Lung cancer survival in Northern Ireland


Published in:
Irish Medical Journal
Lung Cancer Survival in Northern Ireland

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Abstract

Lung cancer causes more deaths than any other cancer in Northern Ireland. Survival, and factors which could influence survival, were examined for the 4,458 patients diagnosed with lung cancer from 1992 to 1996. Overall five-year survival was 18%, but better for females (22%) than males (14%). Survival improved each year although this could not be attributed to treatment changes. Survival was better for men under 65 years, than older men (p = 0.05).

Introduction

Lung cancer causes almost 800 deaths in Northern Ireland each year, more than any other cancer, whilst over 900 patients are diagnosed annually. Marked international variations in the treatment and outcome of lung cancer have been reported over time. Northern Ireland has a stable population and detailed information has been available on patients developing lung cancer since October 1991.

This study examines lung cancer survival, and changes in survival over the five-year study period, 1992 to 1996, in order to determine whether any improvements could be related to changes in clinical practice, and compares survival in Northern Ireland with other European countries and the United States of America (US).

Methods

Dataset

The Northern Ireland Cancer Registry (NICR) records electronically, all incident cases of cancer in Northern Ireland diagnosed since 1993. Data were extracted from the NICR database on all 3,576 malignant lung tumours (International Classification of Diseases, 9th Revision (ICD9 162)) over the period January 1993 to December 1996. Data on 882 patients were also available from an earlier study that spanned a one-year period from October 1991 to September 1992. This one-year period will be referred to as 1992 hereafter. The study was a prospective study using multivariate and univariate statistical analysis.

To allow for deaths from diseases other than lung cancer, survival was expressed as a relative survival rate (RSR). Relative survival is the ratio of the observed survival divided by the survival that the patient would have experienced if s/he had the same probability of dying as the general population having the same age and sex, and thus adjusts for background mortality from all causes. The relative survival rates were calculated using the SURV2 relative survival software developed by the Finnish Cancer Registry.

Linear regression analyses were carried out on the age-standardised incidence and mortality rates separately for males and females to investigate if there were significant trends over the study period, 1992 to 1996. Additionally, Cox proportional hazards regression models were fitted to the data, in order to investigate if year of diagnosis, age at diagnosis, sex, cell type and treatment, and interactions between these factors were significant predictors of survival. Relative survival rates were then calculated for each of the significant predictor variables. The survival rates for Northern Ireland lung cancer patients were compared with the rates for the Republic of Ireland, Scotland, England and Wales, other European registries and the USA.

Results

Incidence and Mortality

During the study period, there were 2,899 male and 1,559 female incident lung cancers, and 2,563 male and 1,326 female lung cancer deaths (Table 1). The incidence and mortality from lung cancer cell in men and women in 1991, but the changes in incidence and mortality were not statistically significant (P>0.05).

Table 1 Incidence and mortality of lung cancer (ICD9 162) in the Northern Ireland population

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>882</td>
<td>774</td>
<td>842</td>
<td>912</td>
<td>963</td>
<td>P=0.26</td>
</tr>
<tr>
<td>EASR per 100,000</td>
<td>84.3</td>
<td>80.6</td>
<td>85.5</td>
<td>70.2</td>
<td>74.7</td>
<td></td>
</tr>
<tr>
<td>(EASR 95% CI)</td>
<td>(79.8 - 89.1)</td>
<td>(82.4 - 88.8)</td>
<td>(80.8 - 86.3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>732</td>
<td>670</td>
<td>754</td>
<td>714</td>
<td>650</td>
<td>P=0.74</td>
</tr>
<tr>
<td>EASR per 100,000</td>
<td>76.6</td>
<td>72.9</td>
<td>79.3</td>
<td>67.0</td>
<td>66.6</td>
<td></td>
</tr>
<tr>
<td>(EASR 95% CI)</td>
<td>(73.0 - 80.2)</td>
<td>(69.5 - 77.3)</td>
<td>(60.9 - 73.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. deaths</td>
<td>513</td>
<td>518</td>
<td>518</td>
<td>512</td>
<td>511</td>
<td>P=0.05</td>
</tr>
<tr>
<td>Male</td>
<td>73.0</td>
<td>75.6</td>
<td>72.9</td>
<td>67.0</td>
<td>66.6</td>
<td></td>
</tr>
<tr>
<td>EASR per 100,000</td>
<td>65.1</td>
<td>62.1</td>
<td>60.9</td>
<td>60.9</td>
<td>60.9</td>
<td></td>
</tr>
<tr>
<td>(EASR 95% CI)</td>
<td>(61.8 - 68.4)</td>
<td>(58.8 - 64.2)</td>
<td>(57.8 - 64.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. deaths</td>
<td>513</td>
<td>518</td>
<td>518</td>
<td>512</td>
<td>511</td>
<td>P=0.24</td>
</tr>
<tr>
<td>Female</td>
<td>20.2</td>
<td>23.9</td>
<td>27.8</td>
<td>27.4</td>
<td>24.0</td>
<td></td>
</tr>
<tr>
<td>EASR per 100,000</td>
<td>23.3</td>
<td>25.9</td>
<td>27.8</td>
<td>27.4</td>
<td>24.0</td>
<td></td>
</tr>
<tr>
<td>(EASR 95% CI)</td>
<td>(23.3 - 26.2)</td>
<td>(25.2 - 29.0)</td>
<td>(24.3 - 29.1)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* EASR = European Age-Standardised Rate

Age and Sex

The age profiles for males and females diagnosed with lung cancer during the study period were similar; their mean (standard error) ages being 68.8 (0.2) and 68.4 (0.3) years respectively. The study population was elderly (median age at diagnosis being 69 years) and predominantly male (65%).

Cell Type

Over the study period, 2,630 (59%) lung cancers were recorded as non-small cell type, 535 (12%) were small cell and 232 (5%) were classified NMV. In 1992 data on cell type were available for 750 (85%) patients compared with 656 (80%) in 1996.

Investigations

Data on bronchoscopy and CT scanning rates were available for 1992 and 1996 data. Bronchoscopies were performed in 494 (56%) lung cancer patients in 1992 and this increased to 585 (67%) in 1996, while CT scanning was used in 220 patients (52%) in 1992 to 586 (67%) in 1996.

Treatment Effects

The overall number of patients having surgery was higher in 1996 (Table 2), although not significantly (P>0.05). There

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was no difference in the proportions of patients having radiotherapy (P>0.05), however, more patients received chemotherapy in 1996 than in 1992 (P<0.05). Differences in treatment may account for variations in survival. A smaller proportion of patients in Northern Ireland received surgery (P<0.001) and chemotherapy (P<0.01) than in the Republic of Ireland, whilst the proportion of patients undergoing radiotherapy was similar.

Table 2 Treatment of lung cancer surgery, chemotherapy and radiotherapy in Northern Ireland and Republic of Ireland by period of diagnosis

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Surgery</th>
<th>Chemotherapy</th>
<th>Radiotherapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992-1995</td>
<td>270</td>
<td>14 (12-16)</td>
<td>7 (6-8)</td>
</tr>
<tr>
<td>1993-1996</td>
<td>269</td>
<td>12 (10-14)</td>
<td>6 (5-7)</td>
</tr>
<tr>
<td>1994-1996</td>
<td>266</td>
<td>11 (9-13)</td>
<td>6 (5-8)</td>
</tr>
<tr>
<td>1995-1996</td>
<td>267</td>
<td>10 (8-12)</td>
<td>6 (5-8)</td>
</tr>
<tr>
<td>1996-1996</td>
<td>268</td>
<td>9 (7-11)</td>
<td>6 (5-8)</td>
</tr>
</tbody>
</table>

Table 3 Hazard ratio, 95% confidence interval, and P-value for change in survival expectancy per unit change in predictor variable

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>Change in survival</th>
<th>95% Confidence Interval</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Female vs. male</td>
<td>0.83</td>
<td>0.71 - 0.97</td>
</tr>
<tr>
<td>Year of Diagnosis</td>
<td>1992 vs. 1993</td>
<td>0.75</td>
<td>0.65 - 0.84</td>
</tr>
<tr>
<td></td>
<td>1993 vs. 1994</td>
<td>0.69</td>
<td>0.54 - 0.87</td>
</tr>
<tr>
<td></td>
<td>1994 vs. 1995</td>
<td>0.63</td>
<td>0.54 - 0.74</td>
</tr>
<tr>
<td></td>
<td>1995 vs. 1996</td>
<td>0.62</td>
<td>0.54 - 0.74</td>
</tr>
<tr>
<td>Age (years)</td>
<td>&lt;65 yrs vs. 65 yrs</td>
<td>0.69</td>
<td>0.54 - 0.87</td>
</tr>
</tbody>
</table>

Table 4 Lung cancer relative survival (95% Confidence Interval) by sex, age at diagnosis and cell type

<table>
<thead>
<tr>
<th>Sex</th>
<th>Age/Cell Type</th>
<th>No Cases</th>
<th>1-year</th>
<th>2-year</th>
<th>3-year</th>
<th>4-year</th>
<th>5-year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>All Ages</td>
<td>270</td>
<td>14 (12-16)</td>
<td>7 (6-8)</td>
<td>6 (5-7)</td>
<td>5 (4-6)</td>
<td>4 (3-5)</td>
</tr>
<tr>
<td>Female</td>
<td>&lt;65yrs</td>
<td>833</td>
<td>12 (10-14)</td>
<td>7 (5-9)</td>
<td>6 (5-7)</td>
<td>5 (4-6)</td>
<td>4 (3-5)</td>
</tr>
<tr>
<td>Male</td>
<td>65yrs</td>
<td>1912</td>
<td>11 (9-13)</td>
<td>6 (5-8)</td>
<td>5 (4-6)</td>
<td>4 (3-5)</td>
<td>3 (2-4)</td>
</tr>
<tr>
<td>Female</td>
<td>&lt;65yrs</td>
<td>489</td>
<td>15 (12-16)</td>
<td>10 (8-12)</td>
<td>9 (8-11)</td>
<td>8 (7-10)</td>
<td>7 (6-9)</td>
</tr>
<tr>
<td>Male</td>
<td>65yrs</td>
<td>997</td>
<td>13 (11-15)</td>
<td>9 (8-11)</td>
<td>8 (7-10)</td>
<td>7 (6-9)</td>
<td>6 (5-8)</td>
</tr>
<tr>
<td>Female</td>
<td>&lt;65yrs</td>
<td>643</td>
<td>18 (16-20)</td>
<td>13 (11-15)</td>
<td>12 (10-14)</td>
<td>11 (10-13)</td>
<td>10 (9-12)</td>
</tr>
<tr>
<td>Male</td>
<td>Non Small</td>
<td>304</td>
<td>13 (11-15)</td>
<td>9 (8-11)</td>
<td>8 (7-10)</td>
<td>7 (6-9)</td>
<td>6 (5-8)</td>
</tr>
<tr>
<td>Female</td>
<td>Non Small</td>
<td>766</td>
<td>7 (5-9)</td>
<td>5 (4-6)</td>
<td>4 (3-5)</td>
<td>3 (2-4)</td>
<td>2 (1-3)</td>
</tr>
<tr>
<td>Male</td>
<td>Small</td>
<td>17 (15-19)</td>
<td>12 (10-14)</td>
<td>9 (8-11)</td>
<td>8 (7-10)</td>
<td>7 (6-9)</td>
<td>6 (5-8)</td>
</tr>
<tr>
<td>Female</td>
<td>Small</td>
<td>406</td>
<td>15 (13-17)</td>
<td>13 (11-15)</td>
<td>12 (10-14)</td>
<td>11 (10-13)</td>
<td>10 (9-12)</td>
</tr>
</tbody>
</table>

Table 5 Hazard ratio, 95% confidence interval, and P-value for change in survival expectancy per unit change in predictor variable

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>Change in survival</th>
<th>95% Confidence Interval</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell Type</td>
<td>Non-small vs. small</td>
<td>0.62</td>
<td>0.54 - 0.74</td>
</tr>
</tbody>
</table>

Sex
Men who significantly had higher survival from lung cancer than women (P<0.005). The percentages of men and women after five years of follow-up were 7% and 9% respectively (Table 4).

National and International Comparisons
Relative survival information was available for the Republic of Ireland, England, and Wales, Scotland, other European Registrars, and the USA. Five-year relative survival rates for Northern Ireland patients 1992-96, of 7% in males and 9% in females were smaller than those in England (1993-95): males 5%, females 10%. They were, however, slightly lower than those in the Republic of Ireland (1994-98): males 8%, females 11%, and in several other European countries, including Finland (1985-89): males 11%, females 12%; Holland (1985-89): males 14%, females 12% and were also poorer than US survival rates (1993): males 13%, females 18%.

Discussion
The period 1992 to 1996 for which the trend was examined is short and the fall in incidence and mortality in women is most likely related to patterns described elsewhere which reflect tobacco consumption.

Survival rates for lung cancer although poor at 9% for females and 7% for males improved between 1992 and 1996, with the hazard of death from lung cancer decreasing year on year. The improvement in survival between 1992 and 1996 was most marked in young men. Overall, survival rates were higher in Northern Ireland than in the rest of the UK. It is likely that, almost all the factors identified during the study period and the active follow-up of cases ensures that the survival figures are unlikely to be significantly underestimated. Higher survival levels in Europe and the USA of up to 15% and 18% respectively indicate that there is potential for future improvement in survival. Moreover, some of these high survival rates relate to periods earlier than this study and may have improved even further for more recent time periods.

The higher survival reported in the USA for lung cancer is similar to differences reported for other cancer sites and may reflect more aggressive investigation. The microscopic verification rate for lung cancer in the USA is 91%.

Overall, patients with non-small cell type lung cancer had significantly better survival rates than those with small cell type (Table 4). The percentages of men alive after five years of follow-up were 7% and 4% for non-small cell and NMV respectively. Only four of the 523 small cell patients survived at least five years after diagnosis.

Non-small vs. small 1.66 1.31 − 2.10 <0.001

Male NMV 453 16 (13-20) 9 (7-11) 7 (4-9) 5 (3-8) 4 (2-6)

Female NMV 453 16 (13-20) 9 (7-11) 7 (4-9) 5 (3-8) 4 (2-6)

Age
Men diagnosed with lung cancer before 65 years had significantly higher survival rates than those diagnosed at older age (9% and 6% respectively, P<0.05). For women, there was no statistically significant difference between the two age groups (P>0.05) (Table 4).
not powerful enough to discriminate the effect of change. The survival of lung cancer patients in Northern Ireland is
less than that of the Republic of Ireland, where a higher proportion of patients were recorded as receiving chemotherapy
and tumour directed surgery. This apparent difference in treatment could reflect the methods of data collection
employed by each Registry and this is worthy of closer scrutiny. (NICR operates electronic notification with selected
note review while the National Cancer Registry of Ireland obtain data through extraction from hospital records by
trained Tumour Registration Officers).

The higher level of microscopic verification in 1992 may reflect the prospective multisource method of data collection
undertaken by a clinician compared with the retrospective electronic data collection which is routine for the NICR. The
level of microscopic verification in Northern Ireland 1996 was comparable at 75% with that reported as high (74.1%) in
Scotland 1995.

A limitation of the study was the insufficient availability of information on disease and stage. There is a need for
standardised information regarding stage of lung cancer at presentation to supplement the current data. Also, a
five-year period is too short to robustly identify trends in survival; we await future data for this analysis.

The use of CT scanning and bronchoscopy had improved in Northern Ireland for CT scan from 52% of patients in 1992
to 67% in 1996 which is better than that of 47% reported in Scotland 1995. The proportion of patients undergoing
investigation by bronchoscopy at 67% was identical to that in Scotland in 1995 and had improved from 56% in 1992. It may
be that better targeting of treatment by enhanced selection of patients for surgery explains, at least in part, the
year on year improvement in survival.

It is likely that survival in lung cancer in Northern Ireland can be improved in the future. Positron Emission
Tomography (PET) promises to improve the selection of patients for lung cancer surgery and hence outcomes. New
radiotherapeutic techniques and increasing numbers of patients (with both small cell and non-small cell) receiving
chemotherapy also promises to improve survival. In Scotland where services are organised in a similar way to Northern
Ireland it was found that management by a respiratory physician, oncologist or thoracic surgeon was an independent
predictor of access to potentially curative treatment and of better survival. This will be further studied in Northern
Ireland as part of the evaluation of the implementation of a review of cancer services introduced by the Campbell
Report.

Despite the improvements reported in this study the poor overall survival, alongside the increase in incidence and
mortality from lung cancer, points to the need for continued action to prevent tobacco use in the population.

Funding:
The N. Ireland Cancer Registry is funded by the Department of Health, Social Services and Public Safety, Northern
Ireland.

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Comments: No Comments

OtherReferences: No References

Acknowledgement: No Acknowledgement