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Original Research Article (Clinical)

Ayurvedic clinical profile of COVID-19 — A preliminary report

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ABSTRACT

Background: Ayurvedic clinical profiling of COVID-19 is a pre-requisite to develop standalone and integrative treatment approaches. At present, Ayurvedic clinicians do not have access to COVID-19 patients in clinical settings. In these circumstances, a preliminary clinical profiling of COVID-19 based on review of modern medical and classical Ayurvedic literature with inputs from Allopathic clinicians treating COVID-19 patients assumes significance.

Objectives: This paper aims to develop an Ayurvedic clinical profile of COVID-19 by literature review supported by analysis of clinical data of a cohort of COVID-19 patients.

Methods: The typical clinical presentation of COVID-19 was categorized based on a cluster of symptoms with reference to “Interim Clinical Guidance for Management of Patients with confirmed coronavirus disease (COVID-19)” released by the US CDC. As the clinical presentation is found to vary widely, research papers reporting clinical symptoms of patient samples from different parts of the world were also reviewed to identify outliers and atypical presentations. Case records of fourteen COVID-19 patients treated at Medanta Hospital, Gurgaon were analyzed to compare symptomatology with data obtained from published literature. Further, a careful correlation was done with the data collected from selected Ayurvedic classical texts and expert views of clinical practitioners to arrive at a preliminary Ayurvedic clinical profile of COVID-19.

Results: COVID-19 can be understood from the Ayurvedic perspective as viñakapha dominant sanātipatajāvara of agantu origin with pittānubandha. The asymptomatic, presymptomatic, mild, moderate, severe and critical stages of COVID-19 with varying clinical presentations have been analysed on the basis of nidāna, doṣa, āyurveda, nidanaparicāka and sārṣṭijāyakā to present a preliminary clinical profile of the disease.

Conclusion: In this paper, we have demonstrated that a preliminary clinical profiling of COVID-19 from the Ayurvedic perspective is possible through literature review supported by discussions with Allopathic clinicians as well as examination of patient case records. The provisional diagnosis proposed can be further developed with continued review of literature, wider cooperation and teamwork with Allopathic physicians and access to clinical data as well as direct clinical assessment of COVID-19 patients.

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1. Introduction

The COVID-19 pandemic has tightened its grip on India. India does not figure in the most severely affected countries [1] but fares worse than the top affected nations in key medical infrastructure
and health care investments. India has fewer hospital beds and doctors per 1000 people than any of the countries affected by COVID-19 [2]. In terms of personal hygiene, a section of the population may not even have adequate facilities for washing hands with soap frequently or hand sanitizers, a basic preventive measure [3]. Moreover, those who progress into critical stages would require intensive care and this can pose a major challenge for the limited hospital resources and capacities in case of a sudden spike in infections.

Considering the fact that COVID-19 requires a structured approach covering preventive care, management in early stages of confirmed disease as well as hospital care for moderately and critically ill patients, it is imperative that the capacity of the AyUSH sector is harnessed to ensure optimal use of the scarce health care resources available in the country. The World Health Organization has also recommended inclusion of traditional medicine in its COVID-19 strategic preparedness and response plan [4]. The focus should not be to just deploy this workforce as a standby option, but to utilize its therapeutic management potential in complementing the treatment administered by modern medicine. Pluralism is one of the core principles in Indian health system as outlined in the National Health Policy 2017, which calls for integrative health practices to achieve national health goals and objectives [5].

To move in this direction, it becomes necessary to develop an Ayurvedic diagnostic and treatment protocol for integration into the standard treatment guidelines of COVID-19. We have a precedent in China, where Traditional Chinese Medicine (TCM) doctors were actively involved in the treatment of COVID-19 patients and the TCM diagnostic classification as well as treatment was integrated into the official management guideline. More than 60,000 patients received TCM medications based on this protocol [6] and TCM interventions have also been included in the official handbooks that recommend protocols for management of COVID-19 [7]. TCM interventions have also figured in research studies that have been initiated to discover a remedy for the disease [8].

In this paper, we are demonstrating that it is possible for Allopathic and Ayurvedic doctors to cooperate and work together to understand the disease better from an Ayurvedic perspective. This will be the first step to develop an integrative treatment protocol incorporating Ayurveda for best outcomes in the management of COVID-19.

An Ayurvedic assessment of the disease can help to classify the clinical presentations of COVID-19 on the basis of the tridosha framework (the three doshas called vata, pitta and kapha represent the self-regulatory mechanisms of the body, the failure of which leads to development of disease). It is seen that the clinical presentations of the patients are different with the lower respiratory, gastrointestinal or upper respiratory systems being variably affected in patients [9]. The question that we are addressing in this paper is whether such clustering of symptoms can be interpreted based on an Ayurvedic understanding of the pathogenesis with reference to imbalance of tridoshas. This would lead to development of appropriately specific Ayurvedic interventions that can be integrated into the evolving COVID management protocol.

2. Methodology

In the prevailing circumstances, Ayurvedic physicians are unable to directly examine COVID-19 patients clinically. For this reason, a triangulation approach has been used for the study. The steps were 1) Study the existing clinical data from review of current scientific literature, 2) Review prospective clinical data collected from hospital documentation and regular discussion with the clinicians treating COVID19 patients and 3) Review relevant Ayurveda literature with the inputs of expert clinicians. The three-pronged strategy in the respective sequence covered the following aspects:

A detailed literature review of the reported typical clinical presentation based on existing data sources such as journal articles and interim clinical guidance on management of patients by agencies such as US CDC (as on April 30, 2020) was undertaken [9]. The global overview reports were screened for key terms relating to COVID19 symptoms, pathogenesis and stagewise understanding. As the clinical presentation is found to vary widely, research papers reporting clinical symptoms of patient cohorts from different parts of the world were also reviewed to identify outliers and atypical presentations.

A quick scoping of PubMed found around 569 articles on COVID19 based on a search with the key words COVID 19, symptoms. It was found that papers reported symptoms related to COVID-19 from specific clusters and cohorts of patients and the information could not be generalized to the larger population. Interim guidelines issued by international agencies like US CDC and WHO [10], which were drafted by reviewing published research papers were selected to study the clinical presentation of COVID-19. Eighteen most relevant papers reviewed by US CDC and WHO were shortlisted for a detailed review based on the following inclusion criteria: 1) Papers reporting from large sample of COVID-19 patients from representative regions of the outbreak of COVID-19, 2) Papers reporting typical presentations of the disease, 3) Papers reporting atypical presentations of the disease.

Clinical case documentations of fourteen COVID-19 patients treated at Medanta Hospital, Gurgaon was examined prospectively. Necessary ethical approval for patient data review was obtained and a confidentiality agreement was signed with the hospital. Baseline data was compiled with a structured questionnaire covering clinical symptomatology and laboratory reports of each patient at the time of admission. This data also included assessment of co-morbidities and other prescriptions at the time of admission. A second set of data was collated, summarizing assessments done during hospital stay. Regular discussions and interactions with the treating allopathic clinicians during the course of management provided individual case narratives and focused clinical perspectives about each patient.

Subsequently, an independent analysis of Ayurvedic literature was carried out. This included three major classical texts (Bhattacharya – Carakasamhiṭṭa, Susrutasaṃhitā, Aṣṭāṅga-ṛṣṭiyāyam and their important commentaries (by Cakrapañi, Aruṇadatta, Hemaṅdri, Indu and Dālhana). In addition, specific diagnostic literature viz. the Jvaranirnaya (an exclusive text on management of fevers), Yogaratnakara (a medieval textbook on Ayurveda), Bhavaprakasa and Madhavanidana (a classical text on diagnosis, etiopathogenesis and differential stage wise classifications) were also studied. Five clinical conditions described in these texts were examined to develop correlation with COVID-19. These were fever (jvara), cough (kāsa), dyspnoea (śvāsa), consumption (rājāyakṣma) and poisoning (visā) including Ayurvedic descriptions of the co-morbidities that indicate poor prognostic outlook for COVID-19. Since COVID-19 is a new disease and not previously described in Ayurvedic classical texts, a detailed study of the etiology (nīdana), status of tridosha, structural elements (dīya) and site of disease (sthāna) was done. The book Siddhāntanidana by Gaṇanātha Sen was reviewed to understand approaches to study new diseases based on principles of Ayurveda. The analysis of sections on epidemics (janapadodhvaṁsa) and diseases of exogenous origin (āgantukavikāra) were also undertaken. Host-pathogen specific interactions as observed in COVID-19 were analysed on the basis of the Ayurvedic understanding of the clinical progression of āgantukā diseases. The pathogenesis of the disease was traced from the point of contact with the causative agent (SARS-CoV-2) and its development through the asymptomatic,
presymptomatic, mild, moderate, severe and critical stages culminating in recovery or death. This was also corroborated with insights from experienced Ayurveda physicians in the team.

3. Results

3.1. Disease profile as per current scientific literature

The incubation period of the SARS-CoV-2 virus is approximately two weeks. Symptoms can manifest within 4–5 days after infection and majority will become sick by 11–12 days. In rare cases it can be delayed even up to 24 days [11].

According to the US CDC, symptoms present at onset of COVID-19 are highly variable. However, in the stage of full-blown disease, 83–99 percent of patients develop fever, 59–82 percent have cough, 44–77 percent have fatigue, 40–84 percent have anorexia, 31–40 patients have shortness of breath, 28–33 percent have sputum production and 11–35 percent have myalgias [9].

Fever, Cough (dry) and Shortness of breath are considered to be the cardinal symptoms of COVID-19. Recently, CDC has added other symptoms to the list like Chills, Repeated shaking with chills, Muscle pain, Headache, Sore throat and New loss of taste or smell [12].

Atypical presentations are mainly seen in older adults and persons with co-morbidities [13]. Fever was absent in up to 44 percent of patients at the onset of the disease, but 89 percent developed fever during hospital stay [14].

Some patients present with gastrointestinal symptoms like diarrhea and nausea and no respiratory symptoms [15]. Vomiting and diarrhea are seen only in less than 10% of the cases. Likewise, upper respiratory symptoms like sore throat, rhinorrhea and headache are sporadically reported. Hemoptysis may also be seen in a similar percentage of cases [14,16–18]. Skin eruptions have been rarely reported [19]. It has been observed in certain cohorts that some patients experienced diarrhoea as first symptom and presented for care later than those with respiratory symptoms [20].

Although age is a higher risk for a bad prognosis, even people in the younger age group without co-morbidities have higher risk of death than that of seasonal influenza [21]. Patients with comorbidities like diabetes, hypertension, cardiovascular disease, cancer are at a high risk for complications and death due to COVID-19 [22].

Interestingly, patients tested positive for COVID-19 have also been reported to be asymptomatic as noticed with patients aboard the ship Diamond Princess [23]. Though subsequent studies have been conducted, the percentage of this occurrence is not accurately known. One study estimated that more than one fourth tested positive for COVID-19 could be asymptomatic [24]. Another study said up to four fifths of those tested positive could be asymptomatic [25]. It has been reported that asymptomatic patients can have typical ground-glass opacities or patchy shadowing in the CT Scans [26,27]. See Table 1 for typical and atypical symptoms of COVID-19.

The US CDC classifies COVID-19 into the following categories based on severity of the presentation.

- Mild to moderate (mild symptoms up to mild pneumonia): 81%
- Severe (dyspnea, hypoxia, or >50% lung involvement on imaging): 14%
- Critical (respiratory failure, shock, or multiorgan system dysfunction): 5%

In the critical stage of COVID-19, patients present with severe hypoxemia, pneumonia and ARDS. If the disease becomes severe, then shortness of breath indicating pneumonia can develop with or without high grade fever. It can progress to severe pneumonia and ARDS of varying severity, which can be life threatening. In the event of an over-exuberant immune response, complications can arise as a result of damage to the lungs. Pneumonia may be mild or severe, ARDS may be mild, moderate or severe requiring oxygenation or ventilator support. Especially in some young people, the immune system can go into an overdrive and manifest the cytokine storm syndrome, which can cause severe lung damage and death. The SARS-CoV-2 induced infection can also be associated with a coagulopathy. CAC (COVID-19 associated coagulopathy) is the acronym used to describe the coagulation changes in COVID-19 patients [28].

In an observational study from Wuhan, China, cardiac injury was seen in 19.7% of patients with confirmed coronavirus disease 2019 (COVID-19) and was an independent predictor of in-hospital mortality [29]. Acute Hemorrhagic Necrotizing Encephalopathy (AHNE), a rare complication of influenza and other viral infections has also been reported in COVID-19 [30]. Liver injury has also been reported in some patients [31]. Sepsis or Septic shock can also set in leading to life threatening situation [10].

Literature review of published studies reveal that COVID-19 patients can have varied clinical presentation with absence of symptoms or atypical presentations in a number of patients.

3.2. Clinical data from a cohort of COVID-19 patients

3.2.1. Patient background

We examined case records of fourteen COVID-19 patients treated at Medanta Hospital, Gurgaon. All were Italian citizens who came to India as tourists and were tested for COVID-19 when some
of them developed symptoms and were admitted to Medanta Hospital.

3.2.2. Patient age group
Except for one patient aged 45, all other patients were in the age group ranging from 60 to 80 years.

3.2.3. Co-morbidities
Seven of the patients had comorbidities out of which ten had diseases that have been identified as high risk for patients with a diagnosis of COVID-19. There were six patients with hypertension, three with cardiac diseases, one with diabetes and one with benign prostate hypertrophy.

3.2.4. Condition at admission
Five patients were asymptomatic at the time of admission and the other nine patients had only mild symptoms.

3.2.5. Symptom profile
In the course of hospital stay, all fourteen patients developed cough, which was the most prominent symptom seen in this cohort. The next common symptom reported was throat pain, which was seen in twelve patients. The third common symptom was fever, which was mostly intermittent and was seen in eleven of the patients. Headache and myalgia were seen in nine and eight patients respectively. Only four patients developed dyspnea, of which two had mixed (inspiratory and expiratory type). Other symptoms reported in decreasing order of frequency are were insomnia, giddiness, loss of appetite, fatigue, severe anxiety, nasal obstruction, nasal discharge, nausea, diarrhea, arthralgia, cold chills, general edema, delerium and confusion. In all, twenty symptoms were reported in this cohort of COVID-19 patients. See Table 1 for symptom profile of the patients.

3.2.6. Clinical course
All the patients who developed dyspnea progressed to acute respiratory distress and required oxygen support. Three of them were hypertensive, one also had cardiovascular disease and one had BPH. Patient 6, who was hypertensive and had cardiac disease, became very critical requiring ventilatory support as well as prolonged stay in hospital and eventually died on the 37th day. This patient (P6) tested negative on the 18th day but again tested positive on the 24th day before turning severely critical. P6 had exhibited severe anxiety and irritability during the hospital stay and also reported the maximum number of thirteen symptoms. Patient 7 was the fastest to recover, testing negative on the fifteenth day and was discharged on the eighteenth day. All other patients tested negative on the seventeenth day and were discharged on the twentieth day.

3.2.7. Medications
Concomitant medications for co-morbidities were continued. Symptoms like fever and aches were managed with antipyretics and analgesics. Antacids were administered for gastrointestinal symptoms. Few patients were also administered sedatives. Vitamin supplements, especially Vitamin C was also administered. Ritonavir-lopinavir combination was administered to three of the four patients who developed ARDS. Hydroxychloroquine and Azithromycin were administered to two of the patients who became severe including the one patient who died.

3.2.8. Comparison of patient data with findings from literature review
We found that the clinical presentation and course of the cohort of COVID-19 patients matched more or less with findings from literature review of published papers. In this cohort, 35% of patients were asymptomatic at the time of admission and except for three patients who developed severe disease (21.43%) and one patient who became critical (7.14%), others developed mild to moderate symptoms during hospital stay (71.43%). P6 became critical and died (7.14%). The higher percentage of patients in the severe and critical category is an expected finding, considering the advanced age of the patients as well as presence of co-morbidities. Cough, throat pain and fever were dominant in this cohort, which have been reported as typical symptoms of COVID-19 patients. The symptoms seen were mainly related to upper and lower respiratory tract. Some patients also reported symptoms related to gastrointestinal tract. Apart from other generalized symptoms like fever and myalgia, psychological symptoms were also seen in some patients. A critical analysis of the data from this cohort of patients from an Ayurvedic perspective is included in the section on discussion. See Supplementary Table 2 for summary of clinical data from this cohort of patients.

As Ayurveda physicians do not have direct access to COVID-19 patients, it was not possible to conduct Ayurvedic clinical examination procedures like trividhāparikṣa, aṣṭāthanāparikṣa or daśavidhāparikṣa. Clinical symptoms were not directly documented by Ayurvedic physicians or those with in-depth understanding of Ayurveda. Considering these limitations, it is possible that symptomatology that is of relevance for Ayurvedic assessment may not have been recorded.

3.3. Disease profile in the light of review of classical ayurvedic literature
We found that Suśrutaśāṃhitā has described epidemic fevers presenting with cluster of symptoms like cough, breathing difficulty, vomiting and headache, which resembles fevers causing severe acute respiratory syndrome (SARS) [Su.S. Su.St. 6.19–20] [32]. Dalhana, the commentator additionally refers to symptoms like anosmia (gandhaṅjana), which are of interest in understanding COVID-19. He also points to the nasal passages as the point of contact with the causative agent of the disease [Su.S. Su.St. 6.19–20] [32]. Suśrutaśāṃhitā does not refer to a specific disease as a well-defined nosological entity in this context, rather only hints at the possibility of epidemic outbreaks of severe respiratory illnesses that resembles SARS and COVID-19 like illnesses. The Carakasāṃhitā devotes an entire chapter for discussion on epidemic diseases and points out how people with different constitutions can be affected by the same disease due to the influence of common etiological factors like air, water, place and time, but does not list or describe specific epidemic diseases [Ca.S. Vi.St. 3.3–6] [33].

Suśrutaśāṃhitā also lists fevers among diseases that are contagious [Su.S. Ni.St. 5–34] [32]. Out of the eight broad categories of fevers described in Ayurveda, the agantuvāyas are caused by external agents [Ca.S. Ni.St. 1.77] [33]. Abhiṣārāgajyava is one of the sub-categories of agantuvāya which includes a sub-type of fever called bhūtabhīṣārāgajyava [Ca.S. Ni.St. 3.111–112, 114–115] [33]. Cakrapāṇidatta clarifies that bhūta means viṣākmi or a virulent organism [Ca.S. Su.St.1.121] [33]. Further, Vijayarakṣita, the commentator of Madhavanandiṇa points out that diseases caused by bhūtopasarga (invasion of bhūta like viṣākmi) can be contagious and spreads from person to person [Ma.Ni. 49.42–43] [34]. Micro-organisms and contagion were well recognised in Ayurveda classical texts. The term kmi generally denotes pathogenic organisms but also includes organisms which are microscopic and not visible to the naked eye (kecid saukṣmyād aḍārāsā) [Ca.S. Vi.St. 7.11] [33]. Such kmis are sohaja (natural) or vaikārika (pathogenic) [Ca.S. Vi.St. 7.11] [33]. Cakrapāṇidatta points out that the natural micro-organisms in the body are not counted here and this is perhaps a very
Table 2
Symptoms of Sannipatajvara reported in COVID-19.

| Symptoms of Sannipatajvara | Mention in Samhitā | Reported in COVID-19 | Reference |
|-----------------------------|---------------------|----------------------|-----------|
| (These are general symptoms of all types of Sannipatajvara and all symptoms may not be seen in all cases) | Frequency | Stages |
| 12 jvarah (fever) | C, S, V | Very common | All stages | WHO [58], CDC [9,12] |
| 1 srashtāgata param (looseness of body parts) | C | Not reported | | |
| 2 gurusrastraṅgasandhitā (heaviness and looseness of body parts) | V | Not reported | | |
| 3 suptāgata (numbness of body) | S | Not reported | | |
| 4 stambhā (stiffness) | S | Not reported | | |
| 5 kṛṣṭāvaṁ nātāgarāṇaṁ (does not lose weight significantly) | C | Not reported | | |
| 6 kṣaṇe dāhāṁ kṣaṇe stītam (alternating heat and cold feeling) | C, S, V | Sometimes | Random | Worldometer [59] |
| 7 ṛṣaṇā (thirst, dehydration) | C, S | Common | Random | Seen in viral infections and also COVID-19 |
| 8 śvādāmutrapurāṇānāṁ ciraṁdārianāmānampāṣāḥ (reduced sweating, output of urine and defecation) | C, S | Reduced output of urine is reported in cases with dehydration | | |
| 9 balabhruṇaṁ (loss of strength) | V | Common | Random | NRC [60] |
| 10 bhramhaṁ (dizziness, giddiness) | C, S, V | Sometimes | Random | URBCS [61] |
| 11 tandaṛa (fatigue) | C, S | Common | Random | WHO [58], CDC [9,12] |
| CUTANEOUS SYMPTOMS | | | |
| 14 mūhuṁ śvedah (repeated sweating) | V | Sometimes | Random | Worldometer [59] |
| 15 atisvedah (excessive sweating) | V | Sometimes | Severe/Critical | Worldometer [59] |
| 16 aiśvedaḥ (absence of sweating) | V | Not reported | | |
| 17 kōthānāṁ śvāvāraktānaṁ mandalānaṁ ca dāriṇām (greyish red skin eruptions) | C, V | Rare | Random | WHO [58] |
| RESPIRATORY SYMPTOMS | | | |
| 18 kāśaṁ (cough) | C, V | Very common | All stages | CDC [9,12] |
| 19 śvāsah (dyspnoea) | C, S, V | Common | All stages | CDC [9,12] |
| 20 kāṇṭhaṁ śūkārīvāraṁ (sore throat) | C, V | Common | All stages | CDC [9,12] |
| 21 svarasaṁ (hoarseness of voice) | V | Sometimes | Random | CDC [9] |
| 22 sūrōtaṁ pākhaṁ (inflammation of nasopharynx, oropharynx and respiratory passages) | C, S | Sometimes | Random | CDC [9] |
| 23 pṛatāntaṁ kāntāhkuṇānaṁ (abnormal breath sounds in throat region) | C, S | Sometimes | Severe/Critical | Yinghui Huang et al [46] |
| 24 ṣīthivaṁ raktaṭtāṣaṁ kāhenōnāmśirṣaṁ ca (hemoptysis) | C, V | Rare | Random | CDC [9] |
| GASTROINTESTINAL SYMPTOMS | | | |
| 25 aruchiḥ (anorexia) | C, S | Common | Random | CDC [9] |
| 26 guruvatmudaraśya (heaviness of abdomen) | C | Not reported | | |
| 27 malasamsaṁgaṁ (constipation) | V | Not reported | | |
| 28 malāṁ ālapo praṛvṛtth (reduced defecation) | V | Not reported | | |
| 29 malāṁ āti praṛvṛtth (diarrhoea) | C, V | Common | Random | CDC [12], WHO [58] |
| MUSCULOSKELETAL SYMPTOMS | | | |
| 32 āsthirāṁ (pain in bones) | C, S, V | Sometimes | Random | WHO [58] |
| 33 sandhirāṁ (pain in joints) | C, S, V | Sometimes | Random | WHO [58] |
| 34 pīṇṭkāruṁ (pain in calf muscles) | V | Sometimes | Random | WHO [58] |
| 35 pāvīravuṁ (pain in the flanks) | V | Sometimes | Severe/Critical | WHO [58] |
| NEUROLOGICAL SYMPTOMS | | | |
| 36 nīḍrānāloṁ (insomnia) | C, S | Sometimes | Random | Zambrelli E et al [43] |
| 37 dīva mahāniḍrā (deep sleep during daytime) | V | Sometimes | Random | Zambrelli E et al [43] |
| 38 niśi jāgaraṇaṁ (unable to sleep at night) | V | Sometimes | Random | Zambrelli E et al [43] |
| 39 sādā niḍra (constant sleep) | V | Sometimes | Random | Zambrelli E et al [43] |
| 40 śirōruṁ (headache) | C, S, V | Sometimes | Random | CDC [9,12] |
| 41 śiṛoṣa loṭhaṇaṁ (dystonic movements, shaking, tremors of head) | C, V | Rare | Severe/Critical | Sohal S et al [62] |
| 42 niḥbhūṅe ārātāṁ (eyes are unsteady and deviated) | C, S | Rare | Severe/Critical | Sohal S et al [62] |
| 43 muśkāṭaṁ (loss of speech) | C | Sometimes | Severe/Critical | WHO [58] |
| 44 cētanācūyṛuṁ (loss of consciousness) | S | Sometimes | Severe/Critical | CDC [12] |
| SPECIAL SENSES | | | |
| 45 sāravā kalūṣe rāktā ca dāriṇāṁ (pink eye) | C, S | Sometimes | Random | WHO [58] |
| 46 saṃsvaṇaṁ kānauṁ (sound in ears) | C, S, V | Not reported | | |
| 47 saruyuḥ kānauṁ (pain in ears) | C, S, V | Not reported | | |
| 48 pariṇagdha kharaspāra jīlha (coarse and inflamed appearance of tongue) | C, V | Rare | Random | Xinhua [63] |
| 49 rāṣaṇa parasya kṛṣṇā (rough and blackish appearance of tongue) | S | Not reported | | |
| 50 śviṣāvadāntā (blackish discoloration of teeth) | S | Not reported | | |

(continued on next page)
There is an opinion in classical texts that the discovery of antiviral agents against specific viruses also exhibit antimicrobial activity against bacteria. Such herbs from suppurating tissues have been found to have beneficial properties. In the Ayurvedic text, there is a mention of herbs and medicines in Ayurveda which have specific properties to prevent and resolve symptoms related to other diseases.

### Table 2

| Symptoms of Sannipātāvāra | Mention in Samhitā | Reported in COVID-19 | Reference |
|---------------------------|--------------------|----------------------|-----------|
| Cardiovascular Symptoms   |                    |                      |           |
| 48 snigdhāsaya (a ticklish feeling in mouth) | V | Not reported |           |
| 50 hṛdī vyāthā (affliction of heart) | C, S, V | Sometimes | Severe/Critical | Rizzo P et al [64] |
| Psychological Symptoms    |                    |                      |           |
| 51 mahā (confusion)       | C, S              | Sometimes            | Severe/Critical | CDC [8,12] |
| 52 pralapā (delirium)     | C, S              | Sometimes            | Severe/Critical | Zambrelli E et al [43] |
| 53 madhā (inebriation)    | S                 | Not reported         |           |
| 54 ummādāh (psychosis)    | S                 | Not reported         |           |
| 55 gitanartanahāsāyadīvikteḥaparvartanān (abnormal behaviour) | V | Not reported |           |

C - Carakasamhitā, S - Susrūtasamhitā, V - Vāgbhata's Aṣṭāṅga-hṛdaya-vyākhyā.

*Reported in the cohort of 14 patients treated at Medanta.*

An early allusion to the human microbiome, He also refers to variation in nomenclature of kṛmīs prevalent in other geographical regions [Ca.S. Vi.St. 7.9] [33]. There is an opinion in classical texts that visamāvāra, a variation of sannipātāvāra can be caused by bhūṭābhīṣāṅga (invasion by bhūtas) [Su.S. Ut.Ta. 39.68] [32]. Many herbs and medicines in Ayurveda have kṛmīghna properties to exhibit antibacterial and antiviral activity [35]. Rākṣōghnakarma or fumigation with herbs, which is recommended to prevent wounds from suppurating and for purifying air have been found to exhibit antinociceptive activity also against viruses [32]. Such herbs described in classical Ayurvedic texts are candidates for research and discovery of antiviral agents against specific viruses.

### Table 3

| Type of Disease | Impact of Disease | Disease Nomenclature | Specific Etiology | Dosavaisamyā (Nature of dosā imbalance) | Dosavikalpa (Granularity of dosā imbalance) | Dīṣya (Body elements affected) | Srotas (Affected body channels) | Rogamārga (Disease Pathways) | Upadrava (Complications) | Vyadhishvabhava (Nature of Disease) | Sikkhasādhya (Favourable Prognosis) | Krcchasādhya (Difficulty to manage) | Asadhya (Bad Prognosis) |
|----------------|------------------|----------------------|------------------|----------------------------------------|------------------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| Sānkṛāmikā (Contagious, Communicable)| Janapadodhvarna (Affects large number of human settlements)| Jvāra (Fever) | Visākrumayā (Caused by virulent pathogens) | Sannipāta (Derangement of all three dosās)| Vatākrapradhāna Pittānubandha (Dominance of Vata and Kapha with association of Pitta) | Rasa (In early stage), Rākta (In late stage) | Prānavāha, Udakavāha, Annavaḥa (Cough and Dyspnoea), Rasavāha (Fever), Raktavāha (Complications) | Kostha, Sākhā (In early stage), Madhyama (In late stage) | Svāskechāra (Shortness of breath), Marmaphāha (Damage to vital organs) | Āsu-kā (Acute) | Alpaligavta (Mild Symptoms), Ekarogamārtha (Affects only one disease pathway) | Madhyligavta (Moderate Symptoms), Svāskechāra (Shortness of breath), Sākhāgatavata (Involvement of external disease pathway) | Vibhaddhāsotavata (Dosas in mutual opposition), Purunālīgavta (Full range of symptoms), Agnāśīya (Digestive and metabolic crisis), Vardhāyikā (Old age), Rogasankara (Co-morbidities), Marmagatavata (Involvement of vital organs) |

### Commentary of Dalhana

In the Ayurvedic text, there is a quotation from Bhoja that allows the migration of kṛmīs from one body to another while explaining how the movement of the mind from one body to another body after death is invisible. Su.S. Sa.St. 1.16 [32]. This is a rare reference in classical texts hinting at the invisible migration of pathogens from one person to the other. Avoiding modes of transmission of diseases described in Ayurveda like physical contact (gatrasamapāra), inhalation (nīhiṣvasa), sitting and sleeping together (sahāsāyāsanā-tāta) Su.Ni.St. 5.33-34 [32] and even keeping away from places where there is chance of exposure is advised as a measure to mitigate the epidemic described in Susrūtasamhitā Su.S. Ut.St. 6.20 [32]. In the Aṣṭāṅga-hṛdaya-vyākhyā, avoiding contact with extraneous disease causing factors like bhūtas-virulent organisms (bhūṭādāyaparsanopayā) is advised as a preventive measure [As.Hr.St. 4.33] [36]. Carakasamhitā specifically advises self-protection (aṃapāta) and relocating to places that have not been affected (śīvanām janapadānām sevanām) Ca.S. Vi.St. 3.15-16 [33].

In fevers caused by abhiṣāṅga in general and even in bhūṭābhīṣāṅga specifically, there is a tendency for derangement of all three dosās leading to what is technically known as sannipātākopa Ca.S. Vi.St. 3.115-116 [33] [As.Hr. Ni.St. 2.43] [36]. Even in agantuvaras caused by extrinsic agents, dosā imbalance occurs eventually [As.Hr.St.1.171] [36].

With this background, it was most appropriate to review the portions of classical Ayurvedic texts dealing with jvara and specifically the bhūṭābhīṣāṅga type of agantuvaras and sannipātāvāra.

Carakasamhitā describes general features of sannipātāvāra and further describes thirteen types based on variations in dosā dominance [Ca.S. Clst. 3.103-109] [33]. On the other hand, Susrūtasamhitā and the works of Vāgbhata describe only general features of sannipātāvāra [Su.Sa. Ut.Ta. 39.35-38] [32] [As.Hr. Ni.St. 2.27-33] [36]. Dalhaṇa points out that even though sannipātāvāra are classified into thirteen types, by finer subclassification and gradation of dosā dominance as well as involvement of dhatu, sannipāta can present in infinite ways [Su.Sa. Ut.Ta. 39.42-44] [32]. Indeed, later texts like Yogaratnakara and Bhavaprakāsa have identified and named many more sannipātāvāras [Yo.Rajvaracikāta, 2-12] [37] like kaṭhakukujavāra which presents with acute respiratory distress [Bh.Pr. Ma.Kh. 1-439-526] [38]. A textbook called Jvaranirnaya was composed by Narayanapandita which gives the most detailed and classified descriptions of jvara in the entire Ayurvedic literature. The chapter on tridosajvara provides a comprehensive categorization and sub-classification of sannipātāvāra [Jvaranirnaya, Tridosā, 1-241] [39]. This text helps very much in understanding how to clinically assess and classify sannipātāvāra on the basis of multiple parameters compiled from other texts like nature of

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combination of ḍosa (samavāyibhedā), the variability of dominance of ḍosas in a particular type of sanātipatitavya, the pattern of fever (continuous, intermittent and so on), seasonality or otherwise, progression in the dhatus, clinical course as well as duration.

Most interestingly, newer presentations of sanātipatitavya documented in various texts in the evolutionary history of Ayurveda have all been compiled together appened by the author's own additions in between. Some sanātipatitavyas are described only in terms of the variation in doṣa imbalance while specific names are given for other sanātipatitavyas like vaikārika, vishūrakā, pappanā and so on. The Jvaranirāgya clearly points to the need for studying and classifying new presentations of sanātipatitavya, which is an approach that assumes relevance in the study of COVID-19

In recent times, Gananatha Sen in his work Siddhāntamādāna discusses about changes in clinical presentations of diseases due to the influence of place and time as well as influence of varied etiological factors [Sid.Ni.] [40]. He points out that textual descriptions of diseases may not match with clinical presentations seen today. In fact, classical Ayurvedic texts provide guideline for analysis of diseases not listed in the literature. Āṣṭāṅgaḥ Aṣṭāṅgayājya points out that analytical understanding of a disease in terms of its finer constituents like sanampripti, site of manifestation and specific nidānas is more important than identifying it by its name [As.Hr.Su.St.12.64-66] [36]. A new disease (anukātyāvadya) can be understood by study of nidāna, ḍosa, svarāṇa [33] and other factors involved in the disease causation, progression and clinical outcomes as evidenced in texts like Madhavanidāna [Ma.Ni.25 and 51] [34].

4. Discussion

COVID-19 being a new disease, we did not expect to find an exactly matching description in the classical Ayurvedic texts. The review of the classical Ayurvedic literature suggests that a careful analysis of the descriptions of sanātipatitavya and correlation with the modern clinical profile of COVID-19 will be helpful in understanding whether this disease can be classified within the generic categorisations of ḍvara in Ayurveda. On the other hand, it will also help us to find out if COVID-19 needs to be classified as an independent disease entity altogether.

4.1. COVID-19 as a type of ḍvara

Fever, the most frequently reported symptom of COVID-19 is seen in 89–99% of patients. On this basis, we can consider COVID-19 as a type of ḍvara. In the cohort of COVID-19 patients that we analysed, fever was not seen in three patients. However, the course of the disease was very mild in these patients and we infer that they remained in the pūrvarupa (prodromal) stage without progressing to full fledged disease. Further studies focused on careful analysis of clinical symptoms with respect to disease progression is needed to make clear distinctions of the clinical stages of COVID-19 from the Ayurvedic perspective.

4.2. COVID-19 as a type of sanātipatitavya based on clinical symptoms

Fever in COVID-19 is mild to moderate, which is typical of fever with dominance of vatū and kaptha as understood in Ayurveda (madhyamavāgyavāgya) [Ca.S.Ci.St.3.86-87] [33]. High grade fever has been reported in exceptional cases. Other major symptoms like cough and breathing difficulty as well as pneumonia and acute respiratory distress syndrome (ARDS) point to involvement of vata and or kaptha [Ca.S.Ci.St. 17.45] [33]. Associated symptoms like chills, shaking, rhinorrhoea, headache, sputum, nausea, vomiting and anorexia are also generally indicative of vata and kaptha dominance [As.Hr.Nl.St.1.25] [36]. Such a presentation is suggestive of vatakaphajāvara. However, some symptoms like confusion, sore throat, haemoptysis and diarrhoea, which are also seen in COVID-19 patients indicate the involvement of pitta as do the sporadic reports of skin eruptions and dizziness [As.Hr.Nl.St.1.18-20] [36]. Since the clinical features of COVID-19 invariably indicates imbalance of all the three ḍosas with fever as a main symptom, the possibility of sanātipatitavya was also examined. We found many features of sanātipatitavya can be seen in COVID-19. Fever, cough, breathing difficulty, headache, sore throat [12], anorexia, confusion, hemoptysis [41], arthralgia [42], conjunctivitis [43], delirium, sleep disturbances [44], seizures [45] dizziness [46], abnormal breath sounds [47] fatigue [48] oral thrush [49] thirst, dehydration and reduced output of urine [50], affliction of heart [51,52], skin rashes [19], loss of speech, deviated eyes [53] inflammation of nasal and respiratory passages and delay of doṣa-apāka are symptoms of sanātipatitavya [Ca.S.Ci.St.1.103-109] [33] seen in COVID-19. For a detailed matching of these symptoms with COVID-19, refer Table 2. One of the thirteen types of sanātipatitavya described in Carakasamhitā shows some symptoms that are similar to COVID-19 but a one to one correlation seems to be inappropriate. The type of sanātipatitavya with dominance of vata and kaptha (vātaslesomlabane), but mild involvement of pitta (pittajāvara) presents with fever, chills, cough, anorexia, thirst, burning sensation and aches [Ca.S.Ci.St.3.92] [33]. The data from the cohort of 14 patients supports these observations. Generally, the symptom profile of the cohort represented features of vatakaphajāvara with cough, sore throat and fever reported as main symptoms and the twenty symptoms reported pointed towards sanātipatitavya. Nausea and anorexia were also reported in some patients as well as diarrhea showing the association of pitta along with kaptha in the kośtha.

4.3. COVID-19 as a type of sanātipatitavya based on clinical course of the disease

The clinical course of COVID-19 also points to the possibility of sanātipatitavya. Sanātipatitavya becomes incurable or difficult to manage if the ḍosa does not undergo pāka (doṣe vibaddhe) due to dysfunction of agni (agnau nāste) and if the full range of symptoms manifest (sarvasampaiprarałakṣana). Even if patients recover, there are chances of residual disabilities (vaikālya) [As.Hr.Nl.St. 2.34] [36]. According to Śūrautṣamhitā, sanātipatitavya typically runs a mild or moderate course for one or two weeks or even more and then becomes severe and the patient either recovers from the crisis or dies [Su.S.Ut.Ta.39.45-46] [32]. This is not characteristic of fevers caused by single doṣa or dual ḍosas. Sanātipatitavya can present with life threatening events [Ca.S.Ci.St.3.109-110] [33]. COVID-19 can turn severe after running mild to moderate course. When it turns critical, mortality is high and even if patients recover residual disabilities have been reported. It is intriguing to note that in our cohort of 14 patients, the patient (P6) who died exhibited the maximum number of thirteen clinical symptoms. It must also be mentioned that in this patient, we observed the triad of symptoms indicating bad prognosis — autsukya (increased anxiety), moha (confusion), arati (irritability and restlessness) [As-Hr. Su.St.1.11] [36].

4.4. COVID-19 as an unlisted type of vatakaphapradhāna sanātipatitavya based on review of texts

The features of COVID-19 do not match exactly with descriptions of specific sanātipatitavyas in classical texts, though it exhibits characteristics of sanātipatitavya in general. For these reasons, we propose that COVID-19 presents clinical features pointing to an Ayurvedic diagnosis of a type of vatakaphapradhāna sanātipatitavya.
with pittanubandha which needs to be described and documented by clinical studies. From the etiological perspective, it is of exogenous origin (agantu).

4.5. Understanding COVID-19 based on analysis of nidana, dosa and dusya

As discussed earlier, an unlisted disease can be studied by analysis of nidana (etiology), dosa and dusya.

4.5.1. Nidana (etiology)

Being an infectious disease and with the SARS-CoV-2 well identified as the causative agent, COVID-19 can be classified as an agantu disease. Not getting in contact with an infected person or contaminated surfaces is the best known and most effective way to prevent the disease. As pointed out earlier, bhutabhisarga by visakrmi is a very plausible understanding of the nidana or etiology of COVID-19 from the Ayurvedic viewpoint. Finer discussions are warranted before viruses can be classified under a specific category of extraneous causative agents described in the classical texts, which is not being attempted in this paper.

4.5.2. Nidana, dosa, dusya interactions (agent—host interactions)

4.5.2.1. The transition of pathogenesis from extrinsic to intrinsic phase

Virus - host interactions lead to disturbances of doshas and subsequent development of pathogenesis. Carakasamhita clarifies in that agantu (fevers of extraneous origin) does not disturb the dosas for a short period of time. In this stage, symptoms may be seen without indication of dosa imbalance [Ca-S-Ni.St.1.30] [33].

4.5.2.2. The manifestation of dosa imbalance.

When there is dry cough, the dominance of vata should be inferred [As.Hr.Ni.St.3.22-24] [36]. If cough is associated with sputum, then a dominance of kapha should be inferred [As.Hr.Ni.St.3.26-27] [36]. The degree of involvement of these two doshas can be understood by analysing the consistency of the sputum - whether it is thick or thin, with the former indicating a complete dominance of kapha [As.Hr.Ni.St.3.26-27] [36]. If there is high grade fever, then dominance of pitta should be inferred. These presentations can vary from person to person. A combination of these features would call for a finer analysis of the degree of involvement of the three doshas in a sannipata situation. Scanty sputum was reported only in few patients in the cohort that we studied, pointing to vata dominant kasa in a group of aged people. The presentation of the disease in asymptomatic, pre-symptomatic, mild, moderate, severe or critical manner depends on the outcomes of the interactions between nidana, dosa and dusya. It is clearly mentioned that when these factors are in opposition there is resistance to disease (vikaravighatatabhava) [Co-S-Ni.St.3.4] [33].

4.5.2.3. The sites of the agent—host interactions.

From an Ayurvedic point of view, the primary site of the disease is the prāṇavaha srotas, which includes both the upper respiratory and lower respiratory tracts [Ca-S.Vi.St.5.8] [33]. In COVID-19, the lower respiratory tract is the centerstage of the pathological events that unfold in the course of the progression of the disease. The most common respiratory symptom seen is cough, which is usually dry. It is usually accompanied by mild to moderate fever. This pattern was clearly observed in the cohort of patients with all patients reporting cough and eleven patients, fever. In some patients, the gastrointestinal system is also affected. The possibility of the virus entering through the mouth and first affecting the gastrointestinal tract before affecting the respiratory system has also been discussed in published papers [55]. In such cases, patients present with symptoms related to pitta and kapha like diarrhoea, nausea or vomiting. This suggests the involvement of kṣaṭha and annavahasrotas from the Ayurvedic perspective [Ca-S.Su.St.11.42-43] [33]. Gastrointestinal symptoms were also reported in the data from the cohort of patients that we reviewed. Considering the fact that fever is the main symptom, the involvement of raktavahasrotas is to be inferred. Respiratory symptoms like cough and dyspnea indicate the involvement of prana-vaha, udakavaha and annavaha srotas [As.Hr.Ni.St.4.3-4] [36]. Clotting of blood has been reported in many patients suggesting the involvement of raktavahasrotas also. In some patients, there are generalised symptoms like skin eruptions indicating involvement of śākha [Ca-S.Su.St.11.42-43] [33]. In others, myalgia and arthralgia have been reported which indicates involvement of madhyamar-gumagra [Ca-S.Su.St.11.42-43] [33]. The dārūṇas involved in COVID-19 can be tentatively considered as rasa and rakta. The damage to heart (hrdaya), brain (siras) and kidneys indicate the affliction of the vital organs (marmas) by the disease [Ca-S.Su.St.11.42-43] [33].

4.5.2.4. The crisis in advanced stages.

As the disease progresses, the efficiency of ojas is compromised and a crisis can develop. Such a presentation is seen in critical COVID 19 cases, characterized by...
disruption of immune system [56] leading to cytokine storm and ARDS, which correlates with ojonirodha described by Sushruta Samhita in the context of severe samnipatajvara/Su.S.Ut.T.39.43–45] [32]. One patient in the cohort of our study progressed to critical stage and died. It is pertinent to point out that this patient reported negative on 18th day but became positive again on 24th day indicating a weakened immune system. The commentator Vijayaarasita points out that accumulation of metabolic byproducts due to aberrations in digestion and metabolism as well as the disturbances in doshas is called in Ayurveda as ama [Ma.Ni.25.1–5] [34]. The development of ama goes hand in hand with the pathogenesis. In a disease with derangement of all three doshas (dosasamrruchana), the ama can become amavisa [biochemical changes leading to sepsis and septic shock] [As.Hr.Su.St.13.26] [36]. There is an opinion amongst Ayurvedic physicians that the concept of viśa must be considered in the etiology of the disease.

4.5.3. Nidānapaṇcaka (five diagnostic descriptors) and Satkriyakalā (clinical course) of COVID-19

An attempt is being made here to give a preliminary outline of the nidānapaṇcaka (five diagnostic descriptors) and Satkriyakalā (clinical course of the disease).

4.5.3.1. Nidāna (etiology). The primary cause of COVID-19 is the SARS-CoV-2, which can be classified as an agantuheṭu in Ayurveda. The role of additional supportive factors like weather, diet, lifestyle and other host related factors that influence the clinical course and progression of the disease need to be studied further.

4.5.3.2. Purvarūpa (prodromal symptoms). Without careful assessment of a large number of patients, it is not possible to meticulously document the prodromal symptoms of COVID-19. In principle, we can say that symptoms that do not give a clear indication of a dosa imbalance can be classified as purvarūpa [Ma.Ni.1.5–6] [34]. Since fever is the most common symptom of COVID-19, presentation of symptoms without fever can also be considered as the prodromal stage of the disease. As pointed out earlier, three patients in the cohort of COVID-19 patients that we studied did not report fever and did not progress to severe or critical stage. Asymptomatic and presymptomatic patients will need to be studied closely to profile the prodromal signs of COVID-19. Pre-symptomatic patients develop symptoms later, but asymptomatic patients can remain so until they test negative. A seemingly unnoticed symptom like anorexia and tiredness may be the indication of the development of ama in the prodromal stage and should not be ignored. Some patients may only notice anosmia [57]. Sometimes asymptomatic COVID-19 patients can show lung damage in CT scans or develop severe disease in the later course of the disease [38].

4.5.3.3. Rūpa (clinical symptomatology). The key symptoms of COVID-19 are fever (jvara), cough (kasa) and shortness of breath (śvāsa), which points to vātakapha dominance. Association of pitta related symptoms and clinical course described earlier indicate that COVID-19 is a type of samnipatajvara. The wide variations in clinical presentations of COVID-19 points to the necessity of identifying sub types based on symptom clusters indicating variations in the tri-dosha imbalance. This calls for a meticulous observation of larger number of patients based on Ayurvedic parameters. Clustering of symptoms was observed in our cohort of COVID-19 patients indicating finer variations in doshavikalpa, which needs further examination and analysis by a more comprehensive clinical study.

4.5.3.4. Upasaya (therapeutic response). Ayurvedic clinical studies need to be conducted to elicit the upasaya (positive) or anupasaya (negative) response to confirm the provisional assessment of dosa imbalance and other Ayurvedic parameters [Ca.S.Vi.Svt.4.7] [33]. This is all the more relevant to distinguish between prakṛtisamassamavaya (when clinical symptoms reflect underlying dosa imbalance) or vikṛtisamassamavaya (where clinical symptoms do not reflect underlying dosa imbalance) type of dosa imbalance as clarified by Cakrapāṇidatta [Ca.S.Ci.St.3.89–109] [33]. In the Īvarānirnaya, the importance of making this clinical distinction is emphasised by classification of both dual dosa and sannipata fivers into the above mentioned two categories in the first verse of the chapter itself [Īvarānirnaya, Tridosaja.1] [39].

4.5.3.5. Samprāṭi (pathogenesis). Being an agantu disease, the disease progresses clinically only when the dosa imbalance is initiated. Sankhyāsamprāṭi – At this point of time, we suggest that COVID-19 is understood as a single disease. However, further clinical studies may help us to sub-classify COVID-19 on the basis of variations in dosa imbalance. Vikalpasamprāṭi – On the basis of our study, a dominance of vāta and kapha accompanied by mild degree of pitta is seen in the presentation and clinical course of the disease. The possibility of variations in different stages of presentation must be further studied clinically. Prādhānyasamprāṭi – COVID-19 is an independent disease (svatāntrayādīti) though it can worsen in the presence of pre-existing co-morbidities. However, pneumonia, ARDS, fatal cardiac events, stroke and such other complications arise in severe and critical cases. The status of these conditions in terms of dependance (paratantrata) and complication (upadrava) [Ca.S.Ci.St.21.40] [33] as well as independent co-morbidities (vyādhisanka) [Ma.Ni.2.33] [34] needs to be further studied. Complications may require urgent and exclusive attention as pointed out in Ārakasamāni. Four patients in our cohort developed upadravas or complications while seven presented with a vyādhisanka situation with co-morbidities. Balasamprāṭi – Even though the singular cause of COVID-19 is the SARS-CoV-2, the severity of the disease highly varies from individual to individual. Further studies are needed to understand the role of extrinsic and intrinsic factors that can influence the severity of the disease. Air pollution has been reported to worsen outcomes in COVID-19. On the other hand, the influence of diet and lifestyle is not as well understood. Kālasamprāṭi – We do not have adequate data to understand the relation between the manifestation of symptoms in relation to diurnal and seasonal variations. Data is also inadequate to conclude whether severity of COVID-19 is linked to cold or warm weather. Meticulous clinical observations are needed to be able to identify specific dosa imbalances by studying the pattern of fever and other symptoms in relation to different times of the day and night.

4.5.4. Saṭkriyakalā (clinical course of the disease)

Further clinical studies are needed to build a detailed description of the clinical course of COVID-19 from an Ayurvedic perspective. An attempt is being made in this paper to sketch a rough outline of the Saṭkriyakalā pointing out the gaps that will need to be addressed by conducting further studies.

4.5.4.1. The Caya, Prakopa and Prasara. The Caya, Prakopa and Prasara stages are difficult to distinguish in an agantu disease. We can tentatively correlate the incubation period of COVID-19 with this phase. This stage need not be totally asymptomatic and symptoms indicating viral infection (hetuvaṇjukalakaṇa) may be present but yet not noticed [Ca.S.Su.St.18.5] [33]. Loss of smell and taste, sore throat, diarrhea and such non-specific symptoms have been reported as the only presenting signs of COVID-19 infection. Being the agantu phase of pathogenesis, dosa specific symptoms will not be seen.
4.5.4.2. The Stage of Sthānasamrāraya. The Stage of Sthānasamrāraya is the stage in which the prodromal symptoms (purvarupa) are manifesting. This stage is not well demarcated in available clinical documentation of COVID-19. Certain presentations with mild symptoms could be potentially classified as the stage of purvarupa but extensive clinical studies are required for a clear understanding.

4.5.4.3. The Stage of Vyakti. The Stage of Vyakti is the symptomatic stage of the disease, which can be mild to moderate or severe. There is further scope for further classification of the clinical presentation of COVID-19 on the basis of specific symptom clusters related to variations in dosa imbalances and location of the disease process.

4.5.4.4. The Stage of Bheda. The Stage of Bheda represents the complications of COVID-19, which is characterized as the critical stage with severe pneumonia, ARDS and hypoxia. This stage of COVID-19 is associated with higher rate of mortality.

Fig. 1 depicts the diagrammatic representation of the clinical course of COVID-19

4.5.5. Sadhyāsādhyata (prognosis)

In the light of information available from published studies, we infer that if kapha is not deranged or depleted, the outcomes are good as are seen in children who have kapha in the natural or prakṛta state [Co.Su.St.17.117] [33]. Kapha in the natural state enhances the bala of the system. In old age, there is depletion of kapha and increase of vāyu. Such patients are at risk for progression of disease to severe stage and poor outcomes [22]. In diseases where there is derangement of kapha like diabetes, the prognostic outlook is not good. In diseases like hypertension with derangement of vātu a bad prognosis is expected. The one patient who died in the cohort of our study had hypertension as well as cardiac disease and was 70 years old. It is clear that while old age and co-morbidities put the patient at a higher risk of complications and death, with proper medical attention and supportive care, such patients can also recover from the disease. In our cohort, thirteen out of fourteen patients were aged between 64 and 77 years and recovered. All those who developed ARDS had co-morbidities.

Other factors like dosaprabhāti (tridosha constitution) of the individual, the geographical region (deśa) as well as the prevailing season (kāla) during the outbreak may have prognostic implications for COVID-19, which deserves attention. We have not done an extensive analysis of the deha, deśa, kāla or prakṛti in this study. However, based on this preliminary understanding of the disease progression and the dosaḥvikalpa, an assumption can be made that those individuals with vātakapha prakṛti and tendency for pitta aggravation may be more susceptible to developing complications. Adequate data is not available for further discussion on this topic in this paper. Table 3 provides the summary of the key elements of the Ayurvedic clinical profile of COVID-19.

5. Limitations of the study

A critical analysis of the clinical presentation of the disease on the basis of the principles of Ayurvedic nosology suggests that COVID-19 can be categorized as agantuka type of vatakaphapradhanam sanripatajāvara with pittanubandha. However, the granularity of the dosa imbalance as well as its dynamic progression in the course of the disease warrants further investigation and analysis. The wide variation in the incubation period, clinical presentation, clinical course and outcomes of the disease is indicative of the complex interactions between the agent and host factors, which is understood in Ayurveda in terms of interaction between nidāna, dosa and duṣya. The clinical course of the disease and its evolution into the critical stage in some patients with fatal outcome or disabilities after recovery is characteristic of the clinical course of sanripatajāvara described in Ayurvedic texts. Further studies are needed to delineate the various clinical stages (vyādhyāvasthās) of the disease to envisage specific therapeutic approaches.

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Fig. 1. Clinical course of COVID-19.
This study has several limitations. At the very outset, we pointed out that Ayurvedic physicians did not have direct access to COVID-19 patients, which ruled out the possibility of a comprehensive clinical assessment of COVID-19 on the basis of Ayurvedic parameters. We have tried to demonstrate that this challenge can be circumvented to some extent by interaction and discussion with Allopathic doctors who are treating COVID-19 patients. However, such an exercise, even when strengthened by review of published literature and classical Ayurvedic literature can only serve the purpose of developing a preliminary clinical profile of COVID-19 from the Ayurvedic perspective. The gaps have been pointed out indicating the specific areas where further studies based on clinical consultation with COVID-19 patients will be needed.

The analysis of clinical data from Medanta demonstrates that it is possible for Ayurveda physicians to cooperate with Allopathic physicians treating COVID-19 patients and that interactions should be encouraged for developing a preliminary understanding of COVID-19 from an Ayurvedic perspective when Ayurvedic physicians do not have direct access to patients. However, it also reveals the challenges in gathering data that is clinically relevant for Ayurveda when Ayurvedic physicians are not directly involved in clinical examination of COVID-19 patients. A comprehensive Ayurvedic understanding of a new disease like this needs clinical examination of patients based on Ayurvedic parameters and a meticulous documentation of clinical symptoms.

6. Conclusion

Based on a preliminary analysis of literature reporting clinical symptoms of COVID-19, study of clinical presentation of a cohort of COVID-19 patients and Medanta and a review of classical Ayurvedic literature, we suggest that COVID-19 can be classified as agantuka jvara with a vātakaphapradhānasannipāta presentation. The dominance of pitta in certain stages of the disease and in some patients should be considered. However, COVID-19 needs to be further subclassified under the category of vātakaphapradhānasannipāta jvara on the basis of a more detailed analysis of clinical symptomatology of a cross section of COVID-19 patients representing diverse populations from different geographical regions in the world.

This paper demonstrates that it is possible to develop provisonal Ayurvedic clinical classifications of COVID-19 in consultation with modern medical doctors treating COVID-19 patients, in a regulatory environment that does not permit Ayurvedic doctors to directly managing COVID19 patients. Studies involving larger number of patients are needed to further develop the approach outlined in this paper and formulate a protocol that can be validated at the point of care. Since Ayurveda management is personalized, closer interactions of Ayurveda experts in hospital settings with patients tested positive is important to refine the clinical profiling.

In India, the Central Government has created an Interdisciplinary AYUSH research Task force for COVID-19. The Task Force has set-up several working groups to explore the various possibilities of integrating Ayurveda with standard of care to deal with the COVID-19 epidemic more effectively. In the meantime, the Government of Kerala announced and rolled out a protocol and program for integrating Ayurveda into the management protocol of COVID19, in the State. This initiative shall implement preventive, mitigative and rehabilitative programs based on Ayurveda for better management of the COVID-19 epidemic in the State. Several other State governments are exploring similar possible integrative approaches. Such policy decisions may create a better integrative environment in the future which underlines the significance of this study.

Declaration of competing interest

Dr. Unnikrishnan PM, listed as the third author, is on the Editorial Board of the Journal, but he was not involved in peer review process and editorial decisions related to this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jaim.2020.05.011.

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