complication	13 (12.1%, 95% CI 6.5–20.2%)
	Anastomotic leak	4 (3.7%, 95% CI 1.0–9.3%)
Length of Stay	Mean ± SD	8.3 ± 6.7 days
	Median (range)	6 (3–45) days
Representation	Represented (30 days)	12 (11.2%, 95% CI 5.8–18.7%)
Readmission	Readmitted (30 days)	8 (7.5%, 95% CI 3.3–14.2%)
Mortality	Inpatient	1 (0.9%, 95% CI 0.02–5.1%)

Demographics and Procedure:

A total of 107 patients were included. The cohort had a mean age of 69.4 years (range: 26–90). The patient population was comprised of 49.5% females indicating a relatively even distribution of gender.

Procedure type, Length & Conversion:

The median duration of surgery was 257 minutes (mean 270.6 ± 89.9 SD; range

100–555). A purely laparoscopic approach was completed in 74/107 cases (69.2%). The conversion rate to open surgery was 23.7% (23/97). When including hybrid procedures, where a planned laparoscopic

case required an open component, the overall conversion/modification rate was 30.8% (33/107). The most commonly performed procedure was laparoscopic right hemicolectomy.

Length of Stay:

The mean length of hospital stay was 8.33 days (SD 6.7; median 6; range 3–45). Prolonged admissions in a subset of patients contributed to the wide variability in length of stay. These were largely influenced by significant comorbidity, medical deterioration or surgical complication in extending recovery time.

Inpatient Complications & Anastomotic Leak:

Inpatient complications occurred in 31 of 107 patients (29.0%), including 13 surgical complications (12.1%). The anastomotic leak rate was 3.7% (4/107).

The most frequent complications observed were medical in nature, with postoperative ileus, anaemia and urinary retention being the most common. Other notable medical issues included pulmonary embolism, pneumonia, acute kidney injury and respiratory failure. Among surgical complications, anastomotic leak was the most common, followed by wound-related issues such as infection, dehiscence, and intra-abdominal or wound collections.

30-Day Representation, Readmission & Mortality:

A total of 12 patients represented within 30 days following discharge, giving a representation rate of 11.2% (95% CI 5.8–18.7%). The most common reasons for representation were abdominal pain and PR bleeding. Of these patients, 8 required readmission (7.5% mean, 95% CI 3.3–14.2%), most commonly related to postoperative complications such as wound infection or ileus.

The mortality rate was 0.9% (1/107; 95% CI 0.02–5.1%), with one death recorded in hospital. The equality of inpatient and 30-day mortality shows that no additional deaths recorded after discharge within the first 30 days.

Oncology Metrics: pathology result, lymph node yield, resection margin status (R0 rate):

Histopathology revealed malignant disease in 80 of 107 patients (74.8%), with the remaining 27 cases (25.2%) reflecting benign pathology. The mean number of lymph nodes harvested per patient was 18.1 (95% CI 16.5–19.7; SD 8.5; range 7–50). This far exceeded the internationally accepted and Australian guideline standard of at least 12 nodes resected to be an indicative marker of surgical quality.[18] A total of 1,519 lymph nodes were collected, of which 6.2% (94/1519) were malignant. Resection margins were clear in 100 patients (93.5%), with positive margins observed in 5 patients (4.7%, 95% CI 0.7–8.7%).

Discussion

This 10-year retrospective audit demonstrates that laparoscopic colectomy can be performed safely, effectively, and sustainably in a rural referral centre.

The Australia and New Zealand Bowel Cancer Outcomes Registry (BCOR) is an annual database for outcomes related to colorectal cancer outcomes.[19] This includes patient demographics, treatment details, complications and mortality. There are some limitations in this comparison, especially the limited sample size in this audit, thus formal statistical comparison was not feasible. Compared with BCOR data from 3,753 patients (December 2023 – December 2024), the audit cohort showed broadly comparable results across all measures. Here, audit values are displayed first, followed by BCOR values. The mean age (69.5 vs 68 years) and gender distribution (49.5% vs 47.3% female) were comparable. Inpatient mortality was low in both groups (0.9% vs 1.1%), while surgical complications were substantially lower in the audit cohort (12.1% vs 19.3%). Specifically, anastomotic leak rates were low and comparable between groups (3.7% vs 2.5%). Mean lengthof-stay was only slightly longer in the audit group (8.3 vs 7.6 days). Oncological outcomes were also favourable, lymph node yield and R0 resection rates were either comparable or outperforming international and Australian standards.[18] The rate of resection margin involvement was comparable in both groups (4.7% vs 4%). The mean number of lymph nodes harvested was significantly above the international standard of 12 nodes both the audit and BCOR cohorts (18 vs 22). Overall, these findings suggest that high-quality laparoscopic colectomy outcomes can be achieved in a rural centre, matching national benchmarks.

Limitations:

This audit has some inherent limitations. Its retrospective design carries risks of incomplete documentation and potential selection bias, particularly as higher-risk patients are often referred on to tertiary centres, which may underestimate complication rates and favour outcomes in other metrics. Patients deemed unsuitable for treatment at Armidale Hospital are usually high anaesthetic risk or those with complex oncosurgical disease requiring care within a colorectal department. The sample size of 107 patients limits statistical power and restricts the ability to perform robust comparative analyses with larger datasets such as BCOR. As a single-centre rural audit, findings may not be generalisable to other institutions with different case-mix profiles, surgical experience or resource availability. Finally, long-term oncological outcomes such as disease-free and overall survival were not evaluated, preventing assessment of longer-term efficacy beyond perioperative and hospital-based metrics.

Conclusion

Beyond clinical metrics, these findings emphasize the broader benefits of providing high-quality colorectal surgery locally. Patients in rural regions typically face substantial barriers to accessing metropolitan hospitals, including travel time, accommodation costs, and disruption to family and community support networks. The ability to undergo elective laparoscopic colectomy close to home not

only mitigates these social and logistical burdens but also supports continuity of care, ease of representation and may potentially improve patient satisfaction and quality-of-life outcomes. Despite surgical service centralisation in Australia, many core surgeries can be safely performed in rural hospitals, and patients should be supported to make informed choices that balance convenience, risk, and quality of care.[20]

This audit highlights that with the right infrastructure and surgical expertise, rural hospitals can provide high-quality care on par with major centres, reinforcing that excellent minimally invasive colorectal surgery can be delivered close to home for rural patients without compromising outcomes.

Abbreviations

ARRH- Armidale Rural Referral Hospital

BMI- Body Mass Index

ICU- Intensive Care Unit

BCOR- Bowel Cancer Outcomes Registry

SD- Standard Deviation

CI- Confidence Interval

Declarations

Ethics approval and consent to participate:

This manuscript has been reviewed by the Hunter New England Health District Research Office. Based on the information provided, this project does not appear to have any ethical risks (as per NSW Health Quality Improvement and Ethics Review: A Practice Guide for NSW) and therefore ethics review is deemed not required. These guidelines are in accordance with the ICMJE recommendations for the conduct of scholarly work in medical journals. Formal ethical review and individual informed consent were deemed unnecessary for this project in accordance with NSW Health guidelines (Quality Improvement and Ethics Review: A Practice Guide).

Informed consent was not obtained from participants as the project was assessed as a quality improvement / retrospective audit of standard care with no ethical risks, receiving institutional oversight and approval from the relevant line manager and Tier 2 Executive within the Hunter New England Human Research Ethics Committee. Furthermore, the waiver of informed consent aligns with national standards for research involving non-identifiable data under the Australian *National Statement on Ethical Conduct in Human Research* (National Health and Medical Research Council, 2023; specifically Section 2.3.10),

given that the audit involved pre-existing, de-identified data of standard care presenting negligible risk to participants and individual consent was impracticable to retrospectively obtain.[21]

Consent for publication:

Not Applicable

Availability of data and materials:

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests:

The authors declare that they have no competing interests.

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Authors' contributions:

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S Smith	Conceptualization, Supervision, Writing – review & editing, Validation.
S Karunaratne	Project administration, Supervision, Writing – review & editing.
J Barker	Project administration, Supervision, Writing – review & editing.
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