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Early View

Research letter

Pattern of cancer patients referral and organisational model of an interventional pulmonology programme during the COVID-19 pandemic

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PATTERN OF CANCER PATIENTS REFERRAL AND ORGANISATIONAL MODEL OF AN INTERVENTIONAL PULMONOLOGY PROGRAMME DURING THE COVID-19 PANDEMIC

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Take-home message: an interventional pulmonary programme can be carried out safely for both the cancer patients and HCWs during the COVID-19 pandemic, keeping in mind that a worrisome reduction of new cancer patients' referral occurs during periods of high community spread of the virus.

To the Editor:

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection and its related disease (Coronavirus disease 2019, COVID-19) have heavily impacted any cancer pathway, with population-based modelling studies predicting a substantial increase in the number of avoidable cancer deaths mainly due to a diagnostic delay [1-3]. While the utility of bronchoscopy for the microbiological confirmation of the SARS-CoV-2 infection has been evaluated, the feasibility and safety of a diagnostic programme aimed at guaranteeing timely invasive procedures to patients with suspected/known thoracic malignancies during the COVID-19 pandemic has not yet been thoroughly assessed [4-6]. In a literature review, we found a single important study which described an organizational model for bronchoscopic procedures during the first wave of the pandemic, when no published guidelines were available [7]. However, it could not analyze the referral pattern over time as it covered a short time frame (2 months), included a relatively small number of cancer patients (126), and did not detail how patients and staff were screened for the SARS-CoV-2 infection [7].

The aim of the present study is to describe the pattern of cancer patients' referral, the organizational model and rate of transmission of the SARS-CoV-2 to health care workers (HCWs) of an Interventional Pulmonology Unit of a tertiary referral center.

A new Interventional Pulmonology Unit was established at Policlinico Gemelli (Rome, Italy) on June 1, 2020, at the end of the first wave of the COVID-19 pandemic. In order to guarantee a fully functional invasive diagnostic and therapeutic programme we used a complex organizational model that followed the Plan, Do, Check, Act approach and took into account strategies regarding patients and HCWs screening for the SARS-CoV-2 infection, distribution of personal protective equipment (PPE), anesthesia protocols, and the characteristics of the operating theatre was

implemented (Table 1). As for the HCWs, we applied a systematic testing regimen including a rapid antigenic test on a nasopharyngeal swab (NPS) every 15 days, as well as a RT-PCR test on a NPS in case of dubious/positive rapid antigenic test or unforeseen exposure to a COVID-19 patient (Table 1). A prospective database was used to record the number, type, anesthesia setting, outcomes and complications of the invasive procedures, as well as the results of the surveillance of the SARS-CoV-2 infection based on NPS in HCWs and patients. The outcomes of the study were: 1) the frequency and type of invasive procedures for oncological patients; and 2) the rate of the SARS-CoV-2 infection in the HCWs and the patients accessing the programme.

During the study period (June 1, 2020 – January 31, 2021) 513 invasive procedures were performed in patients with suspected/known malignancies. Most of the procedures (407/513, 79%) were diagnostic/staging advanced bronchoscopy procedures (endobronchial ultrasound, EBUS; endoscopic ultrasound with bronchoscope, EUS-B; and guided-bronchoscopy) (351/513, 68%) or ultrasound-guided percutaneous needle biopsy (56/513, 11%). The overall number of procedures (279 *versus* 234), mainly the frequency of procedures carried out to obtain the first diagnosis of malignancy (227 *versus* 180), was higher in the first four months, when virus transmission rate in the Rome was low, in comparison with the last four months, which coincided with the second wave of the pandemic (Figure 1). COVID-19-related symptoms or signs or positive SARS-CoV-2 molecular tests were not observed in the HCWs employed during the study. The surveillance protocol helped detect six patients awaiting bronchoscopy who had a positive SARS-CoV-2 RT-PCR test on NPS despite being asymptomatic; their invasive programme was postponed until molecular test conversion. Among the 146 inpatients who underwent two SARS-CoV-2 molecular tests as per our institution protocol in case of hospital stay of more than three days (Table 1), the test results were concordant in 142 (97.3%) and discordant (negative on admission, positive on anticipated discharge) in 4 (2.7%). Notably, these four patients underwent the invasive testing (rigid

bronchoscopy for stent placement, 1 patient; ultrasound-guided needle biopsy of a supraclavicular lymph node, 1 patient; guided-bronchoscopy, 1 patient; and EBUS-TBNA, 1 patient) with a mean distance of 36 hours between the procedure and the positive NPS test result.

Our epidemiological study shows that invasive procedures for cancer patients decreased by 16% during the second wave of the pandemic, although the staff of the unit were not employed in the COVID-19 wards to guarantee healthcare continuity regardless of the SARS-CoV-2 community spread. In an attempt to understand the referral patterns observed during the study, we discussed with many cancer patients the reasons possibly causing a delay in their access to the hospital services during the phases of high community spread of the virus, and identified three important factors. While the fear of acquiring the SARS-CoV-2 infection in the hospitals was the most commonly cited, following the advice of the public authorities to remain home unless indispensable and self-isolating themselves for the fear of being infectious in the presence of mild respiratory symptoms were important factors as well. Unfortunately, the reduction (21%) was mainly relevant for patients with suspected malignancies who should have undergone the first diagnostic/staging invasive procedure. This finding is particularly worrisome as the poor prognosis of lung cancer frequently depends on a delayed diagnosis leading to the disease being identified at advanced stages [3]. No differences were detected in the referral of patients with previously diagnosed cancer needing a diagnostic (i.e., bronchoalveolar lavage for suspected infection during the exposure of a systemic therapy) or a therapeutic procedure (i.e., rigid bronchoscopy for stent placement) in the setting of a defined oncological programme.

None of the HCWs developed the SARS-CoV-2 infection during the study period. This finding is remarkable as bronchoscopy is one among the invasive procedures considered at the highest risk of airborne transmission [8, 9]. Furthermore, four of the patients who underwent the invasive testing were likely infected during the procedure, as they were found to have a positive RT-PCR

NPS within the subsequent 36 hours. One of them, in particular, underwent a rigid bronchoscopy, which is by far the endoscopic procedure associated with the highest risk of viral transmission as it provides a direct communication between the patient's airway and the endoscopy suite [8, 9]. Given these results, we infer that the systematic and correct use of the PPE and the execution of the procedures in an endoscopy suite adequately ventilated and carefully disinfected after each procedure significantly reduces the biological risk [8, 9].

Finally, a screening programme for SARS-CoV-2 infection, which we managed to improve during the study period thanks to the progressive increase in testing capability in Italy, is key for both the HCWs and the patients. However, the sensitivity of the RT-PCT for SARS-CoV-2 ranges between 70% and 85% in symptomatic patients and might be lower in asymptomatic ones based on a low viral load [10, 11]. These diagnostic sensitivity values might partly explain why four inpatients who underwent two RT-PCR tests were found to have discordant test results (negative admission and positive on anticipated discharge). It is, therefore, crucial that PPE is worn to systematically and appropriately during the interventional pulmonology activity even if the pre-procedure molecular screening is negative.

In conclusion, our study suggests that an interventional pulmonary programme can be carried out safely for both the cancer patients and HCWs during the COVID-19 pandemic, keeping in mind that a worrisome reduction of new cancer patients' referral occurs during periods of high community spread of the virus.

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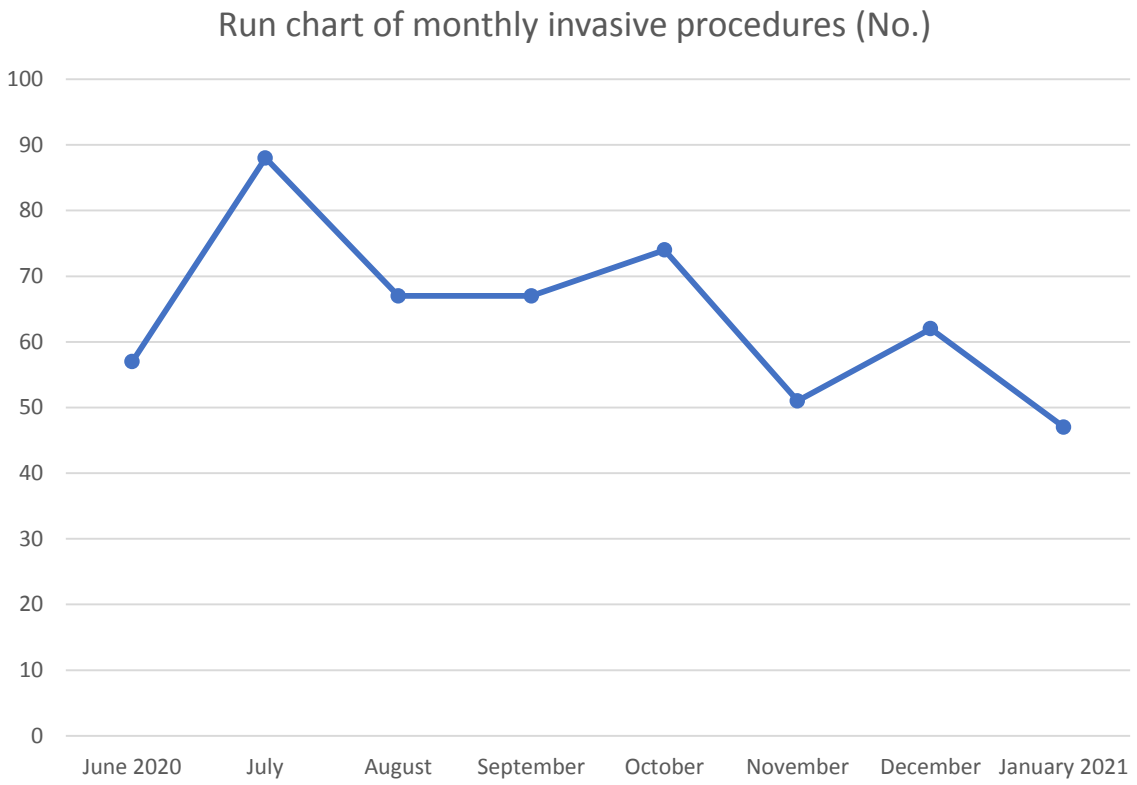
Table 1. Organizational model for the access to the interventional diagnostic and therapeutic invasive procedures and their execution during the COVID-19 pandemic in patients with thoracic malignancies

	June 2020-September 2020	October 2020-January 2021
Inpatients screening for SARS-CoV-2 infection	Symptoms-based screening + RT-PCR on NPS on hospital admission RT-PCR on NPS before discharge for hospital stays > 3 days	Symptoms-based screening + RT-PCR on NPS on hospital admission RT-PCR on NPS before discharge for hospital stays > 3 days
Outpatients screening for SARS-CoV-2 infection	Symptoms-based screening during the pre-procedure outpatient visit Symptoms-based screening the day of the procedure	Symptoms-based screening + RT-PCR on NPS within 48 hours of the procedure Symptoms-based screening the day of the procedure
Health Care Staff screening for SARS-CoV-2 infection	RT-PCR on NPS in case of unforeseen exposure to COVID-19 patient*	Surveillance rapid antigenic test every 15 days RT-PCR on NPS in case of dubious/positive rapid antigenic test or unforeseen exposure to a COVID-19 patient*
PPE worn during each invasive procedure	FFP3 mask, single use gown, gloves, eye protection (glasses or face shield) in pre/intra/post endoscopy setting	FFP3 mask, single use gown, gloves, eye protection (glasses or face shield) in pre/intra/post endoscopy setting
Anesthesia		
Advanced bronchoscopy	General anesthesia, LMA	General anesthesia, LMA
Rigid bronchoscopy	General anesthesia, open airway	General anesthesia, open airway
Standard bronchoscopy	Mild sedation, slotted mask	Mild sedation, slotted mask
US-guided biopsy	Mild sedation	Mild sedation
Operating Theatre	Endoscopy suite with 15 ACH	Endoscopy suite with 15 ACH

Abbreviations: PPE: personal protective equipment; NPS: naso-pharyngeal swab; RT-PCR: real-time polymerase chain reaction; LMA: laryngeal mask airway; US: ultrasound; AHC: air changes per hour

*Unforeseen exposure to a COVID-19 patient typically indicates the execution of an invasive procedure on an patient whose SARS-Cov-2 testing was negative in the 48 hours before the procedure but turned positive in the 7 days after the procedure.

LEGEND TO FIGURE:



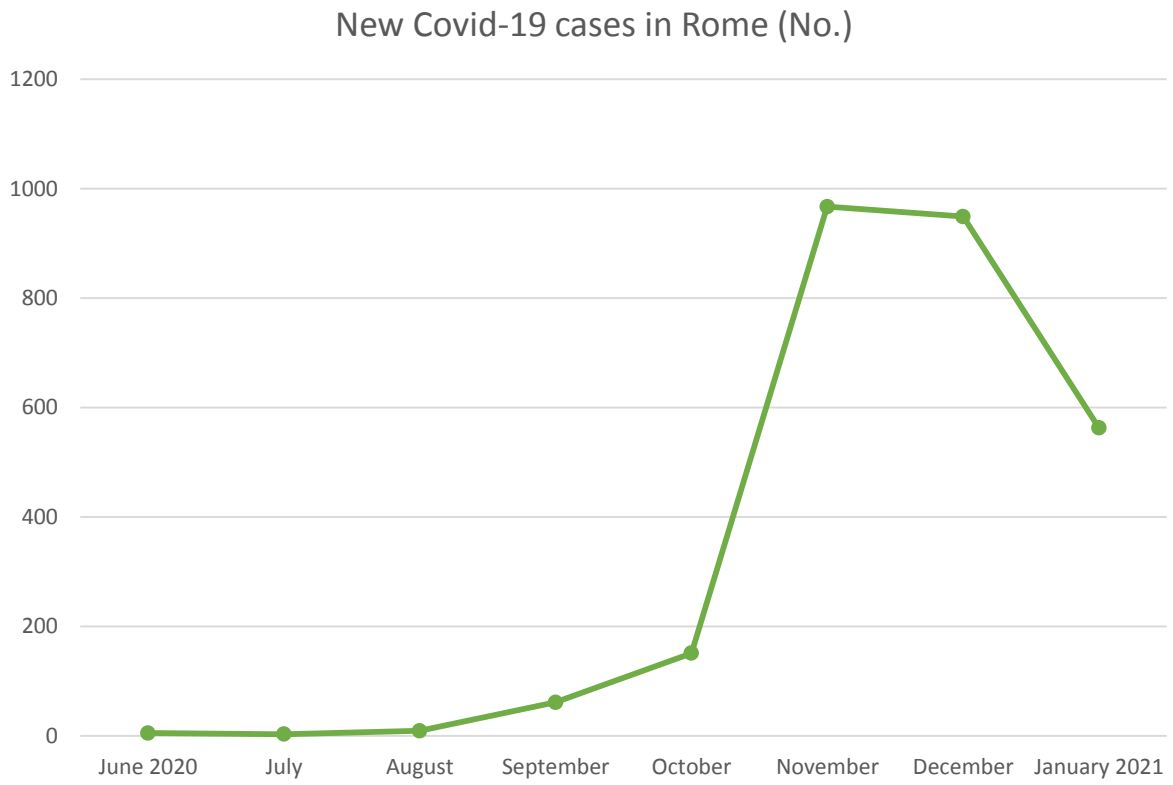


Figure 1. Run chart of monthly invasive procedures and number of new COVID-19 cases recorded in Rome on the first day of each month during the study period