Survival Benefit of Patients Aged ≥ 75 Years Diagnosed With High-risk Non-metastatic Prostate Cancer after Definitive Treatment of the Primary Tumor: A Population-based Study

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Research

Keywords: survival benefit, high-risk prostate cancer, definitive treatment, SEER

Posted Date: June 12th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-34681/v1>

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Abstract

Background: The survival benefit of active treatment for high-risk prostate cancer patients aged ≥ 75 years remains controversial. We further evaluated the effect of definitive treatment (DT) for those patients in a population-based cohort.

Methods: Retrospective analysis of 17848 elderly (≥ 75 years) men in the Surveillance, Epidemiology, and End Results (SEER) database (2004-2016) who diagnosed non-metastatic high-risk prostate cancer. Kaplan-Meier survival curves were used to compare cancer-specific survival (CSS) and overall survival (OS). Propensity-adjusted multivariate Cox regression analysis fitted to identify independent prognostic factors. Logistic regression models were used as a predictor for DT.

Results: A total of 17848 patients were identified, 10365 patients receiving DT (including 4284 receiving surgery, 5683 receiving EBRT, 367 receiving BT, 569 receiving EBRT+BT, 92 receiving Chemotherapy) and 7473 receiving non-DT. PSM methods were performed and compared all baseline factors, including insurance/marital status, age, race, T /N stage, grade, Gleason score (GS), PSA. After PSM, these two groups achieved a median survival time (MST) of 99, 67 months for OS, respectively ($P < 0.01$). And older age (age ≥ 80 years) status showed a worse survival benefit ($P < 0.01$). The subgroup analysis illustrated that surgery (MST=122) vs EBRT (MST=111) vs BT (MST=116) vs EBRT+BT (MST=121) subgroups achieved better OS than Chemotherapy group (MST=66) ($P < 0.01$). However, EBRT+BT subgroup had better 3- and 5-year OS (93% and 82.2%). Multivariate Cox proportional hazards model showed unmarried status, older age (age ≥ 80 years), T4 stage, high tumor grade, PSA ≥ 10 ng/mL were significantly associated with a worse OS, whereas DT (HR, 0.65; $p < 0.001$) and other race (HR, 0.773; $p < 0.001$) were associated with a better OS. And logistic regression illustrated that poor differentiated grade was independently predictor (OR=1.427; $p=0.022$).

Conclusions: This study indicated that insurance status, marital status, age, race, T /N stage, grade, GS, PSA and treatment modalities affected OS and CSS in elderly men with non-metastatic high-risk prostate cancer. DT, especially surgery and radiotherapy, might provide favorable OS not CSS compared with NDT for older patients (≥ 75 years), whereas chemotherapy was not recommended.

Background

Prostate cancer is the most common solid malignant tumor in men, with the highest incidence and the second most common cause of cancer death^[1]. Traditionally, High-risk prostate cancer might progress to castration-resistant prostate cancer or metastatic prostate cancer, which was the main reason for its death^[2]. With regard to treatment, androgen deprivation therapy (ADT) has become the basis of treatment in patients with non-metastatic hormone-sensitive prostate cancer^[3]. Recently, ADT plus abiraterone or apalutamide were also recommended as first-line treatment options for non-metastatic prostate cancer^[3-5]. With the widespread use of PSA screening and the prolonging of lifetime, the prevalence of prostate cancer in elderly people were increasing. However, it remains controversial that whether elderly patients

(≥ 75 years) with high-risk prostate cancer could achieve a different survival benefit from active treatment. Therefore, we conducted a population-based study to investigate the survival benefit of DT in high-risk non-metastatic prostate cancer using SEER program data.

Patients And Methods

Data Source and Study population

The SEER database of the National Cancer Institute, which consists of 18 population-based cancer registries and represents approximately 26% samples of the United States population^[6], as well as cancer incidence and mortality, was the data source for our study.

Prostate cancer patients diagnosed between 2004 and 2016 were selected from the database. The eligibility criteria included the following: (1) no distant metastases (M0 for patients diagnosed between 2004 and 2015 (the 7th AJCC M stage), cM0 or pM0 for patients diagnosed in 2016 (derived-SEER combined M stage)); (2) tumor sequence number labeled “one primary only”; (3) aged ≥ 75 years (4) survival information available; (5) PSA ≥ 20 ng/ml or Gleason score ≥ 8 or T stage $\geq T2c$; (6) surgery or radiotherapy information available; (7) one treatment modality only (8) adenocarcinoma only (histological code: 8140). Finally, a total of 17848 eligible patients were included in this study (Fig. 1)

Variable definitions

Patient demographic characteristics included as following: Insurance status, marital status, age at diagnosis, ethnicity, Year of diagnosis. Tumor characteristics, including tumor grade, serum PSA, Gleason Score, tumor stage T and N, as well as treatment modalities. Particularly, all patients were divided into two groups: non-definitive treatment (NDT) group (no treatment modalities were performed on any patient); definitive treatment (DT) group (patients who underwent only one treatment modality; including surgery/EBRT/EBRT + BT/BT/Chemotherapy). Additionally, the information on the overall survival (OS) status, the cause-specific survival (CSS) status and the months of survival were collected for survival analysis.

Statistical analysis

The chi-square tests were applied to compare the difference of the baseline characteristics between DT and NDT group. Kaplan–Meier method with log-rank test was used to assess the OS and CSS. Propensity score matching (PSM) was used to minimize selection bias based on all baseline characteristics. Subgroup analysis were used to evaluate the prognostic value of different treatment modalities in patients with different baseline factors. Adjusted hazard ratios along with 95% confidence intervals were calculated using the Cox regression model analyses to assess the predictors of CSS and OS. In addition, univariate and multivariate logistic regression analysis were used to evaluate the factors which were associated with treatment modalities. Data analysis were performed with SPSS 23.0 software (IBM Corp., Armonk, USA). P values < 0.05 were considered statistically significant.

Results

Patient characteristics

The baseline characteristics of patients were summarized in Table 1. A total of 17848 patients were identified, 10365 patients receiving DT (including 4284 receiving surgery, 5683 receiving EBRT, 367 receiving BT, 569 receiving EBRT + BT, 92 receiving Chemotherapy) and 7473 receiving NDT. There were statistically significant differences between the DT group and NDT group for all baseline factors in the overall cohort, including insurance status, marital status, age, race, T/N stage, grade, GS, PSA. Notably, the number of patients of DT(58.1%)were obviously more than those NDT patients[41.9%]. PSM methods were performed between the two groups. As shown in the PSM cohort, 9944 patients were identified in DT group and NDT group. There were still differences in some baseline characteristics, though except for insurance status, the rest were well matched (supplement Fig. 1).

Table 1 : Clinical and pathological features of the study population

	Overall cohort				Propensity score matched cohort				
Variable	Total	DTG	NDTG	P value	Total	DTG	NDTG	P value	
No. of patients (%)	17848 (100)	10375 (58.1)	7473 (41.9)		9944 (100.0)	4942 (50.0)	4942 (50.0)		
Insurance (%)				<0.001				<0.001	
Medicaid	863 (4.8)	561 (5.4)	302 (4.0)		463 (4.7)	219 (4.4)	244 (4.9)		
Insured	10711 (60.0)	6978 (67.3)	3733 (50.0)		5202 (52.3)	2260 (45.9)	2922 (58.8)		
Uninsured	104 (0.6)	45 (0.4)	59 (0.8)		62 (0.6)	30 (0.6)	32 (0.6)		
Unknown	6170 (34.6)	2791 (26.9)	3379 (45.2)		4217 (42.4)	2443 (49.1)	1774 (35.7)		
Marital status (%)				<0.001				0.126	
Married	10993 (61.6)	7195 (69.3)	3798 (50.8)		5943 (59.8)	3018 (60.7)	2925 (58.8)		
Unmarried	4520 (25.3)	2491 (24.0)	2029 (27.2)		2872 (28.9)	1413 (28.4)	1459 (29.3)		
Unknown	2335 (13.1)	669 (6.6)	1646 (22.0)		1129 (11.4)	541 (10.9)	588 (11.8)		
Age (years) (%)				<0.001				0.049	
75-79	9542 (53.5)	6901 (66.5)	2441 (32.3)		4376 (44.0)	2428 (49.1)	2338 (47.1)		
80-84	5046 (28.3)	2491 (24.0)	2555 (34.2)		3413 (34.3)	1675 (33.7)	1738 (35.0)		
≥85	3260 (18.3)	969 (9.5)	2277 (30.5)		1795 (18.1)	969 (19.5)	926 (18.6)		
Race (%)				<0.001				0.01	
White	13959 (78.2)	8368 (80.8)	5571 (74.5)		7630 (76.7)	3966 (79.8)	3764 (75.7)		
Black	2097 (11.7)	964 (9.3)	1133 (15.2)		1332 (13.4)	631 (12.7)	701 (14.1)		
Other	1441 (8.1)	699 (6.7)	542 (7.3)		822 (8.3)	411 (8.3)	411 (8.3)		
Unknown	351 (2.0)	124 (1.2)	227 (3.0)		160 (1.6)	64 (1.3)	96 (1.9)		
T stage (%)				<0.001				0.042	
T1	5003 (28.0)	2297 (22.1)	2706 (36.2)		2614 (26.3)	1752 (35.2)	1862 (37.4)		
T2	8748 (49.0)	5214 (50.3)	3534 (47.3)		4803 (48.3)	2355 (47.4)	2248 (45.2)		
T3	3008 (16.9)	2392 (23.1)	616 (8.2)		1114 (11.2)	577 (11.6)	537 (10.8)		
T4	750 (4.2)	414 (4.0)	336 (4.5)		487 (4.9)	232 (4.7)	255 (5.1)		
Tx	339 (1.9)	58 (0.6)	281 (3.8)		126 (1.3)	56 (1.1)	70 (1.4)		
N stage (%)				<0.001				0.015	
N1	16542 (92.9)	9802 (94.5)	6770 (90.6)		9270 (93.2)	4669 (93.9)	4601 (92.5)		
N2	598 (3.4)	343 (3.3)	255 (3.4)		281 (2.8)	120 (2.4)	161 (3.2)		
Nx	678 (3.8)	230 (2.2)	448 (6.0)		393 (3.9)	153 (3.1)	240 (4.8)		
Grade (%)				<0.001				0.01	
Grade I	323 (1.8)	166 (1.6)	157 (2.1)		193 (1.9)	81 (1.6)	112 (2.3)		
Grade II	2232 (12.5)	2385 (23.0)	1448 (19.4)		2111 (21.2)	1007 (20.3)	1104 (22.2)		
Grade III	13042 (73.1)	7667 (73.9)	5375 (71.9)		7370 (74.1)	3756 (75.5)	3614 (72.7)		
Grade IV	850 (4.8)	32 (0.3)	33 (0.4)		45 (0.5)	23 (0.5)	22 (0.4)		
Unknown	555 (3.1)	125 (1.2)	430 (5.7)		225 (2.3)	105 (2.1)	120 (2.4)		
PSA (ng/ml) (%)				<0.001				0.001	
<10	4072 (22.8)	3504 (33.8)	568 (7.6)		1243 (12.5)	686 (13.8)	557 (11.2)		
10-20	1955 (11.0)	1502 (14.7)	453 (6.1)		813 (8.2)	409 (8.2)	404 (8.1)		
>20	10856 (60.8)	4750 (45.8)	6106 (81.7)		7331 (73.7)	3606 (72.5)	3725 (74.9)		
Unknown	965 (5.4)	601 (5.8)	364 (4.9)		557 (5.6)	271 (5.5)	286 (5.8)		
Gleason score				<0.001				<0.001	
≤7	1358 (7.6)	1358 (13.1)	0 (0.0)		65 (0.7)	65 (1.3)	0 (0.0)		
8-9	511 (2.9)	509 (4.9)	2 (0.0)		43 (0.4)	41 (0.8)	2 (0.0)		
Unknown	15979 (89.5)	8508 (82.0)	7471 (100.0)		9836 (98.9)	4866 (97.9)	4970 (100.0)		

Abbreviations: DT G: definitive treatment group ; NDT G: non- definitive treatment group ;

PSA, prostate-specific antigen

OS and CSS in these two cohorts

According to the follow-up results, OS and prostate CSS were observed before and after PSM. The Kaplan-Meier survival curves were performed for these two groups. As was shown in Fig. 2, before PSM, the overall cohort showed that the OS outcomes with a median survival time (MST) of 113 months (95% CI 110.23-115.77) in DT group($P < 0.01$), followed by the NDT group (MST = 61months, 95% CI 86.23–89.77) ($P < 0.01$). For CSS, DT group achieved an MST of 143 months with 95% CI = 140.26-145.74($P < 0.01$) and 147 months with 95%CI 143.74-150.26 in NDT group($P < 0.01$). However, the OS outcomes with an MST of 99 months (95% CI 97.5-102.25) in DT group after PSM($P < 0.01$), followed by NDT group (MST = 67months, 95% CI 64.48–69.52) ($P < 0.01$). And for CSS, the MST was 147 months with 95% CI = 144.65-149.35 in DT group($P < 0.01$) and 147 months with 95%CI 143.10-150.26–90 in NDT group($P = 0.005$). Obviously, older age (age > 80 years) status showed a worse survival benefit from this two cohorts ($P < 0.01$). (Figure 3)

Subgroup analysis of OS in DT group

The subgroup analysis based on different treatment methods in DT group were conducted to explore the differences among the five subgroups and to determine which treatment modality would benefit most. The survival outcomes of each subgroup are shown in supplement Fig. 2. It was obvious that surgery (MST = 122 months; 95% CI = 115.86-128.14) vs EBRT (MST = 111 months; 95% CI = 107.50-114.50) vs BT (MST = 116 months; 95% CI = 105.34-126.57) vs EBRT + BT (MST = 121 months; 95% CI = 111.02-130.98) subgroup achieved better MST than Chemotherapy subgroup, which achieved an MST of 66 months with 95% CI = 30.51-101.49(all $P < 0.01$). However, the EBRT + BT subgroup had better 3- and 5-year OS (93% and 82.2%). Totally, the surgery subgroup was not better than the radiotherapy subgroups. And similar survival outcomes could be obtained from subgroup analysis of CSS.

Multivariate survival analysis using the Cox proportional hazards model

Multivariate Cox proportional hazards model was used to identify independent prognostic factors for non-metastatic high-risk patients in the two cohorts. The baseline characteristics of patients were evaluated. As shown in Table 2, younger age was associated with prolonged OS. Actually, an unmarried status, older age (age $\geq$ 80 years), T4 stage, high tumor grade, PSA $\geq$ 10 ng/mL were significantly associated with a worse OS in the two cohorts before and after PSM (all $p < 0.01$), whereas DT (HR, 0.65; 95% CI 0.615–0.687; $p < 0.001$) and other race(HR, 0.773; 95% CI 0.695–0.859; $p < 0.001$) were associated with a better OS, which reduced the risk of death.

Table 2 Multivariate Cox regression analysis of prognostic factors for OS

variance	Unweighted			weighted		
	P value	HR	95% CI	P value	HR	95% CI
Insurance, n(%)						
medicaid		1			1	
insured	0.736	1.024	0.903-1.161	0.842	1.068	0.871-1.184
uninsured	0.896	0.97	0.822-1.14	0.962	0.985	0.820-1.184
Unknown	0.143	1.099	0.969-1.246	0.638	1.041	0.882-1.228
Marital status, n(%)						
married		1			1	
unmarried	<0.001	1.28	1.216-1.347	<0.001	1.249	1.175-1.327
unknown	0.284	1.036	0.969-1.112	0.882	1.008	0.912-1.113
Age (years), n(%)						
75-79		1			1	
80-84	<0.001	1.813	1.432-1.998	<0.001	1.468	1.378-1.564
≥85	<0.001	2.621	2.467-2.783	<0.001	2.729	2.534-2.938
Race, n(%)						
white		1			1	
black	<0.001	3.298	3.681-7.391	0.242	1.05	0.967-1.140
other	<0.001	5.43	3.814-7.729	<0.001	0.773	0.695-0.859
Unknown	<0.001	4.096	2.865-5.864	<0.001	0.191	0.117-0.312
T stage, n(%)						
T1		1			1	
T2	0.388	1.026	0.969-1.084	0.229	1.042	0.974-1.114
T3	0.16	1.064	0.976-1.159	0.115	1.086	0.980-1.204
T4	<0.001	2.236	2.001-2.449	<0.001	2.112	1.855-2.403
Tx	0.012	1.228	1.047-1.440	0.385	1.119	0.869-1.440
N stage, n(%)						
N0		1			1	
N1	0.029	1.174	1.022-1.348	0.188	1.132	0.942-1.361
Nx	0.002	1.186	1.062-1.323	0.005	1.221	1.063-1.402
Gleason score						
≤7		1			1	
>8	0.078	1.408	0.962-2.054	0.245	1.545	0.741-3.220
Unknown	<0.001	2.57	2.018-3.274	0.321	1.32	0.763-2.282
PSA (ng/ml), n(%)						
<10		1			1	
10-20	<0.001	1.204	1.094-1.325	0.029	1.141	1.013-1.285
>20	<0.001	1.557	1.445-1.678	<0.001	1.475	1.348-1.617
Unknown	<0.001	1.506	1.342-1.690	<0.001	1.451	1.266-1.663
Grade, n(%)						
Grade I		1			1	
Grade II	0.234	0.945	0.839-1.116	0.35	0.864	0.614-1.189
Grade III	0.164	1.215	0.924-1.597	0.171	1.255	0.908-1.738
Grade IV	0.001	1.973	1.323-2.944	0.005	2.004	1.236-3.251
Unknown	0.021	1.415	1.053-1.901	0.163	1.308	0.897-1.909
Group						
DTG	<0.001	0.653	0.620-0.687	<0.001	0.65	0.615-0.687
NDTG		1			1	

Abbreviations: OS, overall survival; HR, hazard ratio

The N stage and black race were no longer significant risk factors after PSM. At last, other clinical characteristics including insurance status, low tumor grade, T₁₋₃ stage, GS had little effect on OS (all p > 0.05).

Univariate and multivariate logistic regression as predictors for DT

According to Univariate and multivariate logistic regression before weighted, most of baseline characteristics were predictors for DT (P < 0.05). However, after weighting by PSM, Univariate analysis revealed that older age (age ≥ 85 years), black race, T₂ stage, N positive, PSA, poor differentiated grade were predictors for DT (P < 0.05). Whereas, after adjusting for all the factors, multivariate analysis illustrated that only poor differentiated grade was independently predictor which was significantly more likely to undergo active treatment (OR = 1.427; p = 0.022)(Table 3)

Table 3 : Univariate and Multivariate logistic analysis of factors predicting DT

variance	Unweighted					weighted				
	Univariate		Multivariate analysis			Univariate		Multivariate analysis		
	OR	P value	OR	95% CI	P value	OR	P value	OR	95% CI	P value
Insurance										
Medicaid	1		1			1		1		
Insured	1.006	0.993	0.854	0.722-1.010	0.086	0.869	0.15	0.853	0.701-1.037	0.11
Uninsured	0.411	<0.001	0.434	0.286-0.676	<0.001	1.045	0.872	1.063	0.621-1.821	0.824
Unknown	0.445	<0.001	0.512	0.431-0.608	<0.001	1.534	<0.001	1.571	1.287-1.918	<0.001
Marital status										
married	1		1			1		1		
unmarried	0.648	<0.001	0.89	0.820-0.965	0.005	0.939	0.164	0.967	0.882-1.060	0.472
unknown	0.221	<0.001	0.32	0.286-0.358	<0.001	0.892	0.178	0.849	0.743-0.969	0.015
Age (years)										
75-79	1		1			1		1		
80-84	0.373	<0.001	0.507	0.468-0.549	<0.001	0.916	0.051	0.965	0.881-1.057	0.445
≥85	0.165	<0.001	0.263	0.238-0.289	<0.001	0.892	0.039	0.97	0.865-1.088	0.601
Race										
white	1		1			1		1		
black	0.585	<0.001	0.667	0.599-0.742	<0.001	0.876	0.026	0.879	0.779-0.992	0.037
other	1.102	<0.001	1.155	1.013-1.318	<0.001	0.974	0.716	0.954	0.823-1.106	0.534
Unknown	0.363	<0.001	0.607	0.463-0.796	<0.001	0.649	0.008	0.642	0.463-0.897	0.009
T stage										
T1	1		1			1		1		
T2	1.738	<0.001	0.882	0.809-0.961	0.004	1.113	0.016	0.997	0.905-1.099	0.955
T3	4.535	<0.001	1.483	1.299-1.694	<0.001	1.142	0.053	0.998	0.856-1.163	0.978
T4	1.452	<0.001	0.981	0.809-1.188	0.841	0.967	0.728	1.018	0.824-1.259	0.867
Tx	0.243	<0.001	0.464	0.336-0.641	<0.001	0.85	0.374	0.888	0.612-1.288	0.53
N stage										
N0	1		1			1		1		
N1	0.929	0.382	0.593	0.480-0.732	<0.001	0.734	0.012	0.782	0.607-1.007	0.057
Nx	0.355	<0.001	0.57	0.470-0.692	<0.001	0.859	0.14	0.846	0.683-1.047	0.123
Grade										
Grade I	1		1			1		1		
Grade II	1.558	<0.001	1.338	1.025-1.746	0.032	1.261	0.127	1.156	0.846-1.581	0.362
Grade III	1.349	0.008	1.488	1.149-1.927	0.003	1.437	0.014	1.427	1.054-1.934	0.022
Grade IV	0.917	0.75	1.359	0.744-2.483	0.318	1.446	0.267	1.53	0.786-2.977	0.211
Unknown	0.257	<0.001	0.435	0.308-0.613	<0.001	1.21	0.335	1.403	0.937-2.102	0.1
Gleason score										
≤7	1		1			1		1		
≥8	0	0.989	0		0.988	0	0.997	0		0.997
Unknown	0	0.985	0		0.985	0	0.997	0		0.997
PSA										
<10	1		1			1		1		
10-20	0.566	<0.001	0.692	0.594-0.806	<0.001	0.822	0.03	0.836	0.697-1.002	0.053
>20	0.126	<0.001	0.255	0.227-0.285	<0.001	0.786	<0.001	0.978	0.853-1.122	0.752
Unknown	0.258	<0.001	0.374	0.310-0.451	<0.001	0.769	0.01	0.736	0.595-0.910	0.005

Abbreviations: OR, odds ratio

Discussion

The clinical high-risk non-metastatic prostate cancer had always been hot and difficult point of treatment. It could progress further to metastatic prostate cancer or castration-resistant prostate cancer, which was often the leading cause of death^[7, 8]. It had been controversial for DT of high-risk prostate cancer^[9, 10]. Generally, young and Localized prostate cancer patients often underwent RP^[11, 12], while elderly patients were often recommended to receive Palliative care or named Endocrine therapy. EAU had recommended ADT as the treatment cornerstone of high-risk prostate cancer^[13]. In recent years, several studies have confirmed its efficacy on metastatic or CRPC^[14-16]. In present study, we assumed that all patients have received ADT treatment, including NDT patients. However, for elderly patients (age ≥ 75 years) with non-metastatic high-risk prostate cancer, except for ADT, there were no detailed consensus on the recommendation of other treatment modalities, including surgery, radiotherapy, chemotherapy.

In our study, using PSM methods we balanced clinical risk factors (including insurance, age, marital status, race, year of diagnosis, T/N stage, Gleason Score, PSA level), which were derived from SEER database in 2004-2016, then compared the survival outcomes between DT and non-DT group. Probably because of poor performance status or comorbidities, the baseline characteristics of elderly patients had significantly differences. Except for Insurance, other factors were matched better, though there were still differences between groups in some factors after weighting by PSM. Nicola et al^[17] found uninsured patients were less likely to receive DT. That was the reason for leading to significant differences in basic

characteristics. Particularly, from those risk factors, we found that the choice of modalities for DT were also different. Most of them chose non-or less- invasive surgery or radiotherapy, and less chose chemotherapy, which was also related to characteristics of the elderly men.

The present study showed that a survival benefit was observed in DT group compared with NDT group. After weighted by PSM, Kaplan-Meier survival curves suggested that the MST of DT group was significantly better than that of NDT group for OS, but for CSS, DT group had no similar advantage. It illustrated that DT could prolong OS by reducing complications or reducing deaths caused by other causes. That showed other causes of death played an important role, which was similar to previous research^[18]. And for the elderly, the survival benefits of DT were decreasing. COX regression analysis found that DT significantly prolonged OS compared with watchful waiting. Furthermore, logistic regression analysis showed poor grade was the independently predictor, which also provided a reference for the clinical choice of treatment modalities.

The survival outcomes of subgroup analysis illustrated that there were significantly differences between chemotherapy group and the other four subgroups, which might be related to the toxic side effects of chemotherapy. Whereas, the survival outcomes of these four subgroups were reported differently^[19, 20]. Therefore, chemotherapy was not recommended in the elderly patients with high-risk population.

However, several limitations remained in current study. Firstly, PSM failed to completely eliminate the difference between the two cohorts, especially for Insurance status; Second, The CSS of the DT group was obviously inferior to NDT group, which was inconsistent with previous studies^[21, 22]. The possible reasons were poor performance status or comorbidities of elderly men and selection bias. Third, Lacking of other information that might be important for prognosis, such as ADT, abiraterone acetate, apalutamide. Fourth, Subgroup analysis was not detailed, such as surgery, including RP, cytoreductive, TURP and so on.

Conclusion

In conclusion, this population-based study indicated that insurance status, marital status, age, race, T/N stage, grade, GS, PSA and treatment modalities affected OS and CSS in elderly men with non-metastatic high-risk prostate cancer. DT, especially surgery and radiotherapy, might provide favorable OS not CSS compared with NDT for older patients (≥ 75 years), whereas chemotherapy was not recommended.

Abbreviations

DT
definitive treatment
NDT
non-definitive treatment
SEER database

Surveillance, Epidemiology, and End Results database

CSS

cancer-specific survival

OS

overall survival

GS

Gleason score

MST

median survival time

ADT

androgen deprivation therapy

PSM

Propensity score matching

CI

Confidence interval

PSA

prostate-specific antigen

HR

hazard ratio

OR

odds ratio

RP

Radical prostatectomy

TURP

Transurethral resection of prostate

EBRT

external beam radiation therapy

BT

brachytherapy

Declarations

Acknowledgements

This study was approved in southeast University. The authors would like to thank Dr.WeiPu Mao and appreciate his support for the preparing of this manuscript.

Authors' contributions

Conception and design: JunJie Yu, Ming Chen; Writing: JunJie Yu, Bin Xu; revision of the manuscript: Ming Chen. All authors read and approved the final manuscript

Funding

No funding received for this study

Availability of data and materials

All data generated or analyzed during this study are included in this published article

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Competing interests

The authors report no conflict of interest.

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Figures

Figure 1

This flow chart describes the steps taken to identify cases in the SEER database of high-risk non-metastatic prostate cancer patients

Figure 2

OS and CSS curves of the two groups before PSM

Figure 3

OS and CSS curves of the two groups after PSM

Supplementary Files

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