Incidence and survival of stomach cancer in a high-risk population of Chile

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Abstract

AIM: To study the incidence and survival rate of stomach cancer (SC) and its associated factors in a high risk population in Chile.

METHODS: The population-based cancer registry of Valdivia, included in the International Agency for Research on Cancer system, covers 356,396 residents of Valdivia Province, Southern Chile. We studied all SC cases entered in this Registry during 1998-2002 (529 cases). Population data came from the Chilean census (2002). Standardized incidence rates per 100,000 inhabitants (SIR) using the world population, cumulative risk of developing cancer before age 75, and rate ratios by sex, age, ethnicity and social factors were estimated. Relative survival (Ederer II method) and age-standardized estimates (Brenner method) were calculated. Specific survival rates (Kaplan-Meier) were measured at 3 and 5 years and survival curves were analyzed with the Logrank and Breslow tests. Survival was studied in relation to demographics, clinical presentation, laboratory results and medical management of the cases. Those variables significantly associated with survival were later included in a Cox multivariate model.

RESULTS: Between 1998 and 2002, 529 primary gastric cancers occurred in Valdivia (crude incidence rate 29.2 per 100,000 inhabitants). Most cases were male (69.0%), residents of urban areas (57.5%) and Hispanic (83.2%), with a low education level (84.5% < 8 school years). SC SIR was higher in men than women (40.8 and 14.8 respectively, \( P < 0.001 \)), risk factors were low education RR 4.4 (95% CI: 2.9-6.8) and 1.6, (95% CI: 1.1-2.1) for women and men respectively and Mapuche ethnicity only significant for women (RR 2.2, 95% CI: 1.2-3.7). Of all cases, 76.4% were histologically confirmed, 11.5% had a death certificate only (DCO), 56.1% were TNM stage IV; 445 cases (84.1%) were eligible for survival analysis, all completed five years follow-up; 42 remained alive, 392 died of SC and 11 died from other causes. 5-year specific survival was higher for patients aged < 55 years (17.3%), with intestinal type of cancer (14.6%), without metastasis (22.2%), tumor size < 4 cm (60.0%), without lymphatic invasion (77.1%), only involvement of the mucous membrane (100%). Statistically significant independent prognostic factors were: TNM staging, diffuse type, metastasis, supraclavicular adenopathy, palpable tumor, and hepatitis or ascites.

CONCLUSION: Social determinants are the main risk factors for SC, but not for survival. An advanced clinical stage at consultation is the main cause of poor SC survival.

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Key words: Survival analysis; Stomach neoplasms; Survival rate; Incidence; Risk factors; Gastrectomy

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INTRODUCTION
In 2002, stomach cancer (SC) was the fourth most common cancer in the world, with 900,937 cases and 700,349 deaths. Two-thirds of these occurred in developing countries\(^1\). The high-risk zones encompass Asia, Eastern Europe, and the Andean region of South America, all of diverse geographical characteristics\(^2\). Chile, a representative of the Andean Region, presents an SC average mortality rate per 100,000 in 1990-2005 of 25.1 for men and 13.2 for women\(^3\). This high SC mortality has not changed in the last 20 years\(^4\). The existence of a population-based Cancer Registry in Valdivia\(^5\) gave us the opportunity to measure SC incidence and survival in a middle-developing country. The Cancer Registry of Valdivia was initiated in 1982 and encompasses the inhabitants of an area of 18,429 square kilometres in Southern Chile; the data are included in the International Agency for Research on Cancer (IARC) cancer reports in 5 continents\(^6\). The aims of this study were to measure SC incidence and risk factors and to assess SC survival.

MATERIALS AND METHODS
Cancer registry of Valdivia
The cancer registry of Valdivia covers a population of 356,396 people, and encompasses a systematic review of records in private and public clinical centers, hospitals and laboratories, and death certificates to identify every cancer case or cancer death occurring among residents of the Valdivia area. To guarantee complete case-ascertainment, it includes various national databases of particular cancers, death certificates and hospital records to identify residents of Valdivia who may have been diagnosed in other regions. This allows near 100% case ascertainment verification in the catchment area.

Cases
The subjects in the study were the 535 SC cases residents of Valdivia, identified in the Cancer Registry of Valdivia between the years 1998 and 2002. Of these, 6 cases were deemed non-eligible due to lack of information, leaving 529 subjects eligible for the study (98.9% of the total cases). In calculating the survival rate, 18 cases were excluded because they had a history of a previous cancer, apart from non-melanoma skin cancer; and 66 were excluded because the only information came from a death certificate or autopsy, leaving 445 (84.1%) cases to estimate SC survival. Deaths occurring within 30 days of a surgery with curative intention (3 cases) were considered deaths from other causes\(^8\). Deaths from other causes were included, but censored.

Incidence and risk factors of stomach cancer
Standardized incidence rates, using the world population, cumulative risk of developing cancer before the age of 75 and rate ratios were estimated according to the methodology proposed by the IARC\(^9\). Population data were obtained from the National Institute of Statistics and the Chilean census of 2002\(^10\). The risk of developing SC was estimated by sex, age, ethnicity (considering anyone with at least one Mapuche surname to be Mapuche, and the rest of the population to be Hispanic/European), education level (0-8 years and more than 8 years of education), urban or rural residency.

Survival analysis
Relative survival was calculated following the Ederer II method\(^11\) and age-standardized estimates were calculated using the approach proposed by Brenner et al\(^12\). Specific survival rates were measured at 3 and 5 years using the Kaplan-Maier method and survival curves for selected characteristics were compared using the Logrank and Breslow tests\(^13\). Those variables significantly associated with survival were later included in a Cox multivariate model\(^14\). Survival was studied in relation to demographics, clinical presentation, laboratory results and medical management of the cases. The characteristics of the tumor registered were: morphology according to the Lauren classification\(^15\), size measured at its largest diameter, location in the stomach (fundus, body or antrum or all the stomach) and invasion of the gastric wall. Stage of the tumor was based on TNM classification system\(^15\). The intervals between the onset of symptoms, the diagnosis and definitive treatment were determined.

RESULTS
Incidence of gastric cancer
Between 1998 and 2002, 529 primary gastric cancers were detected amongst the residents of Valdivia (crude incidence rate 29.2 per 100,000 inhabitants). The majority of cases were men (69.0%), residents of urban areas (57.5%), had a low education level (84.5%) had 8 or less years of schooling) and were predominantly of Hispanic origin (83.2%) (Table 1). Age of cases ranged from 27 to 94 years, being significantly lower in men than women with mean age of 66.8 years [95% confidence intervals (CI): 65.5-68.1] and 70.4 years (95% CI: 68.2-72.6), respectively. Relative risk (RR) of SC was higher among men, particularly at age 55-64 years. Mapuche ethnicity was a significant risk factor only for women (RR 2.2, 95% CI: 1.2-3.7), and low education status was a stronger risk factor for women than for men: RR 4.4, (95% CI: 2.9-6.8) and 1.6, (95% CI: 1.1-2.1), respectively; the highest differential of risk between men and women was found among cases with more than 8 years of education (RR = 7.5, P < 0.001) (Table 1).

Clinical characteristics of the cases
Weight loss and epigastric pain were the most common symptoms in patients at diagnosis, and both symptoms were significantly more common in males than females (Table 2). Signs considered to indicate poor prognosis:...
palpable epigastric mass, ascites or supraclavicular adenopathy, each were present in less than 15% of cases; only a palpable epigastric mass was significantly more common among females (Table 2). The main detection source was histology; only 11.5% of cases were identified by their death certificate only. The latter cases were significantly older: in those over 80, 45.5% and 15.1% were confirmed by death certificate only and histology, respectively (P < 0.001); there was also a higher proportion of women (22.6% vs. 16.1% (95% CI: 9.5-24.5). In univariate analysis, the significant factors for greater than 5 years survival were: younger age; Hispanic/European ethnicity; urban residency; lack of some clinical markers (supraclavicular adenopathy, palpable mass, ascites, or vomiting); gastrectomy; intestinal histological type; localized tumor (Figure 1A); size less than 4 cm, limited to the mucosa, without lymphatic invasion or metastasis; TNM stage 1 (Table 3). Tumors with proximal and distal localization had the same TNM distribution. However, tumors localized in the body had better 5-year survival than those localized to the fundus or in all the stomach, 23.0% vs 14.1% (P = 0.049) and 0% (P < 0.001), respectively; there was no statistical difference in survival between tumor location in the body and antrum (23.0% and 14.8%, P = 0.16, respectively).

The cumulative survival curve of Stage I SC was significantly higher than Stage II, Stage IV or unknown stage (Figure 1B), and was similar in men and women (Figure 1C and D).

### Multivariate survival analysis

The multivariate models only included cases with sufficient clinical data (271 cases, 69%). All cases (445) had “unknown staging” more frequently than the cases included in the multivariate models (17.8% and 8.9% respectively, P = 0.001) while their 5-year survival was lower (10.6% vs 14.1% P = 0.002). Nevertheless, all cases were similar to those included in the multivariate analysis with regard to socio-demographics and to the variables associated with survival in the univariate analysis (listed in Table 3).
In the multivariate analysis, only 6 variables maintained their statistical significance as independent prognostic factors (Table 4). TNM staging was the strongest prognostic variable, the risk of dying in the following year was 23 times higher with stage IV compared with stage I. Other factors of poor prognosis were: diffuse type, presence of metastasis, supraclavicular adenopathy, a palpable tumor and hepatitis or ascites (Table 4).

DISCUSSION

We confirmed that Chile, in particular southern Chile, where Valdivia is located, has one of the highest risks of stomach cancer reported, particularly among men (SIR 40.8 per 100 000 inhabitants). This population has many factors that have been associated with SC such as poverty, a high rural population (32%), poor sanitary conditions in 43% of houses[15], high prevalence of smokers (37.4%), high alcohol consumption (alcohol dependence in the Chilean population varies from 7.2% to 14.1% among low and high socioeconomic groups and from 5.0% to 17.6% among females and males respectively)[16], low daily consumption of fruits and vegetables (32.1%)[17]; and high prevalence of Helicobacter pylori (H pylori) infection, especially among young people[18].

Mapuche ancestry was a significant risk factor (RR: 2.2, 95% CI: 1.2-3.7). Similarly low schooling was a stronger risk factor among women (RR: 4.4 and 1.6 for women and men, respectively) and the highest male/female ratio of 7.5 occurred among people with greater schooling, suggesting that behavioral or environmental factors preferentially protect women of Hispanic origin and with more years of education. In the 2003 National Health Survey of Chile, more educated women had significantly better nutritional indicators than men of high or low educational level and women of low educational level, with body mass index of 25.0 vs 27.8, 26.1 and 28.0, respectively[19]. This better nutritional status is associated with a higher intake of fruits and vegetables among these women, a protective factor for gastric cancer[20].

Also, the 2006 Quality of Life National Survey showed that women added salt to the meals before eating less frequently than men (8.5% and 10.9%, respectively)[17]. In the population, as well as in our series, smoking and alcohol consumption we less frequent in women than men. Interaction of smoking and drinking has been demonstrated to play a role in SC[21]. Plus, in Chile, H pylori infection was also 10% lower among women than men[18]. These environmental factors may interact with susceptibility factors, such as alcohol dehydrogenase polymorphisms[22-24], to explain the predominance among men and also the higher frequency of this cancer in the...
Mapuche areas of southern Chile\(^\text{[18]}\).

In this population-based study only 10.6% of SC survived the 5-year period following the detection of SC. When cases detected by death certificate only were included, the 5-year survival dropped to 9.6% (95% CI: 6.9-12.3). Previous studies based on cases detected at the hospital, reported higher survival rates of 12% to 48.9%\(^\text{[25-27]}\), probably due to a selection bias created at hospital admission, when cases in the advanced stages of the disease who will not benefit from medical care are referred to palliative care units. The mean age of SC in our series was similar to that reported by European population-based cancer registries\(^\text{[28,29]}\), and was 10 years greater than the mean age reported in hospital-based survival studies. The 5-year relative survival rate, adjusted for the life expectancy of the population, was 12.3%, half that reported in population registries in North America\(^\text{[30]}\) and Europe\(^\text{[31]}\), where the survival rates are between 20.1% and 25.6%. Main risk factors of this poor survival were either clinical (palpable tumor, ascites, hepatitis) or related to the tumor characteristics (stage, histological type, metastasis, nodes); there were no significant social determinants of survival. This underlines the relevance of the advanced stage at consultation of most cases. When a gastrectomy with the intention to cure was undertaken the 5-year specific survival was 27.4% (95% CI: 19.0-35.5). The main factors associated with a poor survival were advanced stage at diagnosis (odds ratio of 2.1, 95% CI: 1.6-2.8), palpable tumor (odds ratio of 1.7, 95% CI: 1.3-2.2), and the presence of liver metastasis (odds ratio of 2.9, 95% CI: 1.9-4.4).

### Table 2: Clinical characteristics of the stomach cancer cases entered in the population-based cancer registry of Valdivia 1998-2002 (n = 529)

| Characteristic                        | Cases | Total (%) | Males (%) | Females (%) | P-value sex diff. |
|---------------------------------------|-------|-----------|-----------|-------------|-------------------|
| **Sign and symptoms at diagnosis**    |       |           |           |             |                   |
| Weight loss                           | 294   | 55.6      | 61.1      | 43.3        | < 0.001           |
| Epigastric pain                       | 285   | 53.9      | 57.0      | 47.0        | 0.03              |
| Gastrointestinal bleeding             | 108   | 20.4      | 21.4      | 18.3        | 0.42              |
| Vomiting                              | 106   | 20.0      | 20.8      | 18.3        | 0.50              |
| Abdominal distension                  | 83    | 15.7      | 14.8      | 17.7        | 0.40              |
| Palpable epigastric mass              | 56    | 14.7      | 12.9      | 19.2        | 0.016             |
| Ascites                               | 51    | 13.4      | 13.3      | 13.5        | 0.97              |
| Supraclavicular adenopathy            | 31    | 8.5       | 9.7       | 5.1         | 0.16              |
| **Main detection source**             |       |           |           |             |                   |
| Histological studies\(^1\)            | 404   | 76.4      | 81.3      | 65.2        | < 0.001           |
| Radiological diagnosis                | 25    | 4.7       | 4.9       | 4.3         | 0.74              |
| Clinical or autopsy                   | 39    | 7.3       | 7.2       | 7.9         | 0.75              |
| Only death certificate                | 61    | 11.5      | 6.6       | 22.6        | < 0.001           |
| **Duration of symptoms**              |       |           |           |             |                   |
| < 3 mo                                | 126   | 32.9      | 35.9      | 24.2        | 0.033             |
| 3 to 6 mo                             | 98    | 25.6      | 25.4      | 26.3        | 0.86              |
| > 6 mo                                | 159   | 41.5      | 38.7      | 49.5        | 0.06              |
| **Main diagnostic workout**           |       |           |           |             |                   |
| Gastric endoscopy                     | 412   | 79.4      | 84.6      | 67.7        | < 0.001           |
| Gastric biopsy                        | 401   | 75.8      | 80.8      | 64.6        | < 0.001           |
| Ecography                             | 191   | 36.1      | 37.8      | 32.3        | 0.22              |
| Computed tomography                   | 114   | 21.6      | 22.7      | 18.9        | < 0.001           |
| **Stage TNM**                         |       |           |           |             |                   |
| Stage I                               | 9     | 1.7       | 2.2       | 0.6         | 0.19              |
| Stage II                              | 20    | 3.8       | 2.5       | 6.7         | 0.02              |
| Stage III                             | 53    | 10.0      | 10.4      | 9.1         | 0.65              |
| Stage IV                              | 297   | 56.1      | 58.6      | 50.6        | 0.09              |
| Not determined                        | 150   | 28.4      | 26.3      | 32.9        | 0.12              |
| **Histological type**                 |       |           |           |             |                   |
| Tubular adenocarcinoma                | 148   | 36.0      | 35.2      | 38.3        | 0.56              |
| Tubulopapillary adenocarcinoma        | 35    | 8.5       | 7.6       | 11.2        | 0.25              |
| Papillary adenocarcinoma              | 11    | 2.7       | 2.0       | 4.7         | 0.14              |
| Mucinous adenocarcinoma               | 11    | 2.7       | 2.3       | 3.7         | 0.43              |
| Undifferentiated adenocarcinoma       | 83    | 20.2      | 22.4      | 14.0        | 0.06              |
| Signet ring cell carcinoma            | 77    | 18.7      | 18.1      | 20.6        | 0.57              |
| Non Hodgkin lymphoma                  | 6     | 1.5       | 1.6       | 0.9         | 0.60              |
| Neuroendocrine carcinoma              | 4     | 1.0       | 0.7       | 1.9         | 0.27              |
| Other carcinoma                       | 36    | 8.8       | 9.5       | 6.5         | 0.35              |
| **Tumor location**                    |       |           |           |             |                   |
| Body                                  | 57    | 10.8      | 11.5      | 9.1         | 0.42              |
| Fundus                                | 158   | 29.9      | 33.7      | 21.3        | 0.004             |
| Antrum                                | 122   | 23.1      | 21.9      | 25.6        | 0.35              |
| All stomach                           | 33    | 6.2       | 6.8       | 4.9         | 0.39              |
| Unknown                               | 159   | 30.1      | 26.0      | 39.0        | 0.003             |
| **Habits**                            |       |           |           |             |                   |
| Tobacco use                           | 346   | 44.8      | 51.4      | 29.1        | < 0.001           |
| Alcohol use                           | 338   | 61.2      | 73.6      | 31.3        | < 0.001           |

\(^1\)Includes 3 cases diagnosed based on a biopsy of metastasis; \(^2\)Time between first symptoms and diagnosis.
Table 3  Factors associated with SC survival. Valdivia 1998-2002. Kaplan-Meier (n = 445 cases). Univariate analyses

| Variable                                | n (%)    | 3-yr survival | 5-yr survival | P-value 5-yr survival |
|-----------------------------------------|----------|---------------|---------------|-----------------------|
| Sex                                     |          |               |               |                       |
| Female                                  | 120 (27.0) | 20.3          | 13.0-27.6     | 12.9                  | 6.7-19.1              |
| Male                                    | 325 (73.0) | 13.4          | 9.7-17.1      | 9.8                   | 6.5-13.1              |
| Age (yr)                                |          |               |               |                       |
| < 55                                    | 81 (18.2)  | 21.0          | 12.1-29.9     | 17.3                  | 9.1-25.5              |
| 55-79                                   | 300 (67.4) | 15.5          | 11.3-19.7     | 9.9                   | 6.4-13.4              |
| > 80                                    | 64 (14.4)  | 6.3           | 0.12-8.8      | 4.2                   | 0.9-7.9               |
| Ethnic group                            |          |               |               |                       |
| Mapuche                                 | 76 (17.1)  | 7.3           | 1.2-13.4      | 4.4                   | 0-9.2                 |
| Hispanic                                | 369 (82.9) | 16.9          | 13.0-20.8     | 11.9                  | 8.5-15.3              |
| School years                            |          |               |               |                       |
| 0 to 8                                  | 348 (83.6) | 9.1           | 6.0-12.2      | 6.4                   | 3.7-9.1               |
| > 8                                      | 68 (16.4)  | 19.7          | 10.2-29.3     | 8.9                   | 2.6-15.8              |
| Home                                    |          |               |               |                       |
| Urban                                   | 248 (57.1) | 18.7          | 13.8-23.6     | 12.9                  | 8.6-17.2              |
| Rural                                   | 186 (42.9) | 10.6          | 6.1-15.1      | 8.2                   | 4.1-12.3              |
| Sign and symptoms at diagnosis          |          |               |               |                       |
| Supraclavicular adenopathy              |          |               |               |                       |
| Yes                                     | 28 (8.0)   | 0             | -             | 0                     | -                     |
| No                                      | 321 (92.0) | 18.6          | 14.3-22.9     | 13.8                  | 9.9-17.7              |
| Palpable mass                           |          |               |               |                       |
| Yes                                     | 52 (14.4)  | 8.7           | 1.0-16.4      | 6.2                   | 0-13.1                |
| No                                      | 310 (85.6) | 17.8          | 13.5-22.1     | 13.0                  | 9.2-16.8              |
| Ascitis                                 |          |               |               |                       |
| Yes                                     | 47 (13.0)  | 18.9          | 14.5-23.3     | 13.8                  | 9.9-17.0              |
| No                                      | 315 (87.0) | 18.9          | 14.5-23.3     | 13.8                  | 9.9-17.0              |
| GI bleeding                             |          |               |               |                       |
| Yes                                     | 101 (22.7) | 20.1          | 12.2-28.0     | 13.7                  | 6.9-20.5              |
| No                                      | 344 (77.3) | 13.8          | 10.1-17.5     | 9.7                   | 6.5-12.9              |
| Vomiting                                |          |               |               |                       |
| Yes                                     | 100 (22.5) | 10.3          | 4.3-16.3      | 6.2                   | 1.4-11.0              |
| No                                      | 345 (77.5) | 16.8          | 12.8-20.8     | 11.9                  | 8.4-15.4              |
| Weight loss                             |          |               |               |                       |
| Yes                                     | 277 (62.2) | 13.6          | 9.5-17.7      | 10.0                  | 6.4-13.6              |
| No                                      | 168 (37.8) | 18.1          | 12.2-24.0     | 11.5                  | 6.5-16.5              |
| Abdominal distension                    |          |               |               |                       |
| Yes                                     | 78 (17.5)  | 11.5          | 4.4-18.6      | 7.7                   | 1.8-13.6              |
| No                                      | 367 (82.5) | 16.1          | 12.3-19.9     | 11.2                  | 7.9-14.5              |
| Pain                                    |          |               |               |                       |
| Yes                                     | 271 (60.9) | 19.0          | 14.2-23.8     | 14.5                  | 10.2-18.8             |
| No                                      | 174 (39.1) | 9.6           | 5.2-14.0      | 4.6                   | 1.4-7.8               |
| Months with symptoms                    |          |               |               |                       |
| < 3                                     | 117 (32.3) | 14.9          | 8.3-21.5      | 9.3                   | 3.9-14.7              |
| 3 to 6                                  | 95 (26.2)  | 17.6          | 9.9-25.3      | 14.2                  | 7.1-21.3              |
| > 6                                     | 150 (41.4) | 16.6          | 10.5-22.7     | 13.7                  | 8.1-19.4              |
| Gastrectomy                             |          |               |               |                       |
| Yes                                     | 128 (28.8) | 44.8          | 36.0-53.6     | 33.6                  | 25.1-42.1             |
| No                                      | 317 (71.2) | 3.5           | 1.4-5.6       | 1.3                   | 0.2-6.0               |
| Surgical intention                     |          |               |               |                       |
| Curative                                | 89 (42.4)  | 50.4          | 39.9-60.9     | 38.6                  | 28.3-48.9             |
| Palliative                              | 121 (57.6) | 14.4          | 5.8-23.0      | 10.4                  | 2.6-18.2              |
| Lauren class                            |          |               |               |                       |
| Intestinal                              | 220 (59.1) | 21.0          | 15.5-26.5     | 14.6                  | 9.8-19.4              |
| Diffuse                                 | 152 (40.9) | 11.2          | 6.1-16.3      | 7.0                   | 2.9-11.1              |
| Tumor                                   |          |               |               |                       |
| Localized                               | 325 (91.0) | 20.0          | 15.6-24.4     | 14.6                  | 10.6-18.6             |
| All stomach                             | 32 (9.0)   | 0             | 0             | 0                     | 0-2.6                 |
| Size                                    |          |               |               |                       |
| < 4 cm                                  | 16 (12.8)  | 67.0          | 43.3-90.7     | 60.0                  | 35.1-84.9             |
| 4 to 9.9 cm                             | 71 (56.8)  | 48.3          | 36.3-60.3     | 35.5                  | 23.9-47.1             |
| > 10 cm                                 | 38 (30.4)  | 29.0          | 15.6-43.4     | 21.1                  | 8.1-34.1              |
| Depth                                   |          |               |               |                       |
| Mucosa                                  | 9 (7.1)    | 100           | -             | 100                   | -                     |
| Muscle/subserosa                        | 7 (5.6)    | 85.7          | 59.8-100      | 71.4                  | 37.9-100              |
| Serosa                                  | 110 (87.3) | 38.2          | 29.0-47.5     | 27.2                  | 18.6-35.8             |

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survival was 38.6%, which is comparable to reports from Europe and North America in either population-based or hospital-based registries: 45% in Spain\[30\], 46.1% in Japan\[31\], 29.7% in Florence\[32\] and 32.6% in Côte d’Or\[33\]. We found that the stage of the disease was the main prognostic factor for survival as has been reported by others\[26,27,32,33\]. Thus, in our population the high incidence of SC was aggravated by a very late diagnosis of the disease. Others are proposing a combination of serological tests to screen for gastric atrophy, Helicobacter\[42\] plus alcohol dehydrogenase\[43\], followed by gastroscopy of cases that screen positive. Such a strategy would allow screening of a broad population in a short time to be followed by more invasive techniques in a much smaller group, estimated as 12% in Chile\[42\].

SC has a high incidence rate and a poor prognosis in the province of Valdivia. Main factors associated with poor survival were delays in obtaining medical care; time taken to seek medical care, time to be diagnosed and time to receive medical treatment; once medical care was obtained survival was comparable to other series. Current efforts to shorten these times with greater use of gastric endoscopy may improve this situation.

Table 4 Multivariate analysis of prognostic factors of stomach cancer survival population-based registry of Valdivia (Kaplan-Meier)

| Staging TNM | 95% CI | P-value |
|-------------|--------|---------|
| Stage I     | 1.0    |         |
| Stage II    | 2.77   | 0.3-23.8| 0.05 |
| Stage III   | 6.87   | 0.9-50.6| 0.06 |
| Stage IV    | 22.53  | 3.1-165.2| 0.002 |
| Unknown     | 23.35  | 3.1-173.6| 0.002 |
| Lauren classification | 1.0 |         |
| Intestinal  | 1.68   | 1.3-2.2 | <0.001 |
| Diffuse     |       |         |
| Metastasis  | No     | 1.0     |         |
| Yes         | 1.58   | 1.1-2.3 | 0.019 |
| Supraclavicular adenopathy | No | 1.0 |         |
| Yes         | 1.69   | 1.0-2.8 | 0.037 |
| Palpable tumor | No | 1.0 |         |
| Yes         | 2.04   | 1.4-3.1 | 0.001 |
| Hepatitis or ascites | No | 2.51 | 1.6-3.9 | <0.001 |

1Native American Indian residents of southern Chile.
ACKNOWLEDGMENTS

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COMMENTS

Background

Stomach cancer (SC) has been the main cancer killer in the Chilean population since the 1950s. Despite important socioeconomic development of the country and improvements in health indicators, SC mortality has not decreased. To date, there are no population-based studies of SC incidence and survival in Chile which would illuminate the causes behind the high SC mortality, particularly among men. The cancer registry of Valdivia is currently the only population-based cancer registry in Chile included in the International Agency for Research on Cancer reports and is one of 10 cancer registries in Latin America. This is the first report of SC survival in the Chilean population.

Research frontiers

There have been few studies of the real magnitude of the SC problem and the characteristics of the patients who survive or die from this cancer.

Innovations and breakthroughs

The most innovative product is the exact measurement of the incidence and survival of SC using the most up-to-date statistical methods which provide data which is easily comparable among populations.

Applications

This report represents a baseline of the SC situation in Valdivia and will permit evaluation of future interventions aimed to control SC. The methods presented here can be used to analyze any other cancer covered by a cancer registry.

Terminology

Incidence rate: calculated from the new occurrences of primary SC in the whole area divided by its population in the study period. Standardized incidence rate: the incidence rate adjusted by the age structure of a theoretical population, the world population, to permit direct comparisons between populations of diverse age structure. Specific survival rate: the number of cancer cases that are alive at the end of the study period divided by the person-time of cases over the period at risk of dying of SC. Relative survival rate: the specific survival rate adjusted by the life expectancy of the baseline population.

Peer review

This report presents invaluable data on SC incidence and SC survival in an area at high risk of SC in a middle developing country of Latin America. It provides information about the clinical presentation of SC cases, their sociodemographic characteristics and risk factors and prognostic factors of survival. The results indicate that a late stage at diagnosis is by far the principal explanatory factor of poor survival of SC in the area.

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