

3D laparoscopic radical cystectomy in patients with urinary bladder cancer: a prospective evaluation of safety and efficacy

P Yadav, V Kumar,  A Kumar

Department of Urology and Renal Transplant, VMMC and Safdarjung Hospital, India

Corresponding author, email: access_vinod@yahoo.com

Background: Bladder cancer is one of the most common urological malignancies. Standard surgical treatment for muscle-invasive bladder cancer is open radical cystectomy (RC) with extended pelvic lymph node dissection (EPLND). Not much data is available on three-dimensional (3D) laparoscopic radical cystectomy (LRC). This study aims to prospectively evaluate safety and efficacy of 3D LRC in patients with urinary bladder cancer.

Methods: Thirty consecutive cases of 3D LRC with EPLND with ileal conduit were performed at our centre from January 2019 to June 2020. We analysed the demographic parameters, perioperative outcomes, surgical safety, rate of complications and pathological outcomes.

Results: The mean age of patients was 60.90 years. Mean body mass index (BMI) of the patients was 20.83 kg/m² and 56.67% of patients had comorbidities. Mean cystectomy time was 83.73 min, mean lymph node (LN) dissection time was 31.37 min, mean total operative time was 216.4 min and mean blood loss was 206.33 ml. Mean duration of post-op ileus was 3.77 days and mean hospital stay was 5.83 days. Mean LN yield was 17.53 (14–20). Positive surgical margin (PSM) rate was 0%. Overall complications were observed in 13.33%, of which 3.33% were major complications. Follow-up of all patients at six months was normal. None of the patients had a recurrence or mortality.

Conclusion: This study shows that 3D LRC is safe and efficacious. It may offer surgical advantage in terms of operative times, blood loss, length of stay, perioperative complications and pathological outcomes advantages like PSM rate and LN yield. Results of our study were comparable with other 3D lap RC series and better than the two-dimensional (2D) and open RC series.

Keywords: bladder carcinoma, 3D laparoscopy, radical cystectomy

Introduction

Bladder cancer is one of the most common urological malignancies. Bladder carcinoma is divided into non-muscle-invasive bladder cancer (NMIBC) and muscle-invasive bladder cancer (MIBC). The usual treatment of NMIBC comprises transurethral resection of the bladder tumour with or without adjuvant courses of intravesical immunotherapy or chemotherapy. MIBC is usually treated with radical cystectomy, pelvic lymph node (LN) dissection and urinary diversion with perioperative chemotherapy for patients who are fit.¹ Although the open approach to radical cystectomy with pelvic LN dissection is still considered to be the gold standard procedure, laparoscopic and robotic approaches are replacing open approach in the majority of high-volume tertiary care centres worldwide.^{2,3} When considering laparoscopic radical cystectomy, it is the two-dimensional (2D) system which is in use in most centres. The main drawbacks of 2D laparoscopy are a steep learning curve, more cognitive workload on the surgeon, lack of depth perception and spatial orientation. To overcome this, three-dimensional (3D) laparoscopic systems have been developed with stereoscopic vision, in which depth perception is achieved by combining different unique images received by each eye.⁴⁻⁶ These 3D laparoscopic systems have also undergone change from first-generation to third-generation over the past 2–3 decades. Radical cystectomy is also one of the laparoscopic procedures in the field of urology most likely to benefit from the 3D vision system.⁷ This study aims at evaluating the safety and efficacy of 3D laparoscopic radical cystectomy in patients with urinary bladder cancer prospectively.

Methods

We conducted a prospective evaluation of 3D laparoscopic radical cystectomy in terms of safety and efficacy for cases of urinary bladder cancer. The study was conducted in the Department of Urology and Renal transplant, VMMC and Safdarjung Hospital, New Delhi from January 2019 to June 2020 after approval from the institutional ethics committee. Thirty consecutive patients who satisfied the inclusion and exclusion criteria were included in the study. Inclusion criteria included MIBC without metastasis, extensive disease not amenable to cystoscopic resection, Stage-pT1 grade-3 tumours unresponsive to intravesical BCG vaccine therapy, primary adenocarcinoma, squamous cell carcinoma, or sarcoma. Exclusion criteria included bowel abnormalities such as Crohn's disease, severe irritable bowel syndrome, fat malabsorption, ulcerative colitis, prior history of high-dose radiotherapy to abdomen and/or pelvis, bleeding diathesis, gross unresectable metastatic disease, severe metabolic abnormalities, any comorbidity precluding general anaesthesia and laparoscopic surgery. 3D laparoscopic radical cystectomy and extended pelvic lymph node dissection (EPLND) was performed by a single surgeon expert in laparoscopic procedures using the Karl Storz 3D camera system. Urinary diversion was done in the form of extracorporeal ileal conduit using the Bricker technique in all patients. Small bowel anastomosis was done using staplers. The perioperative outcomes, surgical safety, pathological outcomes, rate of complications and demographic parameters were analysed.

Results

Thirty consecutive patients participated in the study over the study period, which included 27 (90%) men and three (10%) women. The mean age of the patients was 60.90 years, mean body mass index (BMI) was 20.83 kg/m² and 56.67% patients had comorbidities. The various preoperative parameters are mentioned in Table I.

Table I: Preoperative parameters

Parameters	Frequency	Percentage
Resection status during TURBT		
Complete	15	50%
Incomplete	15	50%
Total	30	100%
CT scan findings		
Diffuse wall thickening	3	10%
Single mass lesion	18	60%
Multiple mass lesions	9	30%
Peri-vesical fat stranding	12	40%
LN enlargement	6	20%
Clinical staging		
T1	2	6.67%
T2	14	46.67%
T3b	7	23.3%
T4a	7	23.3%
Total	30	100%
NACT		
Received	13	43.33%
No received	17	56.67%
Total	30	100%

The mean port placement time was 6.00 ± 1.98 minutes (4–12 minutes), mean cystectomy time was 83.73 ± 5.74 minutes (76–98 minutes), mean LN dissection time was 31.37 ± 3.67 minutes (26–40 minutes), mean conduit time was 95.30 ± 9.0 minutes (80–115 minutes), and the mean total operative time was 216.4 ± 14.0 minutes (195–250 minutes). The mean blood loss in our study was 206.33 ± 62.45 ml (range 150–420 ml). The conversion rate to open in our study was 3.3%. The mean duration of postoperative drainage was 4.27 ± 1.11 days (range 3–9), mean duration of postop ileus was 3.77 ± 0.935 days (range 3–8), and mean postoperative hospital stay in our study was 5.83 ± 1.14 days (5–11 days). In our study, we had an overall complication rate of 13.33%. Of these, one (3.33%) had a major complication involving re-exploration for intestinal obstruction (Clavien–Dindo [CD] grade 3B) and the rest (3; 10%), had minor complications (CD grade 1 and 2). There was no perioperative or postoperative disease-specific or other cause mortality. Pathological parameters were recorded in the form of Positive Surgical Margin (PSM) rate which was 0% and the mean LN yield which was 17.53 ± 1.61 (14–20) with LN positivity rate of 36.7%.

On follow-up of patients at six months, all patients maintained their preoperative performance status and none had any functional impairment. There were no patients with new-onset

renal impairment, electrolyte disturbance or anaemia. Follow-up imaging studies showed no alteration. Due to the limited follow-up period, recurrence rate and disease-specific survival could not be commented upon. Table II, Table III and Table IV show the various intraoperative, postoperative and pathological parameters.

Table II: Intraoperative parameters

Parameters	Mean ± SD
Port placement time	6.00 ± 1.98
Cystectomy time	83.73 ± 5.74
LN dissection time	31.37 ± 3.67
Cystectomy + LND time	121.10 ± 8.04
Conduit time	95.3 ± 9.0
Total operative time	216.4 ± 14.0
Blood loss	206.33 ± 62.45

Table III: Postoperative parameters

Parameters	Mean ± SD
Drain removal (days)	4.27 ± 1.11
Duration of postop ileus (days)	3.77 ± 0.935
Postop stay (days)	5.83 ± 1.14
LN yield	17.53 ± 1.61

Table IV: Pathological outcomes

Parameters	Frequency	Percentage
Lymph node positivity		
Positive	11	36.7%
Negative	19	63.3%
Total	30	100%
Pathological staging		
T1	1	3.33%
T2	24	80%
T3a	2	6.67%
T3b	1	3.33%
T4a	2	6.67%
N+	11	36.7%
N-	19	63.3%
Organ confined	25	83.33%
Not organ confined	5	16.67%
Type of malignancy		
TCC	29	96.7%
Adenocarcinoma	1	3.3%
SCC	–	–
Total	30	100%
Surgical margin		
Positive	0	0%
Negative	30	100%
Total	30	100%

Discussion

The management options for MIBC have evolved dramatically over the past three decades and laparoscopic and robotic approaches are increasingly being performed for MIBC cases. 3D laparoscopic

Table V: Comparison between various parameters in our study and other studies

Parameters	Our study mean ± SD	2D LRC series mean ± SD
Cystectomy + LN dissection time (in min)	121.10 ± 8.04	198 ± 20 ⁸ 143 ⁹
Total operative time (in min)	216.4 ± 14.0	305 ± 30 ⁸ 284 ¹⁰
Blood loss (in ml)	206.33 ± 62.45	285 ⁸ 217.5 ± 82.4 ¹¹
Duration of postop ileus (days)	3.77 ± 0.935	3.7 ± 1.1 ⁸ 4.3 ⁹
Postop stay (days)	5.83 ± 1.14	9.2 ± 6.4 ⁸ 12.6 ⁹
LN yield	17.53 ± 1.61	12 ¹ 14 ²

systems have been developed with stereoscopic vision, in which depth perception is achieved by combining different unique images received by each eye. Surgeons may work faster and safer under 3D vision, especially during crucial and complicated surgical manoeuvres during the procedure. 3D laparoscopy actually acts as a bridge between 2D laparoscopy and robotic, in order to get some of the benefits of robotic and at the same time to get away with the extreme cost of procuring and maintaining a surgical robot. Our study prospectively evaluated the safety and efficacy of 3D laparoscopic radical cystectomy in patients with urinary bladder cancer.

The cystectomy time plus LN dissection time was 121.1 + 8.04 minutes in our study compared to 198 + 20 minutes and 143 minutes in 2D laparoscopic cystectomy series by Hemal and Kolla. and Nosov et al. respectively.^{8,9} The total operative time was 216.4 ± 14 minutes in our study compared to 305 ± 14 minutes and 284 minutes in the 2D laparoscopic cystectomy series by Hemal and Kolla and Porpiglia et al. respectively.^{8,10} The blood loss was 206.33 ± 62.45 ml in our study compared to 285 ml and 217.5 ± 82.4 in the 2D laparoscopic cystectomy series by Hemal and Kolla and Tang et al. respectively.^{8,11} Thus, we find the total cystectomy plus LN dissection time, total operative time and blood loss was better than previous studies of 2D laparoscopic cystectomy series.

3D laparoscopy could contribute to shorter operating times because of improved vision, depth perception and hand-eye coordination. It was our impression that dissection during surgery was much better with 3D systems when compared to 2D. Less blood loss may be due to better identification of vascular structures and control of bleeders due to better depth perception.

The mean duration of postop ileus in our study was 3.77 ± 0.935 days compared to 3.7 ± 1.1 days and 4.3 days in 2D laparoscopic radical cystectomy series by Hemal and Kolla and Nosov et al. respectively.^{8,9} The mean duration of post-op stay in our study was 5.83 ± 1.14 days compared to 9.2 ± 6.4 days and 12.6 days in 2D laparoscopic radical cystectomy series by Hemal and Kolla and Nosov et al. respectively.^{8,9} The mean LN yield was 17 ± 5.3 compared to 12 and 14 in 2D laparoscopic radical cystectomy series by Hemal and Kolla and Nosov et al. respectively.^{8,9} Thus,

the duration of post-op ileus, post-op stay and LN was better in our study compared to previous 2D laparoscopic radical cystectomy series. Table V shows the comparison of various parameters in our study and other studies.

The perioperative complications in our study occurred in 13.3% compared to 19.9% and 16.4% in the 2D laparoscopic radical cystectomy series by Hemal and Kolla and Tang et al. respectively.^{8,11} Thus, overall complication was also less in our study as compared to 2D laparoscopic radical cystectomy series.

The PSM rate was found to be comparable to most 2D lap RC series and better than a few 2D lap RC series. The PSM rate in our study was 0% compared to 3.3% and 9.5% in the study by Hemal and Kolla and Nosov.^{8,9}

Due to the limited duration of follow-up (six months), recurrence rate and disease-specific survival could not be commented upon.

Small sample size and lack of control arm for comparison were the major limitations of the study. Also, since other factors may impact the operative time and blood loss, improvement in these parameters using 3D vs 2D laparoscopy may not be truly justified. Moreover, no comment could be made on the oncological outcomes due to the limited follow-up.

Conclusion

Our prospective observational study was aimed at evaluating the safety and efficacy of 3D laparoscopic radical cystectomy in terms of surgical safety, perioperative outcomes and pathological outcomes and found that it is safe and efficacious in the management of patients with MIBC and refractory high-grade superficial bladder cancer. The 3D system might offer surgical or perioperative outcome advantage in terms of operative times, blood loss, length of postop hospital stay, conversion rate and complications. Our series showed favourable pathological outcomes like PSM rate, LN yield and perioperative mortality. The results of our study were comparable with other 3D lap RC series and better than the 2D and open RC series. Randomised control trials with larger sample size and diverse study population are recommended to validate our findings.

Conflicts of interest

The authors declare no conflict of interest.

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Ethical approval

Ethics Committee approval was obtained from the Government of India, VMMC and Safdarjung Hospital Institute Ethics Committee (IEC/VMMC/SJH/Thesis/NOVEMBER/2018/25).

ORCID

V Kumar  <https://orcid.org/0000-0003-0223-2764>

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