The Role of Selective Ligature of Dorsal Vascular Complex in Early Recovery of Continence after Laparoscopic Radical Prostatectomy: First 50 Cases

S.A. Big[1], V.I. Bărbos[1], M. Firezar[1], O.B. Coste[2,3]*, C.D. Buzlea[1], M. Vârlan[1], S. Mîrţ[4], A. Petruţ[1], T.T. Maghiar[2,3], B.O. Feciche[1,3]

[1] Department of Urology, Bihor Emergency Clinical County Hospital, Oradea, Romania
[2] Department of Urology, Pelican Clinical Hospital, Oradea, Bihor
[3] Department of Urology, Faculty of Medicine and Pharmacy, University of Oradea, Romania
[4] Department of Anesthesia and Intensive Care, Bihor Emergency Clinical County Hospital, Oradea, Romania

ABSTRACT

Introduction and Objectives. Early recovery of urinary continence after laparoscopic radical prostatectomy (LRP) is a significant issue for both patients and urologists. In this setting, a selective ligature of dorsal vascular complex (DVC) seems to better preserve the urethral sphincter when compared with standard technique. The aim of this study was to analyze the technique and the continence results of selective ligature of DVC in our first 50 patients undergoing laparoscopic radical prostatectomy.

Materials and methods. We retrospectively included first 50 consecutive patients with clinically localized or locally-advanced prostate cancer who underwent LRP in our department. In all cases, the management of DVC was performed in a selective fashion, by sewing its distal stump after prior sectioning. We evaluated the continence rate at 3 and 6 months by quantifying the number of pads per day. We also recorded the perioperative and pathological variables.

Results. At 3 months post-LRP 27 patients (54%) were continent (zero or one safety pad) and four (8%) had severe incontinence. At 6 months, 33 patients (66%) were continent and only two patients (4%) had severe incontinence. The median blood loss was 400 mL and the number of patients requiring blood transfusions was 5. Eight patients had positive surgical margins, three of them at the level of prostate apex.

Conclusions. The selective management of DVC is feasible in LRP and can contribute to an early return of postoperative continence.

Keywords. Dorsal vascular complex, laparoscopic radical prostatectomy, postprostatectomy urinary incontinence, prostate cancer, Santorini plexus, selective ligature

Correspondence to:
Assist. Prof. Ovidiu Bogdan Coste M.D.
Department of Urology, Pelican Clinical Hospital, Oradea, Bihor 14A-14B Corneliu Coposu Street, postal code 410469, Oradea, Bihor County, Romania,
Tel: +40742556211, email: coste_bogdan@yahoo.com

Introduction and Objectives

Prostate cancer (PCa) is the second most incident solid cancer in men and the fifth cause of cancer mortality in the world [1]. It has a marked heterogenity between patients, with variable evolution from indolent PCa to aggressive variants. After the widespread introduction of screening in PCa, the most of the cases were diagnosed in early stages [2].

Radical prostatectomy (RP) is the main curative treatment modality for local and locally-advanced prostate cancer [3]. Laparoscopic radical prostatectomy (LRP) has become a widely adopted approach in urologic oncology, aiming to preserve urinary continence and sexual function and to minimize the perioperative complications, without compromise the oncological results, when compared with open approach [4].

The return of urinary continence following LRP remains a significant concern, with variable incidence, impacting the quality of life of many patients undergoing this procedure [5]. Many surgical strategies were proposed in order to enhance the recovery of continence, with variable results [6,7]. There is a concerning if the external urethral sphincter is not damaged during the standard ligation of DVC (performed immediately after incision of endopelvic fascia and sectioning of puboprostatic ligaments), given the proximity of the two anatomical structures [7]. There also was shown that this complex contains not only venous sinuses, but also small arterial vessels, nerves and muscle fibers, its function still being investigated. Thus, the selective ligature of the dorsal vascular complex (DVC) has gained increasing attention as a technique to better preserve the urethral external sphincter [8].

The aim of this study was to retrospectively analyze the technique of selective ligature of DVC and the continence-related outcomes after first 50 cases of LRP.

Materials and methods

We retrospectively included in our study first 50 consecutive males with cT1c-3aN0M0 prostate adenocarcinoma who underwent 3D laparoscopic radical prostatectomy in Urology Clinic of Bihor Emergency Clinical County Hospital (Oradea, Romania) between November 2022 and December 2023.

a. Surgical technique

The patient was placed in dorsal decubitus with the surgical table flexed just above iliac crest and in Trendelenburg position. A standard extraperitoneal (properitoneal) approach (5 trocars) was used. In 5 cases, we decided to switch to transperitoneal approach due to inadequate properitoneal working space. After defatting of anterior aspect of prostate, incision of endopelvic fascia and sectioning of puboprostatic ligaments, we did not proceed with standard ligation of DVC, but we isolated and incised the bladder neck. The prostate is then dissected in standard fashion with the anterograde technique. When the DVC has to be managed (Figure 1), we increased the insufflation pressure up to 18 mmHg and we incise the complex using the cold scissors as close as possible to the prostate apex (Figure 2). The surgeon assistant used the suction probe to aspirate the blood and to wash with sterile saline in order to maintain the visibility of anatomical structures. After complete detaching and bagging the prostate, we selectively sewed the DVC (Figure 3), by making several passages (figures of eight) with a unidirectional suture (26 mm half circle needle). We verified the quality of hemostasis by decreasing the insufflation pressure up to 12-14 mmHg. The vesico-urethral anastomosis was performed using Van Velthoven technique with unidirectional suture.

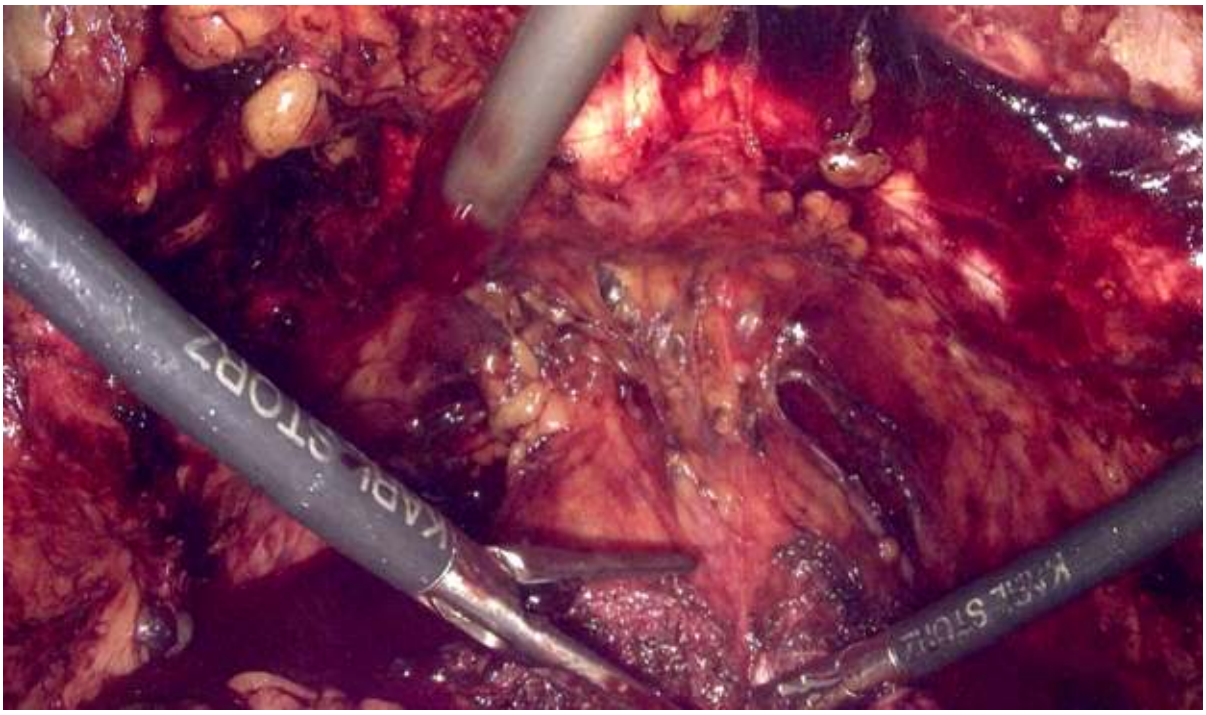


Figure 1. The intraoperative aspect of DVC before sectioning



Figure 2. The DVC is sectioned and the urethra can be seen at the tip of the suction device

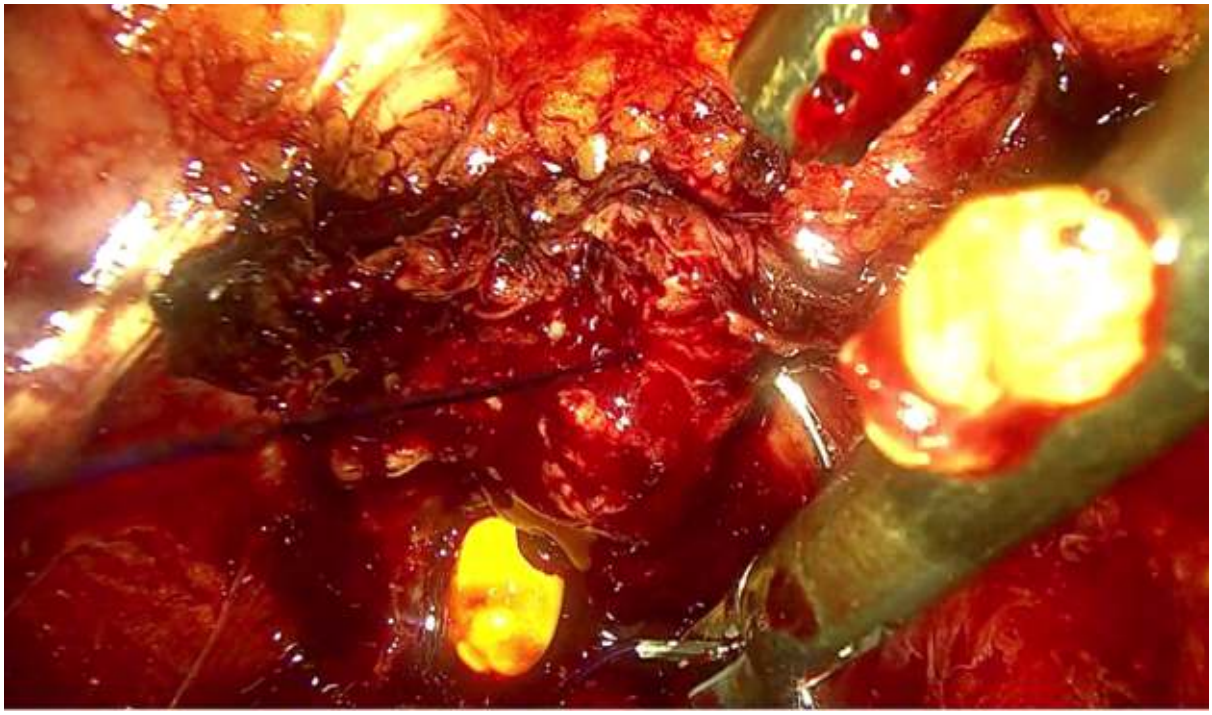


Figure 3. The distal stump of DVC is sewed using unidirectional suture, preserving as much as possible of urethral sphincter. In the bottom of image, the yellow tip of the Foley catheter can be seen

b. Data collection

We recorded the following preoperative characteristics: age, body mass index (BMI), serum prostate specific antigen (PSA), prostate volume, ISUP grade at biopsy, preoperative TNM (Tumour, Nodes, Metastasis) stage.

The intraoperative and postoperative data were recorded: total operative time, estimated blood loss, number of patients who required blood transfusion (and number of transfusions), perioperative complications, conversion to open approach due to uncontrollable bleeding form DVC. urinary catheter duration, postoperative hospital stay. We evaluated the continence at 3 months and 6 months postoperatively by asking the patients the number of pads used per day. We stratified the severity of postprostatectomy incontinence according to the Rocco definition [9]: zero or one safety pad = continent, two pads per day = moderate continence, severe incontinence = more than two pads per day.

We also included in analysis the pathological features of final surgical specimen: pT, pN, pathological ISUP grade, prostate size, tumour volume, surgical margins status.

All the patients given their informed consensus for participation in this study.

c. Statistical analysis

Microsoft Excel and IBM SPSS Statistics 19 were used to evaluate the sample's general characteristics.

For quantitative variables, we verified data normality using the Shapiro-Wilk test, followed by Levene's test for variances equality and Student's t-test (for normally distributed variables) or Mann-Whitney U test (for variables with non-parametric distribution) to compare two quantitative variables. For some ordinal qualitative variables, the Mann-Whitney U test was also used.

Results

Preoperative parameters of the patients are summarized in Table 1. No patient had the preoperative cT3b, cT4, cN1 or cM1.

Table 1. Preoperative parameters of the patients

Parameter, measurement unit		Value (range)
Median age, years		62 (47-73)
Median BMI, kg/m^2		26 (23-34)
Median serum PSA, ng/mL		9 (4-22)
Median prostate volume, mL		47 (30-70)
ISUP grade at biopsy	1	10
	2	16
	3	15
	4	9
Preoperative stage T	cT1c	13
	cT2a	9
	cT2b	14
	cT2c	8
	cT3a	6

The median operative time was 210 minutes (range: 180-250 minutes). Lymph node dissection was performed in 19 cases. Bladder neck preservation was possible in 42 patients (85%). Nerve-sparing was performed in 10 cases (20%).

The median blood loss was 400 mL (range: 100-600 mL). Five patients (10%) required blood transfusion, with only one transfusion unit in each case.

Conversion to open surgery due to uncontrolled DVC bleeding were not encountered. Median catheterization time was 14 days (range: 12-21 days) and mean postoperative stay was 4 days (range: 3-7 days).

Pathological results are summarized in Table 2. Positive surgical margins (R1) were encountered in eight patients, four of them in pT2, three in pT3a and one in pT3b stage, respectively. Eight patients had positive surgical margins (R1). The number of patients with positive surgical margins at prostate apex was three (of the eight cases with R1).

Table 2. Pathological data of final surgical specimen

Variable, measurement unit		Value
pT2, number (%)		37 (74)
pT3a, number (%)		10 (20)
pT3b, number (%)		3 (6)
Pathologic ISUP grade, number (%)	ISUP 1	9 (18)
	ISUP 2	18 (36)
	ISUP 3	14 (28)
	ISUP 4	7 (14)
	ISUP 5	2 (4)
Prostate size, mL, median (range)		44 (30-70)
Dominant tumo ur nodule diameter, mm, median (range)		11 (7-20)
Positive surgical margins (R1), number (%)		8 (16)

According to the definition used in our study, at 3 months post-LRP 27 patients were continent (zero or one safety pad), 19 had moderate incontinence (2 pads) and 4 had severe incontinence. At 6 months post-LRP, 33 patients (66%) were continent, 15 patients (30%) presented moderate incontinence and only 2 patients (4%) had severe incontinence.

Discussion

The recovery of continence is one of the main concerns of patients undergoing radical prostatectomy, expecting also an early return to this function [5]. Minimally invasive approaches aim to improve the functional results, with multiple technical variations described in the last years [6,7]. The anatomical preservation of external urinary sphincter is essential for continence post-RP. Damage to the sphincter during standard ligation of DVC was incriminated to contribute to the postoperative incontinence, due to the proximity of the two structures. There is also a risk of passing the needle through the prostate apex and lasting prostate tissue in place after sectioning the complex [8].

In laparoscopic and robotic surgery, due to the use of pneumoperitoneum, DVC can be safely sectioned without prior ligation, and then placing the suture of the distal stump without intercept the

sphincter muscle fibers. In the studies cited by a review published in 2023 that describes the evolution of DVC control strategy, the blood loss was not clinically significant, but the full continence returned earlier for a greater number of patients with selective ligature of DVC when compared with standard approach during laparoscopic or robotic RP [8].

Porpiglia et al performed first prospective and randomized study that compared the continence results of patients with selective ligation of DVC with those with standard approach during laparoscopic radical prostatectomy. They found a higher continence rate in the first group at 3 months (both in terms of number of daily pads and standardized questionnaire scores), but without statistically significant difference at 6 and 12 months postoperatively [10].

Our continence results at 3 and 6 months are comparable, but slightly inferior with those published in literature [5]. Most of the studies that evaluated the impact of selective control of DVC in continence recovery included cases performed by surgeons with increased experience in LRP, which can explain the higher continence rates compared with our results. The oncological outcomes don't seem to be compromised by selective technique in our study, the rate of positive surgical margins, particularly at the prostate apex, was comparable with the existing data in literature [8,10].

Anatomic studies showed that Santorini's plexus covering the prostate and urethral sphincter contains not only venous sinuses that drains penile veins as it was thought. Two small arteries can be often symmetrically observed. There is a considerable number of nerve fibers, part of neurovascular bundles, that extends on the anterolateral aspect of prostate up to the 2 o'clock (right side) and 10 o'clock (left side), that continues distally. These structures can also be injured during standard management of DVC, thus the collaborative review published (and updated in 2016) in European Urology by Walz et al regarding current knowledge of surgical anatomy of prostate strongly recommends the selective dissection and ligation of the complex [11,12]. Thus, we consider that the preservation of neurovascular elements of DVC using a selective control contributes to the improvement of the functional results after RP.

The main drawback of technique is represented by significant bleeding that negatively influence sometimes the visibility of surgical field and doesn't allow a safe resection of prostate apex with negative margins. There are several tips and tricks that we systematically applied in order to minimize the bleeding originating of the DVC and increase visibility. Firstly, before management of DVC, we increased the insufflation gas pressure to 18 mmHg. In cases with wide Santorini plexus, we first coagulated using bipolar forceps the superficial layer and the lateral parts of complex. We performed the sectioning of DVC just near the prostate apex, not only to better preserve the external urethral sphincter and membranous urethra, but to have a more manageable bleeding, given that the diameter of venous sinuses is smaller at this level when compared with more distal. In our experience, the median blood loss (400 mL) was not higher than reported in most of the study in literature [8,10].

One of the main limitations of this study is the absence of a control study group, given that this is our initial experience in LRP. Because of the retrospective method for data collection, we considered that quantifying number of pads per day is the best way to evaluate the degree of postoperative incontinence. It is more difficult for patients to be objective to a questionnaire when they are asked retrospectively regarding their continence.

Conclusions

Preservation of external urethral sphincter without compromising oncological results during DVC control is essential for early recovery of continence after RP. In our study, we demonstrated that selective ligature of DVC is feasible in LRP, with good oncological and functional results.

References

1. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, Jemal A. Global cancer statistics

2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2024 May-Jun;74(3):229-263. doi: 10.3322/caac.21834.
2. Rawla P. Epidemiology of Prostate Cancer. World J Oncol. 2019 Apr;10(2):63-89. doi: 10.14740/wjon1191.
3. Tilki D, van den Bergh RCN, Briers E, Van den Broeck T, Brunckhorst O, Darraugh J, et al. EAU-EANM-ESTRO-ESUR-ISUP-SIOG Guidelines on Prostate Cancer. Part II-2024 Update: Treatment of Relapsing and Metastatic Prostate Cancer. Eur Urol. 2024 Aug;86(2):164-182. doi: 10.1016/j.eururo.2024.04.010.
4. Rassweiler J, Schulze M, Teber D, Seemann O, Frede T. Laparoscopic radical prostatectomy: functional and oncological outcomes. Curr Opin Urol. 2004 Mar;14(2):75-82. doi: 10.1097/00042307-200403000-00005.
5. Azal W Neto, Capibaribe DM, Dal Col LSB, Andrade DL, Moretti TBC, Reis LO. Incontinence after laparoscopic radical prostatectomy: a reverse systematic review. Int Braz J Urol. 2022 May-Jun;48(3):389-396. doi: 10.1590/S1677-5538.IBJU.2021.0632.
6. Cambio AJ, Evans CP. Minimizing postoperative incontinence following radical prostatectomy: considerations and evidence. Eur Urol 2006;50:903–13. doi: 10.1016/j.eururo.2006.08.009.
7. Sridhar AN, Abozaid M, Rajan P, Sooriakumaran P, Shaw G, Nathan S, Kelly JD, Briggs TP. Surgical Techniques to Optimize Early Urinary Continence Recovery Post Robot Assisted Radical Prostatectomy for Prostate Cancer. Curr Urol Rep. 2017 Sep;18(9):71. doi: 10.1007/s11934-017-0717-4.
8. Wang Y, Cheng X, Xiong Q, Cheng S. The progress of dorsal vascular complex control strategy in radical prostatectomy. J Int Med Res. 2023 Feb;51(2):3000605231152091. doi: 10.1177/03000605231152091.
9. Rocco F, Carmignani L, Acquati P, et al. Restoration of posterior aspect of rhabdoshpincter shortens continence time after radical retropubic prostatectomy. J Urol 2006; 175:2201–6.
10. Porpiglia F, Fiori C, Grande S, Morra I, Scarpa RM. Selective versus standard ligature of the deep venous complex during laparoscopic radical prostatectomy: effects on continence, blood loss, and margin status. Eur Urol. 2009 Jun;55(6):1377-83. doi: 10.1016/j.eururo.2009.02.009.
11. Walz J, Burnett AL, Costello AJ, Eastham JA, Graefen M, Guillonneau B, et al. A critical analysis of the current knowledge of surgical anatomy related to optimization of cancer control and preservation of continence and erection in candidates for radical prostatectomy. Eur Urol. 2010;57:179–92. doi: 10.1016/j.eururo.2009.11.009
12. Walz J, Epstein JI, Ganzer R, Graefen M, Guazzoni G, Kaouk J, et al. A critical analysis of the current knowledge of surgical anatomy of the prostate related to optimisation of cancer control and preservation of continence and erection in candidates for radical prostatectomy: an update. Eur Urol. 2016;70:301–11. doi: 10.1016/j.eururo.2016.01.026.