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Second primary cancers in laryngeal cancer patients in Slovenia, 1961–1996

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Abstract

We analysed the incidence of second primary cancers (SPC) in male laryngeal cancer patients in Slovenia and their survival for the period of 1961–1996. Data were taken from the population-based Cancer Registry of Slovenia. The person-years approach was used and the risk for SPC was expressed as a standardised incidence ratio (SIR). Survival analysis was carried out using the Kaplan–Meier method. Of 2275 male patients, 369 developed SPC (16.2%, total SIR 2.83), most commonly in the head and neck region (SIR 6.07–15.97), lung (SIR 4.15), oesophagus (SIR 4.66), and bladder (SIR 3.0), which points to an important role of common risk factors of smoking and alcohol. SPC were diagnosed in significant excess up to 20 years after the diagnosis of laryngeal cancer. The median survival time from the diagnosis of laryngeal cancer was 3.25 years for patients without a SPC and 6.47 years for patients who developed a SPC. However, the median survival time from the diagnosis of a SPC was only 0.84 years. Patients with laryngeal cancer in Slovenia have a higher risk of developing a SPC than was reported in similar studies in Europe and the USA. This high risk is partly responsible for their relatively poor survival.

Keywords: Laryngeal cancer; Second primary cancers; Standardised incidence ratio; Survival; Slovenia

1. Introduction

Patients with laryngeal cancer have a very high risk of developing second primary cancers (SPCs). The few population studies, which were carried out in population-based cancer registries, report laryngeal cancer patients to have from a 1.3 to 1.72 higher risk of developing a SPC than their respective general populations [1–3]. Studies from hospital-based cancer registries report the relative risk to be up to 2.4 [4,5]. SPCs develop most commonly in the respiratory and upper digestive tract [1–8]. This has been attributed to smoking and excessive alcohol consumption, which are predominant risk factors for cancer in the upper digestive and respiratory tract [9,10].

Smoking and excessive alcohol consumption are widespread habits in Slovenia, although smoking is reported to be declining in the last decade [11]. As a consequence, there is a high incidence of smoking- and alcohol-related cancers that are occurring also as multiple primary cancers. The connection between these two risk factors and the occurrence of a SPC has already been established in patients with cancer of the mouth and pharynx in Slovenia [12]. The relative risk for SPCs in patients with cancers of the mouth and pharynx in Slovenia was compared with those of New South Wales (Australia) and Scotland. Slovenian patients had a 3.5 times higher risk of developing a SPC than the general population of Slovenia, which was also the highest risk among all three registries. SPCs predominantly occurred in the upper digestive and respiratory tract. Similar results are expected in laryngeal cancer patients in Slovenia. Thus, by determining the site- and time-distribution of SPCs, we can deduce possible relationships between SPCs and known risk factors for laryngeal cancer. This would enable us to derive guidelines for the follow-up of patients and to develop preventive actions. Additionally, we wanted to investigate the influence of SPCs on the survival of laryngeal cancer patients in Slovenia, which is at present poorer than in most Western European countries [13]. SPCs could contribute to this poorer survival, especially if we consider the poor prognosis of patients with some SPCs in the upper digestive and respiratory tract like SPCs of the lung or oesophagus.

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2. Patients and methods

Data on laryngeal cancer patients were taken from the Cancer Registry of Slovenia. The Registry covers the entire population of the Republic of Slovenia, which numbers approximately 2 million people. It has been collecting cancer incidence and survival data since 1950. Reporting of cancer cases has been compulsory and all registered cancer patients have been followed annually until death. The main sources of data are notifications from hospitals, autopsy reports and death certificates. In cases of incomplete notifications and notifications from death certificates, additional information has been actively sought. Multiple notifications on one patient are linked by the patient's personal identification number (PIN) and the special registration number. Cases of multiple primary cancers are thoroughly revised by the Registry physician. The quality of data corresponds to the standards of the International Association of Cancer Registries (IACR). An average of 1% of patients have been lost to follow-up 5 years after the diagnosis. Until 1990, the Cancer Registry of Slovenia performed an active follow-up of registered patients. Since 1990, the dates of death and loss to follow-up have been determined by annual linkage between the databases of the Cancer Registry of Slovenia and the Population Registry of Slovenia.

2915 patients with laryngeal cancer, 2705 male and 210 female, were diagnosed and registered in Slovenia in the period from 1961 to 1996. We limited our analysis to male patients only, since in Slovenia laryngeal cancer is approximately 10 times less common in women, providing too few cases for a meaningful analysis. In addition, there is a difference in exposure to the predominant risk factors for laryngeal cancer (tobacco and alcohol) between men and women in Slovenia [11]. Of the 2705 male patients, we further excluded 276 patients in whom laryngeal cancer was diagnosed at the time of death and 154 patients in whom laryngeal cancer was not the first primary cancer. The characteristics of the remaining 2275 male patients are presented in Table 1. Among them, 793 (34.9%) had glottic cancer and 1482 (65.1%) had cancer of other and unidentified parts of the larynx.

Table 1
Characteristics of male patients diagnosed with laryngeal cancer in Slovenia, 1961–1996

No. with first primary cancer	2275
No. of SPC by the end of study	369 (16.2%)
Average age at diagnosis of first cancer	59.1 years
Average age at diagnosis of SPC	63.7 years
Person-years of follow-up	10 753.6
Average follow-up	4.78 years (0–27)
Microscopically-confirmed first cancer	97.7%
Microscopically-confirmed SPC	60.4%

SPC, second primary cancer.

SPCs were defined according to IARC (International Agency for Research on Cancer)/IACR rules [14]:

1. The recognition of the existence of two or more primary cancers does not depend on time.
2. A primary cancer originates in a primary site or tissue and is not an extension, a recurrence or a metastasis.
3. Only one tumour shall be recognised in an organ or a pair of organs or tissue (as defined by the three-digit code of the International Classification of Diseases (ICD)).
4. Rule 3 does not apply if tumours in an organ are of a different histology.

We included SPCs that occurred simultaneously with laryngeal cancer. Many other investigators decided to exclude synchronous SPCs because the risk of misclassifying a progress of the first cancer as a new primary is highest in the first months after the diagnosis of the first cancer. This risk is small in the Cancer Registry of Slovenia, since every report of multiple cancers in 1 patient is thoroughly checked by the Registry physician in collaboration with the team of clinicians and pathologists. Contrary to some other investigators, we also included non-melanoma skin SPCs because the reporting is deemed adequate in Slovenia. We excluded *in-situ* SPCs and cases of third and fourth primary cancers in 1 patient.

The risk of developing a SPC is presented as a standardised incidence ratio (SIR), which was obtained by dividing the observed number of cancer cases (O) with the expected number (E). The expected number of SPCs for each site was calculated from the observed person-years at risk multiplied by age-specific and period-specific incidence rates for the general male population of Slovenia. The statistical significance of the SIR was calculated assuming the Poisson distribution of the observed number of SPCs. This method of analysis ensured compatibility with other population-based studies on SPCs. Person-years at risk were calculated from the date of diagnosis of laryngeal cancer to the defined exit date, which was either the date of the diagnosis of the SPC, the date of death, the date of loss to follow-up or the date of the end of the study (31 December 1996), whichever occurred first. 29 patients in our cohort (1.3%) were lost to follow-up.

We performed the analysis of the SIR by the time since the diagnosis of laryngeal cancer (less than 1 year, 1–4, 5–9, 10–14, 15–19, 20+) and by the sub-site of laryngeal cancer. For the analysis of the SIR by the subsite of laryngeal cancer, we divided our cohort into the group of glottic cancer patients (ICD-8 code 161.0) and into the group of patients with cancer of other and unidentified parts of larynx (ICD-8 codes 161.8 and 161.9). In Slovenia, this second group comprises mostly supraglottic cancer.

We also performed the survival analysis using the standard Kaplan–Meier method and compared survival curves of laryngeal cancer patients with and without SPCs using the log-rank test. In patients who developed a SPC, we also analysed the survival since the diagnosis of the SPC. We analysed causes of death in our cohort, too; but since the reporting of causes of death to the Registry is incomplete, these results are not very informative.

3. Results

We observed 369 cases of SPCs (16.2%), while only 130.4 were expected (Table 2). The risk of developing a SPC was 2.8 times higher than expected in the general male population of Slovenia (SIR 2.83). The risk was highest for cancers of mouth and pharynx (SIR 10.07 for mouth, SIR 9.67 for oropharynx and SIR 6.07 for hypopharynx). The risk was also significantly higher for SPCs of the oesophagus (SIR 4.66), lung (SIR 4.15), bladder (SIR 3.0) and non-melanoma skin cancers (SIR 2.74). The risk was the highest in the first year after the diagnosis of laryngeal cancer (SIR 4.36) and remained high for up to 20 years.

The analysis of the SIR by the sub-site of laryngeal cancer showed that patients with glottic cancer have a lower risk of developing a SPC than patients with cancer of other and unidentified parts of the larynx (SIR 2.14 versus SIR 3.47) (Table 3). This difference was statistically significant. There was no significant difference in the site distribution of the SPCs, except for lung cancer, which was more common in patients with cancer of the other parts of the larynx. In general, SPCs were more common in patients with cancer of the other parts of the larynx for all smoking- and alcohol-related sites, except for bladder cancer, which was more common in patients with glottic cancer.

By the end of our study, 1606 patients died; 973 (60.6%) of them died of laryngeal cancer, 127 (7.9%) died of a SPC and the remaining 506 patients (31.5%) died of causes other than cancer. Among the patients who developed a SPC, 313 (84.8%) died by the end of our study, a SPC being the officially reported cause of death in 37.9% of them and laryngeal cancer in 31.6%. The baseline characteristics of patients with and without a SPC, who were included in the survival analysis, are given in Table 4. Fig. 1 shows that the 5-year survival from the diagnosis of laryngeal cancer was 41% for patients without a SPC and 59% for patients who developed a SPC (the median survival time of 3.25 years and 6.47 years, respectively). However, the 5-year survival from the diagnosis of a SPC was only 12% (the median survival time of 0.84 years) (Fig. 2). The analysis of survival of patients with localised (T1-2 N0 M0) glottic cancer, who generally have the best prognosis among the laryngeal cancer patients, was also performed. It showed that the median survival time from the diagnosis of laryngeal cancer was 10.35 years for patients without a SPC and 8.42 years for patients who developed a SPC, but the 5-year survival from the diagnosis of laryngeal cancer was not influenced by the development of a SPC (Fig. 3).

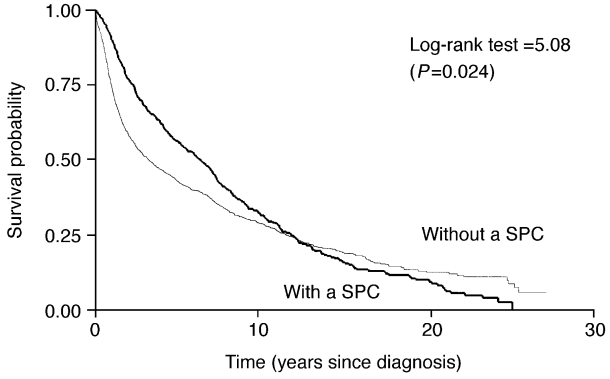

Fig. 1. Kaplan–Meier estimates of crude survival rates among male laryngeal cancer patients with (bold line) and without (faint line) a second primary cancer (SPC), calculated from the time of diagnosis of laryngeal cancer.

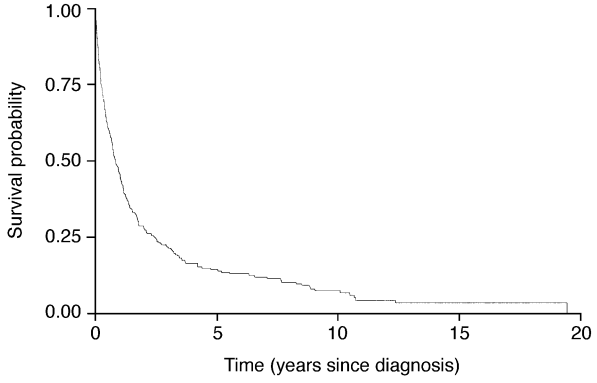

Fig. 2. Kaplan–Meier estimates of crude survival rates among male laryngeal cancer patients who developed a second primary cancer (SPC), calculated from the time of diagnosis of the SPC.

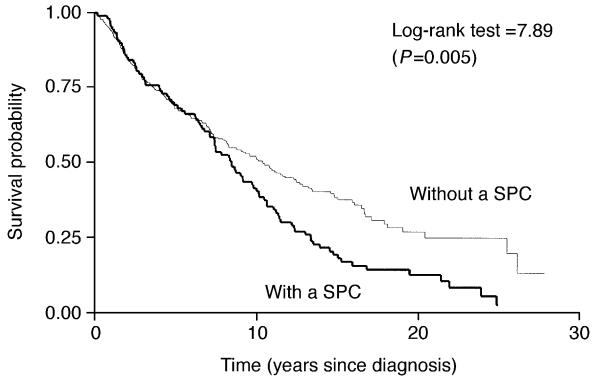

Fig. 3. Kaplan–Meier estimates of crude survival rates among males with localised glottic cancer with (bold line) and without (faint line) a second primary cancer (SPC), calculated from the time of diagnosis of glottic cancer.

Table 2
Standardised incidence ratio for selected second primary cancers by years since the diagnosis of laryngeal cancer

Site	Person-years	Years since first primary cancer						
		0–1	1–4	5–9	10–14	15–19	20+	All
		1932.8	4367.2	2702.9	1195.7	411.5	143.5	10753.6
All sites	O	**85**	**127**	**84**	**48**	**18**	7	**369**
	SIR	**4.36**	**2.68**	**2.4**	**2.59**	**2.51**	2.45	**2.83**
	95% CI	**3.5–5.4**	**2.2–3.2**	**1.9–3.0**	**1.9–3.4**	**1.5–3.9**	0.9–5.0	**2.5–3.1**
Lip	O	1	2	0	**3**	1	0	**7**
	SIR	4.69	4.27	0	**20.76**	19.63	0	**5.84**
	95% CI	0.1–26.5	0.5–15.4	0–12.3	**4.1–58.4**	0.5–111	0–184	**2.3–12.0**
Tongue	O	**7**	**6**	**4**	**3**	1	**1**	**22**
	SIR	**30.26**	**10.9**	**10.9**	**18.85**	18.68	**66.1**	**15.97**
	95% CI	**12.2–62.7**	**4.0–23.7**	**2.9–27.7**	**3.9–54.8**	0.5–111	**1.3–279**	**9.9–24.1**
Salivary glands	O	0	0	0	0	0	0	0
	SIR	0	0	0	0	0	0	0
	95% CI	0–184	0–73.8	0–92.2	0–184	0–369	–	0–24.6
Oral cavity	O	**9**	**4**	**4**	**2**	0	0	**19**
	SIR	**29.18**	**5.32**	**7.95**	**8.9**	0	0	**10.07**
	95% CI	**13.3–55.1**	**1.4–13.7**	**2.2–20.5**	**1.1–32.8**	0–52.7	0–104	**6.0–15.7**
Oropharynx	O	**5**	**7**	**6**	**3**	1	**2**	**24**
	SIR	**12.51**	**7.14**	**9.12**	**9.96**	9.38	**66.65**	**9.67**
	95% CI	**4.1–29.2**	**2.8–14.7**	**3.3–19.8**	**20.6–292**	0.23–50.7	**8.1–241**	**6.2–14.3**
Epipharynx	O	0	0	0	0	0	0	0
	SIR	0	0	0	0	0	0	0
	95% CI	0–123	0–46.1	0–73.8	0–123	0–369	–	0–17.6
Hypopharynx	O	**5**	0	**3**	0	0	0	**8**
	SIR	**23.06**	0	**8.5**	0	0	0	**6.07**
	95% CI	**7.4–53.0**	0–6.9	**1.8–25.0**	0–24.6	0–73.8	0–184	**2.6–11.9**
Oesophagus	O	**3**	**7**	**4**	0	1	0	**15**
	SIR	**5.78**	**5.7**	**4.64**	0	6.68	0	**4.66**
	95% CI	**1.2–16.9**	**2.3–11.7**	**1.3–11.9**	0–8.9	0.2–37.1	0–92.2	**2.6–7.6**
Stomach	O	1	2	3	1	0	0	7
	SIR	0.2	0.23	0.66	0.47	0	0	0.33
	95% CI	0–1.12	0–0.8	0.1–1.9	0–2.6	0–4.8	0–14.2	0.1–0.6
Colon	O	2	0	2	0	0	**2**	6
	SIR	2.3	0	1.11	0	0	**10.53**	0.91
	95% CI	0.2–8.3	0–1.6	0.1–3.9	0–3.5	0–8.4	**1.3–40.1**	0.3–2.0
Rectum	O	0	3	2	1	0	0	6
	SIR	0	1.05	0.91	0.83	0	0	0.74
	95% CI	0–3.2	0.2–3.0	0.1–3.3	0–4.6	0–7.7	0–21.7	0.3–1.6
Liver	O	0	1	0	0	0	0	1
	SIR	0	2.26	0	0	0	0	0.82
	95% CI	0–21.7	0–12.7	0–11.2	0–20.5	0–52.7	0–123	0–4.6
Pancreas	O	1	1	1	1	0	0	4
	SIR	1.98	0.81	1.04	1.94	0	0	1.15
	95% CI	0–11.1	0–4.5	0–5.8	0–10.7	0–18.4	0–52.7	0.3–2.9
Nose, sinuses	O	0	0	0	1	0	0	1
	SIR	0	0	0	18.63	0	0	2.51
	95% CI	0–61.5	0–24.6	0–36.9	0.5–111	0–184	0–369	0–13.9
Larynx	O	0	0	1	0	0	0	1
	SIR	0	0	1.05	0	0	0	0.28
	95% CI	0–6.05	0–2.6	0–5.8	0–8.4	0–23.1	0–73.8	0–1.5
Lung	O	**31**	**64**	**34**	**19**	**6**	1	**155**
	SIR	**4.04**	**4.34**	**3.9**	**4.59**	**3.94**	1.75	**4.15**
	95% CI	**2.7–5.7**	**3.3–5.5**	**2.7–5.4**	**2.8–7.1**	**1.4–8.5**	0–10.7	**3.5–4.8**

Table 2 (*continued*)

Site	Person-years	Years since first primary cancer						
		0–1	1–4	5–9	10–14	15–19	20+	All
		1932.8	4367.2	2702.9	1195.7	411.5	143.5	10753.6
Pleura,mediastinum	O	1	0	0	0	0	0	1
	SIR	19.57	0	0	0	0	0	2.99
	95% CI	0.5–111	0–30.7	0–41.0	0–73.8	0–184	0–369	0–16.9
Malignant melanoma	O	0	1	0	0	0	0	1
	SIR	0	1.91	0	0	0	0	0.69
	95% CI	0–18.4	0–10.7	0–9.5	0–17.6	0–41.0	0–123	0–3.8
Non-melanoma skin cancer	O	**10**	**10**	4	4	**4**	1	**33**
	SIR	**5.1**	**2.27**	1.33	2.37	**5.91**	3.33	**2.74**
	95% CI	**2.4–9.4**	**1.1–4.2**	0.4–3.4	0.6–6.1	**1.6–15.1**	0–19.9	**1.9–3.8**
Prostate	O	2	4	6	3	2	0	17
	SIR	0.94	0.86	1.76	1.46	2.39	0	1.27
	95% CI	0.1–3.4	0.2–2.2	0.6–3.8	0.3–4.3	0.3–8.5	0–11.2	0.7–2.0
Bladder	O	0	**6**	**6**	3	1	0	**16**
	SIR	0	**3.26**	**4.11**	3.62	3.03	0	**3**
	95% CI	0–4.9	**1.2–7.1**	**1.5–8.9**	0.7–10.6	0–16.9	0–30.7	**1.7–4.9**
Kidney, urether, other	O	0	3	0	0	0	0	3
	SIR	0	2.93	0	0	0	0	1.05
	95% CI	0–9.0	0.6–8.6	0–4.8	0–8.6	0–21.7	0–52.7	0.2–3.0
Thyroid	O	1	0	0	0	**1**	0	2
	SIR	14.05	0	0	0	**54.22**	0	4.86
	95% CI	0.3–79.6	0–23.1	0–36.9	0–73.8	**1.3–279**	0–369	0.6–17.6
Lymphomas	O	0	0	1	0	0	0	1
	SIR	0	0	2.5	0	0	0	0.6
	95% CI	0–15.4	0–6.1	0.6–13.9	0–18.4	0–61.5	0–184	0–3.6
Leukaemias	O	2	2	1	1	0	0	6
	SIR	5.15	2.1	1.37	2.46	0	0	2.22
	95% CI	0.6–18.5	0.2–7.6	0–7.6	0.1–13.6	0–23.1	0–52.7	0.8–4.8

O, observed number of SPCs; SIR, standardised incidence ratio; 95% CI, 95% Confidence Interval.
Statistically significant values of SIR are written in bold.

Table 3
Standardised incidence ratio for selected second primary cancers by sub-site of laryngeal cancer in men

	Glottic cancer			Cancer of other parts of larynx		
Site	O	SIR	95% CI	O	SIR	95% CI
Oesophagus	**5**	**3.38**	**1.1–7.9**	**10**	**5.71**	**2.7–10.5**
Liver	0	0	0.0–6.2	1	1.58	0.0–8.8
Lung	**48**	**2.94**	**2.2–3.9**	**107**	**5.06**	**4.1--6.1**
Skin	9	1.55	0.7–2.9	**24**	**3.85**	**2.5–7.5**
Bladder	**10**	**3.83**	**1.8–7.0**	6	2.19	0.8–4.8
Mouth, pharynx	**21**	**6.38**	**3.9–9.8**	**52**	**12.9**	**9.6–16.9**
All sites	**130**	**2.14**	**1.8–2.5**	**239**	**3.47**	**3.0–3.9**

O, observed number of SPCs; SIR, standardised incidence ratio; Mouth, pharynx consists of the following sites: tongue, oral cavity, oropharynx, nasopharynx, hypopharynx; 95% CI, 95% Confidence Interval.
Statistically significant values of SIR are written in bold.

4. Discussion

Our results show that male laryngeal cancer patients in Slovenia had a significant 2.8 times higher risk of developing a SPC than the general male population of Slovenia. This risk was much higher than has been reported in similar studies [1–8], especially for SPCs of the mouth and pharynx. A significantly high risk for most SPCs could be attributed to underlying smoking habits (lung and bladder SPCs) or to combination of

Table 4
Selected characteristics of male laryngeal cancer patients included in the survival analysis, with and without a SPC

Characteristic	With SPC (total = 369)	Without SPC (total = 1906)	Test
Glottis	130 (35.2%)	663 (34.8%)	Chi^2 test = 0.03
Other parts of larynx	239 (64.8%)	1243 (65.2%)	
Localised disease	229 (62.1%)	928 (48.7%)	Chi^2 test = 22.12*
Regional or distant spread	140 (37.9%)	978 (51.3%)	
Average age at the diagnosis of laryngeal cancer	58.1 years	60.1 years	Two-tailed t-test = 3.37*

SPC, second primary cancer.
*$P < 0.05$.

smoking and excessive alcohol consumption (SPCs of the oral cavity, pharynx and oesophagus), which have also influenced the development of laryngeal cancer [15,16]. Although we do not have the data on the smoking and drinking habits of our patients, the distribution of SPCs suggests that the aetiological risk factors for the first cancer are important in pathogenesis of the second cancer. This diffuse effect of carcinogens on the mucosa of the upper respiratory and digestive tract has been described by Slaughter in 1953 [17] and termed as "field cancerization". Our findings strongly support this concept and are consistent with the results of other similar studies.

There have been speculations that SPCs could also be related to the radiotherapy treatment for laryngeal cancer. This relationship has been confirmed for some other first primary cancers, notably cervical cancer [18], but not for first primary cancers of the head and neck area [8,19]. We could not exclude the influence of radiotherapy on the development of SPCs in our cohort, but there is some indirect evidence against it. The risk for SPCs was the highest in the first year after the diagnosis of laryngeal cancer, while the carcinogenic effects of radiotherapy are usually observed 10 years or more later [18]. In addition, the risk for a SPC of the thyroid gland, which is very radiosensitive, was not significantly increased.

The significantly high risk of non-melanoma skin SPCs can be explained by the increased diagnostic surveillance of cancer patients. Additionally, both non-melanoma skin cancer and laryngeal cancer are more frequent in the rural areas of Slovenia. This overlapping geographical distribution suggests that the laryngeal cancer patients are frequently outdoor workers and thus more exposed to the sun, which influences the development of a non-melanoma skin SPC [20].

The analysis of the SIR by the sub-site of laryngeal cancer shows that patients with cancer of other and unidentified parts of larynx had a higher risk of developing a SPC than patients with glottic cancer. This is consistent with the results of several other studies [5,21,22]. The possible explanation could be that the glottis is affected predominantly by smoking alone as opposed to the supraglottis, which is in direct contact with both smoke and alcohol boluses and which comprises most of our second group of patients. Additionally, the poor diet of alcohol abusers also presents a risk factor [10]. A prospective study with the data on smoking and drinking habits, as well as the diet, of the laryngeal cancer patients would be needed to confirm this hypothesis.

The survival analysis for all laryngeal cancer patients shows patients with a SPC to have a slightly better survival (at 5 years from the diagnosis of laryngeal cancer) than patients without a SPC. These results only appear to be controversial. The comparison between patients with and without a SPC showed differences in some of the variables which have a known influence on the survival of cancer patients (age at diagnosis, stage). Patients without a SPC were significantly older at the diagnosis and had a higher stage of laryngeal cancer than those with a SPC, which probably resulted in their poorer survival. Consequently, those with a SPC have a better overall survival and are therefore exposed longer to the risk of developing a SPC, which then proves to be rapidly fatal.

We analysed separately the survival of patients with localised glottic cancer, who generally have the best prognosis among laryngeal cancer patients. Among them, patients who developed a SPC had a significantly lower survival than patients without a SPC. Their survival worsened approximately 7 years after the diagnosis of laryngeal cancer, which corresponds to the weighted median time at which these patients developed a SPC.

We can conclude that, although SPCs have an influence on the survival of laryngeal cancer patients in Slovenia, they are outweighed by other known prognostic baseline characteristics of laryngeal cancer patients. It has already been established that these characteristics are worse in Slovenia than in other Western European countries [13]. The percentage of glottic cancer as well as localised laryngeal cancer is lower in Slovenia. The high relative risk for SPC thus only contributes to, but is not the determinant, of the worse survival of laryngeal cancer patients in Slovenia.

The site- and time-distribution of the SPCs in our study suggests possible strategies for a more effective follow-up of laryngeal cancer patients and preventive actions. Our results show that the risk for a SPC was the highest in the first year and remained significantly high up to 20 years after the diagnosis of laryngeal cancer. We would therefore recommend a longer medical surveillance of laryngeal cancer patients, aimed particularly at the early detection of SPCs in the upper respiratory and digestive tract. However, it remains unclear whether such surveillance would improve the survival of laryngeal cancer patients in Slovenia. It is also not certain whether the cessation of smoking and alcohol drinking after the diagnosis of laryngeal cancer can decrease the risk for SPCs [15,23]. With respect to the high risk of SPCs of the respiratory and upper digestive tract, an active approach to cessation of these two habits in patients with laryngeal cancer might be beneficial.

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