**Figure S1** Flow chart of enrolled cancer patients.



Abbreviations: EORTC QLQ: European Organization for Research and Treatment of Cancer Quality of Life Questionnaire.

**Figure S2** Prognostic nutritional index in different cancer types stratified by age.



Abbreviations: GC: gastric cancer; EC: esophagus cancer; CRC: colorectal cancer; NPC: nasopharyngeal carcinoma; BC: breast cancer; HPPC: hepatobiliary and pancreatic cancer.

**Figure S3** Determining the cut-off value of low PNI according to the maximally selected rank statistics.



Abbreviations: PNI: prognostic nutritional index.

**Figure S4** Association of PNI levels with mortality in cancer patients stratified by age and nutrition status.



PNI and all-cause mortality for patients <65 years (**a**); ≥ 65years (**b**); NRS-score <3(**c**); NRS-score ≥3(**d**); Hazard ratios are indicated by solid lines and 95% confidence intervals (CIs) by shaded areas. Reference point was calculated cut-off value (46.05). All models were adjusted for cofounders including age, gender, TNM stage, Eastern Cooperative Oncology Group performance status, tumor type, previous treatment, smoking and drinking status, weight loss, NRS score, hemoglobin level, hand grip strength, calf-circumference, triceps skinfold, mid-arm circumference, calf circumference, diabetes mellitus, hypertension and coronary heart disease.

**Figure S5** Association of PNI levels with mortality in cancer patients stratified by tumor type.



PNI and all-cause mortality for patients with (**a)** lung cancer; (**b**) gastric cancer; (**c**) esophagus cancer; (**d**) colorectal cancer; (**e**) nasopharyngeal carcinoma; (**f**) breast cancer; (**g**) hepatobiliary cancer and pancreatic cancer (HPPC); (**h**) cervical cancer; (**i**) other cancer. Hazard ratios are indicated by solid lines and 95% confidence intervals (CIs) by shaded areas. Reference point was calculated cut-off value (46.05). All models were adjusted for cofounders including age, gender, TNM stage, Eastern Cooperative Oncology Group performance status, tumor type, previous treatment, smoking and drinking status, weight loss, NRS score, hemoglobin level, hand grip strength, calf-circumference, triceps skinfold, mid-arm circumference, calf circumference, diabetes mellitus, hypertension and coronary heart disease.

**Figure S6** Association of PNI levels with mortality (**a**) and Kaplan-Meier survival analysis of OS (**b**) in overweight or obese patients with cancer after excluding cancer patients dying within 3 months.



(**a**)Hazard ratios are indicated by solid lines and 95% confidence intervals (CIs) by shaded areas. Reference point was calculated cut-off value (PNI=46.05). All models were adjusted for cofounders including age, gender, TNM stage, Eastern Cooperative Oncology Group performance status, tumor type, previous treatment, smoking and drinking status, weight loss, NRS score, hemoglobin level, hand grip strength, calf-circumference, triceps skinfold, mid-arm circumference, calf circumference, diabetes mellitus, hypertension and coronary heart disease; (**b**) Low PNI was associated with a poor prognosis after adjustment by age, gender, tumor type, ECOG performance status, TNM stage, hemoglobin, weight loss and surgery. OS: overall survival; PNI: prognostic nutritional index.

**Figure S7** Association of PNI levels with mortality (**a**) and Kaplan-Meier survival analysis of OS (**b**) in overweight or obese patients with cancer after adjusting using propensity score matching.



(**a**)Hazard ratios are indicated by solid lines and 95% confidence intervals (CIs) by shaded areas. Reference point was calculated cut-off value (PNI=46.05). All models were adjusted for cofounders including age, gender, TNM stage, Eastern Cooperative Oncology Group performance status, tumor type, previous treatment, smoking and drinking status, weight loss, NRS score, hemoglobin level, hand grip strength, calf-circumference, triceps skinfold, mid-arm circumference, calf circumference, diabetes mellitus, hypertension and coronary heart disease;(**b**) Low PNI was associated with a poor prognosis after adjustment by age, gender, tumor type, ECOG performance status, TNM stage, hemoglobin, weight loss and surgery. OS: overall survival; PNI: prognostic nutritional index.

**Table S1.** Univariate and multivariate Cox regression analysis of OS in overweight or obese patients with cancer.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Variables** | **No. of patients (%%)** | **Univariate Analysis** | | | **Multivariate Analysis** | | |
| **Hazard Ratio** | **95% CI** | ***P-value*** | **Hazard Ratio** | **95% CI** | ***P-value*** |
| Age, years |  |  |  |  |  |  |  |
| <65 | 2615 | Reference |  |  |  |  |  |
| ≥65 | 917 | 1.61 | 1.40 to 1.84 | <0.001 |  |  |  |
| Gender |  |  |  |  |  |  |  |
| Male | 1691 | Reference |  |  |  |  |  |
| Female | 1841 | 0.51 | 0.44 to 0.58 | <0.001 |  |  |  |
| Smoking |  |  |  |  |  |  |  |
| Absent | 2260 | Reference |  |  |  |  |  |
| Present | 1272 | 1.74 | 1.52 to 1.98 | <0.001 |  |  |  |
| Drinking |  |  |  |  |  |  |  |
| Absent | 2917 | Reference |  |  |  |  |  |
| Present | 615 | 1.55 | 1.33 to 1.81 | <0.001 |  |  |  |
| Primary tumor |  |  |  |  |  |  |  |
| Lung cancer | 815 | Reference |  |  | Reference |  |  |
| Gastric cancer | 293 | 0.61 | 0.49 to 0.76 | <0.001 | 0.72 | 0.57 to 0.91 | 0.006 |
| Esophagus cancer | 111 | 0.92 | 0.67 to 1.28 | 0.631 | 1.23 | 0.88 to 1.71 | 0.230 |
| CRC | 568 | 0.44 | 0.36 to 0.53 | <0.001 | 0.60 | 0.49 to 0.73 | <0.001 |
| NPC | 374 | 0.14 | 0.10 to 0.21 | <0.001 | 0.24 | 0.16 to 0.35 | <0.001 |
| Breast cancer | 848 | 0.12 | 0.09 to 0.16 | <0.001 | 0.27 | 0.20 to 0.36 | <0.001 |
| HPPC | 98 | 1.27 | 0.95 to 1.70 | 0.100 | 1.58 | 1.18 to 2.12 | 0.002 |
| Cervical cancer | 169 | 0.21 | 0.13 to 0.32 | <0.001 | 0.37 | 0.23 to 0.59 | <0.001 |
| Other cancer | 256 | 0.52 | 0.40 to 0.68 | <0.001 | 0.69 | 0.53 to 0.90 | 0.007 |
| Stages |  |  |  |  |  |  |  |
| I | 528 | Reference |  |  |  |  |  |
| II | 976 | 2.60 | 1.73 to 3.92 | <0.001 |  |  |  |
| III | 946 | 5.64 | 3.81 to 8.35 | <0.001 |  |  |  |
| IV | 1082 | 15.27 | 10.43 to 22.35 | <0.001 |  |  |  |
| M category |  |  |  |  |  |  |  |
| M0 | 2560 | Reference |  |  | Reference |  |  |
| M1 | 972 | 4.87 | 4.27 to 5.56 | <0.001 | 3.56 | 3.08 to 4.10 | <0.001 |
| ECOG performance status |  |  |  |  |  |  |  |
| ≤ 1 | 3219 | Reference |  |  | Reference |  |  |
| > 1 | 313 | 1.84 | 1.53 to 2.22 | <0.001 | 1.62 | 1.32 to 1.99 | <0.001 |
| Weight-loss |  |  |  |  |  |  |  |
| Absent | 3090 | Reference |  |  | Reference |  |  |
| Present | 442 | 1.86 | 1.58 to 2.20 | <0.001 | 1.38 | 1.11 to 1.70 | 0.003 |
| NRS-score |  |  |  |  |  |  |  |
| NRS < 3 | 2908 | Reference |  |  |  |  |  |
| NRS ≥ 3 | 624 | 1.70 | 1.46 to 1.97 | <0.001 |  |  |  |
| PNI |  |  |  |  |  |  |  |
| Normal | 2433 | Reference |  |  | Reference |  |  |
| Low | 1099 | 2.37 | 2.08 to 2.70 | <0.001 | 1.45 | 1.26 to 1.68 | <0.001 |
| MAC |  |  |  |  |  |  |  |
| High | 2953 | Reference |  |  |  |  |  |
| Low | 579 | 1.21 | 1.02 to 1.43 | 0.027 |  |  |  |
| Radical surgery |  |  |  |  |  |  |  |
| No | 2034 | Reference |  |  | Reference |  |  |
| Yes | 1498 | 0.50 | 0.43 to 0.57 | <0.001 | 0.71 | 0.60 to 0.83 | <0.001 |
| Radiotherapy |  |  |  |  |  |  |  |
| No | 3119 | Reference |  |  |  |  |  |
| Yes | 413 | 1.21 | 0.99 to 1.46 | 0.052 |  |  |  |
| HGS |  |  |  |  |  |  |  |
| High | 2808 | Reference |  |  |  |  |  |
| Low | 724 | 1.18 | 1.01 to 1.38 | 0.039 |  |  |  |
| CC |  |  |  |  |  |  |  |
| High | 2910 | Reference |  |  |  |  |  |
| Low | 622 | 1.40 | 1.20 to 1.65 | <0.001 |  |  |  |
| TSF |  |  |  |  |  |  |  |
| High | 3104 | Reference |  |  |  |  |  |
| Low | 428 | 1.66 | 1.39 to 1.98 | <0.001 |  |  |  |
| Hemoglobin, g/dL |  |  |  |  |  |  |  |
| Normal (≥12) | 2543 | Reference |  |  | Reference |  |  |
| Abnormal (< 12) | 989 | 1.60 | 1.39 to 1.83 | <0.001 | 1.39 | 1.20 to 1.62 | <0.001 |
| Total protein, g/L |  |  |  |  |  |  |  |
| Normal (≥60) | 3206 | Reference |  |  |  |  |  |
| Abnormal (< 60) | 326 | 1.72 | 1.43 to 2.08 | <0.001 |  |  |  |

Abbreviations: CRC: colorectal cancer; HPPC: hepatobiliary and pancreatic cancer; NPC: nasopharyngeal carcinoma; HPPC: hepatobiliary and pancreatic cancer; M: metastasis; ECOG, Eastern Cooperative Oncology Group; M: metastasis; NLR, neutrophil-to-lymphocyte ratio; PLR, platelet-to-lymphocyte ratio; NRS-2002: Nutritional Risk Screening-2002; TSF, triceps skinfold; MAC: Mid-arm circumference; CC: calf-circumference; HGS: hand grip strength; PNI: prognostic nutritional index.

**Table S2** The association between PNI and all-cause mortality in overweight or obese patients with cancer after excluding cancer patients dying within 3 months.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Groups | n=3,434 | Crude model | | Adjusted model\* | | Adjusted model\*\* | |
| **HR (95% CI)** | **P-value** | **HR (95% CI)** | **P-value** | **HR (95% CI)** | **P-value** |
| PNI in all patients |  |  |  |  |  |  |  |
| By cut-off value |  | 0.47(0.41,0.53) | <0.001 | 0.51(0.44, 0.58) | <0.001 | 0.74(0.64,0.87) | <0.001 |
| Per SD |  | 0.68(0.64,0.73) | <0.001 | 0.71(0.67, 0.76) | <0.001 | 0.83(0.77, 0.89) | <0.001 |
| By quantile |  |  |  |  |  |  |  |
| Q1(≤45.1) | 863 | Reference |  |  |  | Reference |  |
| Q2(45.1 to 49.25) | 860 | 0.71(0.59, 0.84) | <0.001 | 0.75(0.64, 0.90) | <0.001 | 0.86(0.72, 1.03) | 0.095 |
| Q3(49.25 to 52.8) | 861 | 0.50(0.41, 0.60) | <0.001 | 0.54(0.45, 0.66) | <0.001 | 0.81(0.66, 1.00) | 0.048 |
| Q4(>52.8) | 850 | 0.31(0.25, 0.38) | <0.001 | 0.34(0.27, 0.42) | <0.001 | 0.58(0.45, 0.73) | <0.001 |
| P value for trend |  |  | <0.001 |  | <0.001 |  | <0.001 |

SD: standard deviation. \*adjusted for age, gender; \*\*adjusted for age, gender, TNM stage, Eastern Cooperative Oncology Group performance status, tumor type, previous treatment, smoking and drinking status, weight loss, NRS score, hemoglobin level, hand grip strength, calf-circumference, triceps skinfold, mid-arm circumference, calf circumference, diabetes mellitus, hypertension and coronary heart disease.

**Table S3** Clinicopathological characteristics in overweight or obese patients with cancer after adjustment using propensity score matching

|  |  |  |  |
| --- | --- | --- | --- |
| **Characteristics** | **PNI levels** | |  |
| **High PNI**  **(n=910)** | **Low PNI**  **(n=910)** | ***P*-value** |
| Age, years, n (%)\* |  |  | 0.960 |
| ≤65 | 623(68.5%) | 624(68.6%) |  |
| >65 | 287(31.5%) | 286(31.4%) |  |
| Gender, n (%)\* |  |  | 0.708 |
| Male | 462 (50.8%) | 454 (49.9%) |  |
| Female | 448 (49.2%) | 456 (50.1%) |  |
| Smoking, n (%)\* |  |  | 0.808 |
| Absent | 577(63.4%) | 572(62.9%) |  |
| Present | 333(36.6%) | 338(37.1%) |  |
| Drinking, n (%)\* |  |  | 0.310 |
| Absent | 745(81.9%) | 728(80.0%) |  |
| Present | 165(18.1%) | 182(20.0%) |  |
| ECOG performance status, n (%)\* |  |  | 0.152 |
| ≤ 1 | 821 (90.2%) | 802 (88.1%) |  |
| > 1 | 89 (9.8%) | 108 (11.9%) |  |
| TNM Stages, n (%) \* |  |  | 0.818 |
| I | 103 (11.3%) | 114 (12.5%) |  |
| II | 237 (26.0%) | 240 (26.4%) |  |
| III | 242 (26.6%) | 243 (26.7%) |  |
| IV | 328 (36.1%) | 313 (34.4%) |  |
| Weight-loss, n (%)\* |  |  | 0.489 |
| Absent | 764 (84.0%) | 753 (82.7%) |  |
| Present | 146 (16.0%) | 157 (17.3%) |  |
| Tumor types, n (%)\* |  |  | 0.981 |
| Lung cancer | 249 (27.4%) | 232 (25.5%) |  |
| GC | 87 (9.6%) | 89 (9.8%) |  |
| Esophagus cancer | 34 (3.7%) | 32 (3.5%) |  |
| CRC | 174 (19.1%) | 187 (20.5%) |  |
| NPC | 43(4.7%) | 46 (5.1%) |  |
| Breast cancer | 145 (15.9%) | 153 (16.8%) |  |
| HPPC | 35(3.8%) | 31(3.4%) |  |
| Cervical cancer | 54(5.9%) | 57(6.3%) |  |
| Others | 89(9.8%) | 83(9.1%) |  |
| Hemoglobin, g/dL\* |  |  | 0.630 |
| Normal (≥12) | 563(61.9%) | 553(60.8%) |  |
| Abnormal (< 12) | 347(38.1%) | 357(39.2%) |  |

\*These variables were included in the propensity score matching analysis. Abbreviations: ECOG: Eastern Cooperative Oncology Group; GC: gastric cancer; CRC: colorectal cancer; HPPC: hepatobiliary and pancreatic cancer; NPC: nasopharyngeal carcinoma; PNI: prognostic nutritional index.