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Prospective Evaluation of Laparoscopic D3 Right Hemicolectomy: A Single Center Experience of 142 Cases

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Abstract **Background:** Adequate lymphadenectomy is a key determinant of oncologic outcomes in right-sided colon cancer, influencing staging accuracy, adjuvant therapy and long-term survival. D3 lymphadenectomy combined with Complete Mesocolic Excision (CME) has demonstrated superior nodal yield and oncologic clearance compared with conventional resections. However, the laparoscopic approach remains technically demanding and prospective data from the Indian subcontinent are limited. This study aimed to evaluate the feasibility, safety and short-term oncologic outcomes of laparoscopic D3 right hemicolectomy. **Methods:** This prospective observational study was conducted at a tertiary care teaching hospital between January 2018 and December 2025. Patients aged ≥18 years with histologically confirmed right-sided colon adenocarcinoma undergoing elective laparoscopic D3 right hemicolectomy were included. A standardized medial-to-lateral approach with central vascular ligation and CME was used in all cases. Primary outcomes included feasibility, lymph node yield and R0 resection rate, while secondary outcomes included operative parameters, postoperative recovery and 30-day morbidity and mortality. **Results:** A total of 142 patients underwent laparoscopic D3 right hemicolectomy. All procedures were completed laparoscopically with a conversion rate of 0%. The mean operative time was 146±34 minutes and mean intraoperative blood loss ranged from 100 to 150 mL. The mean lymph node yield was 45±8.4. R0 resection was achieved in all patients. Early postoperative recovery was observed, with tolerance of solid oral diet at a mean of 24 hours and a mean hospital stay of 7 days. Major complications included anastomotic leak in 3 patients (2.1%) and wound-related complications in 5%, with no 30-day mortality. **Conclusion:** Laparoscopic D3 right hemicolectomy is a safe, feasible and oncologically sound procedure in experienced centers. The high lymph node yield, zero conversion rate and acceptable morbidity support its role in the management of right-sided colon cancer. Further multicentric studies with long-term follow-up are required to establish survival benefits.

Key Words Laparoscopy, Colon, D3 Lymphadenectomy, Central Vascular Ligation, Oncologic Outcomes

INTRODUCTION

Right-sided colon cancer constitutes a significant proportion of colorectal malignancies. Adequate lymphadenectomy is a critical determinant of oncologic outcomes, influencing staging accuracy, adjuvant therapy and survival. The concept of D3 lymphadenectomy, originally described in Japanese oncologic practice, involves removal of lymphatic tissue along the central feeding vessels combines with Complete Mesocolic Excision (CME) [1,2].

Several studies have demonstrated superior lymphnode yield and improved oncologic clearance with D3 dissection compared to conventional D2 resection [3,4]. However, laparoscopic D3 right hemicolectomy remains technically demanding due to complex anatomy and proximity to the superior mesenteric vessels [5,6]. Consequently, its adoption has largely been limited to high-volume centers.

Prospective data evaluating laparoscopic D3 hemicolectomy, particularly from the Indian subcontinent, remain scarce. The present study reports our Prospective single-center experience with laparoscopic D3 right hemicolectomy over a seven-year period, focusing on feasibility, safety and short-term oncologic outcomes.

METHODS

Study Design

This is a Prospective observational study conducted at a tertiary care teaching hospital by a single operating surgeon from January 2018 to December 2025. Institutional ethics committee approval was obtained and informed consent was taken from all patients.

Patient Selection

Patients aged ≥= 18 years with histologically proven right-sided colon adenocarcinoma (cecum, ascending colon, hepatic flexure) planned for elective laparoscopic surgery were included.

Exclusion Criteria

- Emergency presentation
- Distant metastasis at presentation
- Palliative resections

Preoperative evaluation included colonoscopy with biopsy and contrast-enhanced computed tomography for staging (Figure 1).

Surgical Technique

All procedures were performed under general anesthesia using a standard multi-port laparoscopic technique. The Figure 2 demonstrates laparoscopic port placement for colorectal surgery. A 10 mm camera port is positioned at the umbilicus to provide central visualization of the operative field. A 12 mm working port is placed in the left hypochondrium, allowing introduction of larger instruments such as staplers or advanced energy devices. Two 5 mm working ports are positioned in the lower quadrants to facilitate appropriate triangulation and ergonomic instrument manipulation.

This port configuration enables optimal exposure, safe dissection along anatomical planes and effective instrument handling during the procedure.

A medial-to-lateral approach (Figure 3) was employed in all cases. The SMV and ileocolic vessels were identified and ligated at their origin from the superior mesenteric artery and vein (Figure 4). When present, the right colic vessels were ligated centrally. The right branch of the middle colic artery or the main pedicle of middle colic was divided flushly at its origin (Figure 5). D3 lymphadenectomy was defined as central vascular ligation with removal of lymphatic tissue along the main feeding vessels, combined with complete mesocolic excision.

The Figure 6 demonstrates division of the greater omentum during right hemicolectomy. The omentum is elevated and dissected using an advanced energy device,

Figure 1: CECT Image of Ascending Colon Growth (Blue Arrows)

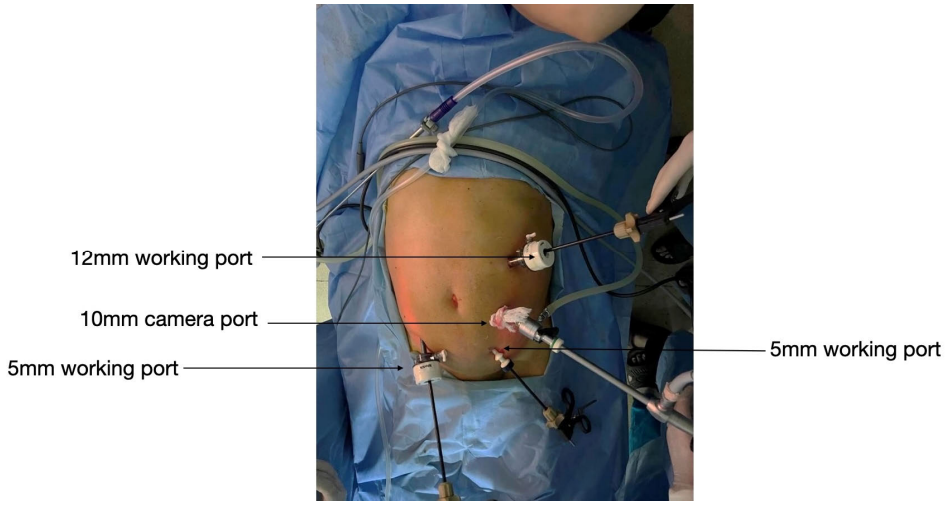

Figure 2: Laparoscopic Port Positions

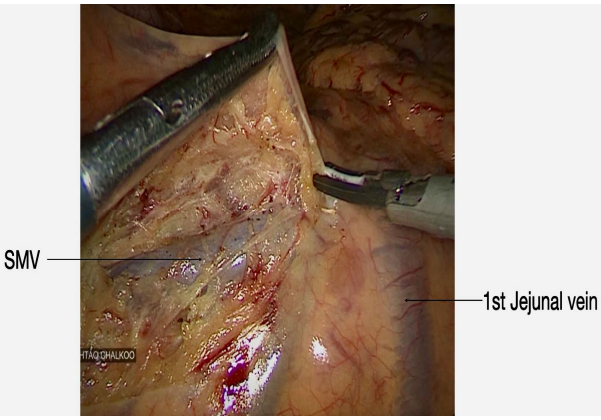

Figure 3: SMV First Approach

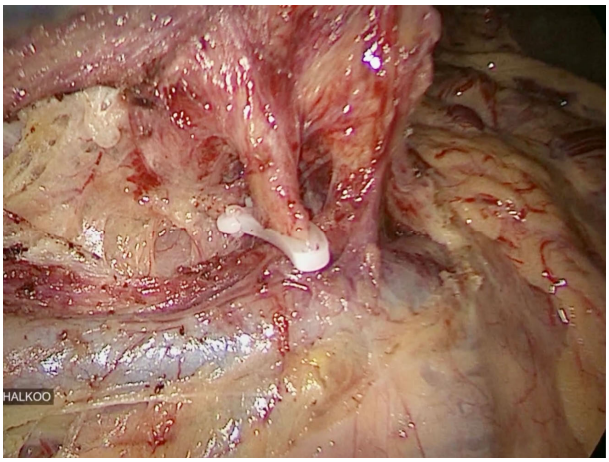

Figure 4: Ileocolic pedicle flushly ligated at its origin

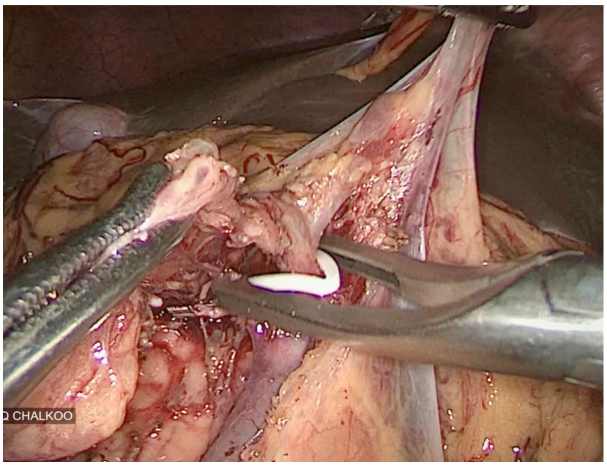

Figure 5: Ligation of Middle colic pedicle

separating it from the transverse colon along the avascular plane. This step facilitates entry into the lesser sac and mobilization of the hepatic flexure, ensuring safe exposure of the gastrocolic ligament and middle colic vessels, ensures oncological clearance adequate oncologic clearance and

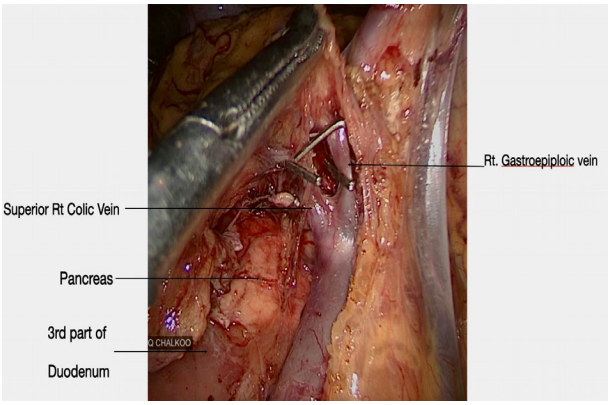

Figure 6: Omentectomy

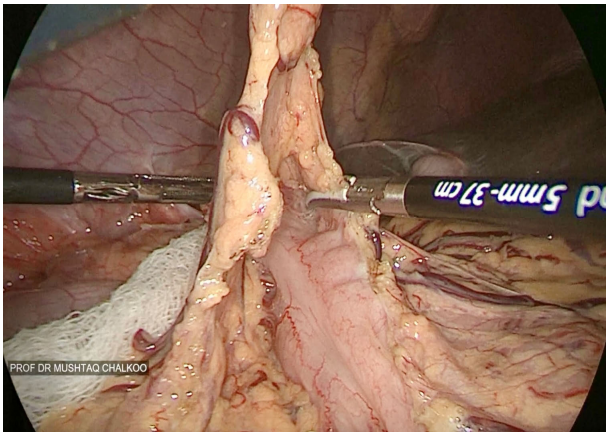

Figure 7: Ligation of Gastro-Colic Trunk of Henle

exposure of the transverse mesocolon. Care is taken to maintain hemostasis and preserve surrounding structures while completing the omental division.

A medial-to-lateral approach facilitates early exposure of the Superior Mesenteric Vein (SMV), allowing precise identification of the GCTH at its junction with the SMV. Careful sharp dissection along the SMV, with meticulous clearance of surrounding lymphatic and adipose tissue, is essential due to the significant anatomical variability of the GCTH. Controlled ligation using clips or energy devices minimizes the risk of venous avulsion and troublesome bleeding, which can be difficult to control laparoscopically (Figure 7).

Gastrocolic ligament division (Figure 8) provides access to the lesser sac and aids medial-to-lateral dissection and hepatic flexure mobilization.

The transverse colon is transected using an endostapler introduced through the mesenteric window, while the terminal ileum is dissected to facilitate specimen mobilization (Figure 9, 10).

Colonic mobilization (Figure 11) was completed and bowel continuity was restored using intracorporeal or extracorporeal anastomosis based on surgeon preference. Specimen extraction was performed using a protective retrieval bag.

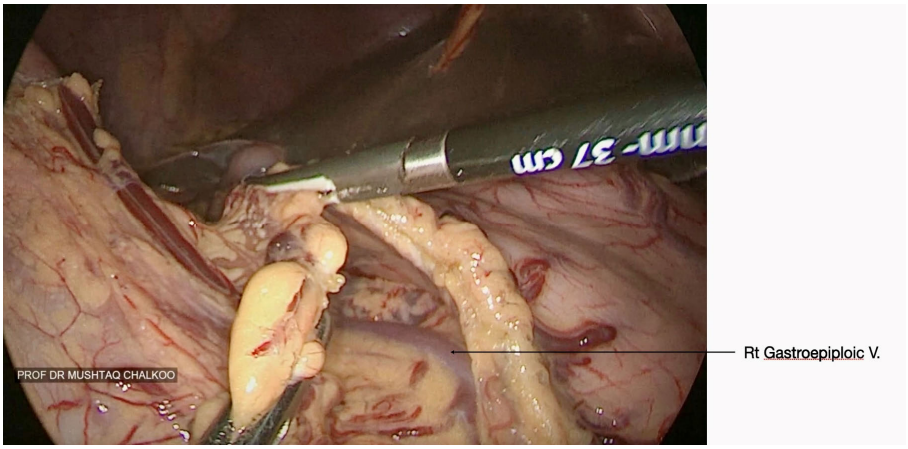

Figure 8: Gastrocolic Ligament Divided to Enter the Lesser Sac

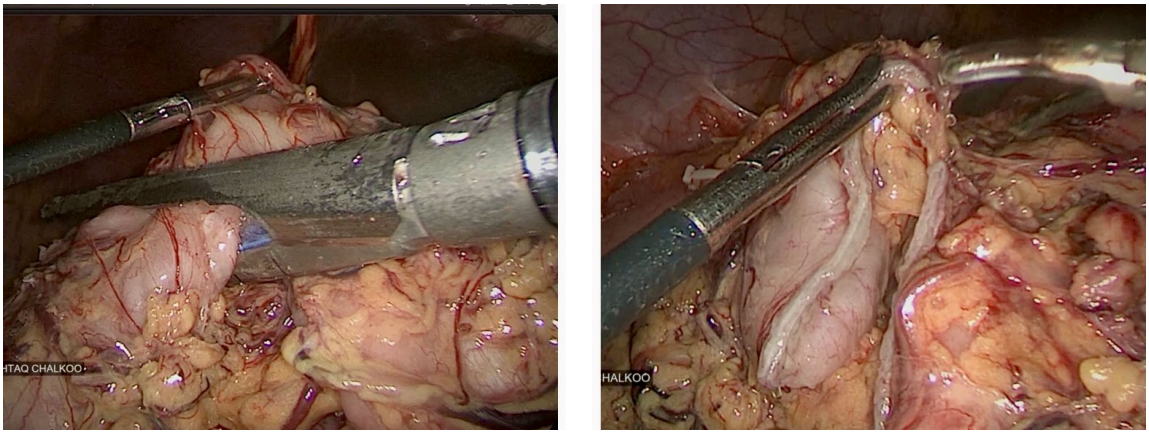

Figure 9: Endostapler Fired on the Transverse Colon

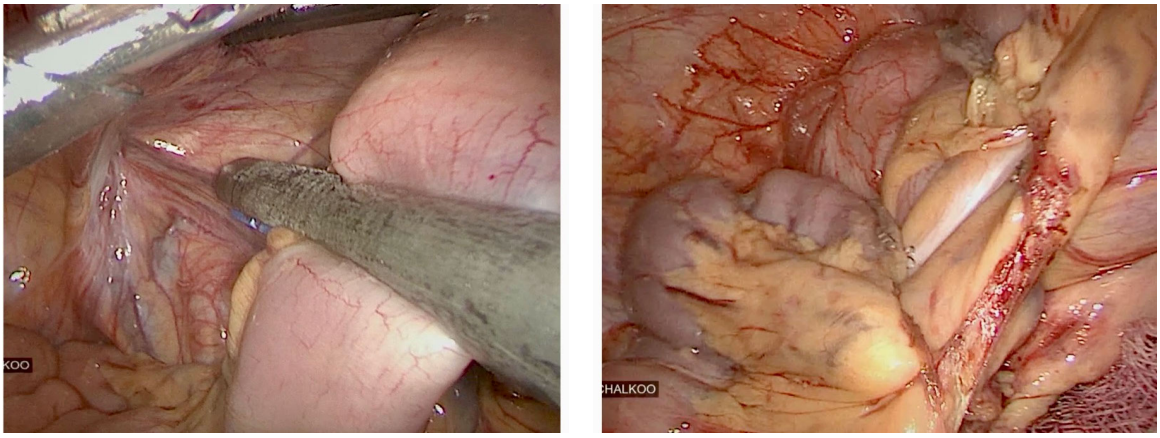

Figure 10: Endostapler Fired on the Terminal Ileum and Resected

After complete mesocolic excision and central vascular ligation, specimen retrieval reveals a well-defined retroperitoneal plane with clear exposure of the pancreas, duodenum and superior mesenteric vein (Figure 12).

Endostapler-assisted intracorporeal ileo-transverse anastomosis with subsequent enterotomy closure using V-Loc 2-0 (Figure 13).

Mesenteric defect closure performed to prevent internal herniation following intracorporeal anastomosis (Figure 14).

The Figure 15 is an immediate postoperative laparoscopic abdominal image after specimen retrieval and port site closure, with a rain in the left hypochondrium. Right sided 5 mm working port incision was extended to retrieve the specimen.

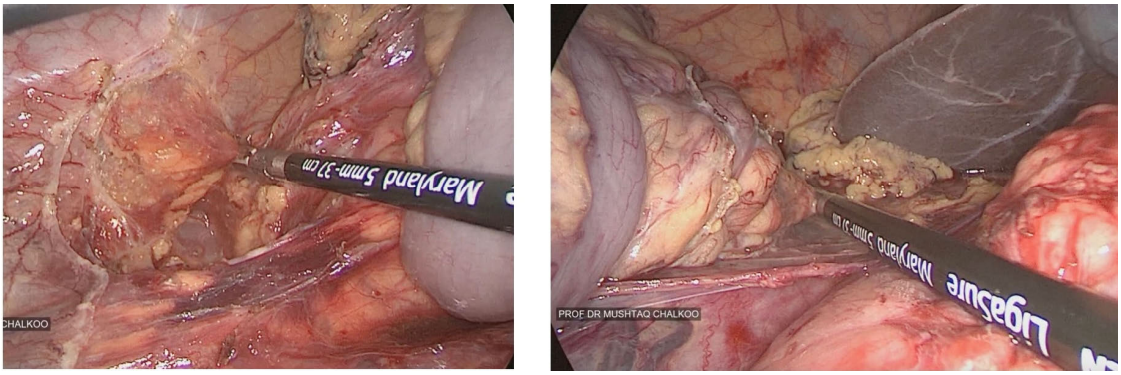

Figure 11: Mobilisation of Cecum, Ascending Colon and Hepatic Flexure

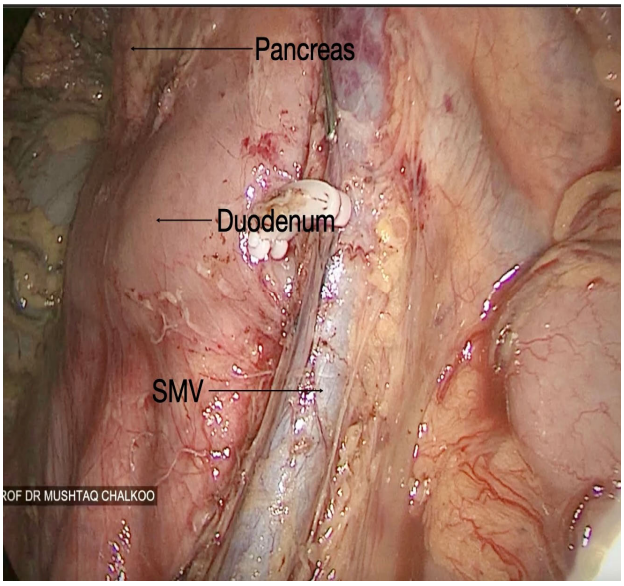

Figure 12: Retroperitoneal View After Complete Mesocolic Excision and Central Vascular Ligation

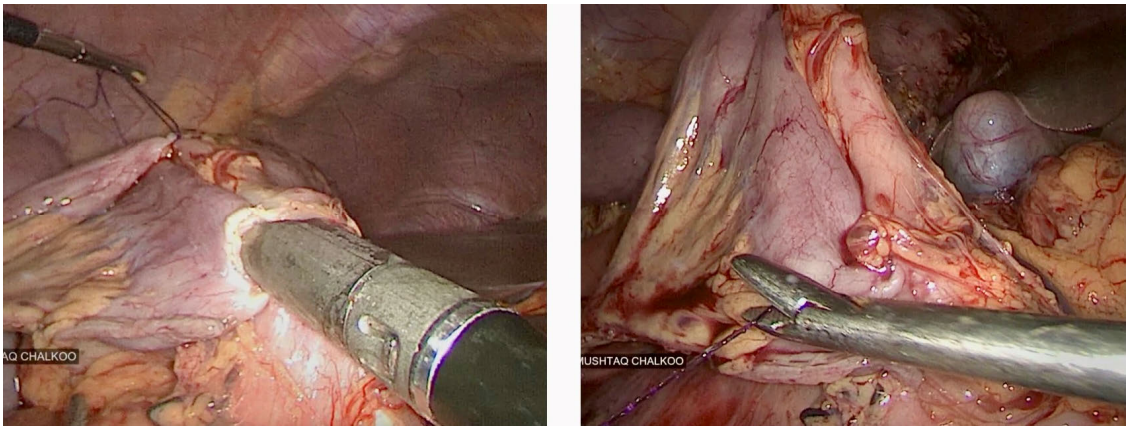

Figure 13: Intracorporeal Ileo-Transverse Anastamosis using V-Loc 2-0

Outcome Measures

Primary outcomes included feasibility, lymph node yield and R0 resection rate. Secondary outcomes included operative time, blood loss, conversion rate, postoperative recovery and 30-day morbidity and mortality. Complications were graded using the Clavien-Dindo classification [7].

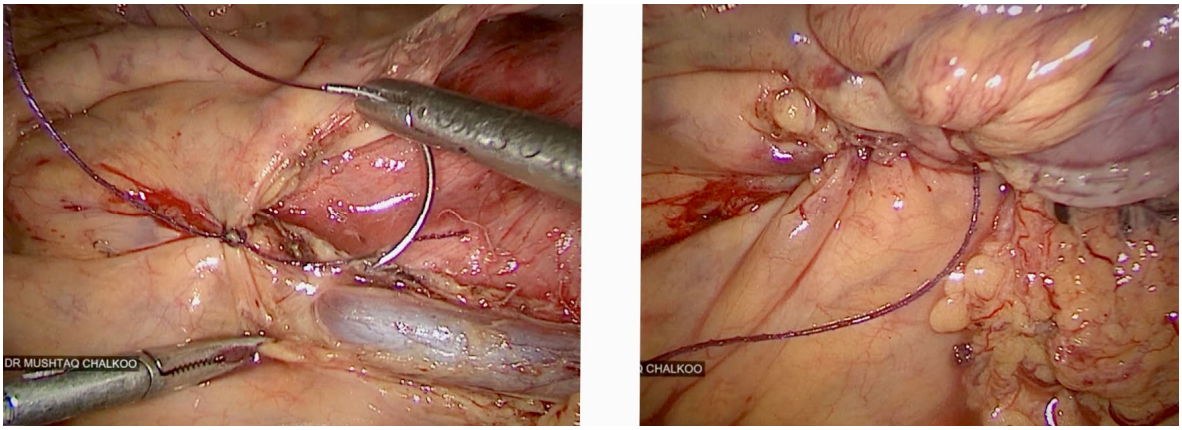

Figure 14: Closure of Mesenteric Defect

Figure 15: Post Specimen Retrieval and Drain Placement

Statistical Analysis

Data were analyzed using descriptive statistics. Continuous variables were expressed as Mean±standard deviation and categorical variables as frequencies and percentages.

RESULTS

A total of 142 patients underwent laparoscopic D3 right hemicolectomy during the study period.

All procedures were completed laparoscopically, with a conversion rate of 0%. The mean operative time was 146 34 minutes and average intraoperative blood loss ranged from 100-150 ml (Table 2).

The mean lymph node yield was 45 8.4, indicating adequate central lymphadenectomy. R0 resection with negative proximal and distal margins was achieved in all patients (Table 3).

Patients tolerated solid oral diet at a mean of 24 hours postoperatively. The mean hospital stay was 7 days. Postoperative ICU admission was required in 22.8% of patients (Table 4).

Major postoperative complications included anastomotic leak in 3 patients (2.1%). Wound site complications were observed in 5% of patients. There was no 30 day mortality (Table 4).

DISCUSSION

The extent of lymphadenectomy in right-sided colon cancer remains a subject of ongoing debate. D3 lymphadenectomy aims to address potential central nodal spread and has demonstrated improved nodal clearance in several studies [1,4,5]. However, technical complexity has limited its widespread laparoscopic adoption.

In this prospective series, laparoscopic D3 right hemicolectomy was found to be feasible and reproducible, with a zero conversion rate, reflecting procedural standardization and institutional expertise. The mean lymph node yield of 45 8.4 is notably higher than recommended standards and compares favorably with previously published Eastern and Western series [1,4,5].

Several studies have demonstrated that laparoscopic right hemicolectomy offers acceptable short-term outcomes with the benefits of minimally invasive surgery [8,9]. In the present study, operative time and blood loss were within acceptable limits and early resumption of oral diet and reasonable hospital stay further support this approach.

Postoperative morbidity was acceptable, with a low incidence of anastomotic leak and no perioperative mortality. The limitations of this study include its single-center design, lack of a comparison group and absence of long-term oncologic outcomes.

CONCLUSIONS

Laparoscopic D3 right hemicolectomy is a safe, feasible and oncologically sound procedure when performed in experienced centers. The excellent lymph node yield and acceptable morbidity observed in this prospective study support its role in the management of right-sided colon cancer. Further multicentric studies with long-term follow-up are required to establish survival benefits.

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