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Does patient age affect survival after radical cystectomy?

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OBJECTIVE

- To analyse the impact of patient age on survival after radical cystectomy (RC).

PATIENTS AND METHODS

- After ethics review board approval, two databases of patients with bladder cancer (BC) undergoing RC at the University Heath Network, Toronto, Canada (1992–2008) and the University of Turku, Turku, Finland (1986–2005) were retrospectively analysed.
- A total of 605 patients who underwent this procedure between June 1985 and March 2010 were included.
- Patients were divided into four age groups: ≤59, 60–69, 70–79 and ≥80 years.
- Demographic, clinical and pathological data were compared, as well as recurrence-free survival (RFS), disease-specific survival (DSS) and overall survival (OAS) rates.

RESULTS

- Compared with younger patients (age ≤79 years), elderly patients (age ≥80 years) had higher American Society of Anesthesiologists scores ($P < 0.001$), a greater number of lymph nodes removed during surgical dissection ($P < 0.001$), and underwent less adjuvant treatment ($P < 0.001$).
- Choice of urinary diversion differed among the groups, with ileal conduit being used for all patients ≥80 years ($P < 0.001$).
- No differences were noted between age groups with respect to RFS ($P = 0.3$), DSS ($P = 0.4$) or OAS ($P = 0.4$).

CONCLUSION

- Although RC is an operation with significant morbidity, it is a viable treatment option for carefully selected elderly patients. Senior patients (≥80 years) should not be denied RC if they are deemed fit to undergo surgery.
- Senior adults do not suffer from adverse histopathological features as compared with younger patients.

KEYWORDS

bladder cancer, radical cystectomy, age, elderly

What's known on the subject? and What does the study add?

Elderly patients have more years to compound comorbidities and it has previously been shown that comorbidity is an important predictor of overall survival in patients with bladder cancer, including those treated with radical cystectomy (RC). Other studies have also demonstrated higher stage at diagnosis, higher rate of upstaging on final pathology and a longer delay to definitive therapy for older patients. Because of these findings, elderly patients are being offered RC less often than younger patients. Whether or not this practice is justified has come under recent scrutiny and there has been much conflicting data in the literature. While some studies have shown worse outcomes for elderly patients, others have shown similar results for both elderly and younger patients.

Large population-based databases have recently been used to try to determine whether age effects outcome after RC but their conclusions may not be as generalizable as ours for several reasons: billing code data was used to build patient cohorts, patients were generally recipients of Medicare, lack of pathological review, and lack of available and accurate clinical data. Our series is unique in that it comprises a large group of patients from two major tertiary care academic institutions using a very robust dataset. Pathological specimens were reviewed by dedicated genitourinary pathologists, including those recovered from peripheral hospitals. Our sample size is one of the largest single- or multi-institutional studies.

INTRODUCTION

Bladder cancer (BC) continues to be an important global health burden, and in 2008 there were an estimated 386 300 new cases and 150 200 deaths from this disease [1]. While there is a fourteenfold variation in incidence internationally, it is the fifth most common malignancy overall and the second most common genitourinary malignancy after prostate cancer in the USA [1,2]. Traditionally, prognostic factors for advanced disease have focused on tumour biology, namely stage and histological grade. However, a patient's overall fitness is also a strong predictor of survival.

The incidence of BC increases with age [3]. According to data from the American Cancer Society, the probability of developing BC in the age group 60–69 years is 1/104 and 1/378 for males and females, respectively. For the age group >70 years, it is 1/28 and 1/99 for males and females, respectively [2]. Thus, while advances in medicine have increased the mean lifespan of the population, it has also generated a society of elderly patients affected by this disease and likely to seek treatment. Older patients have more years to compound comorbidities and it has previously been shown that comorbidity is an important predictor of overall survival (OAS) in patients with BC, including those treated with cystectomy [4–6]. Other studies have also shown a higher stage at diagnosis, higher rate of upstaging on final pathology and a longer delay to definitive therapy for older patients [7–10].

While chemotherapy and radiation have an important therapeutic role in the treatment of patients who are unfit for definitive extirpative therapy and in select patients suitable for bladder-sparing approaches, RC with urinary diversion remains the 'gold standard' treatment for muscle-invasive disease or recurrent pathological T1 (pT1)/carcinoma *in situ* (CIS) after multiple failures of intravesical BCG therapy. RC alone may offer a 50–70% 5-year disease-specific survival (DSS) [11,12]. Nonetheless, RC with urinary diversion is one of the most complex urological surgical procedures and single-institution and population-based mortality rates range from 0.3 to 6.8% [13].

It is for these reasons that urologists often opt for more conservative therapies. Senior patients are often treated with radiation therapy rather than RC, not based on the best indication for each approach but rather based on their age [14]. Ideal candidates for bladder-sparing therapies are however limited, and include those with unifocal T2 tumours in the absence of CIS or hydronephrosis, as these factors have been shown to negatively impact patient survival [15].

The deferral of RC for these more conservative methods in some patients who are not ideal candidates for bladder-sparing therapies may have the untoward effect of increasing cancer-specific mortality. Finally, bladder-sparing methods may also cause significant morbidity through recurrent pelvic disease, refractory gross haematuria, clot retention, severe LUTS, ureteric obstruction, radiation cystitis and proctitis, repeat anaesthesia and pelvic pain.

Whether age itself is an independent prognostic factor for patients undergoing RC for BC is controversial and there is still much discrepancy in the literature. While some studies have shown worse outcomes for older patients [8,9,16–19], others have shown similar results among age groups [7,20–25]. Our group aimed to add to the literature by analysing the impact of age on survival after RC in a large multi-institutional cohort and to study whether elderly patients suffer from adverse histopathological features as compared with younger patients.

METHODS

A database comprising 681 patients who underwent RC for BC at two academic centres (University Heath Network, Toronto, Canada, 1992–2008 and University of Turku, Turku, Finland, 1986–2005) was retrospectively analysed. Research ethics board approval was obtained for both datasets at their respective centres. Thirty of these patients received salvage RC after failed radiotherapy or neoadjuvant chemotherapy and they were excluded from the analysis. Forty-six patients with non-urothelial malignancies were also excluded. Thus, our final cohort comprised 605 patients with urothelial BC who underwent RC.

Patients were divided into four groups by age: ≤59, 60–69, 70–79 and ≥80 years. The following data were retrospectively collected: gender, American Society of Anesthesiologists (ASA) score, diversion type, clinical stage, use of adjuvant/neoadjuvant treatment and median number of days between last transurethral resection (TUR) and RC (Table 1). Information from pathological specimens was collected in a similar fashion: grade, pathological T stage, pathological N stage, number of lymph nodes (LNs) removed, number of positive LNs, surgical margin status and pathological upstaging (Table 2). Pathological upstaging was defined as either an increase in T- and/or N-stage after the pathological specimen was analysed compared with the initial clinical impression. Tumour grade was reported according to either the WHO 1973 or WHO/International Society of Urological Pathology 2004 classifications depending on the era of pathological analysis [26,27]. Stage was recorded according to the 2002 TNM classification scheme [28].

The initial diagnostic evaluation consisted of bimanual examination before TUR under general anaesthesia. Abdominal and pelvic CT and chest x-rays were performed on all patients. All transurethral resection of bladder tumour (TURBT) and RC specimens were evaluated by specialist genitourinary pathologists. When the initial TURBT was performed at a peripheral centre, either TURBT slides were reviewed or re-TURBT was performed at the study institutions noted.

The indications for RC included pT2 disease or superficial BC (T1 or CIS) which had failed multiple trials of TURBT and intravesical therapy. RC included removal of the bladder and distal ureters as well as seminal vesicles and prostate in males and uterus, ovaries and anterior vaginal wall in females. Pelvic lymphadenectomy (PL) and extent of resection was left to the judgment of the individual surgeon. Whereas most of the patients from the Toronto cohort underwent PL, most of the patients from Turku underwent limited or no PL. Age was not taken into consideration when deciding on the surgical extent of PL.

Patients were monitored based on the judgment of the treating surgeon but, in general, this consisted of follow-up every 3 months for the first year, bi-annual follow-up until 5 years and annual follow-up thereafter. Follow-up time was defined as the period from the date of the

TABLE 1 Characteristics of patients in the different age groups

	Age group				
	≤59 years	60–69 years	70–79 years	≥80 years	*P*
No. of patients	165	192	201	47	
Gender, *n* (%)					0.6
Female	36 (27)	42 (31)	42 (31)	14 (10)	
Male	129 (27)	150 (32)	159 (34)	33 (7)	
ASA score, *n*					<0.001
1–2	132 (83)	120 (66)	82 (43)	14 (36)	
3–4	27 (17)	61 (34)	110 (57)	25 (64)	
Missing (34)					
Clinical stage, *n* (%)					0.6
CIS/cTa	21 (13)	35 (18)	24 (12)	7 (15)	
cT1	47 (28)	55 (29)	58 (29)	10 (21)	
cT2	72 (44)	86 (45)	89 (44)	24 (51)	
cT3	17 (10)	9 (5)	19 (9)	4 (9)	
cT4	8 (5)	7 (4)	11 (5)	2 (4)	
Median days between last TUR and RC (min, max) (339 patients have available data)	67 (8–395) (*n* = 75)	69 (10–272) (*n* = 92)	70 (6–370) (*n* = 133)	69 (19–350) (*n* = 39)	0.6
Neoadjuvant treatment, *n* (%)	22 (13)	18 (9)	14 (7)	2 (4)	0.1
Diversion, *n* (%)				47 (100)	<0.001
Conduit	62 (38)	112 (58)	172 (86)		
Neobladder	80 (48)	58 (30)	21 (10)		
Continent cutaneous diversion	23 (14)	19 (10)	6 (3)		
Ureterosigmoideostomy	0	2 (1)	0		
Other	0	1 (1)	2 (1)		
Adjuvant treatment, *n* (%)	42/162 (26)	26/184 (14)	14/195 (7)	1/42 (2)	<0.001

RC to the patient's last visit, death or recurrence.

Statistical analysis was performed using SPSS version 17.0 (SPSS Inc., Chicago, IL, USA). Categorical variables were evaluated and compared using chi-squared and Fisher exact tests, as required. Multivariate analysis was performed using logistic regression. DSS, recurrence-free survival (RFS) and OAS curves were generated using the Kaplan–Meier method and log-rank statistics.

RESULTS

As shown in Table 1, differences were noted among the various age groups with respect to ASA score ($P < 0.001$); 25/39 (64%) patients ≥80 years vs 198/532 (37%) patients ≤79 years had ASA score 3–4 and 14/39 (36%) patients ≥80 years vs 334/532 (63% patients ≤79 years had ASA score 1–2 ($P = 0.001$).

The choice of urinary diversion also differed among the groups ($P < 0.001$); 47/47 (100%) patients ≥80 years had ileal conduits. The rate of neobladder and continent cutaneous diversion use decreased with increasing age: 21/199 (11%) patients 70–79 years vs 138/354 (39%) patients ≤69 years underwent neobladder creation ($P < 0.001$) and 6/199 patients (3%) patients 70–79 years vs 42/354 (12%) patients ≤69 years underwent continent cutaneous diversion ($P < 0.001$).

The four groups differed in their usage of adjuvant treatments ($P < 0.001$, respectively); 1/42 (2%) patients ≥80 years vs 82/541 (15%) patients ≤79 years underwent adjuvant treatment ($P = 0.04$). There were no differences noted among the groups in terms of gender, clinical stage, treatment delay from the time of last TUR to RC or rates of neoadjuvant treatment.

Characteristics of the pathological specimens were also compared (Table 2). As shown, differences were noted among the four groups with respect to the total number of LNs removed during the surgical dissection ($P < 0.001$): 23/44 (52%) patients ≥80 years vs 195/518 (38%) patients ≤79 years had ≥10 LNs removed and 4/44 (9%) patients ≥80 years vs 156/518 (30%) patients ≤79 years had 0 LNs removed ($P = 0.01$). In addition, differences were noted in the rate of metastatic LN positivity among the four groups ($P = 0.005$); however, this did not seem to occur in a chronological stepwise fashion by age. While the group 60–69 years had a lower number of positive LNs compared with the other three groups ($P = 0.005$), no differences were noted between patients ≥80 years and those <79 years or those ≤59 years. No differences were noted among the groups in terms of grade, pathological T stage, pathological N stage, surgical margin status or upstaging.

The median (range) follow-up time for the whole cohort was 26 (1–264) months and was 10 (1–107) months for the patients ≥80 years. As shown in Fig. 1, there were no differences in RFS among the groups studied ($P = 0.3$). A plot of DSS is shown in Fig. 2; no differences in DSS were noted among the age groups ($P = 0.4$). OAS is shown in Fig. 3; no differences in OAS were

TABLE 2 Characteristics of pathological specimens in the different age groups

	Age group				
	≤59 years	60–69 years	70–79 years	≥80 years	*P*
No. of patients	165	192	201	47	
Grade, *n* (%)					0.4
G 1–2/Low Grade	17 (10)	27 (14)	24 (12)	3 (6)	
G 3/High grade	148 (90)	165 (86)	177 (88)	44 (94)	
Pathological stage, *n* (%)					0.1
pT0	38 (23)	48 (25)	38 (19)	8 (17)	
pT1	26 (16)	35 (18)	35 (17)	2 (4)	
pT2	39 (24)	40 (21)	39 (19)	14 (30)	
pT3	49 (30)	50 (26)	58 (29)	16 (34)	
pT4a	10 (6)	19 (10)	26 (13)	6 (13)	
pT4b	3 (2)	0	5 (2)	1 (2)	
Pathological N stage, *n* (%)					0.1 (Nx not included)
N0	79 (48)	99 (51)	107 (53)	35 (74)	
N1	28 (17)	14 (7)	26 (13)	6 (13)	
N2	15 (9)	9 (5)	21 (10)	2 (4)	
N3	0	1 (1)	2 (1)	0	
Nx	43 (26)	69 (36)	45 (22)	4 (9)	
No. of LNs removed, *n* (%) (43 patients missing)					0.0005
0	43 (29)	68 (39)	45 (23)	4 (9)	
1–9	55 (37)	51 (29)	61 (31)	17 (39)	
≥10	51 (34)	55 (32)	89 (46)	23 (52)	
LN (+), *n* (%)	43 (26)	24 (13)	49 (24)	8 (17)	0.005
Surgical margin (+), *n* (%)	10 (6)	19 (10)	24 (12)	3 (6)	0.2
Upstaging, *n* (%) (From T0-1 to T2 or higher)	13 (8)	23 (12)	18 (9)	6 (13)	0.5

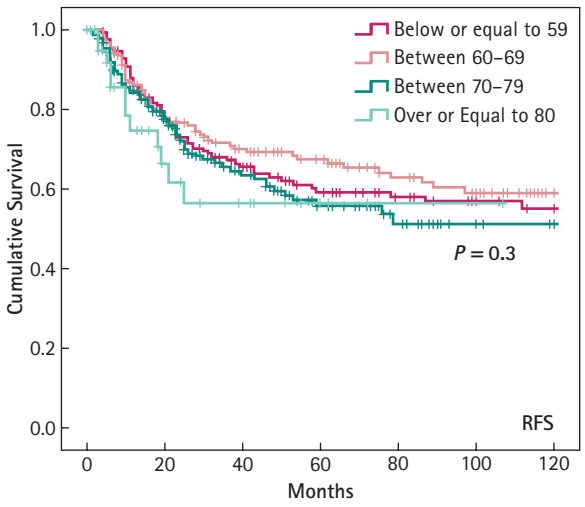

FIG. 1.
Kaplan–Meier survival plots of different age groups for RFS.

noted among the groups ($P = 0.4$). ASA group, pathological stage and LN positivity were found to be significant in univariate analyses (Table 3). Pathological stage and LN positivity were the only variables that proved significant in multivariate analyses for RFS, DSS and OAS (Table 4). Age group was also included here although it was not a significant factor in univariate or multivariate analyses for any of these survival measures.

DISCUSSION

Radical cystectomy is one of the most morbid operations within urological oncology and, compared with other urological diseases that expose a patient to high surgical risk, aggressive BC is relatively common; ≈25% of patients with BC present initially with muscle-invasive disease. One study of 358 patients showed an overall complication rate of 49%, a major complication rate of 13% and a mortality rate of 3% within 3 months of RC [29].

Major peri- and early postoperative risks specific to RC include bleeding, bowel necrosis, bowel leak, fistulae formation, urinoma, ureteric stenosis, pyelonephritis, wound problems, lymphocele formation and direct damage to adjacent structures (bowel, rectum and bladder). Other more general complications which are shared among similar high risk surgical procedures include myocardial infarction, congestive heart failure, stroke, deep vein thrombosis/pulmonary embolism, pneumonia, neuropathies and arrhythmias. Long-term complications may include any of the above plus those related to infectious, structural, metabolic and lithogenic factors. One

study found an overall conduit-related complication rate of 61%, with a mean of 2.3 complications per patient [30].

Thus, many urologists may be tempted to offer some patients more conservative methods of therapy, even those who otherwise have clear indications for RC. This may not be an unreasonable approach in certain instances, especially given the decent outcomes obtainable with bladder-sparing therapy. Shipley *et al.* [11] noted a 63% DSS among 190 patients with carcinoma invading bladder muscle treated with aggressive TURBT, chemotherapy and radiotherapy. The present dataset did not include the treatment patterns of matched elderly patients with advanced/refractory BC who opted for bladder-sparing protocols, but it would be interesting to compare these two cohorts with regard to survival characteristics during future investigations.

Certainly, elderly patients are being offered RC less often than younger patients. Schrag *et al.* [31], using the Surveillance, Epidemiology and End Results (SEER) database, showed that 55% of patients aged 65–69 years underwent RC for muscle-invasive disease compared with only 27% of those aged 80–84 years. Whether or not this practice is justified has come under recent scrutiny and there has been much conflicting data in the literature.

The present findings suggest that carefully selected elderly patients have similar RFS, DSS and OAS compared with younger patients undergoing the same procedure. These findings are consistent with those of other authors. In a study of 447 patients, Rink *et al.* [7] noted no difference in complications, DSS or OAS. Clark *et al.* [23] showed no differences in complications or operative mortality amongst a group of 1054 patients stratified by age. Donat *et al.* [24] analysed a group of 1142 patients who underwent RC and found that DSS of octagenarians was comparable to their younger counterparts. As expected, in the present study, octogenarians had a shorter follow-up compared with the entire cohort (median 10 vs 26 months) and this may have significantly influenced the results. If one assumes that more events occur in patients ≥80 years, longer follow-up in this group may have resulted in poorer outcomes.

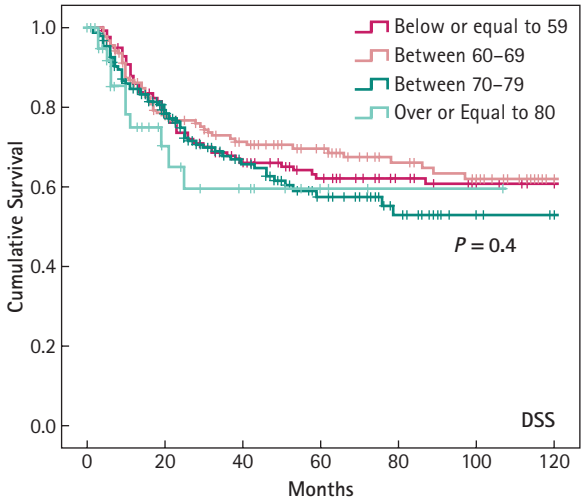

FIG. 2.
Kaplan–Meier survival plots of different age groups for DSS.

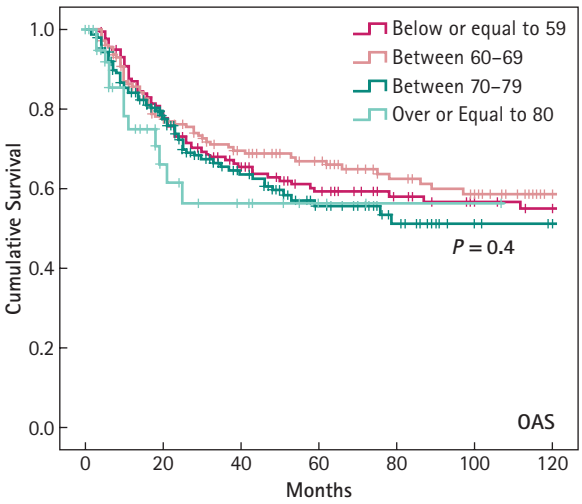

FIG. 3.
Kaplan–Meier survival plots of different age groups for OAS.

Studies from other specialties have also shown good outcomes for major elective operations in the elderly [32–34]. Often, poorer outcomes were attributable to competing comorbidities and operations being performed on an emergency basis. For colorectal surgery, it has previously been shown that complications such as anastomotic leak rates were similar for older and younger patients [35,36].

Efforts to analyse the effect of comorbidity on outcome are still in their early stages and several scoring systems have been proposed, each with their own performance characteristics and validity data. Comparisons are mainly based on retrospective data and expert opinion [37]. Our group chose the ASA scoring system as it is widely available from the medical records of surgical patients and thus readily available for retrospective analysis.

In one study from the head and neck literature, the ASA score had similar if not greater prognostic ability for mortality than the Charlston Comorbidity Index (the most widely sited of such indices) [38]. In a similar comparison of these indices using patients undergoing radical prostatectomy, Froehner *et al.* [39] found that the ASA score was also superior in that it was able to define a low-risk group and allowed better discrimination of comorbid and overall survival Another study compared five different indices of comorbidity and found that only ASA score was able to discriminate patients undergoing radical prostatectomy into low-, medium- and high-risk groups [40]. To our knowledge, no studies have

TABLE 3 Univariate analyses of factors for RFS, DSS and OAS

	RFS		DSS		OAS	
	Mean (SD)	*P*	Mean (SD)	*P*	Mean (SD)	*P*
Gender						
Male	78.8 (2.6)	0.9	81.3 (2.6)	0.8	78.7 (2.6)	0.9
Female	78.0 (4.9)		81.3 (4.9)		78 (4.9)	
Age group						
≤59 years	79.1 (4.1)	0.3	82.1 (4.1)	0.4	79.1 (4.1)	0.4
60–69 years	83.5 (3.9)		85.7 (3.9)		83 (3.9)	
70–79 years	74.8 (4.3)		76.8 (4.3)		74.8 (4.3)	
≥80 years	65.9 (9.2)		68.9 (2.3)		65.9 (9.2)	
ASA score group						
1–2	82.4 (2.8)	0.04	84.6 (2.8)	0.06	82.4 (2.8)	0.03
3–4	72.5 (3.9)		75.5 (4)		72.1 (3.9)	
P stage						
T0-T1	109 (3.1)	<0.001	109 (3.1)	<0.001	109 (3.1)	<0.001
T2	96.8 (4.4)		97.9 (4.3)		95.8 (4.4)	
T3	77.1 (5.0)		80.7 (5)		77.1 (5)	
T4	58.2 (4.6)		60.1 (4.7)		58.2 (4.6)	
LN positivity						
Negative	88.2 (2.4)	<0.001	89.7 (2.4)	<0.001	88 (2.4)	<0.001
Positive	41 (4.7)		47.2 (5.2)		41 (4.7)	
LNs removed						
0–10	79.4 (2.9)	0.4	81.7 (2.9)	0.7	79.1 (2.9)	0.4
≥11	72.7 (4.5)		78.3 (4.6)		72.7 (4.6)	
Margin status						
Negative	79.6 (2.4)	0.1	81.9 (2.4)	0.4	79.5 (2.4)	0.2
Positive	68.3 (8.9)		76.7 (8.9)		68.4 (8.9)	

TABLE 4 Multivariate analyses of factors for RFS, DSS and OAS

	RFS		DSS		OAS	
	P	HR (95% CI)	*P*	HR (95% CI)	*P*	HR (95% CI)
Age group						
≤59 (Ref.)	0.9	1	0.9	1	0.7	1
60–69	0.7	1 (0.6–1.5)	0.9	0.9 (0.6–1.4)	0.6	0.9 (0.5–1.4)
70–79	0.9	1.1 (0.7–1.6)	0.4	0.9 (0.6–1.5)	0.4	0.9 (0.6)
≥80		0.9 (0.5–1.9)		0.7 (0.3–1.6)		0.7 (0.3–1.5)
ASA group						
1–2 (Ref.)		1		1		1
3–4	0.09	1.3 (0.9–1.9)	0.3	1.2 (0.8–1.7)	0.1	1.3 (0.9–1.8)
P stage						
T0-T1 (Ref.)	0.01	1	0.04	1	0.01	1
T2	<0.001	2.5 (1.2–5.6)	<0.001	2.3 (1–5.1)	<0.001	2.8 (1.3–6)
T3	<0.001	4.4 (2.0–9.5)	<0.001	3.9 (1.8–8.6)	<0.001	4.6 (2.2–10)
T4	<0.001	6.1 (2.8–13)	<0.001	5.7 (2.7–12.4)		6.4 (3–13.7)
LN positivity						
Negative (Ref.)		1		1		1
Positive	<0.001	2.1 (1.5–3.2)	<0.001	2.1 (1.4–3.1)	<0.001	2.2 (1.5–3.2)

HR, hazard ratio.

analysed these scales specifically in patients undergoing RC.

In the present study, elderly patients (age ≥80 years) had higher ASA scores than younger patients (<79 years) and yet RFS, DSS and OAS were similar among the four age groups studied. This is a potential source of bias. It is possible that the present cohort of elderly patients undergoing RC may have been carefully selected and was not necessarily representative of a random sample of patients with BC in this age group. Older patients were also found to have more LNs removed compared with younger patients, which implies either a more aggressive surgical dissection or simply more fibrofatty tissue noted during the dissection.

Furthermore, elderly patients received less adjuvant therapy and this may be a reflection of lower disease aggressiveness, greater adequacy of surgical resection and/or the treatment era in which the RC was performed. That said, another possible explanation is that elderly patients were declined chemotherapy or radiotherapy in order to avoid their potentially serious local and systemic toxicities. Elderly patients were also offered ileal conduits more often than other diversion types. Surgeons may have been more cautious about offering continent diversions to older, more frail patients given the higher complication rates, as well as the higher commitment and motivation required by patients to manage them [41,42].

By contrast to other studies [7–10], our group found no differences in terms of pathological T stage for the older age group. Older patients may have more adverse pathological features for a number of reasons: a reluctance by the surgeon to offer definitive therapy, weakened immunity or change in the biological potential of the tumour itself. Patients diagnosed with advanced BC may have a very narrow window of cure and one study suggested that a delay from diagnosis of muscle invasion to RC of longer than 12 weeks resulted in a higher incidence of extravesical disease and node positivity [43]. Related to this is whether or not older age predicts a higher likelihood of pathological upstaging from the initial TURBT and several studies have shown conflicting results [7,44]. In the present series, older age was not associated

with delays in therapy or pathological upstaging.

We found that there was less LN positivity in the age group 60–69 years than in the other age groups, but this is difficult to interpret in the setting of age alone as there does not seem to be any trend from youngest to oldest. Perhaps more important is the finding that the group ≥80 years did not have a higher rate of LN positivity than the other groups.

Large population-based databases have recently been used to try to determine whether age effects outcome after RC [9,16] but their conclusions may not be as generalizable as ours for several reasons: billing code data was used to build patient cohorts, patients were generally recipients of Medicare, lack of pathological review, and a lack of available and accurate clinical data. The present series is unique in that it comprises a large group of patients from two major tertiary care academic institutions using a very robust dataset. Pathological specimens were reviewed by dedicated genitourinary pathologists, including those recovered from peripheral hospitals. Our sample size is one of the largest amongst the single- or multi-institutional based studies.

Unfortunately, evidence-based guidelines for the management of BC in the elderly are sparse. In one study of over 11 000 patients, using SEER data, older age and higher medical comorbidity, was associated with a decreased likelihood of receiving RC for stage 2 muscle-invasive BC and that only 21% of 3263 such patients received the 'gold standard' treatment [45]. It also noted cancer-specific mortality to be the main cause of mortality in such patients. Thus, one may infer that adequate disease control by extirpative therapy might improve survival. By actively denying patients this guideline-recommended therapy for aggressive disease, patient care may be compromised.

In conclusion, advanced age has commonly been used as a reason to deny patients RC in the setting of carcinoma invading bladder muscle or refractory recurrent pT1/CIS which otherwise may be amenable to such therapy. While much discrepancy exists in the literature regarding the scientific basis of this practice, our group noted no difference in disease-related outcomes in a large, carefully selected population, stratified by age. Based on these results, we recommend that RC be offered to appropriately selected elderly patients in the setting of such advanced disease.

CONFLICT OF INTEREST

None declared.

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Abbreviations: **RC**, radical cystectomy; **BC**, bladder cancer; **RFS**, recurrence-free survival; **DSS**, disease-specific survival; **OAS**, overall survival; **CIS**, carcinoma *in situ*; **ASA**, American Society of Anesthesiologists; **TUR**, transurethral resection; **LN**, lymph node; **TURBT**, transurethral resection of bladder tumour; **PL**, pelvic lymphadenectomy; **SEER**, Surveillance, Epidemiology and End Results.