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Brief Correspondence

Predicting Competing Mortality in Patients Undergoing Radical Prostatectomy Aged 70 yr or Older

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Abstract

Estimating the risk of competing mortality is of importance in tailoring optimal individual management strategies in patients with early prostate cancer. Using proportional hazard models for competing risks, we determined which parameters predict competing mortality in patients selected for radical prostatectomy aged 70 yr or older and compared the prognostic impact of individual parameters with that of their younger counterparts. Three common diseases (diabetes mellitus, chronic lung disease, and other cancer) that predicted competing mortality in younger men were not predictors of competing mortality in men selected for radical prostatectomy aged 70 yr or older (hazard ratio [HR]: < 1). Besides age (HR/yr: 1.08, $p = 0.0255$), peripheral vascular disease (HR: 2.33, $p = 0.0195$), cerebrovascular disease (HR: 2.23, $p = 0.0242$), American Society of Anesthesiologists physical status class 3 (HR: 2.19, $p < 0.0001$), current smoking (HR: 2.18, $p = 0.0098$), and lower or unknown level of education (HR: 2.07, $p = 0.0002$) were independent predictors of competing mortality in patients aged 70 yr or older. Combining these five conditions in a score might provide a superior comorbidity measure in this particular population.

Patient summary: Stricter selection may diminish the prognostic significance of several common diseases in men selected for radical prostatectomy aged 70 yr or older whereas other parameters (peripheral vascular disease, cerebrovascular disease, American Society of Anesthesiologists physical status class 3, current smoking, and level of education) sustained their meaningfulness and should be taken into consideration when the risk of competing mortality is estimated.

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Long-living elderly men may benefit from prostate cancer screening and from more active treatment. Therefore, estimating the risk of competing mortality is of paramount importance [1–4]. There is, however, no generally accepted tool for this purpose [1]. For patients selected for radical prostatectomy aged 70 yr or older, a stricter selection of favorable risks may influence the prognostic significance of individual risk factors for competing mortality. In this study, we investigated the impact of this selection process on the prognostic significance of comorbid conditions and related parameters.

Using proportional hazard models for the subdistribution of competing risks according to Fine and Gray, we studied 2961 consecutive patients treated at our institution

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Table 1 – Optimal models predicting competing mortality in patients selected for radical prostatectomy at an age of <70 yr versus those who underwent surgery at an age of 70 yr or older

	<70 yr (n = 2418)				≥70 yr (n = 543)			
Category	*N*	HR	95% CI	*p* value	*N*	HR	95% CI	*p* value
Age (continuous variable/yr)	NA	1.12	1.08–1.15	<0.0001	NA	1.09	1.01-1.18	0.0255
Angina pectoris (CCS classes 2–4 vs 0–1)	99	1.50	1.04–2.17	0.0312	34			
Hypertension (vs none)	1240				339			
History of thromboembolism (vs none)	75				16			
Myocardial infarction (vs none)	98				27			
Cardiac insufficiency (NYHA classes 2–4 versus 0–1)	116				45			
Peripheral vascular disease (vs none)	56	2.04	1.35–3.09	0.0007	16	2.33	1.15–4.75	0.0195
Cerebrovascular disease (vs none)	56				24	2.23	1.11–4.47	0.0242
Chronic lung disease (vs none)	233	1.72	1.29–2.28	0.0002	69			
Ulcer disease (vs none)	92				19			
Diabetes mellitus (vs none)	291	1.58	1.19–2.09	0.0015	91			
Connective tissue disease (vs none)	21				1			
Hemiplegia (vs none)	2				0			
Moderate or severe renal disease (vs none)	26	5.54	3.13–9.81	<0.0001	8			
Solid tumor, leukemia, or lymphoma (vs none)	78	1.69	1.02–2.80	0.0416	20			
Liver disease (vs none)	26				8			
Dementia (vs none)	1				1			
Current smoker (vs ex/nonsmokers)	292	2.06	1.59–2.67	<0.0001	27	2.18	1.21–3.93	0.0098
Body mass index <25 kg/m^2 (vs 25+ kg/m^2)	668				154			
ASA class 3 (versus 1–2)	378	1.63	1.24–2.14	0.0005	134	2.19	1.50–3.21	<0.0001
No university degree/master craftsman[a] (vs yes)	1372	1.39	1.11–1.74	0.0037	311	2.07	1.41–3.05	0.0002

ASA = American Society Association physical status classification; CCS = Classification of angina pectoris of the Canadian Cardiovascular Society; CI = confidence interval; HR = hazard ratio; NA = not available; NYHA = Classification of cardiac insufficiency of the New York Heart Association.
[a] Unknown.

between 1992 and 2007 in order to determine which parameters predicted competing mortality in this particular population. Furthermore, we compared the prognostic impact of individual parameters between patients selected for radical prostatectomy aged 70 yr or older with their younger counterparts. Potential prognostic parameters were obtained from preoperative evaluation records and discharge letters. Only parameters recorded in at least five patients were included in the model calculation. Deaths in the absence of uncontrolled prostate cancer progression or from unknown causes (n = 2) were considered deaths from competing causes. Demographic data of the study sample are shown in Supplementary Table 1.

Besides age, five parameters were independent predictors of competing mortality with hazard ratios of around 2 in patients aged 70 yr or older (Table 1). With diabetes mellitus, chronic lung disease, and other cancer, three common comorbid conditions independently predicting competing mortality in younger patients were not thoroughly associated with competing mortality beyond the 70th yr of age (Supplementary Table 2). Based on the model obtained in the latter population, patients were subdivided into quartiles concerning the parametric part of model-predicted hazards (Supplementary Fig. 1). Only patients above the fourth quartile reached the 10-yr mortality rate (29.4%) expected in the local normal population with the same age structure (data source: www.statistik.sachsen.de).

Giving one point for each parameter of the model in Table 1 except for age (ie, for peripheral vascular disease, cerebrovascular disease, American Society of Anesthesiologists [ASA] physical status class 3, current smoker, and no university degree or master craftsman or unknown level of education as measures for possible occupational or life style-related risk factors), we calculated a score and compared it with five other measures of comorbidity for which data were available in our database (Charlson score, modified Charlson score, modified Lee mortality index, prostate cancer specific comorbidity index, and unweighted Charlson score) [5–9]. Age was excluded because not all comparators contained age-related variables and the age spectrum of patients selected for radical prostatectomy at an age of 70 yr or older is limited. The score identified in this study performed best concerning the separation of the mortality curves (illustrated by the p values of comparisons of neighboring curves) and the Akaike's information criterion figures, respectively (Fig. 1). The obtained simple score reproduced remarkably well with the multivariable model and reached narrowly the same Akaike's information criterion figure as the stratification into quartiles shown in Supplementary Figure 1 (1425 vs 1422).

Besides accurate risk prediction, simplicity of use is of concern with comorbidity classifications in men with early prostate cancer [9]. In the suggested score, the five identified parameters representing different health aspects may rapidly be assessed during daily clinical practice.

The ability of clinicians to predict life expectancy has been called into question and available models have not been considered as better than government life tables [1]. This study provides arguments for the opposite. In the subgroup of patients selected for radical prostatectomy aged 70 yr or older, government life tables would predict a 10-yr mortality rate of 29.4% which corresponds with the

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