ORIGINAL ARTICLE

Incidental tomographic findings in patients with a Confirmed Diagnosis of COVID-19: An Observational Study

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Abstract

Objective: Describe incidental tomographic in the sample, correlating them with risk factors for chest diseases and sociodemographic data. **Methods:** This is a retrospective and observational study covering 162 patients admitted to the COVID sector of the HU/UFJF, from April 1, 2020, to July 7, 2021, with a confirmed laboratory diagnosis of COVID-19. The variables were described in absolute and relative frequencies. The comparison of the correlation between the outcome variable (the tomographic findings) for independent samples was performed using Pearson's chi-square test (without correction) or Fisher's test when relevant. **Results:** Of the 162 patients, 15.4% had a solitary pulmonary nodule; 14.8% had multiple pulmonary nodules; 1.8%, lung mass; 3.1%, mediastinal mass, and 9.3% had mediastinal adenomegaly. Findings such as excavations, pleural effusion, emphysema, PTE, pneumothorax, chronic interstitial disease, cavitation, aneurysms, and significant atheromatosis, classified in this study in the "Other" category showed impressive results, with an overall prevalence of 81.5%. This study demonstrated that 34% of patients had two or more types of incidental CT findings and that 88.3% of patients had at least some type of incidental CT finding. **Conclusion:** The pandemic of SARS-CoV-2 infections has brought a series of challenges and lessons learned to healthcare teams around the world. The massive implementation of highly sensitive diagnostic methods, such as chest tomography, ends up bringing an additional challenge, which is to deal with incidental findings, making good clinical reasoning necessary to avoid unnecessary investigations and not leave without diagnosis and treatment of diseases in early and asymptomatic stages.
Keywords: Coronavirus infections, COVID-19, Multidetector computed tomography, Incidental findings, SARS-CoV-2.

Resumo

Objetivo: Descrever os achados incidentais tomográficos na amostra, correlacionando-os com fatores de risco para doenças torácicas e dados sociodemográficos. **Método:** Trata-se de um estudo retrospectivo e observacional, abrangendo 162 pacientes admitidos no setor COVID do HU/UFJF, no período de 1º de abril de 2020 a 7 de julho de 2021, com diagnóstico laboratorial confirmado de COVID-19. As variáveis em frequências absolutas e relativas foram descritas. A comparação da correlação entre a variável desfecho (os achados tomográficos) para amostras independentes foi realizada por meio do teste qui-quadrado de Pearson (sem correção) ou Fisher quando pertinente. **Resultado:** Dos 162 pacientes, 15,4% apresentavam nódulo pulmonar solitário; 14,8%, nódulos pulmonares múltiplos; 1,8%, massa pulmonar; 3,1%, massa mediastinal e 9,3%, adenomegalia mediastinal. Achados como escavações, derrame pleural, enfisema, TEP, pneumotórax, intersticiopatia crônica, cavitação, aneurismas e ateromatose significativa, classificados, neste estudo, na categoria "Outros", apresentaram resultados impactantes, com uma prevalência global de 81,5%. Este estudo demonstrou que 34% dos pacientes apresentavam 2 ou mais tipos de achados tomográficos incidentais e que 88,3% dos pacientes apresentavam pelo menos algum tipo de achado tomográfico incidental. **Conclusão:** A pandemia de infecções pelo SARS-CoV-2 trouxe uma série de desafios e aprendizados para as equipes de saúde em todo o mundo. A realização maciça de métodos diagnósticos de elevada sensibilidade, como a tomográfica de tórax, acaba por trazer um desafio adicional, que é o de lidar com achados incidentais, fazendo-se necessário um bom raciocínio clínico para evitar investigações desnecessárias e não deixar sem diagnóstico e tratamento doenças em fases iniciais e assintomáticas.
Palavras-chave: Infecção por Coronavírus, COVID-19, Tomografia computadorizada Multidetectores, Achados incidentais, SARS-CoV-2.

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INTRODUCTION

In late 2019, a new species of Coronavirus, SARS-CoV-2, was identified as the etiologic agent of a pneumonia outbreak in the Chinese city of Wuhan.[1] The dissemination occurred quickly and exponentially, being declared a pandemic by the World Health Organization on March 11, 2021. This pandemic caused significant impacts on health systems around the world, especially in relation to the occupation of hospital beds and intensive care, suspension in the performance of elective diagnostic and therapeutic procedures, cancer screening and clinical follow-up of chronic diseases.[2,3,4]

The gold standard for the diagnosis of this infection is the Reverse Transcriptase Polymerase Chain Reaction test (RT-PCR) of nasal or oropharyngeal swab specimens.[5,6] Computed tomography (CT), although not indicated for the diagnosis of the disease, has become a valuable tool for the follow-up of the evolution and detection of possible complications, with a sensitivity of 94%, specificity of 37% and negative predictive value of 95.4-99.8%.[3,7]

Although not pathognomonic and may overlap with findings from other viral infections, some tomographic changes in COVID-19 have characteristics that set them apart from those seen in other infections, often being highly suggestive of this particular infection.[5,6,7] Ground-glass opacities, usually bilateral and of peripheral basal predominance, are found in 57 to 98% of patients and are considered an early manifestation of the disease.[3,5,6] Mosaic paving is seen in five to 89% of patients, with a higher incidence in the peak phase of the disease (about ten days).[3,5,6] Parenchymal consolidations (two to 64% of cases), reticular lung opacities (48% of cases), subpleural lines (20% of cases), and Inverted Halo Sign (4% of cases) usually indicate more advanced stages of the disease and are common in individuals over 60 years of age.[3,5,6] Airway changes, such as air bronchograms, are infrequent and can be considered a sign of severity.[3,5,6] With the exponential increase in the number of CT scans performed, there has also been an increase in incidental findings, such as lymphadenopathy, excavations, pleural effusion, pulmonary nodules, emphysema, chronic interstitial disease, aneurysms, and significant atheromatosis, which should raise a concern about other differential diagnoses put on the back burner by the context of the SARS-CoV-2 pandemic[1,4,5,6,7,]

This study aims to describe the incidental tomographic findings in the sample, correlating them with risk factors for thoracic diseases and socio-demographic data.

METHODS

This is a retrospective observational study encompassing 162 patients admitted to the COVID sector of the HU/UFJF Santa Catarina Unit, ward and/or Intensive Care Unit, from April 1, 2020, to July 7, 2021, with a confirmed laboratory diagnosis of COVID-19 (RT-PCR, rapid test, or immune-chromatographic). The following data were collected from the AGHU electronic medical record: socio-demographic data; smoking history; previous diagnosis of chronic obstructive pulmonary disease (COPD); and type of hospitalization (ward or ICU).

The inclusion criteria were patients with a diagnosis of COVID-19 confirmed by laboratory analysis. Patients hospitalized with suspected COVID-19 without a laboratory-confirmed diagnosis and those who did not have a chest CT scan during hospitalization were excluded.

One hundred and sixty-two chest CT scans of patients with COVID-19 admitted to HU-UFJF were reviewed by a second-year Radiology and Imaging Diagnosis resident physician, supervised by an attending radiologist at HU-UFJF. The process of examination re-evaluation was performed by image analysis with a subsequent comparison with the respective official report of each examination, and no significant differences were observed. After reviewing each exam, all incidental pathological findings, which were not related to COVID-19 infection, were tabulated in an Excel spreadsheet. The information collected was gathered in a database, by Microsoft Office Excel® 2007 software, for analysis and subsequent construction of tables and graphs.

The variables were described in absolute and relative frequencies, comparing their differences by mean, median, and variability measures (standard deviation/confidence interval). The comparison of the correlation between the outcome variable (the tomographic findings) for independent samples was performed using Pearson's chi-square test (uncorrected) or Fisher's test when appropriate. To measure the association effects between exposure and outcome for the tomographic findings, an Odds Ratio model was used. The predictive variables

"Solitary pulmonary nodule" and "Multiple pulmonary nodules" were used in the bivariate analysis because they present, in percentage terms, higher prevalence among the incidental tomographic findings evaluated and because they are clinically more significant for the scope of this study. The logistic regression model was chosen for univariate and multivariate data. In this technique, the dependent variable (outcome) is a dichotomous random variable that takes the value (1) if the event of interest occurs or (0) otherwise. Prevalences of tomographic findings are presented as absolute and relative (percentage) values and were adjusted within each category of variables of interest, accompanied by the univariate (raw) ORs and followed by their 95% CIs. Finally, a multivariate logistic model was fitted, considering associations in the multivariate modeling for all variables measured in the previous phase. The selection of the final multivariate model that best explained the study objective was defined by the final quality of fit based on Akaike's Information Criterion (AIC). The significance level was alpha ≤ 0.05 for the 95% CI. The analyses were performed in the Data Analysis and Statistical Software College Station (STATA 15, Texas, USA).

A waiver of the Free and Informed Consent Term (FICT) was requested. The study was approved by the Ethics Committee on Human Research (REC) of UFJF under Opinion No. 5.137.797 and CAAE No. 50860121.6.0000.5133.

RESULTS

From April 1, 2020, to July 7, 2021, 354 patients with a confirmed diagnosis of COVID-19 were hospitalized, and 192 were excluded from the study due to failure to perform chest CT during the hospitalization period. Thus, the total sample analyzed in this study consists of 162 individuals, as shown in Figure 1.

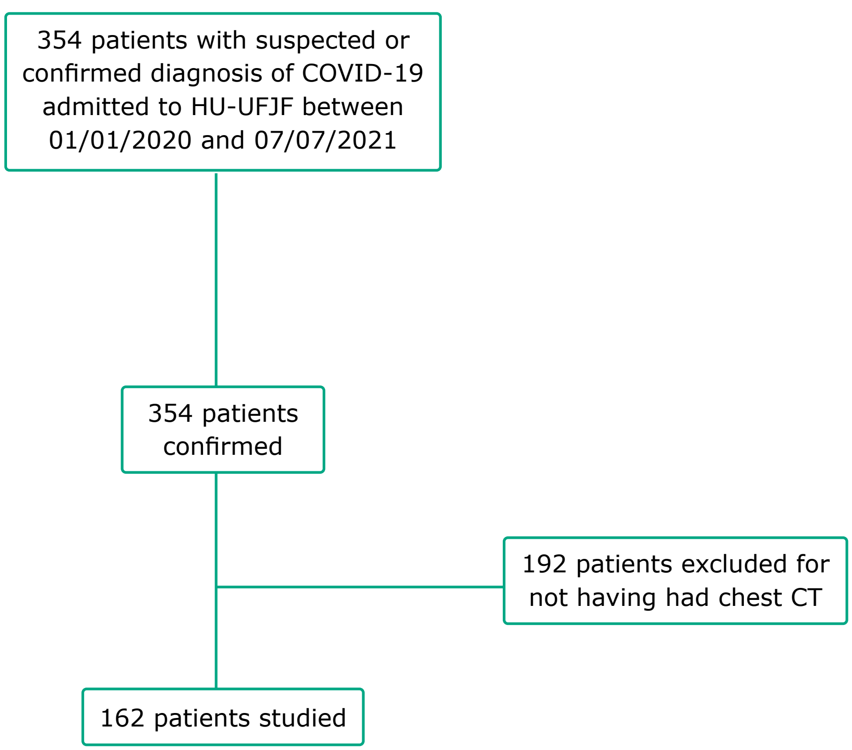

Figure 1: Study selection flow chart.

Among the 162 patients evaluated in this study, 52.5% were aged greater than or equal to 60 years, with ages between 16 and 91 years as extremes. Regarding gender, 50.6% of the total were men. Among the 162 patients, 33.3% had confirmed smoking and 8% had COPD. Due to the lack of description in the electronic medical record, in 27.8% of the cases, there is no information about smoking. Most evolved with hospital discharge, with a mortality of 16.1%. These data are shown in Table 1.

Table 1
Characteristics of the patients studied

		N	%
Age	Up 59 years old	77	47.5
	> 60 years old	85	52.5
Sex	Male	82	50.6
	Female	80	49.4
Home	Juiz de Fora	126	77.8
	Matias Barbosa	5	3.1
	Rio Novo	3	1.8
	Chiador	2	1.2
	Santos Dumont	2	1.2
	São João	2	1.2
	Chácara	2	1.2
	Santana do Deserto	2	1.2
	Other locations	18	11.3
Smoking	No	63	38.9
	Yes	54	33.3
	No data in the medical record	45	27.8
COPD	No	130	80.2
	Yes	13	8.0
	No data in the medical record	19	11.8
Outcome	Discharge	136	83.9
	Death	26	16.1

Table 2 shows the data of incidental tomographic findings. Of the 162 patients, 15.4% had solitary pulmonary nodule; 14.8%, multiple pulmonary nodules; 1.8%, pulmonary mass; 3.1%, mediastinal mass, and 9.3%, mediastinal adenomegaly. Findings such as excavations, pleural effusion, emphysema, PTE, pneumothorax, chronic interstitial disease, cavitation, aneurysms, and significant atheromatosis, classified in this study in the "Other" category showed impressive results, with an overall prevalence of 81.5%. Table 3 shows that 34% of the patients had two or more types of incidental tomographic findings and that 88.3% of the patients had at least some type of incidental tomographic finding.

Table 2
Incidental tomographic findings

Tomographic finding		N	%
Solitary pulmonary nodule	Absent	137	84.6
	Present	25	15.4
Multiple pulmonary nodules	Absent	138	85.2
	Present	24	14.8
Pulmonary mass	Absent	159	98.2
	Present	3	1.8
Mediastinal mass	Absent	157	96.9
	Present	5	3.1
Mediastinal adenomegaly	Absent	147	90.7
	Present	15	9.3
Others	Absent	30	18.5
	Present	132	81.5

Table 3
Number of lesions, according to the type of incidental tomographic finding, in the study patients

Number of lesions	N	%
No incidental CT findings	19	11,7
Only 1 type of incidental tomographic finding	88	54,3
> 2 types of incidental tomographic findings	55	34

During the bivariate analysis for solitary pulmonary nodule, only the independent variable "age" obtained statistical significance (p-value = 0.033), in which patients aged 60 years or older had a higher prevalence of the presence of this nodule (relative frequency of 21.2%) compared to those under 60 years of age (relative frequency of 9.1%), as shown in Table 4.

During the bivariate analysis for multiple pulmonary nodules, only the independent variable "COPD" obtained statistical significance (p-value = 0.004), in which the prevalence of multiple nodules occurred in almost half of the patients with COPD (relative frequency of 46.2 %), according to Table 5.

Regarding the finding of lung mass, there was no statistically significant relationship, with a p-value < 0.05. It is worth remembering that a significant loss of data regarding smoking and COPD may have interfered with the analysis of these data.

Table 4
Bivariate analysis for solitary pulmonary nodule

Independent variables		Total	Solitary Pulmonary Nodule 0 N (%)	Solitary Pulmonary Nodule 1 N (%)	p-value	OR (95%CI)
Sex	Male	82 (50,6)	68 (82,9)	14 (17,1)	0.559	Reference
	Female	80 (49,4)	69 (86,3)	11 (13,7)		0.77 (0.32-1.82)
Age	Up to 59 years old	77 (47,5)	70 (90,9)	7 (9,1)	0.033	Reference
	≥ 60 years old	85 (52,5)	67 (78,8)	18 (21,2)		2.68 (1.05-6.84)
Smoking	No	63 (38,9)	51 (81,0)	12 (19,0)	0.525	Reference
	Yes	54 (33,3)	46 (85,2)	8 (14,8)		0.73 (0.27-1.96)
	No data in the medical record	45(27,8)	40 (88,9)	5 (11,1)		0.53 (0.17-1.63)
COPD	No	130 (80,3)	109 (83,8)	21 (16,2)	0.997	Reference
	Yes	13 (8,0)	11 (84,6)	2 (15,4)		0.94 (0.19-4.57)
	No data in the medical record	19 (11,7)	17 (89,5)	2 (10,5)		0.61 (0.13-2.84)
Outcome	Discharge	136 (84,0)	116 (85,3)	20 (14,7)	0.558	Reference
	Death	26 (16,0)	21 (80,8)	5 (19,2)		1.38 (0.46-4.08)

Tabela 5
Bivariate analysis for multiple pulmonary nodules

Independent variables		Total	Pulmonary Nodules 0 N (%)	Pulmonary Nodules 1 N (%)	p-value	OR (95%CI)
Sex	Male	82 (50,6)	72 (87,8)	10 (12,2)	0.342	Reference
	Female	80 (49,4)	66 (82,5)	14 (17,5)		1.52 (0.63-3.67)
Age	Up to 59 years old	77 (47,5)	65 (84,4)	12 (15,6)	0.793	Reference
	≥ 60 years old	85 (52,5)	73 (85,9)	12 (14,1)		0.89 (0.37-2.11)
Smoking	No	63 (38,9)	55 (87,3)	8 (12,7)	0.362	Reference
	Yes	54 (33,3)	43 (79,6)	11 (20,4)		1.75 (0.65-4.75)
	No data in the medical record	45(27,8)	40 (88,9)	5 (11,1)		0.85 (0.26-2.82)
COPD	No	130 (80,3)	114 (87,7)	16 (12,3)	0.004	Reference
	Yes	13 (8,0)	7 (53,8)	6 (46,2)		6.10 (1.82-20.4)
	No data in the medical record	19 (11,7)	17 (89,5)	2 (10,5)		0.83 (0.17-3.97)
Outcome	Discharge	136 (84,0)	115 (84,6)	21 (15,4)	0.608	Reference
	Death	26 (16,0)	23 (88,5)	3 (11,5)		0.71 (0.19-2.59)

DISCUSSION

The use of chest CT as a means of clinical follow-up and detection of complications in patients with COVID-19 will inevitably lead to incidental tomographic findings since both the lung parenchyma and the surrounding extra-pulmonary structures of the mediastinum, cardiovascular system, and upper abdomen will be evaluated by chest CT.[7,8,9] It is worth noting that the way of classifying and defining a clinically significant incidental finding varies among existing studies. Even among radiologists, there seems to be no consensus on this definition and on the management of these incidental findings detected at CT screening.[9]

Currently, after reviewing the literature, it is noted that the prevalence of incidentally diagnosed cancer is still quite restricted, probably due to the challenges in identifying these cases using large databases and the limited amount of research on this topic.[8] In addition, estimates of clinically significant incidental findings vary substantially depending on the imaging modality used and the field evaluated (specific organ or whole body).[8]

In this study, among the 162 patients evaluated, 88.3% had at least one type of incidental tomographic finding, which should raise some concern with the other diagnoses put in the background by the context of the SARS-CoV-2.9 pandemic.[9]

Kilsdonk et al. (2021) noted in their study that of 232 participants screened with chest CT for COVID-19, 126 participants (54%) had one or more incidental findings and 53 participants (23%) had a clinically relevant incidental finding (coronary artery calcifications, suspicious breast and lung nodules), requiring further clinical investigation.[9]

Studies in the setting of coronary artery disease and lung cancer screening have shown that incidental findings are not uncommon.[9] Most of these findings do not have a clinically relevant implication; however, a small amount may be considered relevant, depending on the method of analysis used and the definition given to incidental findings.[9]

Thus, the detection of incidental findings may be considered desirable, since early diagnosis of clinically silent and potentially serious lesions contributes to decreased morbidity and mortality.[9] However, it is worth noting that further diagnostic investigation of these incidental findings may lead to unnecessary additional costs and increased anxiety, time, and risk of iatrogenic complications.[9]

Koning et al. (2020), in a randomized, controlled, population-based study initiated in 2000, the NELSON Study, revealed a reduction in the relative risk of death from lung cancer of 24% over ten years among men (rate ratio 0.76; p=0.01) and 33% among women (rate ratio 0.67, ranging from 0.41 to 0.52 between years seven and nine of follow-up).[10] That is, this study showed that patients screened with low-dose CT had lower lung cancer mortality rates compared to those without CT screening.[10]

According to the new guideline released by the European Society for Medical Oncology, patients presenting with suspicious nodules or masses on chest CT should also undergo additional diagnostic procedures and biopsies.[11] A new guideline has also been released by the American College of Chest Physicians recommending delaying cancer screening for lung nodules smaller than eight millimeters with advanced diagnostic procedures for nodules at higher cancer risk.[12] According to the Center for Disease Control and Prevention guideline, considering the pandemic context, diagnostic procedures should be delayed if delaying them would not have a detrimental outcome for the individual.[13]

The pandemic of SARS-CoV-2 infections has brought a number of challenges and lessons to healthcare teams around the world. The massive use of highly sensitive diagnostic methods, such as chest CT scanning, poses an additional challenge in dealing with incidental findings, requiring good clinical judgment to avoid unnecessary investigations and to avoid leaving early and asymptomatic disease undiagnosed and untreated.

CONCLUSION

As it is a retrospective observational study with a relatively modest sample, the present study has certain limitations, mainly in relation to the generalization of its results. However, it can be considered a valuable contribution as a source of initial information so that further studies can be carried out, including providing long-term patient follow-up data, so that the outcomes related to the identification of incidental findings on chest CT can be known for patients with SARS-CoV-2 infection, enabling a better correlation between risk factors for chest diseases and sociodemographic data, such as smoking, COPD, gender, and age group.

REFERENCES

1. Shoji H, Fonseca EKUN, Teles GBS, Passos RBD, Yanata E, Silva MMA, Funari MBG, et al. Relatório estruturado de tomografia computadorizada de tórax para a pandemia do COVID-19. einstein (São Paulo). 2020;18:eED5720. https://doi.org/10.31744/einstein_journal/2020ED5720.
2. Deroose CM, Lecouvet FE, Collette L, et al. Impacto da crise do COVID-19 na imagem em estudos oncológicos. Eur J Nucl Med Mol Imaging. 2020;47(9):2054-2058.
3. Meirelles GSP. COVID-19: a brief update for radiologists. Radiol Bras. 2020. 53(5):320-328. https://doi.org/10.1590/0100-3984.2020.0074.

4. Yekedüz E, Karcıoğlu AM, Utkan G, Ürün Y. A clinical dilemma amid COVID-19 pandemic: missed or encountered diagnosis of cancer? Future Oncol. 2020;16(25):1879-81.

5. Bertolazzi P, Melo HJ de F e. A importância da Tomografia Computadorizada no diagnóstico da COVID-19 / The importance of Computed Tomography in diagnosis of COVID-19. Arq Med Hosp Fac Cienc Med Santa Casa São Paulo [Internet]. 6º de maio de 2020 [citado 2º de agosto de 2021];65(1):1 of 4. Disponível em: https://arquivosmedicos.fcmsantacasasp.edu.br/index.php/AMSCSP/article/view/590.

6. Oliveira Pinheiro D, Franco Costa Lima C, Santos Leite Pessoa M, Bezerra Holanda JL. ACHADOS NA TOMOGRAFIA DE TÓRAX NO PACIENTE COM COVID-19. Cadernos ESP [Internet]. 21º de maio de 2021 [citado 3º de agosto de 2021];15(1):122-8. Disponível em: //cadernos.esp.ce.gov.br/index.php/cadernos/article/view/353.

7. Rosa MEE, Matos MJR, Furtado RSOP, Brito VM, Amaral LTW, Beraldo GL, Fonseca EKUN, et al. Achados da COVID-19 identificados na tomografia computadorizada de tórax: ensaio pictórico. einstein (São Paulo). 2020;18:eRW5741. https://doi.org/10.31744/einstein_journal/2020RW5741.

8. Koo MM, Rubin G, McPhail S, Lyratzopoulos G. Câncer diagnosticado incidentalmente e cenários clínicos comumente anteriores: uma análise descritiva transversal de dados de auditoria em inglês. BMJ Aberto. 2019;9(9):e028362.

9. Kilsdonk ID, de Roos MP, Bresser P, Reesink HJ, Peringa J. Frequency and spectrum of incidental findings when using chest CT as a primary triage tool for COVID-19. Eur J Radiol Open. 2021;8:100366.

10. Koning, HJ, *et al*. Reduced lung-cancer mortality with volume CT screening in a randomized trial. N Engl J Med. 2020;382:503–513.

11. Passaro A, Addeo A, Von Garnier C, Blackhall F, Planchard D, Felip E, et al. ESMO Management and treatment adapted recommendations in the COVID-19 era: Lung cancer. ESMO Open. 2020;5(Suppl 3).

12. 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: CHEST Expert Panel Report. Radiol Imaging Cancer. 2020;2(3):e204013.

13. Centers for Disease Control. Framework for healthcare systems providing non-covid-19 clinical care during the COVID-19 pandemic (2020).

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