COVID-19 Exposure Risk of Healthcare Personnel in Digestive Endoscopy: A Prospective Study

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Abstract

Background: Of many descriptive papers about healthcare workers' (HW) COVID-19 infection, asymptomatic cases have not yet considered.

Aims: The present study calculated the numbers of COVID-19 patients afferent to GI endoscopy and the number of positive HW using nasopharyngeal swabs (NS), serological rapid IgM/IgG tests (SRT) and serological quantitative IgG test (SQT).

Methods: The study was conducted from 2nd to 30th April 2020. All the recommended national and international indications on infection control measures were followed. Out of 1227 patients accepted, 1009 were included in the study. 38 HW were tested by NS, SRT and SQT. Descriptive statistical analyses were used to summarize the data.

Results: 17 patients were diagnosed COVID-19 positive at NS. 9 patients were known positive at the time of the endoscopy and 8 were diagnosed COVID-19 positive after the procedure. Of the 38 HW, 2 were positive both to NS and SRT with IgM/IgG lines; 7 showed IgG line only at SRT, confirmed by SQT with negative NS. Other 7 HW showed not well-defined line of IgG at SRT, confirmed negative by SQT. The two cases positive to NS and IgM/IgG SRT were asymptomatic. The crude contagion's rate (R_0) was 0.41 and 1.7% of COVID-19 patients caused 19% of positive cases in HW.

Conclusions: Not previously diagnosed COVID-19 patients expose HW to additional and incalculable risk of contamination. Association between different tests reduced the variability related to possible confounding factors and increases the accuracy. Since most cases in HW seem to go asymptomatic, large-scale tests using both NS and SRT for both HW and patients should be recommended to minimize the risk of in-hospital infection's relapses.

Introduction

Many studies have been published on COVID-19 in GI endoscopy: infection control measures, observational studies and description of activities during SARS-COV-2 outbreak have been described [1–7]. Although the studies considered the protection of healthcare workers (HW), only few papers described the percentage of positive cases in HW [1,6,7] and no studies considered the asymptomatic cases in the personnel. However, this point has become crucial because asymptomatic, but positive HW can cause in-hospital spreading of the infection and should be considered to calculate the percentage of contaminated workers, especially at the beginning of the so-called phase 2 (gradually re-opening of elective procedures).

The aims of the present study were to calculate the number of COVID-19 patients, the number of positive cases in HW using both nasopharyngeal swabs and serological rapid tests and to obtain the R_0 (contagion's rate) in GI endoscopy in a tertiary referral center as indication of HW exposure. No pre-specified hypotheses are available because some studies [1] reported the number of positive healthcare

workers but not the total number of HW. From the previous studies, a comprehensive exposition of less than 1% to COVID–19 patients can be estimated.

Methods

This is an observational prospective study.

The key elements of our study were, on one side, assessing the total number of patients submitted to GI endoscopy from the 2nd to the 30th April 2020 and extrapolating the number of COVID–19 patients at the time of the endoscopy (performing a follow-up of 15 days after the endoscopy to include also postprocedural diagnoses). On the other side, HW were tested by nasopharyngeal swab at the end of the study period and serological rapid test during the first week and the last week of the study at a constant interval of 3 weeks to calculate the total number of positive cases. Serological rapid tests were not used on patients' population because of lack of available tests and the need to calculate only the infective cases, not the immunological response.

Presence of SARS-COV–2 nucleic acids was detected by standard RT-PCR technology. Two validated kits were used: Allplex 2019-nCoV Assay (Seegene Technology Inc, Seoul, South Korea) and GeneFinder™ COVID–19 Plus RealAmp Kit (ELITechGroup, Turin, Italy).

The serological rapid tests studied both IgG and IgM with a declared sensitivity of 100% for IgG and 85% for IgM (PrimaLab, Balerna, Switzerland). The tests were immediately repeated in case of not diagnostic results. If the line for positive IgG or IgM was not well evident after the two tests, we considered a negative result.

Quantitative serological IgG test used in the study was ELISA test researching IgG anti-S1/anti-S2 for SARS-CoV–2, available and validated for HW screening in the region of the study (Lombardia, Italy).

Study population derived from a high-volume COVID–19 hospital of Milan, Italy with a tertiary referral endoscopy center.

The study period was from the 2nd to the 30th April 2020 and the follow-up included the whole study period for HW and patients. It was decided on the base of the stable standardization of the personal protective measures (PPE) and the availability of both nasopharyngeal swabs and serological rapid tests. Infection control measures were in line with national and international recommendations and were stratified in risk classes to save personal protective equipment [2].

The eligibility criteria for patients were scheduled endoscopy in the study period, previously present data in the hospital system, in- or out-patients, patients from other hospitals. All the patients were informed about the study at the time of the endoscopy; the study did not involve any additional measure or risk for the patients.

For COVID–19 patients' group, personal data, date of endoscopy, onset of symptoms, date of test, presenting symptoms at the endoscopy and clinical course were recorded.

The eligibility criteria for HW were clinical work since 1st February 2020 only in the endoscopy unit, no involvement in COVID–19 wards, signed informed consent. All the HW were volunteers.

For HW group, exposure to COVID–19 patients, onset of suspicious symptoms (also before the study period since the 1st February 2020), photos of the serological tests after 10 minutes, serological tests' platforms, results of nasopharyngeal swabs, past medical history, drugs and clinical course were registered. All the data were collected in Excel database and subsequently analyzed.

Descriptive statistical analyses were used to summarize the data. Continuous variables with normal distribution were defined as mean and standard deviation. Categorical variables were expressed as absolute and relative frequencies and comparisons between the results were assessed by 2 test.

The study size was determined by reduction of elective endoscopies during COVID–19 outbreak.

Out of 1227 patients accepted in endoscopy unit during the study period, 1009 were included in the study according to eligibility criteria.

All the 38 members of endoscopy staff accepted to take part in the study and were included according to eligibility criteria.

The outcomes were: 1) calculating the number of COVID–19 patients on the total amount of included patients; 2) calculating the number of members of HP positive to nasopharyngeal swab and/or to serological rapid tests. A ratio of contamination (R_0) in GI endoscopy was defined as the rate of number of positive HW on COVID–19 patients; $R_{0\%}$ was, instead, defined as the ratio of percentage of positive cases in HW on percentage of COVID–19 patients in the study period.

The bias of the study included pre-test variability for nasopharyngeal swab, impossibility to perform the nasopharyngeal test to the total number of patients' population, low sensitivity of serological rapid tests, confounding factors (drugs, comorbidities, early exposure), use of qualitative tests and interpersonal variability.

Perform of both tests on HW and inclusion of data on drugs, past medical history and personal/familial contacts affected by COVID–19 of HW aimed to eventually identify any confounding factor. No subgroup was considered in the present study.

Results

Study period lasted 28 days (2nd–31th April 2020).

1227 patients were submitted to GI endoscopy (591 esophagogastroscope, 575 colonoscopy, 32 EUS, 29 ERCP). 1009 (M 643, F 366, mean age: 54.23 y.o.) of 1227 matched the eligibility criteria; the remaining 118 patients were not present in hospital's system before the endoscopy. 486 patients were out-patients and 523 were in-patients, including transfers from other hospitals to perform advanced endoscopic procedures.

17 patients (M 14, F 3, mean age: 58.19 y.o.) were found COVID-19 positive; 9 were known positive at the time of the endoscopy; 8 patients were diagnosed COVID-19 positive after the procedure. In five cases, the patients developed symptoms after the endoscopy (at 76 days); in one case, the patient was intubated in the emergency department before the endoscopy (and the nasopharyngeal swab was on course at the time of the procedure) and, in the remaining two cases, the patients had suggestive symptoms and typical features at thoracic CT scan but two negative consecutive nasopharyngeal swabs (bronchoalveolar lavage had then confirmed the diagnosis in both cases). 8 on 17 patients had acute upper gastrointestinal bleeding, 4 acute diarrhea, 3 bloody diarrhea, one acute cholangitis, one walled-off pancreatic necrosis. During the follow-up, all the positive patients presented to the Emergency Department, 8 were hospitalized (3 needed Intensive Care Unit), 2 died.

All the HW of Endoscopy Unit accepted to participate in the study. 38 workers were included on the base of the eligibility criteria (M 10, F 28, mean age: 47.18 y.o.; 8 endoscopists, 1 dedicated anaesthetist, 22 endoscopy nurses and 7 social health professionals). None had familial and/or personal COVID-19 contacts.

Of the 38 members, 2 were positive to nasopharyngeal swab and two serological rapid test showed evident IgM and IgG line; 7 showed well demarcated line of IgG at the serological rapid test with negative nasopharyngeal swab. Other 7 healthcare workers showed a not well-defined line for IgG at serological tests in presence of negative nasopharyngeal swab. Quantitative IgG serological test confirmed these results as negative. Furthermore, these HW had, in past medical history, celiac disease in one case, rheumatoid arthritis in two cases and scleroderma in one case. Nasopharyngeal swab was negative in all the other cases. Quantitative IgG serological test was in line with serological rapid test results: both IgG/IgM positive and IgG positive at rapid tests were found positive at quantitative ELISA test.

The two swab-serological tests positive cases were asymptomatic. Five out of seven cases of IgG positive serological tested healthcare workers had respiratory symptoms, fever and/or diarrhea during February (comprehensive period: 3rd–29th February 2020); the other were asymptomatic.

We identified as potential confounding factors to define positivity to the test in HW groups the onset of dubious and not well-demarcated IgG line in the serological rapid tests, especially in presence of some chronic disorders. Difference of analysis on HW using serological rapid tests and nasopharyngeal swabs is confirmed statistically significant ($p < 0.05$) according to χ^2 test.

Using χ^2 test to compare quantitative and qualitative serological tests, no statistical difference was found ($p > 1.0$).

The limits of the study are subsequently described.

Asymptomatic positive patients were not included because full-scale tests on general population were not performed in Italy at the time of the present study.

Although IgG line in serological rapid tests can be consistent to negative nasopharyngeal swab, we must underline this incongruity as a potential limit of our study.

Infection of HW could be caused by external and/or familial non recognized contacts.

The crude R_0 was 0.41 (7/17). If percentage on total number were considered, 1.7% of COVID-19 patients caused 19% of positive cases in HP, so $R_{0\%}$ was 11.18.

The results are resumed as flowchart in Table 1.

Discussion

The study presented the data of COVID-19 spreading in GI endoscopy calculating both the number of COVID-19 patients and number of positive HW.

A first data is the chance to cure COVID-19 patients without a definitive diagnosis: this expose the HW to additional and incalculable risk of contamination. PPE saving imposed to HW operating on non-infected patients to maintain a medium level of protection not sufficient to minimize the risk of transmission. Furthermore, these not previously diagnosed cases increased the potential contamination of working environment because they did not follow the dedicated routes of isolation. A limit in the identification of COVID-19 patients is the absence of symptoms in many cases: for this reason, we think that we are still underestimating the number of affected patients and subsequently the exposure of HW. This limit is related to the fact that asymptomatic patients did not undergo nasopharyngeal swab in Italy during the study period.

Studying the group of COVID-19 patients, the majority had gastrointestinal bleeding as presenting symptom for GI endoscopy: particular care should be given to urgent endoscopies with this indication. Gastrointestinal bleeding can be related to many causes in these cluster and can also be a confounder even if already reported in other papers [9].

Analyzing GI endoscopy personnel, HW started to follow guidelines and recommended use of PPE since the 1st February 2020. PPE saving constricted HW to stratify the protection according to a theoretical risk of infection [2]. Despite of these recommendations, the number of HW that experienced the SARS-COV-2 infection was 29% according to rapid serological tests. Two asymptomatic cases were positive for both swab and serological tests with IgM/IgG lines and, so on, infective. This consideration is important to avoid letting our guard down in social life. The results of serological rapid tests must be read prudently on the base of past experiences for other viral infections [10]. On the other hand, we must underline the importance of a correct performance of nasopharyngeal swabs to reduce the rate of false negative cases

[10]. For the two HW positive to both tests, the diagnosis could be assumed as definitive. On the other hand, for the workers IgG positive at serological rapid test but negative at nasopharyngeal swab, we had to consider two possible interpretations: 1. These HW had experienced asymptomatic (or pauci symptomatic) form of COVID–19 and developed immunological memory; 2. These HW were false positive of the test. We tried to exclude the second interpretation by repeating twice the serological tests at a 3 week-interval and finding exactly the same results in the whole HW. Moreover, quantitative IgG serological tests was also performed. The present study would benefit of results' comparison with similar studies in tertiary referral hospitals to confirm external validity.

R_0 was calculated as for general population and resulted <1 . This result should confirm that the PPE measures were sufficient to minimize the spreading. However, our calculation can be partially invalidated by the impossibility to consider asymptomatic positive patients.

Someone can think that full-scale testing on HW would be sufficient to minimize the intra-hospital infection, especially considering $R_0 < 1$. However, it depends mainly on “silent exposure” to non-diagnosed cases.

Thus, we would like to conclude saying that, at the beginning of the so-called “phase 2”, large-scale tests on general population are fundamental not only to estimate the real risk of exposure for HW but mostly to avoid incalculable spreading of asymptomatic yet infective COVID–19 patients in hospitals.

Declarations

Ethical disclosure statement.

The present study was approved by our internal Ethical Committee (Santagostino Medical Center, int. 2/2020).

Patient consent statement.

The present study did not involve any additional procedure for the studied patients. Informed consent was obtained by all the patients for routine procedures.

Funding sources

The present study was self-founded by Santagostino Medical Center.

Conflict of Interest

The authors declare that they have no conflict of interest.

Ethical approval:

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent:

Informed consent was obtained from all individual participants included in the study.

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Table

Due to technical limitations, table 1 is only available as a download in the supplemental files section.

Table 1. Resuming flowchart of results.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Table1.jpeg](#)