



# Spontaneous pneumomediastinum in patients with COVID-19 pneumonia

## Pneumomédiastin spontané au cours de l'infection à Coronavirus-19

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### ABSTRACT

**Introduction:** Spontaneous pneumomediastinum (SPM) is a rare affection in general population. Only few cases have been reported during this ongoing global pandemic of Coronavirus-2019 (COVID-19). The ethiopathogeny of this complication is poorly understood.

**Observations:** we reported ten cases of SPM complicating coronavirus pneumonia. There were six men and four women. Age varies from 32 to 66 years. Pneumonia was severe for all cases defined by a blood oxygen saturation < 90% on admission. All patients were hospitalized in intensive care unit and treated by high-flow oxygen for nine patients and non-rebreather masks for one patient. Repeated chest computed tomography (CT) scan showed resolution of the pneumomediastinum and appearance of signs of pulmonary fibrosis for four cases.

**Conclusions:** Chest CT scan must be performed in front of any sudden deterioration in respiratory status of patients with COVID-19 pneumonia to not miss mechanical complication such as SPM. This complication seems to be associated with severe forms of COVID-19.

**Key words:** Severe acute respiratory syndrome coronavirus 2, Diagnostic, Complication, prognosis

### RÉSUMÉ

**Introduction :** Le pneumomédiastin spontané est une affection rare dans la population générale et seulement quelques cas ont été décrits au cours de la pandémie actuelle à COVID-19. Ses mécanismes étiopathogéniques demeurent mal élucidés.

**Observations :** Nous rapportons les observations de dix patients hospitalisés pour une pneumopathie COVID-19 et qui ont présenté un pneumomédiastin spontané. Il s'agit de six hommes et de quatre femmes d'âge compris entre 32 et 66 ans. La pneumopathie était sévère (définie par une saturation pulsée en oxygène à l'admission < 90%) dans tous les cas et a nécessité un séjour en réanimation avec recours à l'oxygénothérapie à haut débit à l'aide de canule nasale pour neuf patients et par masque haute concentration pour un seul patient. Le pneumomédiastin est survenue à plus de sept jours de l'oxygénothérapie haut débit pour tous les patients et était associé à un pneumothorax bilatéral dans un seul cas.

L'évolution était favorable pour tous les patients avec sevrage de l'oxygène et résorption du pneumomédiastin. On a noté l'apparition de signes de fibrose pulmonaire au scanner de contrôle à trois mois pour quatre patients.

**Conclusions :** le pneumomédiastin spontané, bien que rare, doit être évoqué devant toute aggravation respiratoire chez un patient suivi pour une COVID-19 et doit faire réaliser une imagerie thoracique. Il serait associé à des formes sévères de cette maladie et à des phénomènes inflammatoires intenses conduisant parfois à des lésions de fibrose pulmonaire nécessitant un suivi prolongé.

**Mots clés :** Coronavirus 2 du syndrome respiratoire aigu sévère, Diagnostic, Complication, Pronostic

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## INTRODUCTION

Spontaneous pneumomediastinum (SPM) is defined by the presence of free air in the mediastinum without an apparent cause such as thoracic trauma, surgery, or any other medical procedure (1). This is a rare entity in the general population occurring in one case out of 32896 patients (2). During the 2002 epidemic of severe acute respiratory syndrome (SARS), SPM was common (1) and up to 11.6% of cases were reported by Chu et al. (2), whereas only a few cases have been reported in the literature during the pandemic of severe acute respiratory syndrome coronavirus 2 (SARS-CoV2). Incidence of this affection and their involved factors are still unclear (1).

Through the observations of 10 cases of SPM complicating SARS-CoV2 infection, we aimed to discuss the mechanisms involved in its occurrence as well as its clinical and evolutionary particularities.

## METHODS AND RESULTS

Among a series of 384 SARS-CoV pneumonia hospitalized in the pneumology department in Mohamed Taher Maamouri hospital

between november 2020 and august 2021, we have reported ten cases of SPM (Table1). These were six men and four women. The patients' age varies from 32 to 66 years. One asthmatic woman was pregnant at her third trimester on admission. No patient was smoker. COVID-19 was confirmed by Reverse Transcription Polymerase Chain Reaction in all cases. Pneumonia was severe for all patients defined by a blood oxygen saturation < 90% on admission (3). All patients were hospitalized in intensive care unit. Oxygen was provided by high-flow nasal canula for nine patients (oxygen flow ranging from 40 to 60 l/min) and non-rebreather masks for one patient. All patients had been a systemic corticosteroid therapy by Dexamethasone with a minimum dose of eight mg per day. In addition to the pneumomediastinum, CT scan showed ground-glass opacity and pulmonary condensation extended to more than 75% of the pulmonary parenchyma for seven patients and affecting 50 to 75% of the parenchyma for the three others (Figures 1 and 2). A segmental pulmonary embolism was associated in one patient and bilateral pneumothorax in another. SPM occurred between 11 and 45 days of symptoms and between 7 and 31 days of corticosteroid therapy.

**Table1.** Detailed data of the 10 patients

Patient	Sex	Age	BMI	Comorbidity	Modalities of oxygen therapy	Extent of CT involvement/ associated abnormalities	Pulmonary fibrosis on 3 months CT
1	M	43	30	No	HFNC	>75%	No
2	M	53	28	Diabetes mellitus	HFNC	50-75%	Lost to follow-up
3	M	58	21	Diabetes mellitus	NB masks	>75% / PE	Yes
4	M	47	34	Arterial hypertension	HFNC	>75%	Yes
5	W	51	31	No	HFNC	80%	Yes
6	W	32	39	Asthma	HFNC	>75%	Lost to follow-up
7	W	53	29	Diabetes mellitus	HFNC	50-75%	Lost to follow-up
8	M	43	26	No	HFNC	>75%	No
9	W	46	22.4	No	HFNC	80% / PNO	No
10	M	66	28	No	HFNC	50-75%	Yes

BMI : body mass index; CT : computed tomography; HFNC: high flow nasal canula; NB : non-rebreather; P: patient; PE : pulmonary embolism; PNO : pneumothorax, ; W : Women ; M : men



**Figure 1.** Cross section Chest computed tomography showing pneumomediastinum (white arrow) peripheral and subpleural ground glass patches (black arrow)



**Figure 2.** Cross section Chest computed tomography showing pneumomediastinum (white arrow) peripheral and subpleural ground glass patches and pulmonary consolidations (black arrows)

In the case of pneumothorax, a bilateral chest drain was required. All patients were discharged after oxygen withdrawal. Seven patients had a three months CT scan control. Four cases had developed pulmonary fibrosis.

## DISCUSSION

Ten cases of SPM have been reported among a series of 384 COVID-19 pneumonia. All patients were hospitalized in intensive care unit requiring systemic corticosteroid and oxygen therapy by high-flow nasal cannula for nine patients and by non-rebreather masks for one patient. No death was noticed. Four patients developed pulmonary fibrosis on three month CT scan. COVID-19, a multi-systemic affection caused by SARS-CoV2 virus, has a respiratory system tropism. Main CT feature detected in COVID-19 pneumonia are peripheral and subpleural ground glass patches and pulmonary consolidation. Other less typical CT findings, found in almost 10% of cases, are pseudonodular condensations, unilateral pulmonary involvement or pleural effusion (4). During this current pandemic, pneumothorax and pneumomediastinum were rare complications of COVID-19 pneumonia and only few cases of SPM have been reported in the literature (1). SPM occurred when there is a sudden increase in intra-alveolar pressure resulting in alveolar rupture.

Therefore, releasing air centripetally dissects the pulmonary interstitium and migrates through the peribronchial and perivascular sheaths to the mediastinum (5).

The associated factors with this affection, as reported in the literature, are male gender and the preexistence of lung disease. Nevertheless, SPM has been described in patients free of any past history of respiratory disease as is the case for nine of our patients (6).

Potential ethiopathogenic mechanisms involved in the occurrence of SPM remain unclear. In the context of COVID-19, weakening of the respiratory epithelium by inflammatory phenomena associated with increased intrathoracic pressure during coughing efforts has been reported (1). Moreover, high-flow oxygen therapy is believed to be implicated in the genesis of SPM. Indeed, a moderate level of continuous positive pressure was measured with this device of the order of 2.9 cmH<sub>2</sub>O at a flow rate of 20l/min increasing to 7.4 at a flow rate of 60 l/min. Thus, this

positive pressure may cause a barotrauma (7).

Pneumomediastinum would be facilitated when barotrauma occurs on a lung previously weakened by systemic corticosteroid therapy. Indeed, a deleterious action of this medication on the respiratory epithelium has been reported by some authors. However, the time between the beginning of this treatment and the onset of SPM has not been specified (5). In our observation, all patients received more than 10 days of systemic corticosteroid and nine of them required high-flow nasal cannula oxygen therapy.

Chest radiography with both posteroanterior and lateral views is usually sufficient for the diagnosis.

Chest CT is needed in the presence of clinical suspicion with a negative chest X-ray or to rule out a secondary pneumomediastinum (1).

During COVID-19 pneumonia, SPM was considered as a factor of poor prognosis by some authors. It was also associated with fatal issue (6). All our cases were hospitalized in intensive care unit. No death was noted, but a progression toward pulmonary fibrosis was observed in four cases, attesting to the intensity of initial inflammatory phenomena.

Treatment of isolated SPM without pneumothorax is based on symptomatic measures combining analgesic treatment, bed rest and oxygen therapy. Its evolution is toward spontaneous resolution after a few days (1).

## CONCLUSION

Although it is a rare complication during COVID-19 pneumonia, SPM should be considered in front of any worsening of respiratory status in patients with SARS-CoV2 infection and chest imaging must be performed. Its evolution is usually spontaneously favorable; however, cardiorespiratory monitoring is necessary because of the risk of complications including cardiac tamponade that may sometimes require urgent surgical drainage.

## REFERENCES

1. Complication of COVID-19. *Rev Mal Respir* 2020; 37 :680-3.
2. Chu C M, Leung Y Y, Hui J Y H, Hung I F N, Chan V L, Leung W S et al. Spontaneous pneumomediastinum in patients with severe acute

- respiratory syndrom. *Eur Respir J* 2004; 23: 802-4.
3. World Health Organization. COVID-19 clinical management: living guidance, 25 November 2021
  4. Li Y, Xia L. Coronavirus disease 2019 (COVID-19): role of chest CT in diagnosis and management. *Am J Roentgenol* 2020;214:1280-6
  5. Allaoui A, Aboudib F, Bouissar W, Echchilali K, Moudatir M, Alaoui F Z et al. Spontaneous pneumomediastinum: A rare complication of dermatomyositis. *Rev Pneumol Clin* 2017; 73: 258-62.
  6. Reyes S, Roche B, Kazzaz F, Ocasionez D, Lal A, Martin R et al. Pneumothorax and pneumomediastinum in COVID-19: a case series. *Am J Med Sci* 2020 ; 20 : 30512-7.
  7. Groves N, Tobin A. High flow nasal oxygen generates positive airway pressure in adult volunteers. *Aust Crit Care* 2007; 20: 126-31