

Therapeutic management of patients with lung cancer during the COVID-19 pandemic

Manejo terapéutico de pacientes con cáncer de pulmón durante la pandemia de COVID-19

Daniel Alejandro Denis-Piedra¹  , Elia de la Caridad Rodríguez-Venegas¹ , Omar Luis Hernández-García² 

¹Universidad de Ciencias Médicas de La Habana. Facultad de Ciencias Médicas “Finlay Albarrán”. La Habana, Cuba.

Received: June 28, 2020 | Accepted: July 22, 2020 | Published: July 24, 2020

Cite as: Denis-Piedra DA, Rodríguez-Venegas EC, Hernández-García OL. Manejo terapéutico de pacientes con cáncer de pulmón durante la pandemia de COVID-19. Univ Méd Pinareña [Internet]. 2020 [cited: access date]; 17(1):e572. Available from: <http://www.revgaleno.sld.cu/index.php/ump/article/view/572>

ABSTRACT

Introduction: the World Health Organization announced COVID-19 outbreak as a pandemic on March 11th, 2020. Cancer patients are more susceptible to viral infections than those suffering from other diseases, possibly because of the immunosuppressive status caused by both cancer and its treatments such as chemotherapy or surgery.

Objective: to characterize the therapeutic management of patients with lung cancer during the COVID-19 pandemic.

Method: information search was completed through the combination of terms in PubMed, SciELO, LILACS, Cochrane Library and Web of Science databases; 30 of them were chosen.

Development: a successful management of lung cancer requires of frequent visits and admissions to hospitals to complete investigations, radiotherapy and chemotherapy, among others. During the course of several weeks, added to the immunosuppression and the poor functional and structural status of lungs, supposes a great risk for SARS-CoV-2 infection. The treatment of lung cancer presents variations in case of COVID-19 infection, where some therapeutic options like surgeries and adjuvant therapies are restricted, and in some cases must be postponed.

Conclusions: cancer patients may be more susceptible to infection. Treatment of lung cancer should be completed with a series of adjustments according to the situation of the local epidemic to reduce the risk of tumor progression and COVID-19 infection.

Keywords: Lung Neoplasm; Coronavirus Infections; Cancer Care Facilities; Oncology Service, Hospital.

RESUMEN

Introducción: el 11 de marzo de 2020, la Organización Mundial de la Salud declaró como pandemia a la COVID-19. Los pacientes con cáncer de pulmón son más susceptibles a la infección por coronavirus, debido al estado de inmunosupresión causado tanto por el cáncer como por los tratamientos, como la quimioterapia o la cirugía.

Objetivo: caracterizar el manejo terapéutico de los pacientes con cáncer de pulmón durante la pandemia por COVID-19

Método: se realizó una búsqueda de información mediante la combinación de términos en las bases de datos PubMed, SciELO, LILACS, Cochrane Library y Web of Science; seleccionándose 30 de estos.

Desarrollo: el manejo exitoso del cáncer de pulmón requiere visitas frecuentes al hospital y admisión para investigaciones, radioterapia, quimioterapia, entre otros. En el transcurso de muchas semanas, esto añadido a la inmunosupresión y el mal estado funcional y estructural de los pulmones, supone un gran riesgo a la infección por SARS-CoV-2. El tratamiento del cáncer de pulmón presenta variaciones en caso

de infección por COVID-19 limitándose en algunas de las opciones terapéuticas tales como la cirugía y la terapia adyuvante que en algunos casos debe posponerse.

Conclusiones: los pacientes con cáncer pueden ser más susceptibles a la infección. El tratamiento de la neoplasia de pulmón se debe realizar con una serie de ajustes de acuerdo con el estado de la epidemia local para reducir el riesgo de progresión tumoral e infección por COVID-19.

Palabras clave: Neoplasias Pulmonares; Infecciones por Coronavirus; Instituciones Oncológicas; Servicio de Oncología en Hospital.

INTRODUCTION

SARS-CoV-2 (severe acute respiratory syndrome coronavirus-2), as designated by the International Committee on Virus Taxonomy, is the causal agent of the current pandemic. The disease caused by SARS-CoV-2 was officially designated by the World Health Organization (WHO) as Coronavirus Disease 2019 (COVID-19).⁽¹⁾ In December 2019, a group of patients in Wuhan, Hubei Province, China, were diagnosed with pneumonia of unknown origin. On March 11, 2020, WHO declared COVID-19 a pandemic.^(2,3,4)

As of June 23, 185 countries have reported cases of COVID-19. The region of Las Americas reports 4,512,775 confirmed positive cases, 49,79 % of total reported positive cases worldwide, with 226,445 deaths for a fatality rate of 5,02 %. At the end of June 23rd, Cuba reported a new case of COVID-19, for a quantity of 2 319 people positive to SARS-CoV-2, without reporting death on the day. Cuba accumulated 157 387 samples analyzed and 2 319 confirmed positive cases (1,5 %). Up to that date 85 deaths accumulated for a fatality rate of 3,66 %, two foreign patients were evacuated and 2 130 patients recovered (91,9 %). Havana maintained the highest rate of incidence with 5,06.⁽⁵⁾

Most of the persons confirmed positive with the disease show mild symptoms given by fever, cough, and sore throat. Another group of patients suffers from more severe manifestations that evolve towards respiratory distress. In particular, older patients and those with associated comorbidities are the most likely to evolve in this way; people with chronic respiratory diseases, with heart conditions, immunocompromised individuals or people of any age with severe obesity.^(3,4)

Cancer patients are more susceptible to viral infections than those suffering from other diseases, possibly because of the immunosuppressive status caused by both cancer and its treatments such as chemotherapy or surgery. Cancer constitutes one of the main causes of morbidity and mortality worldwide and in Cuba; it is the second cause of death.⁽¹⁾

Lung cancer is the most common fatal malignancy. It usually occurs between 40 and 70 years old. Lung tumors can be classified as primary or secondary, malignant or benign, endobronchial or parenchymal. It usually occurs in patients who smoke, with respiratory manifestations that appear or are aggravated in an acute manner and constitute symptoms of alarm, but on other circumstances, its clinical evolution is to some extent silent.^(6,7,8,9)

The successful management of lung cancer requires frequent visits to the hospital and admission for investigations, radiotherapy, and chemotherapy, among others. Over the course of many weeks, this added to immunosuppression and poor functional and structural status of the lungs, supposing a great risk factor to SARS-CoV-2 infection.^(10,11,12,13,14,15) Therefore, the management of lung cancer during the COVID-19 pandemic is a difficult task and all necessary measures must be taken to protect both the patient and the staff.

The objective of this study was to characterize the therapeutic management of patients with lung cancer during the COVID-19 pandemic.

METHOD

Information search was conducted in PubMed, SciELO, LILACS, Cochrane Library and Web of Science databases of published articles on the topic COVID-19 and lung cancer patients until June 2020. The terms

COVID-19, coronavirus, SARS-CoV-2, lung cancer and lung neoplasia and their English translations were used: coronavirus disease-2019, coronavirus, SARS-CoV-2, lung cancer, lung neoplasia and other articles and books were added aimed at providing the necessary elements for the development of the article; with 30 available references.

DEVELOPMENT

Risk for COVID-19 in cancer patients

According to the data obtained by Liang et al.⁽¹⁶⁾, there was a higher incidence of COVID-19 in cancer patients than in the general population. In the study, half of the cancer patients had a disease in course of more than 4 years, indicating that a substantial proportion of these patients could be clinically cured. Therefore, any conclusions that generalize to all cancer patients should be prudently interpreted. Out of the 18 patients with cancer, 13 had a history of surgical resection; the prolonged effect induced by surgery, including immunosuppression. Therefore, the comparison of patients with COVID-19 and surgical history with and without cancer would be of interest.

Xu et al.⁽¹⁷⁾ reported that patients with cancer are prone to serious events of COVID-19 (requiring invasive ventilation or leading to death). Evidence indicates that the overwhelming inflammation and lung associated with cytokine storm produces lesions that could predispose to these serious events in COVID-19 patients.

Chen et al.⁽⁴⁾ explain that one of the possible reasons for the susceptibility and prognosis of patients with cancer and COVID-19 is the increased propensity to smoke. It has been shown that tobacco significantly increases the gene expression of Angiotensin Converting Enzyme 2 (ACE 2), facilitating the binding of the virus to its receptor, which could explain the high susceptibility to COVID-19 in smokers.⁽¹¹⁾

Xia et al.⁽¹⁸⁾ pointed out that tobacco, as the main cause of chronic obstructive pulmonary disease (COPD), has been identified as an independent risk factor in confirmed positive cases of COVID-19. Patients who smoke for all the above reasons have a higher risk of complications and worse prognosis for both COVID-19 and cancer, so they are considered independently.

Therapeutic management of patients with lung cancer during the COVID-19 pandemic

Chen et al.⁽⁴⁾ noted that bronchoscopy remains an important diagnostic tool in patients with lung cancer, but as an aerosol-generating procedure, it could pose a high risk of infection to nearby healthcare personnel. Therefore, careful preparation and safety measures taken by the staff are important; elective bronchoscopy should be postponed, temperature should be measured and the patient's travel history and contact tracing requested before the procedure, and real-time polymerase chain reaction (RT-PCR) testing for SARS-CoV-2 should be performed prior to the procedure as much as possible.

In the first stage, surgery is a definitive treatment for early-stage non-small cell lung cancer (NSCLC).⁽⁴⁾ Chen et al.⁽¹³⁾ noted in their study that delaying surgery due to COVID-19 pandemic can significantly affect the prognosis of lung cancer patients at this stage; therefore, they suggest that surgery for patients with early lung cancer should be performed as soon as possible once they are completely rule out as SARS-CoV-2 infection.

Yang et al.⁽²⁰⁾ noted that if there are any suspicious symptoms of COVID-19 in patients, SARS-CoV-2 RNA screening should be performed to rule out infection before surgery. For patients on adjuvant therapy after lung cancer surgery, they recommend adequately extending the interval between adjuvant therapy and surgery during the COVID-19 outbreak. It points to adjuvant treatment with gefitinib as having the lowest risk of myelosuppression compared to vinorelbine plus cisplatin.^(17,18)

Chen et al.⁽⁴⁾ and Arrieta et al.⁽²¹⁾ in their studies state that guidelines for advanced stage treatment were established for patients with advanced NSCLC during the epidemic. It was suggested that infection should be treated first in patients with COVID-19 and all anticancer therapy should be discontinued for severe patients; for mild and moderate patients, targeted therapy can be continued or discontinued; chemotherapy and immunotherapy are not recommended.

Guckenberger et al.⁽²³⁾ recommended in their study for patients after treatment with COVID-19, to start the targeted therapy 2 weeks after the pneumonia is cured. Intravenous chemotherapy, immunotherapy, and anti-angiogenesis are recommended to be started after 4 weeks from the eradication of pneumonia. For patients with COVID-19 and advanced NSCLC, routine anti-tumor therapy is recommended. Therefore, anti-tumor therapy does not vary in advanced cases of non-small cell lung cancer.

The symptoms and imaging features of interstitial pneumonia caused by immunotherapy are quite similar to those of COVID-19 pneumonia.⁽²⁶⁾ Hence the importance of distinguishing interstitial pneumonia induced by immunotherapy from that provoked by COVID-19.

Luo et al.⁽²²⁾ and Moujaess et al.⁽²⁴⁾ point out that the fact that COVID-19 has been generalized in the world, it is difficult to accurately distinguish pneumonia caused by immunotherapy from that caused by coronavirus only with the epidemiological history. They state that RT-PCR for SARS-CoV-2 should be actively performed in these patients and immunotherapy should be carried out with caution in the special epidemic period to avoid this problem. Instead, if the pneumonia is mild, simultaneous treatment with EGFR TKIs (Epidermal Growth Tyrosine Kinase Inhibitors) and antiviral treatment may be safe for COVID-19 infected patients.

Mazzone et al.⁽²⁵⁾ in their study discussed about a patient with NSCLC who was treated with Kaletra (lopinavir/ritonavir) and osimertinib at the same time after diagnosis of mild COVID-19 infection; two weeks later the pneumonia was cured and the tumor remained stable. Tian et al.⁽²⁶⁾ and Wang et al.⁽¹⁵⁾ note in the randomized trial evaluating the efficacy of lopinavir/ritonavir that in patients with confirmed SARSCoV-2 infection, there is no difference in the time to clinical improvement between lopinavir/ritonavir and standard treatment. It is suggested that the combination of lopinavir/ritonavir with osimertinib results in virological clearance and stable tumor.

Luo et al.⁽²²⁾ and Xuy et al.⁽²⁷⁾ indicate that small cell lung cancer (SCLC) progresses rapidly, and the median survival time of patients with extensive stage SCLC is only 9-11 months. Delayed treatment will lead to tumor progression and worse prognosis in patients with extensive stage SCLC. Shankar et al.⁽⁹⁾ and Dingemans et al.⁽¹⁰⁾ claim that for patients with extensive stage SCLC, regular chemotherapy should be performed in local hospitals under the premise of excluding COVID-19.

Leung et al.⁽¹¹⁾ stated that, if the disease progresses, chemotherapy regimens can be adjusted according to the condition, and oral Anlotinib is also an option in China, which has been approved by the National Medical Products Administration in China only as a third line or beyond therapy for SCLC based on the results of the phase II clinical trial (ALTER 1202).⁽⁴⁾

Detection of COVID-19 in cancer patients during their admission to hospital institutions

Tian et al.⁽²⁶⁾ in their study point out that, in the early stage of the epidemic, cross-infection in the hospital is more risky for patients and medical workers. The most common symptom of COVID-19 is fever and therefore, an admission screening process should be developed according to this symptom. It states that temperature testing should be performed at hospital entrances, the outpatient clinic and wards. For patients preparing for admission, routine blood count and high-resolution CT scans of the chest are mandatory. COVID-19 virus nucleic acid and IgM/G ELISA (enzyme-linked immunoassay) testing will be performed for patients with suspected pneumonia on CT images. Confirmed positive cases should be transferred to the designated hospital and patients excluded from COVID-19 will receive anti-tumor treatment.

Given that COVID-19 infected patients may be asymptomatic, RT-PCR should currently be performed for all patients with potential exposure and suggestive clinical history even without respiratory symptoms.⁽²⁹⁾ Xiey col.⁽²⁸⁾ noted that in screening for 19-COVID infections, the detection sensitivity of SARS-CoV-2 by RT-PCR was not high enough. The study states that the sensitivity of a single respiratory swab was 70 % and can be increased to 94 % with a second test, and 98 % with a third. Therefore, repeat testing may be important and necessary to make a diagnosis of COVID-19. In case of poor detection, findings in the chest computed tomography (CT) are of great value for early diagnosis of COVID-19.

According to the National Lung Screening Trial Research⁽³⁰⁾, computed tomography (CT) is of great importance for early diagnosis of COVID-19 in the chest because of its increased sensitivity. In most cases, CT and PCR testing should be used together for diagnosis of COVID-19. Masjedi et al.⁽²⁹⁾ in their study of 1014 patients with SARS-CoV-2, 59 % of whom had positive RT-PCR, while 88 % had positive CT. The sensitivity of the chest CT scan was 97 %, which is higher than that of RT-PCR. Therefore, in COVID-19 admission tests for cancer patients, the chest CT should be included. However, repeated exposure of patients to CT scans may cause serious problems in the future, including carcinogenesis.

The U.S. National Lung Screening Trial (NLST) shows that low-dose computed tomography (LDCT) can reduce lung cancer mortality by providing a safe screening tool.⁽²⁸⁾ For those patients whose imaging cannot exclude COVID-19, further judgment should be made based on history, clinical symptoms, and complete blood count (CBC) results. Suspect cases should be isolated and treated as soon as possible.⁽²⁹⁾

CONCLUSIONS

Cancer patients may be more susceptible to infection. Treatment of lung cancer should be completed with a series of adjustments according to the situation of the local epidemic to reduce the risk of tumor progression and COVID-19 infection. It is vitally important to emphasize effective prevention of cross-infection of COVID-19 and rational disposition of cancer treatment because as the spread of COVID-19 is effectively controlled, medical work will gradually return to cancer treatment.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest

AUTHOR'S CONTRIBUTION

DADP was responsible for the conceptualization, methodology and management of the project; DADP, ECRV and OLHG participated in the original draft, revision and editing. All authors accepted the final version of the manuscript.

FINANCING

The authors did not receive funding for the development of this article.

BIBLIOGRAPHIC REFERENCES

1. Suárez Rodríguez C, Collado Falcón JC. Características y tratamiento del paciente oncológico en el marco de la actual pandemia de la COVID-19. Rev haban cienc méd [Internet]. 2020 [citado 10/06/2020]; 19 (Supl.):e3396. Disponible en: <http://www.revhabanera.sld.cu/index.php/rhab/article/view/3396>
2. Flick H, Arns BM, Bolitschek J, Bucher B, Cima K, Gingrich E, et al. Management of patients with SARS-CoV-2 infections and of patients with chronic lung diseases during the COVID-19 pandemic. Wien Klin Wochenschr [Internet]. 2020 [citado 10/06/2020]; 47(4):[aprox 7 p]. Disponible en: <https://doi.org/10.1007/s00508-020-01691-0>

3. Ismael J, Losco F, Quildrian S, Sanchez P, Pincemin I, Lastiri J, et al. Multidisciplinary approach to COVID-19 and cancer: consensus from scientific societies in Argentina. *ecancer* [Internet]. 2020 [citado 10/06/2020]; 14:1044. Disponible en: <https://doi.org/10.3332/ecancer.2020.1044>
4. Chen H, Wu X, Wang W, Wang Q. When cancer encounters COVID-19 in China: what have we suffered, experienced and learned. *JJCO*. [Internet]. 2020 [citado 10/06/2020]; 1-7. Disponible en: <http://ncbi.nlm.nih.gov/pmc/articles/PMC7239118/pdf/hyaa077.pdf>
5. Opening remarks at the media briefing on covid-19. Organización Mundial de la Salud [Internet]. Suecia: OMS; 2020 [actualizado 11 de marzo 2020; citado 18 de junio de 2020]. Disponible en: <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020>
6. García-Navarro CA, Marrades Sicart R, Molins López R. Tumores broncopulmonares. En: C. Rozman, A. Agustí et al, editores. *Medicina Interna*. Vol 2. 17ma edición. España: Elsevier; 2012. p.722-734.
7. Horn L, Pao W, David H. Johnson. Neoplasia de pulmón. En: Barnes PJ, Longo DL, Fauci AS, et al, editores. *Harrison principios de medicina interna*. Vol 1. 18ª ed. México: McGraw-Hill; 2012. p. 737-753.
8. Noor Husain A. Pulmón. En: Vinay Kumar, Abul K.Abbas, Jon C.Aster, et al, editores. *Robins Patología Humana*. 9na ed. España: Elsevier; 2012. p. 505-523.
9. Shankar A, Saini D, Bhandari R, Bharati SJ, Kumar S, Yadav G, et al. Lung cancer management challenges amidst COVID-19 pandemic: hope lives here. *Lung Cancer Manag.* [Internet]. 2020 [citado 10/06/2020]; 10:2217. Disponible en: <http://ncbi.nlm.nih.gov/pmc/articles/PMC7202360/PDF/LMT-2020-0012.pdf>
10. Dingemans AM, Soo RA, Jazieh AR, Rice SJ, Kim YT. Treatment Guidance for Patients With Lung Cancer During the Coronavirus 2019 Pandemic. *J Thorac Oncology*. [Internet]. 2020 [citado 10/06/2020]; 15: 1119-1136. Disponible en: <https://doi.org/10.1016/j.jtho.2020.05.001>
11. Leung JM, Yang CX, Tam A, Shaipanich T, Hackett TL, Singhera GK, et al. ACE-2 expression in the small airway epithelia of smokers and COPD patients: 2020 Guidance for Lung Cancer in COVID-19 15 implications for COVID-19. *Eur Respir J* [Internet]. 2020 [citado 10/06/2020]; 55(5):2000688. Disponible en: <https://doi.org/10.1183/13993003.00688-2020>
12. Guan WJ, Ni ZY, Hu Y, Liang C, Ou J, He L, et al. Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med* [Internet]. 2020 [citado 10/06/2020]; 382:1708-1720. Disponible en: <https://www.nejm.org/doi/full/10.1056/NEJMoa2002032>
13. Chen N, Zhou M, Dong X, Qu J, Gong F, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *Lancet*. [Internet]. 2020 [citado 10/06/2020]; 395:507-513. Disponible en: <https://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2820%2930211-7/fulltext>
14. Zhang JJ, Dong X, Cao YY, Yuan YD, Yang YB, Yan YQ, et al. Clinical characteristics of 140 patients infected with SARS-CoV-2 in Wuhan, China [e-pub ahead of print]. *Allergy* [Internet]. 2020 [citado 27/06/2020]; 75(7):1730-1741. Disponible en: <https://doi.org/10.1111/all.14238>
15. Wang Y, Zhang D, Du G, Du R, Zhao J, Jin Y, et al. Remdesivir in adults with severe COVID-19: a randomized, double-blind, placebo controlled, multicenter trial. *The Lancet* [Internet]. 2020 [citado 20/06/2020]; 395(10236):1569-1578. Disponible en: [https://doi.org/10.1016/S0140-6736\(20\)31022-9](https://doi.org/10.1016/S0140-6736(20)31022-9)
16. Liang W, Guan W, Chen R, Wang W, Li J, Xu K, et al. Cancer patients in SARS-CoV-2 infection: a nationwide analysis in China. *The Lancet Oncol* [Internet]. 2020 [citado 10/06/2020]; 21(3): 335-337. Disponible en: [http://dx.doi.org/10.1016/S1470-2045\(20\)30096-6](http://dx.doi.org/10.1016/S1470-2045(20)30096-6)

17. Xu Z, Shi L, Wang Y, Zhang J, Huang L, Zhang C, et al. Pathological findings of COVID-19 associated with acute respiratory distress syndrome. *The Lancet Respir Med* [Internet]. 2020 [citado 10/06/2020]; 8 (4): 420-422. Disponible en: [https://doi.org/10.1016/S2213-2600\(20\)30076-X](https://doi.org/10.1016/S2213-2600(20)30076-X)
18. Xia Y, Jin R, Zhao J, Li W, Shen H. Risk of COVID-19 for patients with cáncer. *Lancet Onco.* [Internet]. 2020 [citado 23/06/2020]; 21:2020. Disponible en: [https://doi.org/10.1016/S1470-2045\(20\)30150-9](https://doi.org/10.1016/S1470-2045(20)30150-9)
19. Salazar MC, Rosen JE, Wang Z, Arnold BN, Thomas DC, Herbst RS, et al. Association of delayed adjuvant chemotherapy with survival after lung cancer surgery. *JAMA Oncol* [Internet]. 2017 [citado 23/06/2020]; 3 (5): 610-19. Disponible en: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5824207>
20. Yang L, Xu HY, Wang Y. Diagnostic and therapeutic strategies of lung cancer patients during the outbreak of 2019 novel coronavirus disease (COVID-19). *Zhonghua Zhong Liu Za Zhi* [Internet]. 2020 [citado 23/06/2020]; 42: e006. Disponible en: <https://europepmc.org/article/med/32118394>
21. Arrieta O, Cardona AF, Lara L, Heredia D, Barrón F, Zatarain-Barrón ZL, et al. Recommendations for detection, prioritization, and treatment of thoracic oncology patients during the COVID-19 pandemic: The THOCOoP cooperative group. *Crit Rev Oncol/Hematology.* [Internet]. 2020 [citado 10/06/2020]; 153: 103033. Disponible en: <https://doi.org/10.1016/j.critrevonc.2020.103033>
22. Luo J, Rizvi H, Preeshagul IR, Egger JV, Hoyos D, Bandlamudi C. COVID-19 in patients with lung cáncer. *Ann Oncol.* [Internet]. 2020 [citado 10/06/2020]; S0923-7534 (20): 39894-X. Disponible en: <https://doi.org/10.1016/j.annonc.2020.06.007>
23. Guckenberger M, Belka C, Bezjak A, Bradley J, Daly ME, DeRuyscher D, et al. Practice recommendations for lung cancer radiotherapy during the COVID-19 pandemic: An ESTRO-ASTRO consensus statement. *Radiotherapy Oncol.* [Internet]. 2020 [citado 23/06/2020]; 146: 223-229. Disponible en: <https://doi.org/10.1016/j.radonc.2020.04.001>
24. Moujaess E, Kourie HR, Ghosn M. Cancer patients and research during COVID-19 pandemic: A systematic review of current evidence. *Crit Rev Oncol/Hematology.* [Internet]. 2020 [citado 23/06/2020]; 150: 102972. Disponible en: <https://doi.org/10.1016/j.critrevonc.2020.102972>
25. Mazzone PJ, Gould MK, Arenberg DA, Chen AC, Choi HK, Detterbeck FC, et al. Management of Lung Nodules and Lung Cancer Screening During the COVID-19 Pandemic. *J Am Coll Radiol.* [Internet]. 2020 [citado 23/06/2020]; 17(7):845-854. Disponible en: <https://doi.org/10.1016/j.jacr.2020.04.024>
26. Tian J, Yuan X, Xiao J, Zhong Q, Yang C, Liu B, et al. Clinical characteristics and risk factors associated with COVID-19 disease severity in patients with cancer in Wuhan, China: a multicentre, retrospective, cohort study. *Lancet Oncol* [Internet]. 2020 [citado 23/06/2020]; 21:2020. Disponible en: [https://doi.org/10.1016/S1470-2045\(20\)30309-0](https://doi.org/10.1016/S1470-2045(20)30309-0)
27. Xu Y, Liu H, Hu K, Wang M. Clinical recommendations on lung cancer management during the COVID-19 pandemic. *Thoracic Cancer.* [Internet]. 2020 [citado 23/06/2020]; 11: 2067-2074. Disponible en: <http://ncbi.nlm.nih.gov/pmc/articles/PMC7283707/pdf/TCA-9999-na.pdf>
28. Xie X, Zhong Z, Zhao W, Zheng C, Wang F, Liu J. Chest CT for typical 2019-nCoV pneumonia: relationship to negative RT-PCR testing. *Radiology* [Internet]. 2020 [citado 23/06/2020]; 296(2): [aprox 12 pag]. Disponible en: <http://doi:10.1148/radiol.2020200343>
29. Masjedi H, Omid R, Zamani H, Perota G, Zare MH. Radiation dose and risk of exposure-induced death associated with common computed tomography procedures in Yazd Province. *Eur J Radiol* [Internet]. 2020 [citado 23/06/2020]; 126:108932. Disponible en: <http://dx.doi.org/10.1016/j.ejrad.2020.108932>

30. National Lung Screening Trial Research T. Reduced lung-cancer mortality with low-dose computed tomographic screening. N Engl J Med [Internet]. 2020 [citado 23/06/2020]; 365:395-409. Disponible en: <https://pubmed.ncbi.nlm.nih.gov/21714641/>