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REVIEW ARTICLE

Radical cystectomy practice patterns in the Nordic countries: results from the prospective NorCys study

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ABSTRACT

Background: Muscle invasive bladder cancer (MIBC) is an aggressive disease with a high mortality rate. Radical cystectomy (RC) is the standard treatment for MIBC and selected non-muscle invasive bladder cancer (NMIBC) cases. The NorCys-study (NCT04523038, NCT04537221 and NCT04523025) aims to validate biomarkers predicting RC outcomes. This report describes RC practice patterns across the Nordic countries.
Materials and Methods: This prospective, multi-institutional study included bladder cancer patients undergoing RC with or without preoperative chemotherapy in all five Nordic countries from 5/2020 to 1/2025. Clinical and pathological data were collected prospectively into REDCap database and analysed using descriptive statistics, Wilcoxon rank sum and Pearson's Chi-squared tests.
Results: A total of 1,642 patients from 15 centres were enrolled. Of these, 35% (531) had clinical NMIBC (T1-Tis-Ta), and 65% (999) had cT2-4 disease. Preoperative chemotherapy was administered to 398/929 (43%) cT2-4 or node-positive patients. The most common neoadjuvant chemotherapy (NAC) regimens were gemcitabine – cisplatin (GC) (275/475 [58%]) and dose-dense methotrexate, vinblastine, doxorubicin and cisplatin (dd-MVAC) (144/475 [30%]). Robot-assisted RC was the most common surgical approach administered in 886 of 1,472 (60%) cases, with variation between centres. Ileal conduit was the predominant diversion method in 1,375 out of 1,465 cases (94%). Median surgical time was 322 min, blood loss was 300 mL and hospital stay was 9 days. Final pathology demonstrated pT0 in 29%, ≥pT2 in 43% and lymph node metastases 203 (17%).
Conclusion: This study reports current RC practices amongst Nordic countries. Patient cohorts did not differ between countries, and although the practices were generally similar, some differences were noted in chemotherapy regimens, the use of robotic-assisted surgery and rates of early RC.

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Introduction

Approximately 7,200 new bladder cancer (BC) cases are diagnosed annually in the Nordic countries, and 25% are muscle invasive bladder cancers (MIBCs) [1]. BC is three times more common in men; however, women are more likely to present with a more advanced tumour stage [2]. MIBC is associated with high mortality and radical cystectomy (RC) with pelvic lymph node dissection (PLND) is the standard treatment [3]. RC is also recommended as the first line treatment for selected patients with non-muscle invasive bladder cancer (NMIBC) with a very high risk for disease progression. To improve survival outcomes, cisplatin-b--ased neoadjuvant chemotherapy (NAC) is recommended for eligible patients with MIBC undergoing RC [3], and in node positive disease, induction chemotherapy with either cisplatin- or carboplatin combinations has evolved as a treatment standard [4].

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Extend of the disease is the main prognostic factor for patients undergoing RC [5, 6], and tumour downstaging with NAC has been shown to be a proxy for chemosensitivity and improved survival without increasing the risk for postoperative complications [7–10]. Nevertheless, RC is an operation prone to postoperative complications. Approximately 60% of patients experience some adverse events postoperatively, and mortality rates vary between 1% and 10% [11, 12]. Risk of complications increases with age, comorbidity, body mass index (BMI), advanced tumour stage, blood loss and longer surgical time [11–13]. The enhanced recovery after surgery protocol (ERAS) has been introduced to reduce the risk of complications, enhancing patient recovery after surgery and shortening hospital stay [14]. The protocol emphasises avoiding bowel preparation and nasogastric tubes, promoting early peroral feeding and applying non-narcotic pain management strategies. Recently, robot-assisted radical cystectomy (RARC) has gained popularity alongside open radical cystectomy (ORC), offering comparable oncological outcomes and rates of major complications. RARC is associated with reduced blood loss, fewer transfusions and shorter hospital stays, though it might involve longer surgical time [15].

Several studies have examined country-specific trends in RC practices across the Nordic countries. Surveys and national databases in Denmark, Finland, Iceland, Norway and Sweden have analysed surgical volume and methods, complications, chemotherapy use and perioperative outcomes [16–21]; however, high-quality prospective series in a modern and population-based setting with centralised cystectomy care is currently lacking.

The Nordic Cystectomy (NorCys) trial was launched in 2020 to investigate predictive and prognostic biomarkers related to postoperative complications and BC survival in a multi-national fashion (NCT04523038, NCT04537221 and NCT04523025) in Nordic countries. Specifically, NCT04523025 assesses the prognostic value of the neutrophil-lymphocyte ratio (NLR) for oncological outcomes, NCT04523038 investigates the role of low albumin levels in predicting postoperative complications and NCT04537221 examines the potential impact of perioperative blood transfusions on cancer-specific survival. The aim of this article is to describe practice patterns across various centres in the Nordic countries, with particular emphasis on differences in treatment pathways, surgical approaches and the application of preoperative chemotherapy (neoadjuvant or induction).

Materials and methods

This prospective, registered, multi-institutional study was conducted in all five Nordic countries (Denmark, Finland, Iceland, Norway and Sweden) as a joint effort of the Nordic urothelial cancer research group (NORTH-REG). The study was approved by the National Ethics Committees in each participating country. The national principal investigator was responsible for obtaining individual hospital permissions. The trial was carried out in the accordance with the Declaration of Helsinki in the revised version of Somerset West, South Africa 2013 and the Principles of Good Clinical Practice (ICH-GCP). A signed and informed consent was obtained from all subjects. To date, a total of 15 centres (Denmark, *n* = 4; Finland, *n* = 5; Iceland, *n* = 1; Norway, *n* = 1 and Sweden, *n* = 4) have participated in the study.

The inclusion criteria for this study were as follows: histologically confirmed BC planned to be treated RC with or without NAC or induction chemotherapy, age ≥18 years. Palliative cystectomies were also included. The procedure was classified as palliative if it was performed without the radical intent (e.g. leaving metastatic Lymph nodes (LN)) and merely done to alleviate symptoms (e.g. bleeding, pain or obstruction). The operation was recorded as palliative based on the treating physician's assessment. Patients were excluded from the study if RC was performed for other reasons than BC, patient received other forms of surgical treatment for BC than RC and lack of signed consent.

After consenting, the delivery or omission of planned treatment was recorded. Basic clinical information such as patient age, BMI, American Society of Anesthesiologists (ASA) classification and smoking status before surgery was recorded. Charlson co-morbidity (CCI) score was used in preoperative comorbidity evaluation [22]. Information on preoperative chemotherapy, including the regimen and number of cycles administered, was also collected. Details of RC included surgical method (robot, open), surgical time, estimated blood loss, diversion type and whether urethrectomy was performed. All pathology reports were reviewed, and the Tumor, Nodes, Metastasis (TNM) classification was used to evaluate the clinical stage at diagnosis and the final pathological stage at the time of RC [5]. Information on the total number of positivity of lymph nodes excised at the time of RC was included.

All patient data were collected into a secure online research electronic data capture platform, REDCap. REDCap is a browser-based software for electronic data, and it is used for academic clinical and translational research purposes [23, 24]. All the data were collected in an electronic case report form as pseudonymised coded data. The interactive web response (IWRS) automatically generated the de-identification code, and the key to the coding was maintained in each participating centre. We collected information if data were not available (NA), and real missing data were requested from each centre. We reported number of observations in each table for each variable to transparently report number of missing data (*n*, %). Variables were summarised with descriptive statistics. Normality of continuous variables was evaluated visually and tested with the Shapiro-Wilk test. Due to non-normality median and interquartile ranges were reported, categorical variables were summarised with counts and percentages. The Wilcoxon rank sum test was used for continuous variables and Pearson's Chi-squared test for categorical variables. For robotic surgery and NAC, their associations with clinical explanatory variables were analysed using binominal logistic regression models.

All tests were performed as two-sided with a significance level set at 0.05. The analyses were performed using RStudio, version 2024.04.2 based on R, version 4.4.1.

Results

The first subject was consented to the study on May 2020, and at the time of data collection (January 2025), a total on 1,642 subjects were enrolled from 15 centres.

Table 1 presents the baseline characteristics and clinical staging of the tumours per participating country. Most patients (76%) were male, and the median age was 73 (Inter quartile range [IQR]: 66–78) years. The median BMI was 26.4 (IQR: 23.9–29.4). For comorbidities, 1,003/1,548 (65%) of the subjects had CCI ≥ 3. A majority (56%, 811/1,440) of the patients had an ASA-score 2, and 518/1,440 (36%) had ASA ≥ 3. Approximately one fifth (275/1,516, 18%) of the study cohort was active smokers; however, only 379/1,516 cases (25%) did not have any smoking history. A total of 531/1,530 (35%) patients underwent RC for clinical NMIBC (cTa-T1-Tis), with rates varying from 13/110 (17%) in Norway to 280/729 (39%) in Denmark. Overall, 249/1,530 (16%) were suspected to have extravesical tumour growth on diagnosis (cT3-4). In Denmark, the cT-category was ≥T2 in most cases, but more detailed staging was not specified. Overall, 185/1,488 (12%) of the cohort had cN+ disease, and urothelial carcinoma accounted for 1,457/1,557 (94%) of all cases.

Surgical details are depicted in Table 2. In the entire cohort, RARC was the most common surgical modality performed in 886/1,472 (60%) with significant variability between the participating countries and centres. In Finnish centres, only 10/247 (6%) surgeries were performed with robot-assisted RC, whereas in Iceland, almost all (29/31 [94%]) cases were performed using robotic assistance. In countries where

Table 1. Basic characteristics of the study cohort (*N* = 1,642) included in the NorCys trial between May 2020 and January 2025 across 15 Nordic centres.

Characteristic (*n*, %)	Denmark	Finland	Iceland	Norway	Sweden	Overall
	N = 729[1]	*N* = 247[1]	*N* = 31[1]	*N* = 110[1]	*N* = 525[1]	*N* = 1,642[1]
Age (1,548, 94%)[2]	73 (66, 78)	72 (64, 76)	72 (63, 76)	72 (67, 77)	74 (68, 78)	73 (66, 78)
Gender (1,642, 100%)						
Female	171 (23%)	54 (22%)	9 (29%)	26 (24%)	126 (24%)	387 (24%)
Male	558 (77%)	193 (78%)	22 (71%)	84 (76%)	399 (76%)	1,255 (76%)
BMI (1,538, 94%) (kg/m^2)	26.5 (23.8, 29.5)	26.9 (24.2, 29.8)	26.8 (24.9, 29.7)	25.9 (22.5, 29.4)	26.3 (24.1, 29.2)	26.4 (23.9, 29.4)
CCI (1,548, 94%)						
0	9 (1%)	7 (3%)	1 (3%)	0 (0%)	8 (2%)	25 (2%)
1	62 (9%)	30 (13%)	2 (7%)	7 (6%)	36 (7%)	137 (9%)
2	175 (26%)	57 (24%)	10 (33%)	30 (28%)	111 (22%)	383 (25%)
3	312 (47%)	104 (44%)	13 (43%)	48 (44%)	251 (49%)	728 (47%)
4	101 (15%)	34 (15%)	4 (13%)	23 (21%)	99 (19%)	261 (17%)
5	9 (1%)	2 (1%)	0 (0%)	0 (0%)	3 (1%)	14 (1%)
ASA (1,440, 88%)						
1	67 (10%)	6 (3%)	3 (10%)	1 (1%)	34 (8%)	111 (8%)
2	391 (57%)	72 (40%)	25 (81%)	60 (60%)	263 (60%)	811 (56%)
3	225 (33%)	93 (52%)	3 (10%)	36 (36%)	143 (32%)	500 (35%)
4	6 (1%)	7 (4%)	0 (0%)	3 (3%)	2 (0%)	18 (1%)
Smoking (1,516, 92%)						
Current	152 (22%)	34 (17%)	2 (7%)	20 (20%)	67 (14%)	275 (18%)
Former	407 (59%)	91 (46%)	18 (62%)	56 (57%)	290 (58%)	862 (57%)
Never	135 (19%)	72 (37%)	9 (31%)	22 (24%)	141 (28%)	379 (25%)
cT[3] (1,530, 93%)						
Ta-Tis-T1	280 (39%)	41 (21%)	7 (23%)	13 (17%)	190 (38%)	531 (35%)
T2	395 (55%)	108 (54%)	16 (52%)	39 (51%)	190 (38%)	750 (49%)
T3	26 (4%)	39 (20%)	8 (26%)	19 (25%)	99 (20%)	192 (13%)
T4	14 (2%)	11 (6%)	0 (0%)	5 (6%)	27 (5%)	57 (4%)
cN (1,488, 91%)						
N+	62 (9%)	26 (13%)	3 (10%)	8 (12%)	85 (17%)	185 (12%)
N0	630 (91%)	173 (87%)	27 (90%)	59 (88%)	412 (83%)	1,303 (88%)
Histology (1,557, 95%)						
Urothelial ca	659 (92%)	187 (94%)	30 (97%)	98 (95%)	483 (95%)	1,457 (94%)
Squamous ca	23 (3%)	2 (1%)	0 (0%)	1 (1%)	13 (3%)	39 (3%)
Adeno ca	6 (1%)	4 (2%)	0 (0%)	0 (0%)	3 (1%)	13 (1%)
Small cell ca	15 (2%)	3 (2%)	0 (0%)	3 (3%)	1 (0%)	22 (1%)
Other	15 (2%)	2 (1%)	1 (3%)	2 (2%)	6 (1%)	25 (2%)

BMI: body mass index; CCI: Charlson Comorbidity Index; ASA: American Society of Anesthesiologists Classification; cT: clinical T-category; cN: clinical N-category.

[1]Median (Q1, Q3); n (%); [2]number and percentage of patients with available data of entire cohort; [3]cT-category for MIBC was not routinely differentiated between cT2 and cT3 in Denmark.

Table 2. Surgical details and hospital stay of the study cohort (*N* = 1,642) included in the NorCys trial between May 2020 and January 2025 across 15 Nordic centres.

Characteristic (*n*, %)	Denmark	Finland	Iceland	Norway	Sweden	Overall
	N = 729[1]	*N* = 247[1]	*N* = 31[1]	*N* = 110[1]	*N* = 525[1]	*N* = 1,642[1]
Surgical modality (1,472, 90%)[2]						
Open	95 (13%)	168 (94%)	2 (6.5%)	61 (55%)	260 (58%)	586 (40%)
Robotic	613 (87%)	10 (6%)	29 (94%)	49 (45%)	185 (42%)	886 (60%)
Diversion method (1,465, 89%)						
Conduit	678 (96%)	158 (89%)	31 (100%)	93 (85%)	415 (94%)	1,375 (94%)
Continent cutaneous pouch (Lundiana)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (0%)	1 (0%)
Neobladder	26 (4%)	19 (11%)	0 (0%)	14 (13%)	15 (3%)	74 (5%)
Ureterocutaneostomy	3 (0%)	1 (1%)	0 (0%)	2 (2%)	9 (2%)	15 (1%)
Urethrectomy (1,351, 82%)						
No	598 (88%)	150 (85%)	31 (100%)	23 (92%)	315 (71%)	1,117 (83%)
Yes	78 (12%)	27 (15%)	0 (0%)	2 (8%)	127 (29%)	234 (17%)
Lymphadenectomy (1,452, 88%)						
Extended	451 (64%)	29 (17%)	0 (0%)	22 (22%)	135 (31%)	637 (44%)
Standard	216 (31%)	126 (72%)	16 (52%)	62 (63%)	283 (64%)	703 (48%)
Limited	8 (1%)	6 (3%)	4 (13%)	10 (11%)	5 (1%)	33 (2%)
None	31 (4%)	14 (8%)	11 (35%)	4 (4%)	19 (4%)	79 (5%)
Time from skin to skin (min) (1,466, 89%)	301 (249, 367)	264 (221, 300)	364 (334, 383)	260 (200, 303)	439 (360, 534)	322 (259, 410)
Length of stay (days) (1,334, 81%)	8 (6, 12)	10 (8, 14)	4 (4, 4)	8 (7, 11)	11 (8, 14)	9 (7, 13)
Blood loss (millilitres) (1,293, 79%)	200 (100, 400)	825 (550, 1,300)	100 (90, 250)	425 (200, 725)	350 (200, 600)	300 (150, 650)
Intraoperative transfusions (1,420, 86%)						
Yes	23 (3%)	60 (26%)	1 (3%)	0 (0%)	78 (17%)	162(11%)
No	644 (97%)	170 (74%)	30 (97%)	44 (100%)	370 (83%)	1,258 (89%)
Postoperative transfusions (1,157, 70%)						
Yes	108 (20%)	36 (22%)	3 (10%)	1 (25%)	109 (26%)	257 (22%)
No	432 (80%)	129 (78%)	28 (90%)	3 (75%)	308 (74%)	900 (78%)

[1]*n* (%); Median (Q1, Q3); [2]number and percentage of patients with available data of entire cohort.

univariate analyses were conducted, ASA score and cT category were significantly associated with the selection of RARC versus open surgery. However, after multivariate adjustment, only study country remained independently associated with RARC utilisation.

In RARC procedures, 98% of urinary diversions were performed intracorporeally. The most common diversion method was the ileal conduit performed in 1,375 out of 1,465 cases (94%). Other diversion methods were neobladder (74/1,465 [5%]), ureterocutaneostomy (15/1,465 [1%]) and continent cutaneous pouch (1/1,465 [0%]). The utilisation of neobladders ranged from 0% (Iceland) to 14/110 (13%) in the Norwegian centre. There was also significant variability in the rate of urethrectomy. In Iceland, no urethrectomies were performed, whereas in Swedish centres, urethrectomy was performed in 127/525 (29%) surgeries. Most patients received either standard (703/1,452 [48%]) or extended (637/1,452 [44%]) PLND. The median surgical time was 322 min with no difference between RC and RARC (ORC median 324 min vs. RARC median 320 min, $p = 0.450$). The median blood loss was 300 ml, and the blood loss was higher in open versus RARC (ORC median 600 ml vs. RARC median 200 ml, $p < 0.001$). Median hospital stay was 9 days (IQR: 7, 13), which is the shortest in Iceland (4 days, IQR: 4, 4). Patients treated with ORC had a longer median hospital stay (10 vs. 7 days). The median length of hospital stay was 9 (7–13) days amongst patients receiving an ileal conduit, similarly 9 (8–13) days amongst those undergoing ureterocutaneostomy, whereas patients with a neobladder had a median hospital stay of 10 (7–13) days. Intraoperative transfusions were administered to 162/1,420 (11%) patients, with rates varying across countries from 0% to 26%. Postoperative transfusions were administered to 257/1,157 (22%) patients.

Table 3 describes the use of neoadjuvant and induction chemotherapy and details of NAC. A total of 398/929 (43%) MIBC patients did not receive chemotherapy. NAC was combined with RC with curative intent in 389/929 (43%) cases, and induction chemotherapy was received by 83/929 (9%) MIBC patients. The Supplement Table S2A provides uni- and multivariate analyses of factors affecting the utilisation of NAC. In country with univariate analysis study, age, smoking, cT-category and cN-category but not gender and ASA-score were associated significantly with the NAC use. In country with a multivariate model study, BMI, smoking and clinical stage (both cT- and cN-categories) were independently associated with NAC use, and the study country and clinical stage had the strongest effect.

Induction regimen was used in a larger proportion in Sweden (20%) compared to the other countries (0–8%). In the entire cohort, the median time from Transurethral Resection of Bladder

Tumor (TUR-BT) to cystectomy was 131 days for patients receiving neoadjuvant or induction chemotherapy and 50 days for those without. Supplementary Tables S1A and S1B show the time taken for the RC procedure with a division of different time periods. This demonstrates that in the entire cohort, the time from TUR-BT to RC was >110 days in 100 (11%) subjects without NAC and >180 days in 87 (17%) subjects with NAC. Palliative RC was performed in 22/974 (2%) patients. Cisplatin-Gemcitabine (GC) was the most common NAC regimen (275/475 [58%]), followed by dose-dense Methotrexate, Vinblastine, Doxorubicin and Cisplatin (dd-MVAC) (144/475 [30%]). GC was mainly used in Danish and Finnish centres, whilst Icelandic, Norwegian and Swedish centres primarily used dd-MVAC. In addition, a few patients (56/475 [12%]) received carboplatin-gemcitabine or other non-specified regimens in the induction setting, that is, clinically node positive disease. The mean number of NAC cycles was 3 (IQR: 3, 4), and the mean number of cycles administered as induction chemotherapy was 5 (IQR: 4, 6).

Table 4 presents the final pathological stages of the cystectomy specimens (pT). The postoperative pathological stage was T0 in 364/1,266 cases (29%), Ta-Tis-T1 in 355/1,266 cases (28%), whereas 547/1,266 (43%) patients had T2 or higher disease. Patients treated with NAC achieved pT0 disease more frequently (40%) than those not receiving NAC (22%) (Supplementary Table 3). The median number of lymph nodes removed was 21 (IQR: 15–29), and 203/1,206 (17%) surgical specimens showed pathological lymph node involvement. Lymph node positivity was observed in 16% of patients treated with NAC compared with 17% of patients not treated with NAC (Supplementary Table 3).

Discussion

This prospective study reports the characteristics of RCs performed at 15 centres in all five Nordic countries during 2020–2024, an era following a great degree of centralisation of such surgery. The Nordic countries have similar public health systems with centralised care of RCs into academic centres. Despite this, practice patterns differences exist. The most significant differences between the centres were the use of RARC, extent of

Table 3. Details of neoadjuvant and induction chemotherapy in the NorCys study for muscle invasive (cT ≥ ct2) or clinically node positive (cN+) subjects (*N* = 999)

Characteristic (*n*, %)	Denmark	Finland	Iceland	Norway	Sweden	Overall
	N = 435[1]	*N* = 158[1]	*N* = 24[1]	*N* = 66[1]	*N* = 316[1]	*N* = 999[1]
Planned treatment (988, 99%)[2]						
RC only	217 (52%)	65 (41%)	3 (13%)	30 (45%)	129 (42%)	444 (46%)
RC + NAC	177 (43%)	78 (49%)	19 (79%)	31 (47%)	113 (36%)	418 (43%)
RC + induction chemotherapy	19 (5%)	5 (3%)	2 (8%)	0 (0%)	64 (21%)	90 (9%)
Palliative RC	3 (1%)	10 (6%)	0 (0%)	5 (8%)	4 (1%)	22 (2%)
Delivered chemotherapy (929, 93%)						
Induction chemotherapy	21 (5%)	4 (3%)	2 (8%)	0 (0%)	56 (20%)	83 (9%)
NAC	179 (43%)	74 (49%)	19 (79%)	32 (48%)	94 (34%)	398 (43%)
RC only	215 (52%)	72 (48%)	3 (13%)	34 (52%)	124 (45%)	448 (48%)
Regimen (475, 48%)						
CAR-GEM	6 (3%)	1 (1%)	0 (0%)	0 (0%)	15 (10%)	22 (5%)
CIS-GEM	168 (86%)	72 (94%)	6 (29%)	7 (22%)	22 (15%)	275 (58%)
dd-MVAC	1 (1%)	0 (0%)	14 (67%)	24 (75%)	105 (70%)	144 (30%)
Other	20 (10%)	4 (5%)	1 (5%)	1 (3%)	8 (5%)	34 (7%)

RC: radical cystectomy; NAC: neoadjuvant chemotherapy; CAR-GEM: Carboplatin – Gemcitabine; CIS-GEM: Cisplatin – Gemcitabine; dd-MVAC: dose-dense Methotrexate, Vinblastine, Doxorubicin and Cisplatin.

[1]*n* (%); [2]number and percentage of patients with available data of entire cohort.

Table 4. The final pathological stage of radical cystectomy specimen in the NorCys study (*N* = 1,642)

Characteristic (*n*, %)	Denmark	Finland	Iceland	Norway	Sweden	Overall
	N = 729[1]	*N* = 247[1]	*N* = 31[1]	*N* = 110[1]	*N* = 525[1]	*N* = 1,642[1]
pT (1,266, 77%)[2]						
T0	176 (32%)	55 (32%)	12 (39%)	18 (19%)	103 (25%)	364 (29%)
Ta-Tis-T1	143 (26%)	26 (15%)	6 (19%)	31 (33%)	149 (36%)	355 (28%)
T2	105 (19%)	20 (11%)	4 (13%)	13 (14%)	59 (14%)	201 (16%)
T3	92 (17%)	46 (26%)	7 (23%)	29 (31%)	74 (18%)	248 (20%)
T4	34 (6%)	27 (16%)	2 (6%)	4 (4%)	31 (7%)	98 (8%)
pN (1,206, 73%)						
N+	82 (16%)	34 (21%)	4 (18%)	19 (22%)	64 (16%)	203 (17%)
N0	447 (84%)	130 (79%)	18 (82%)	68 (78%)	340 (84%)	1,003 (83%)
Total nodes (1,222, 74%)	22 (16, 28)	18 (10, 23)	8 (0, 10)	15 (11, 23)	25 (18, 34)	21 (15, 29)

pT: pathological T-category; pN: pathological N-category.

[1]*n* (%); Median (Q1, Q3); [2]number and percentage of patients with available data of entire cohort.

PLND, reconstruction with neobladder and performance of urethrectomy. Despite some differences in preoperative stage distribution, the use of preoperative chemotherapy was rather similar. The study is based on selected centres in each country, which means that some differences between countries may actually reflect local traditions (except for Iceland, which has only one centre for RC). Our study is one of the largest prospective studies and presents contemporary data in international Nordic setting. In future publications from NorCys, it will be of interest to examine the impact of different imaging modalities, such as Positron Emission Tomography – Computed Tomography (PET-CT) versus conventional CT, on clinical decision-making, including the extent of lymphadenectomy and selection of patients for NAC.

Use of RARC

In our study, all RCs were performed as open RC (ORC) or RARC. ORC has traditionally been the standard surgical modality; however, the use of robotic surgery has increased exponentially during the last decade, and it has shown reduced perioperative morbidity whilst maintaining oncological outcomes [25]. Previously, in the Nordic countries, a survey was conducted across 47 centres performing RCs. This study examined surgical volume, complications, preoperative imaging, chemotherapy use, multidisciplinary conferences, and perioperative and postoperative care practices from 2016 to 2017. At that time, RARC was used in 46% of the cases [16]. In the current study, the most common surgical modality was RARC, accounting for 60% of all procedures. RARC was the predominant surgical approach in Danish centres (87%) and Iceland (94%). A previous Danish nationwide study identified all BC patients who underwent RC (2006–2013) from the Danish National Hospital Register, evaluating perioperative mortality, length of hospital stay and readmissions by time trends, technique and volume. They reported an RARC rate of only 19%, whilst our study highlights a marked Danish increase to 87% over the last decade [19]. In our study, in a multivariate model, only study country was associated significantly with the use of RARC, highlighting that the adoption phase of RARC affects the surgical modality more than patient or tumour characteristics.

Diversion methods and use of primary urethrectomy

Ileal conduit was the most common diversion method in the present study, and it was utilised in 94% of cases. Neobladder reconstruction was performed in fewer patients, with clear differences between countries. In Finnish (11%) and Norwegian centres (13%), neobladder procedures were more common than in other countries. Crozier and co-workers reported that the decision of urinary diversion method is influenced by the patient's overall condition, cancer prognosis, surgical technique and quality of life considerations [26]. When choosing a neobladder, the risk of local and urethral recurrence must be considered as well as good kidney function, motivation and capability to perform self-catheterisation [26]. Additionally, surgery time was observed to be longer when constructing a neobladder. In the RAZOR-trial, all the patients underwent extracorporeal diversion [15]. Mastroianni et al evaluated differences between ORC and RARC with intracorporeal urinary diversion and reported significantly lower perioperative transfusion rates and perioperative bleeding using the intracorporeal diversion technique [27]. We observed that patients who underwent ORC had greater blood loss and longer median hospital stay (10 days) compared to those who underwent RARC (7 days). In Swedish centres, a higher proportion of patients were operated with primary urethrectomy (29%), whereas the proportion of patients receiving a neobladder was lower than in Finnish and Norwegian centres. Whether these different practice patterns are related to preoperative use of resection biopsies from the prostatic urethra or propensities to use continent reconstructions in general is not known.

Pelvic lymphadenectomy

In our study, the standard lymphadenectomy template was the predominant choice except for Danish centres where an extended PLND was preferred. Standard pelvic lymphadenectomy (sPLND) involves the excision of nodal tissue around the internal and external iliac artery, and the obturator fossa with the upper boundary being the point where the common iliac artery bifurcates. In contrast, the aortic bifurcation constitutes the upper boundary of an extended pelvic lymphadenectomy (ePLND), which is the aortic bifurcation [3]. The different proportion of clinically node positive disease between countries (9% – 17%) could be related to differences in staging methods (CT vs. Fluorodeoxyglucose (FDG) PET-CT). These staging modalities might also influence the propensity to use an extended lymphadenectomy template (as well as the use of induction chemotherapy regimen). A systematic review of 11 studies (2 Randomized Controlled Trial (RCT), 9 observational) including 4,001 patients reported that extended PLND was associated with improved recurrence-free survival and lowers 5-year recurrence rates compared to standard PLND. No significant differences were observed in disease-specific survival, overall survival or complication rates [28]. Also, recent data from the randomised Southwest Oncology Group (SWOG) S1011-trial showed no survival benefit from ePLND compared to sPLND, and the extended surgery was associated with increased peri-operative morbidity and mortality [29].

Use of preoperative chemotherapy

If eligible, MIBC patients undergoing RC should be offered neoadjuvant cisplatin-based combination chemotherapy [3]. In the landmark paper by Grossman et al. published in 2003, a median survival benefit of over 30 months using platinum-based NAC was reported compared to patients treated with RC alone [7]. A survival benefit of up to 8% has been verified in 4 meta-analyses since [9, 30–32]. In our study, the NAC utilisation rate amongst the patients with cT2 or higher disease was 43%. Our utilisation rate was slightly higher than the national Finnish NAC utilisation rate of 29% reported by Nikulainen et al. but aligns with their findings when excluding ineligible patients [17]. In Sweden, 65% of patients received cisplatin-based NAC in 2023, a proportion higher than in our cohort; however, this estimate was restricted to patients younger than 76 years [21]. In addition, when chemotherapy trends were analysed from Surveillance, Epidemiology, and End Results (SEER) data during 2004–2012, NAC was used in 18% of cases, with 69% receiving cisplatin-based regimens [33]. Thus, our findings suggest an increasing adoption of NAC in clinical practice; however, within the 5-year study period, we did not observe any meaningful temporal variation in its uptake. In our trial, the clinical stage and the study country had the strongest effect on the NAC utilisation. In Swedish and Norwegian centres and in Iceland, the most common regimen was dd-MVAC, whilst in Finnish and in Danish centres, GC was the regimen of choice. The VESPER-trial compared survival outcomes between dd-MVAC and GC and initially showed dd-MVAC to be slightly more toxic in terms of tolerability. However, survival results released in 2022 showed that dd-MVAC improved 3-year progression-free survival compared to GC, perhaps favouring the use of dd-MVAC over GC [34]. Furthermore, 5-year overall survival outcomes favour dd-MVAC over GC in the neoadjuvant settings [35]. The same trial reported a pT0 rate of 42% for dd-MVAC and 36% for GC, with <pT3 observed in 77% and 63% of cases, respectively. In comparison, our study demonstrated a lower pT0 rate (29%) but a similar proportion of <pT3 cases (73%) [35]. Unlike the VESPER-trial, our study has not yet separately analysed patients who received NAC and those who underwent RC only. However, a forthcoming publication will provide more detailed evaluations of these subgroups. The treatment landscape for MIBC is set for substantial transformation due to the advent of novel immunotherapies. Currently, a possible implementation of durvalumab in combination with GC in the neoadjuvant and adjuvant setting is in the pipeline, based on the survival benefit from such treatment compared to neoadjuvant GC alone (NIAGARA-trial) [36].

Perioperative outcomes

In Sweden, a prospective RC database was established in 2011, collecting data on perioperative parameters and early complications. Compared to a report from the database published in 2024, our findings show similar median blood loss (350 mL vs. 300 mL); however, hospital stay is slightly shorter (11 days vs. 9 days) [37]. However, the values are identical to those reported for the Swedish cohort in our study [37]. In our study, no significant difference in surgical time was observed between RARC and ORC. The median surgical time for RARC was 320 min, whilst for ORC, it was 324 min ($p = 0.450$). On the other hand, blood loss and length of hospital stay were lower and shorter, respectively, in the countries that predominantly used RARC (median 600 ml vs. 200 ml, $p < 0.001$ and 11 days vs. 8 days $p < 0.001$), which is in line with randomised data in the 2018 RAZOR-trial that randomised patients between ORC and RARC with an extracorporeal urinary diversion [15]. In that study, lower blood loss but longer operative time was observed in the RARC group. Also, the median length of hospital stay was lower in the RARC-group [15]. Similar findings as in the Parekh et al. study were reported in the iROC study, where hospital stay was shorter (7 vs. 8 days), intraoperative blood loss was lower (200 ml vs. 550 ml), but the operative time is longer for RARC versus ORC (295 min vs. 270 min), although with a total intracorporeal technique with RARC [38]. In our study, the similar operative times for ORC and RARC may reflect the changing landscape with increased adoption of robotic surgery, leading to a reduction in operative time for RARC as the experience with the technique grows.

Conclusion

This study highlights significant variations in practice patterns for RC across the Nordic countries, with diverse approaches to preoperative chemotherapy and surgical methods and serves as a preliminary report on the ongoing NorCys trial. A limitation of the present study is that, whilst data are presented in aggregated form by country, not all centres within each country contributed. Additionally, the results may not reflect practices outside Nordic countries, especially countries with different healthcare systems. Specifically, all centres in Iceland and Norway participated, whereas only selected centres contributed from other countries (e.g. 5 of 7 in Finland). Consequently, the coverage of radical cystectomies within each country is incomplete, which should be considered when interpreting the generalisability of the findings. Despite these limitations, the prospective, multi-institutional, and international design strengthens the validity of the findings, and to our knowledge, this represents the largest prospectively collected RC cohort to date across five countries.

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