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J Minim Access Surg. 2023 Apr-Jun; 19(2): 288–295.
Published online 2022 Nov 30. doi: 10.4103/jmas.jmas_141_22

PMCID: PMC10246628
PMID: 36629220

Robot-assisted retroperitoneal lymph node dissection for post-chemotherapy residual mass in testicular cancer: Long-term experience from a tertiary care centre

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Abstract

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Objectives:

To present our intermediate to long-term oncological and functional outcomes of robot-assisted retroperitoneal lymph node dissection (RA-RPLND) in post-chemotherapy (PC) residual mass in testicular cancers. To the best of our knowledge, this is the largest single-centre experience of RA-RPLND for in such setting.

Methods:

Prospectively maintained database of carcinoma testis patients undergoing RA-RPLND from February 2012 to September 2021 was reviewed. Patient demographics, tumour stage and risk groups and chemotherapy details were recorded. Intraoperative details and post-operative complications were also noted. Pathological outcomes included were lymph node yield and histopathology report. Further, follow-up was done for recurrence and antegrade ejaculation status.

Results:

Total of 37 cases were done for PC residual masses. International germ cell cancer collaborative group good, intermediate and poor risk proportion was 18 (48.6%), 14 (37.8%) and 5 (13.5%), respectively. Bilateral full template dissection, unilateral modified template dissection and residual mass excision was performed in 59.5% (22/37), 35.1% (13/37) and 5.4% (2/37) patients, respectively. The median size of the excised residual mass was 3.45 cm interquartile range (IQR 2–6 cm), with the largest being 9 cm. The median lymph nodal yield was 19. The most common histology was necrosis (n = 24, 65%), followed by teratoma (n = 11, 30%) and viable malignancy (n = 2, 5%). Antegrade ejaculation was reported in 32 patients (86.4%). After a median follow-up of 41 (IQR 14–64) months, only one patient had a recurrence.

Conclusions:

RA-PC-RPLND is thus a safe, feasible and oncologically effective option for selected patients. With increasing experience, larger masses can also be dealt with efficiently.

Keywords: Germ cell tumour, post-chemotherapy, robotic retroperitoneal lymph node dissection, testicular cancer

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Surgical resection of visible residual masses after chemotherapy for non-seminomatous germ cell tumours (NSGCT) is mandated when serum levels of tumour markers are normal or normalising.[1] This is because a good number of patients harbour viable malignancy or teratoma in their retroperitoneum after chemotherapy. Chemotherapy-induced desmoplastic reaction, dissection around major vessels and need for multiorgan resection in addition to compromised pulmonary, renal and haematologic reserve make post-chemotherapy retroperitoneal lymph node dissection (PC-RPLND) a complex and challenging procedure. To reduce the morbidity related to open RPLND, laparoscopic and now robot-assisted RPLND (RA-RPLND) are increasingly being performed.

The first published report of RA RPLND was in 2006.[2] Since then, many investigators have published their experiences. However, the follow-up in these studies is short, and data on PC RA-RPLND are sparse. We aim to present our intermediate-to-long-term oncological and functional outcomes of RA-RPLND in PC setting. To the best of our knowledge, this is the largest single-centre experience of RA-RPLND for PC residual masses in testicular cancers.

Growing experiences from studies including ours shall pave the way for the utilisation of robotic approach in early metastatic seminomas where their evidence for the use of RPLND is still expanding.[3]

METHODS

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A retrospective review of a prospectively maintained database of carcinoma testis patients undergoing RA-RPLND from February 2012 to September 2021 was done. Patients undergoing RA-RPLND performed by two Uro-onco-surgeons (SKR, AS) for PC residual masses were analysed. Baseline patient details, tumour characteristics and chemotherapy details were recorded. Response evaluation after chemotherapy was done using contrast-enhanced computed tomography (CT) scan for NSGCT and positron emission tomography CT for seminoma. Intraoperative details such as operative time, estimated blood loss (EBL), patient position, dissection template and additional procedures performed were noted.

Patient was placed in a modified lithotomy position with arms by the side. Pressure points were padded, and shoulder supports were applied. The table was made steep Trendelenburg with a 10°–15° right tilt to make small bowel fall out of the field. 8 mm camera port was placed in between the umbilicus and symphysis pubis. Other working robotic ports were made, two in the right lower quadrant and one in the left lower quadrant. Two assistant ports (one 5 mm, another 12 mm) were created in the left lower quadrant, as shown in Figure 1.

Figure 1

(a) Port positions for RA-RPLND in supine position, (b) Docking from head end for da Vinci Si and X, (c) Lateral docking from left side for Xi system. RA-RPLND: Robot-assisted retroperitoneal lymph node dissection

The robotic surgical technique used has been previously described.[4] The surgery was performed using da Vinci Si^{HD}, X and Xi surgical system. The Si^{HD} platform was used in the initial cases, but now we are using the later ones. The peritoneal flap of the small bowel mesentery and descending colon can be sutured to the anterior abdominal wall for retraction. In addition, a 'reverse' Pansadora stitch for the sigmoid colon may aid exposure [Figure 2]. In the Xi system, the robot was undocked at the completion of the retroperitoneal part and redocked after rotation of boom for the pelvic part and remnant cord excision. Abdominal Jackson-Pratt drain was placed in all patients.

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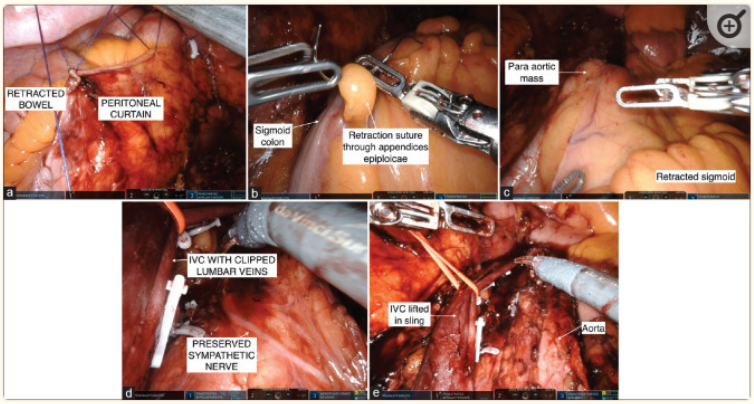

Figure 2

(a) Peritoneal retraction stitch, (b) Reverse Pansadora stitch being taken, (c) Retracted colon and visible para-aortic mass after the stitch, (d) Preserved sympathetic nerves, (e) Completed bilateral template dissection

Post-operatively, early ambulation was encouraged, and thromboprophylaxis was given to all patients. The drain was removed by days 3–4 when output was serous and <300 ml/day. The patient was discharged with the drain if the output was chylous and/or more than 300 ml/day. A step-up approach was followed for the management of chylous ascites. Initially, dietary modifications in the form of fat-free diet and medium chain triglyceride-based feeding are initiated. Injection of octreotide 100 mcg subcutaneous thrice daily was added if dietary modifications failed to decrease the output. In addition, the patient may be kept nil per oral and parenteral nutrition initiated if the above measures fail. In refractory cases, interventions such as surgical re-exploration or intralymphatic lipoidal injection are contemplated.

Pathological outcomes included were lymph node yield and histology of the specimen. Further, follow-up was done for recurrence and antegrade ejaculation status. The assessment of ejaculation was based on patient interview during follow-up with patient answering it either as present, absent or present with low volume.

RESULTS

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Between February 2012 and September 2021, 40 RA-RPLND were performed, of which 37 were done for PC residual masses, and the remaining three were primary RPLND. The results described subsequently pertain to the PC-RA-RPLND cohort.

The median age of the cohort was 27 years interquartile range (IQR 23–34.5). Median body mass index at surgery was 23.69 kg/m^2 (IQR 20.62–26.15). The most common histology of the testicular primary was NSGCT (n = 33, 89.2%) with seminoma in one (2.7%) and burnt-out primary in 4 (10.8%) patients. Bleomycin, etoposide and cisplatin (BEP) was the most commonly received induction chemotherapeutic regime (35/37). Three of the 37 patients received additional second-line chemotherapy before surgery [Table 1].

Table 1

Tumour characteristics and operative details

Parameters	*n* (%)
Total RA-RPLND patients (*n*=40)	
P-RA- RPLND	3 (19)
PC-RA-RPLND	37 (81)
Testicular pathology (*n*=37)	
Mixed NSGCT without seminoma	19
Mixed NSGCT with seminoma	3
Pure NSGCT without seminoma	5
Pure NSGCT with seminoma	6
Seminoma	1
Burnt out primary	3
Pre-chemotherapy clinical stage	

IIA	1
IIB	7
IIC	7
IIIA	10

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RA-RPLND: Robot-assisted retroperitoneal lymph node dissection, P-RA-RPLND: Primary RA-RPLND, PC-RA-RPLND: Post-chemotherapy RA-RPLND, NSGCT: Non-seminomatous germ cell tumours, BEP: Bleomycin, etoposide, cisplatin, TIP: Paclitaxel, ifosfamide, cisplatin, VeIP: Vinblastine, ifosfamide, cisplatin, VIP: Etoposide, ifosfamide, cisplatin, VAC: Vincristine, dactinomycin and cyclophosphamide

The procedure was performed in lateral position and supine position in 43% (16/37) and 57% (21/37) patients, respectively. Bilateral full template dissection was performed in 59.5% (22/37) of patients with unilaterally modified template dissection and residual mass excision was performed in 35.1% (13/37) and 5.4% (2/37) patients, respectively. Nerve preservation by virtue of unilateral template and/or dedicated nerve sparing dissection was achieved in 33 (89%) patients. The median console time and EBL were 180 (IQR 150–300) min and 150 ml, respectively. The median size of the excised residual mass was 3.45 cm (IQR 2–6 cm), with the largest mass successfully excised being 9 cm. The median lymph nodal yield was 19 with the most common histology in the excised nodes being necrosis (n = 24, 65%), followed by teratoma (n = 11, 30%) and viable malignancy (n = 2, 5%) [Table 2].

Table 2

Comparison with contemporary series

Variables*	Present study	Roger li 2019	Nason 2021	Ohlman 2021
PC-RA-RPLND (total RA-RPLND)	37 (40)	30	9 (27)	16 (23)
IGCCCG				
Good risk	18 (48.6)	25 (83.3)	NR	9 (56)
Intermediate risk	14 (37.8)	4 (13.3)		5 (31)
Poor risk	5 (13.5)	1 (3.3)		2 (13)
Median age (years)	27	30	25.7	32
Median BMI (kg/m^2)	23.69	30.4	24.9	27.8
Laterality of primary (right/left)	19/18	13/17	4/5	6/10
Pathology of orchiectomy (NSGCT/seminoma/burnt out)	33/1/3	30/0	9/0	14/2
Median OT time (min)	180[#]	371	500	359
Median EBL (ml)	150	235	100	275
Median LOS (days)	4.5	NA	2	6
Pathology of RPLND, n (%)				

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*Continuous variables are presented as median (IQR) and categorical variable as n (%) except series of Nason who reported range, [$]Two cases were desperation RPLND, [#]Console time. IQR: Interquartile range, RPLND: Retroperitoneal lymph node dissection, RA-RPLND: Robot-assisted-RPLND, PC-RA-RPLND: Post-chemotherapy RA-RPLND, NSGCT: Non-seminomatous germ cell tumours, IGCCCG: International germ cell cancer collaborative group, EBL: Estimated blood loss, LOS: Length of stay, BMI: Body mass index, OT: Operative, NR: Not reported, NA: Not available

Prophylactic DJ stenting was performed in three patients in whom the ureter was involved by the desmoplastic reaction. High inguinal orchiectomy at the time of RPLND was performed in three patients. Eight patients (21.6%) underwent procedures in addition to RPLND either simultaneously or staged for complete oncologic clearance. The details of these procedures are given in Table 3. Thoracic mass excision (open/video assisted) was the most common additional procedure performed in six patients (75%). Viable malignancy was detected in one such patient who had necrosis on the RPLND biopsy. Another patient who had mature teratoma on the RPLND specimen also had mature teratoma on bilateral lung mass excision. One patient underwent supraclavicular lymph node dissection in addition to RPLND and bilateral video-assisted thoracic surgery. Interestingly, immature teratoma was detected in the neck nodes despite necrosis being detected in

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Interestingly, immature teratoma was detected in the neck nodes despite necrosis being detected in the abdomen + chest specimens.

Table 3

Additional resection, its pathology and retroperitoneal pathology

Additional procedure	Pathology of metastatic site	Pathology of retroperitoneal node
Left VATS	Necrosis	Necrosis
Left VATS	Necrosis	Necrosis
Bilateral VATS	Right: Necrosis Left: Viable malignancy	Necrosis
Bilateral VATS + left SCLN dissection	VATS: Necrosis Left SCLN: Immature teratoma	Necrosis
Left VATS with right thoracotomy	Bilateral mature teratoma	Mature teratoma
Right thoracotomy	Necrosis	Necrosis
Left adrenalectomy	Necrosis	Necrosis
Retrocrural lymph node dissection*	Necrosis	Necrosis

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*Patient underwent open conversion for IVC injury. VATS: Video-assisted thoracic surgery, SCLN: Supra clavicular lymph node, IVC: Inferior vena cava

Major intraoperative complications encountered included aortic (n = 1) and inferior vena cava (IVC) injury (n = 1). The aortic injury was successfully managed robotically; however, the IVC injury necessitated open conversion. Overall, 4 (10.8%) patients required conversion to open approach. Indications for conversion being: dense desmoplasia with the inability to proceed (n = 3) and dense desmoplasia, leading to intraoperative IVC injury (n = 1) [Table 4].

Table 4

Post-operative complications

Clavien-Dindo classification	Type of complications	*n* (%)
2	Paralytic ileus	4 (10.8)
	Blood transfusion	3 (8.1)
	Chyle leak managed conservatively	4 (10.8)
3a	Chyle leak needing intralymphatic lipoidal injection	2 (5.4)
3b	Chyle leak needing open surgical ligation	3 (8.1)

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Post-operatively, Chylous drain output was seen in 9 (24.3%) patients which was managed conservatively in four patients, required intralymphatic lipoidal injection in two patients and open surgical ligation in three patients. Paralytic ileus was seen in four patients (10.8%) and was managed conservatively in all. Blood transfusions were required in three patients. None of our patients experienced any pulmonary complications in the post-operative period.

At a median follow-up of 41 (IQR 14-64) months, recurrence was seen in only one patient [Table 5]. This patient had International Germ Cell Cancer Collaborative Group (IGCCCG) intermediate-risk disease and both pre and PC stage IIC. Bilateral standard template dissection was done, and 30 lymph nodes were identified. Pathology was suggestive of necrosis. Unfortunately, patient reported at 4 months with a rise in tumour markers. Imaging revealed recurrences in the liver, pelvis and retroperitoneum. The patient was started on salvage chemotherapy with paclitaxel, ifosfaomide and cisplatin (TIP) regimen. However, the patient progressed and deteriorated after one cycle and succumbed. Antegrade ejaculation was reported in 32 patients (86.4%).

Table 5

Characteristics of patient who had the recurrence

Age at surgery	Orchiectomy histology	Pre-chemotherapy stage	IGCCCG risk	Post-chemotherapy stage	Size of nodal mass	Template	Conversion	Nodal yield
27 years	Embryonal Ca and Teratoma	IIC	Moderate	IIC	8 cm	B/L standard	No	30

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RPLND: Retroperitoneal lymph node dissection, IGCCCG: International germ cell cancer collaborative group, B/L: Bilateral, CT: Chemotherapy

DISCUSSION

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We report possibly the largest single-centre experience of RA-PC-RPLND performed by two highly experienced surgeons from a tertiary care centre dealing with high volumes of testicular cancer. This report of consecutive cases reiterates the feasibility and safety and, more importantly, highlights the long-term oncological efficacy of the procedure in this select cohort of patients.

RA-RPLND is a complex and challenging undertaking more so in the PC setting where studies have shown longer operative times, higher EBL with a greater proportion of patients requiring adjunctive procedures/open conversion and higher rates of perioperative complications as compared to primary RPLND.[5,6] The use of the robotic approach for RPLND is aimed at reducing perioperative morbidity and enhancing recovery after surgery.

Considerable expertise from open RPLND and the inherent advantages of the robotic platform (tremor filtration, 3D vision, magnification and 7° of motion freedom) enabled our smooth transition into minimally invasive RPLND. Our approach gradually evolved from the lateral approach to the supine approach over a period of time which was greatly aided by the upgradation of the da Vinci Si to the latest Xi version.

Inherent patient hesitation to undergo primary RPLND and the increasing role of chemotherapy in the management of testicular tumours are reflected in the very low numbers of primary RPLND performed at our institution. Thus, we started initially with smaller PC residual masses, and as our experience grew, we became adept at managing larger masses such that more than one-third of the excised masses measure 5 cm or more in size, with the largest size successfully removed robotically being 9 cm.

Patient selection is critical for PC-RA-RPLND. Authors have suggested avoiding the procedure in patients with ≥5 cm lesions and/or intermediate/poor risk IGCGCG groups as chances of vascular intervention in such patients is high.[7] We believe that volume of the retroperitoneal disease is not the only factor that should be considered while selecting a patient for RA-PC-RPLND. Chemotherapy-induced intense perinodal fibrosis and adhesions can even make resection of smaller masses a daunting task. Unfortunately, pre-operative imaging at present is not accurate enough to predict such reactions and the magnitude of desmoplasia needs to be assessed intraoperatively. Patients with large-volume disease, circumferential major vessel involvement and renal vessel encasement should seldom be approached robotically.

There is always a risk of major vascular injury owing to the lack of tactile feedback with plastered planes PC. Such injuries may be managed robotically with no further consequence (as the aortic injury in our study) or may require open conversion (as was required for the IVC injury). The rate of open conversion in our series was 10.8%, with dense desmoplastic reaction with failure to progress safely being the most common reason. These patients belonged to IGCCCG intermediate (n = 2) and poor (n = 2) risk categories. The reported rates in the literature vary from 10% to 25%,[5-7] with commonly reported factors leading to conversion being poor retroperitoneal exposure, renal vascular injury necessitating repair/nephrectomy and/or ventilatory issues secondary to pneumoperitoneum. Retroperitoneal exposure can be optimised by routine hitching of the peritoneal curtain to the anterior abdominal wall, which also prevents the small bowel loops from coming into the field. An additional 10°–15° right tilt in the supine Trendelenburg position also helps. A 'reverse' Pansadora stitch can help retract the sigmoid from the operative field.

Chylous ascites are one of the most common complications after RA-RPLND for testis cancer and have been reported to be in the range of 3%–11% in different RA-PC-RPLND series.[5-8] The incidence of Chylous leak in our patients was 24.3%. It may be noteworthy that the increased incidence may be attributed to a few factors. We routinely place intraabdominal drains in all our patients undergoing RPLND, which is not what is practised universally at other centres where a

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pigtail/drain is inserted if complications due to chylous ascites/lymphocoeles arise. Furthermore, low-fat dietary modifications are not instituted as a dictum in all our patients postoperatively. We do acknowledge the fact that 12% of our patients required an intervention for the management of significant chylous output. All these cases were seen in the 1st 2 years of programme initiation and could be attributed to scarce clipping of major lymphatics, especially around the left renal vein and para-aortic region. We learned from our mistakes and made appropriate amends to our technique and since then have not experienced any case of chylous leak requiring an intervention for management.

Our patients are usually referrals from distant parts of the country and thus are discharged once their drains are removed, normal diet is tolerated well and no intravenous fluid supplementation is required. These factors may account for a slightly longer length of hospital stay seen in our study.

Recurrences after open PC-RPLND have been reported to the tune of 11%–22.7%,[9,10] depending on the template of dissection and IGCCCG risk stratification. Direct comparison of PC-RA-RPLND oncological outcomes with the open cohort is not wise as the former is offered in the highly selected group of patients. Contemporary series of RA-PC-RPLND have reported recurrence rates of approximately 10%–11%.[6,7] We report a much lesser recurrence rate of 2.7%. Approximately two-third of our patients had necrosis in their RPLND specimen biopsy as compared to approximately one-third in the other series. Furthermore, the proportion of viable malignancy at RPLND in our series was only 5% as compared to 17% and 31% reported by Li *et al.* and Ohlmann *et al.*, respectively. Calaway *et al.* report from a high-volume referral centre described unique aberrant recurrences in patients undergoing RA-RPLND (primary/PC) elsewhere, implicating that the robotic approach may have been responsible for such patterns of recurrence.[11] We did not experience any unusual pattern of recurrences in our study. Most recurrences reported in these patients usually occur within 2 years of surgery,[12] and thus, our median follow-up of 41 months is a sufficient period to comment on at least early relapses following this procedure. Reports of robotic RPLND by Stepanian *et al.*,[13] Pearce *et al.*[14] and Rocco *et al.*[15] on 20, 47 and 58 procedures which included both primary and PC patients and median follow of 49, 16 and 47 months, respectively, have also not reported any in-field recurrences or unusual out-of-field recurrences.[9]

Antegrade ejaculation was seen in 86.4% of our patients. Four of these patients subjectively reported decreased ejaculate volume. Nerve preservation at RPLND requires sound knowledge of the retroperitoneal neuroanatomy.[16] Despite the desmoplastic reaction seen in PC patients, one can still perform nerve preservation. Ejaculation status post-R RPLND for testis cancer is reported in very few studies, with rates of retrograde ejaculation ranging from 10% to 20%.[13,17,18]

Growing experiences from studies including ours shall pave the way for utilisation of robotic approach in early metastatic seminomas where their evidence for the use of RPLND is still expanding.

CONCLUSION

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No study is without limitations. Although this is the largest experience of PC-RA-RPLND yet, the numbers are still low. Direct head-to-head comparisons of open and robotic approaches for similar PC-RPLND patients are needed to definitively establish the role of RA-PC-RPLND. A longer follow-up may reveal information regarding late relapses in patients undergoing this procedure.

RA-PC-RPLND is thus a safe, feasible and oncologically effective option for selected patients with a definitive learning curve. With increasing experience, larger masses can be dealt with efficiently with this approach. However, such cases are better suited to high-volume centres with multispeciality assistance available if required. Strict adherence to oncologic principles is a must to deliver the best outcomes to these patients.

The research was approved by Institutional Review Board (No. RGCIRC/IRB/12/2022).

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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