

Original Paper

Economic Impact of Early Detection and Treatment of Skin Cancer on the Health Care System

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REZUMAT

Cancerle cutanate-impactul economic asupra Sistemului Public de Sănătate al detecției și tratamentului precoce

Cancerle cutanate au o incidență în creștere și costuri ridicate pentru sistemul public de sănătate. Obiectivele acestui studiu sunt: evaluarea managementului pacienților ce prezintă cancer cutanat, identificarea caracteristicilor personale ale pacienților cu tumori cutanate, elaborarea unui algoritm care să determine un bun control al acestei patologii pe termen lung, estimarea costurilor pentru tratament. Studiul s-a desfășurat pe un număr de 263 de pacienți, care au beneficiat de excizie chirurgicală, urmată de o procedură reconstructivă și de alte terapii asociate, în funcție de examenul histopatologic. Având în vedere costurile per pacient și numărul anual de cazuri noi, am calculat costurile pentru fiecare din anii incluși în studiu. Bazat pe trendul incidenței am estimat costurile tratamentului până în anul 2020. În concluzie, programele de detecție precoce și dezvoltarea unor ghiduri practice de tratament, au un important potențial pentru un beneficiu atât economic cât și privind sănătatea populației.

Cuvinte cheie: cancer cutanat, sistemul public de sănătate, costurile tratamentului, expunerea solară

ABSTRACT

Skin cancer have an increasing incidence and high costs for the public health care system. The objectives proposed for fulfilling the research study goals are: evaluation of management for patients with skin cancer, identifying personal characteristics of patients with skin cancer, elaboration of an algorithm to determine a good control of the disease in the long term, estimation of skin cancer treatment costs. The study comprises a total of 263 patients who benefited of surgical excision followed by a reconstructive procedure and other associated treatments based on histopathological diagnosis. Taking into account costs per treated case and the annual number of new cases we calculated the costs per each year included in the study and based on the incidence trend we estimated the costs involved till 2020. We concluded that early diagnosis programs with development of practice guidelines for treatment have strong potential for health and economic benefits.

Key words: skin cancer, health care system, treatment costs, sun exposure

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INTRODUCTION

Non-melanoma skin cancer (NMSC) ranks as the fifth most costly cancer to treat in the United States even though the mortality rate is not high [1].

In Romania, the dermatologist is the one who generally detects skin cancer, but any clinician, especially the primary care physician who has a constant connection with the patient, plays an important role in skin cancer detection. In the early detection stage, a good collaboration with the plastic surgeon permits the surgical excision of the tumour with oncologic safety margins and primary suture, resulting in minimal costs [2]. Unfortunately, a great number of patients involved in our study (>84%) showed up in more advanced stages which required a reconstructive method.

The main types of skin cancer are basal cell carcinoma (BCC), squamous cell carcinoma (SCC) and cutaneous malignant melanoma (MM), the non-melanoma skin cancer representing 40% of all cancers detected worldwide [3]. Even if the basal cell carcinoma rarely metastasizes, local evolution may lead to impaired quality of life, functional complications and deformities[4]. Squamous cell carcinoma and cutaneous malignant melanoma are metastatic tumours, usually requiring associated oncological treatment [5]. Early detection assures a survival rate of more than 95% even in cases of malignant melanoma with less than 1 mm margins extending into the subcutaneous fat [6].

MATERIAL AND METHODS

The study, a retrospective review, was carried out using the database of patients operated in the Plastic Surgery Department of the Emergency Clinical Hospital "Prof. Dr. Agrippa Ionescu", between January 2012 and December 2014. For all the excised lesions a histopathological examination was provided by the Pathology Department of the Emergency Clinical Hospital "Prof. Dr. Agrippa Ionescu".

A number of 263 patients with skin cancer were enrolled in the study and the following detailed variables were used to assess the study outcome: age, gender, associated pathology, smoking and sun exposure history, anatomical distribution of the lesions, histopathological subtypes, reconstruction method used and the absence of tumour cells in the excision limits. Most of the surgical procedures were performed under general anaesthesia and the safety excision margins were marked under loupe magnification.

The safety excision margins were set at 3 mm for small and well defined basal cell carcinoma and at 1 cm for those ulcerated, morpheaform or imprecisely demarcated. For squamous cell carcinoma with a diameter greater than 2 cm and for high risk lesions a 6 mm margin was used [7].

The safety margins for cutaneous malignant melanoma were chosen depending on the tumour thickness and appearance: thin, non-ulcerated lesions were resected with 1 cm margin and thicker or ulcerated lesions were treated with 2 cm margin [8].

For closing the skin defect, primary suture and reconstructive techniques like skin grafts and local or distant flaps were used [9]. The follow-up appointments after surgery were scheduled at one week, one month, 3, 6, 9 months and yearly [10].

Statistical analysis was performed using SPSS 17.0 software (chi-square frequently test, Kendall correlation test, Fisher test), MSO/Excel 2013. The level of statistical significance was considered at $p < 0.05$.

RESULTS

From 263 patients with skin cancer, 150 patients were males and 113 patients were females (**Table 1**). Most patients were from urban areas (175 patients) compared to those from rural areas (88 patients).

We ascertain that the highest prevalence of skin cancer was in the age group 66-96 years (134 patients), with the mean age at 64,63 years, with a minimum at 23 years and a maximum at 95 years, with a standard deviation of 15,58; the older patients were from rural areas ($p < 0,04$).

Although age has a negative correlation with the diagnosis of malignant melanoma, this form of cancer, the most aggressive type of skin tumour and also one of the most aggressive tumours in general, has a more and more frequent incidence in the age group 20-45 years.

For the patients included in the research, presence of associated pathology was statistically significant ($p < 0,035$), with a higher correlation with age ($p < 0,001$) and with patients living in rural areas ($p < 0,005$). Only 46% of patients have a history of chronic sun exposure of over 10 years and 30% of them are smokers. We found a correlation between squamous cell carcinoma and smoking ($p < 0,001$), as well as between history of chronic sun exposure and rural origin of the patients ($p < 0,001$). (**Table 2**)

Most of the lesions were found in the area of the head (137 patients) compared with those on the trunk (126 patients). The location of the skin tumour in the head region was correlated with patients living in rural areas

| | Gender | | Total | P value |
|---------------|--------|--------|-------|---------|
| | male | female | | |
| age groups | | | | |
| 20- 45 years | 27 | 16 | 43 | 0,126 |
| 46 - 65 years | 55 | 31 | 86 | 0,012 |
| >65 years | 68 | 66 | 134 | 0,931 |
| Total | 150 | 113 | 263 | 0,026 |

Table 1. Gender and age distribution

| | comorbidity | | Total | P value |
|-------|-------------|----|-------|---------|
| | yes | no | | |
| 2012 | 40 | 26 | 66 | 0,109 |
| 2013 | 54 | 35 | 89 | 0,056 |
| 2014 | 82 | 26 | 108 | <0,001 |
| Total | 176 | 87 | 263 | <0,001 |

Table 2. Associated pathology

($p < 0,005$), in contrast with those from urban areas who generally presented with atumour on the trunk region ($p < 0,017$).

The most frequent histopathological type was basal cell carcinoma (188 patients), followed by squamous cell carcinomas (45 patients) and melanoma (30 patients) (Table 3).

Considering the closure of the defect, most patients required reconstruction methods (flaps, skin grafts) after excision. The absence of the tumour cell in the excision margins was found to be statistically significant ($p < 0,015$), but the presence of tumour cells in the excision margins was correlated with female patients ($p < 0,029$) and with age ($p < 0,009$).

DISCUSSIONS

The study high lights that basal cell carcinoma is the most common type of skin cancer. The presence of skin cancer on the trunk region of patients living in urban areas, who are not chronically exposed to ultraviolet radiation, is a warning on the harmfulness of acute sun exposure [11]. The advanced stage tumours located in the head region (an easily detectable location by primary care physicians) have a higher incidence in the rural population, which points out to the low primary screening performed there. The general practitioner should play a more important role in skin cancer primary detection and in admission of the rural population to health facilities.

During the study we also listed the premalignant lesions surgically excised in the same period for which we found an increased incidence as well (Table 4). This is a warning sign, but also points out the good collaboration between dermatologists and plastic surgeons, which led to curative treatment with minimum costs for a hospital day care. Moreover, this is proven by the increase in number of primary sutures (10%) used after tumour excisions in 2014, which demonstrates early stage detection [12].

The public health system reimburses approx. 5€ for an appointment with a physician, 80 € for a one day hospital stay including the surgical procedure under local anaesthesia (for a small premalignant or non-invasive malignant lesion) and 400 € for a more extensive surgical procedure that involves post-excision defect reconstruction under general anaesthesia, 30-42 €/session of radio-

| Year | Histologic types | | |
|-------|------------------|-----|----|
| | BCC | SCC | MM |
| 2012 | 47 | 12 | 7 |
| 2013 | 64 | 15 | 10 |
| 2014 | 77 | 18 | 13 |
| Total | 188 | 45 | 30 |

Table 3. Type of skin cancer

| Year | Patient | |
|-------|-------------|----------------------|
| | Skin cancer | Precancerous lesions |
| 2012 | 66 | 92 |
| 2013 | 89 | 124 |
| 2014 | 108 | 197 |
| Total | 263 | 413 |

Table 4. Premalignant lesions

therapy treatment (a patient need 20-25 sessions) and 270 €/week for adjuvant immunotherapy of melanoma (a patient need one year of immunotherapy). The costs are similar to the ones established in the European Union.

Patients with suspected malignant skin lesions followed a treatment algorithm that includes a histopathological diagnosis followed by curative or palliative therapy according to the type and extension of the lesion and to international protocols [13] (Fig. 1).

Costs were estimated through a bottom-up approach method. This cost of illness study is conducted to measure economic burden of disease and to highlight the magnitude of financial impact of disease on society [14]. It is estimated that in 2020 the number of new cases of skin cancer will be around 15 million world wide [15].

The costs per patient were established by using the skin cancer pathway and costs for each treatment step. Combining these data, costs per case of premalignant lesion were 115 €, 1035 € per case of BCC, 1875 € per case of SCC and 14875 € per case of MM (it results from costs of immunotherapy used for treatment of patients

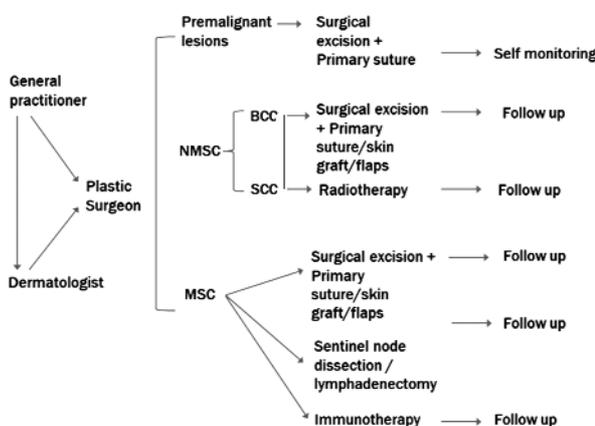
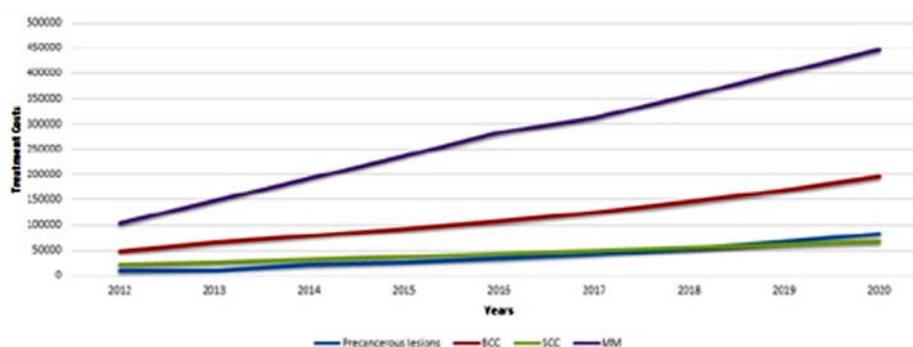


Figure 1. Skin cancer care pathway

Figure 2. Estimated treatment cost



with melanoma in advanced stages). This costs were similar to costs registered in other countries [14].

These costs per treated case were multiplied (based on annual incidence) with the number of patients that received the same treatment and we estimated the costs per each year included in the study.

The annual treatment costs estimated for every year comprised in the study (2012-2014), for each of the 3 types of cancer as well as for all premalignant lesions treated in that period of time were extrapolated, based on the incidence trend, until 2020 (Fig. 2).

By analysing medical costs for the treatment of our clinic's skin cancer patients in 2012, 2013, 2014 and measuring yearly costs for each type of skin tumour (basal cell carcinoma, squamous cell carcinoma or malignant melanoma), we obtained a clear image of the up-to-now spending trends with possibilities to explore the situation over the near future. Annual medical spending for skin cancer patients treated in our clinic increased from approximately 175270 € in 2012 to 306820 € in 2014. This increase is mainly the result of skin cancers' fast growing incidence and not due to higher prices of health care procedures.

According to the estimates, costs for treating MM cases will reach approx. 446250 €, 195968 € for treating BCC cases, while costs for treating premalignant lesions will sum up to 82756€, outnumbering those for SCC treatment. The total cost of malignant melanoma cases treatment would cover 5 times the treatment of premalignant lesions [16]. Effective prevention and a better popularization of skin care pathway would allow an easy access to health care and reduce the economic burden [14]. Rocha et al (2002) affirmed that since the skin" is easily accessible for self examination and medical inspection it serves as an ideal model for implementing mechanisms that permit the diagnosis of tumours at early stages"[15].

The research limits were: the lack of official national data concerning incidence, prevalence or mortality of skin cancer cases, all of that forcing us to the strict usage of data obtained in the study; the results obtained through a better

prevention and innovative treatment (chemotherapy for advanced cases of melanoma) included in national programs, could not be estimated; the costs of complications, nonmedical direct costs and indirect costs are not included in the study, unlike medical costs (medical consultation, laboratory tests, surgical procedures, anatomopathology exam, immunotherapy, radiotherapy).

CONCLUSIONS

Increased incidence of skin cancers and the costs incurred by the public health system should determine the development of practice guidelines and nation wide protocols for early detection and treatment [17,18,19].

Surgical excision with oncologic safety margins limits is the gold standard in diagnoses and therapy [20]. Although basal cell carcinomas do not have metastatic potential, their treatment in advanced stages involves complex reconstruction procedures under general anaesthesia, with high risk of functional and aesthetic deficits and increased costs for the health care system [21].

Public education on early detection and proper treatment with good collaboration between the plastic surgeon, dermatologist and primary care physician might increase the rate of curative excision and significantly lower the costs [22].

Primary care physicians should be trained in diagnosing skin lesions suspected of malignancy (ABCDE criteria for pigmented lesions), since early detection of melanoma can save lives [23]. Their awareness and involvement in the examination of the patient's skin (with more than half of skin lesions being present on the face) would considerably reduce the costs.

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