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Implementation of proton therapy in the portuguese context of radiotherapy

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Introduction

Cancer is a national and international health care concern. It's important to find strategies for early diagnosis as well as for the optimization of the various therapeutic options currently existing in Portugal[1]. Cancer is the second leading cause of death in Portugal, the choice of this study, is due to the importance of radiotherapy approach in cancer treatment and because is the therapy used in 40% of oncology patients. Radiation therapy has evolved at a technological level, that allows new treatment techniques that are more efficient and that also promotes greater professional satisfaction[2].

The hadrons are charged particles, used in cancer therapy. These particles can bring a paradigm shift regarding the therapeutic approach in radiotherapy[3,4]. The technique used is proton therapy, that reveal to be more accurate, efficacious and less toxic to surrounding tissue[5-7]. Proton therapy may be a promising development in the field of oncology and how the treatment is given in radiotherapy. Although there is awareness of the benefits of proton therapy in oncology it's also important to take in consideration the costs of these therapy, because they are considerably higher than conventional treatments of radiotherapy.

Given the lack of a proton therapy service in Portugal, this study aims to be a documentary analysis of clinical records that will achieve the following objectives: to identify the number of cancer patients diagnosed in 2010 in Portugal and to calculate the estimated number of patients that could have been treated with proton therapy according to the Health Council of the Netherlands registration document.

Materials and Methods

The sample of this study was obtained from the International Classification of Diseases [ICD]-9 and ICD-10 classification from the Ministry of Health. This International classification correspond to the diagnostic and therapeutic procedures performed in the hospitalized patients on public hospitals in 2010 in Portugal. To be able to calculate and estimate the number of patients to be treated annually with proton therapy, it was used the sample from 2010 and the document made by The Health Council of the Netherlands. Data analysis was performed using descriptive statistical techniques with resource to the software Microsoft Excel 2010 from Microsoft Windows XP operating system. The analysis of this data was perform considering the categories established in the document from Health Council of Netherlands, which were the standard indications, priority indications, indications for model-based and indications in order to prevent or reduce secondary cancer.

Results and discussion

Netherlands has a similar study carried out in 2009, regarding the number of oncology patients diagnosed and targeted to radiotherapy, in order to understand the number of diagnosed patients, that could received proton therapy.

To identify the number of patients for possible proton therapy, the conditions are divided according to the therapeutic indications, concerning to the location of the tumor and the number of hospitalized patients diagnosed in 2010 (figure 1).
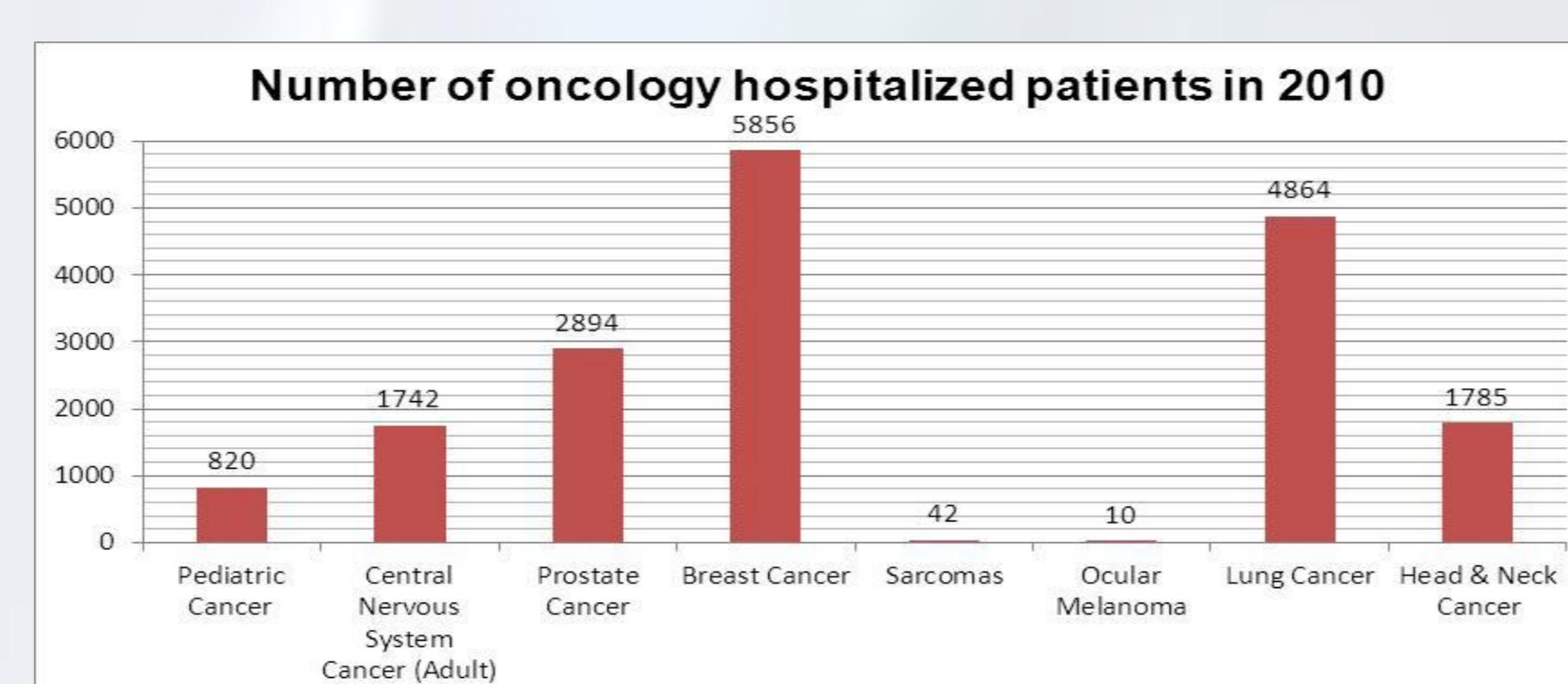

Figure 1: Number of oncology ihospitalized patients in 2010.

The Health Council of the Netherlands conducted a systematic review of literature that intended to establish the outcomes of the studies in proton therapy. The result could confirm or change the clinical efficiency of proton therapy. Following the same study, that was conducted in Netherlands with cancer data refer to 2005, we included four categories, that will be divided by the number of hospitalized patients registered in 2010, obtaining the estimate of these patients targeted radiotherapy and proton therapy. For this study and the Dutch study were not considered patients with metastases and patients who *a priori* would not be eligible for proton therapy.

The results refer to four categories, which were the standard indications, priority indications, indications for model-based and indications in order to prevent or reduce secondary cancer. Standard indications are the standard cases that benefit most clinically with proton therapy. These cases are intraocular melanoma and pediatric cancer (figure 2).

Priority indications include those tumors in which you want to obtain a higher local tumor control and can be distinguished into two categories. The 1st category includes instances where the dose administered can not be filed without being irradiated the surrounding critical organs. The 2nd category has directions to investigate the benefit of protons through the application of randomized studies with dose escalation and subsequent increase in local control. Priority indications correspond to the central nervous system cancer, head & neck cancer, prostate cancer, lung cancer and sarcomas (figure 3).

The model base indications is associated with increased quality of treatment and was considered the cases in which the proton therapy intends to reduce the adverse effects while maintaining the maximum administered dose in the target volume. Tumors with this statement are CNS tumors, head & neck cancer, prostate cancer, lung tumors, breast cancer and sarcomas (figure 4). The indications for the purpose of reducing secondary cancer, consider that despite the beneficial effects of the control tumor irradiation can become a problem in the long term due to the risk of secondary tumor induction. Under this category, studies show that tumors that fall are tumors of the breast, lung, gastric tumors and sarcomas. Based on the results obtained and because of the absence in registration of other malignancies, considered for this category, breast tumors are the only ones considered for the estimation (figure 5).

Localization	Number of inpatients in 2010	% of number of patients treated in 2010	Number of patients treated with radiotherapy	Estimative of patient for protontherapy (%)	Number of patients directed for protontherapy
Ocular Melamoma	10	47%	5	80%	4
Pediatric Cancer	820	50%	410	80%	328
Total	830		415		332

Figure 2: Standard Indications

Localization	Number of inpatients in 2010	% of patients treated with radiotherapy	Number of patients treated with radiotherapy	Estimative of patient for protontherapy	Number of patients directed for protontherapy
Lung cancer(2ª Cat.)	4864	76%	3697	15%	555
CNS cancer (2ª Cat.)	1742	92%	1603	25%	401
Sarcomas (1ª Cat.)	42	100%	42	25%	11
Head & Neck cancer (1ªCat.)	1785	92%	1642	47%	772
Prostate cancer(2ªCat.)	2894	60%	1736	10%	174
Total	11327		8720		1913

Figura 3: Priority indications

Localization	Number of patients in 2010	% of patients treated with radiotherapy	Number of patients treated with radiotherapy	Estimated patients for protontherapy	Number of patients for protontherapy
Lung cancer	4864	76%	3697	15%	555
CNS cancer	1742	92%	1603	25%	401
Sarcomas	42	100%	42	25%	11
Head & Neck cancer	1785	92%	1642	47%	772
Prostate cancer	2894	60%	1736	10%	174
Breast cancer	5856	83%	4861	5%	243
Total	17183		13581		2156

Figure 4: Indications for model-base

Localization	Number of patients in 2010	% number of patients treated with radiotherapy	Number of patients treated with radiotherapy	Estimated patients for protontherapy	Number of patients for protontherapy
Breast cancer	5856	83%	4861	5%	243
Total	5856		4861		243

Figure 5: Indications for reducing secondary malignancies

In conclusion, the study of the Netherlands was extremely important due to the possible model-based implementation for proton therapy in Portugal. It is achieved, thereby, an estimate number of patients eligible for proton therapy, based on the relationship of cancer cases diagnosed each year and "targeted" to radiotherapy. Based on this results, we estimated to treat about 4,644 patients / year in Portugal with proton therapy.

The introduction of a new therapy will be planned in a gradual manner, to be treated up to approximately 4000 patients / year. It is considered that this investment is not intended to waive the technical beam of photons / electrons, but become an accepted treatment modality in cancer therapy and recognized to being inserted in an environment of clinical research and technology.

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