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Case Report

Standalone Ayurvedic treatment of high-risk COVID-19 patients with multiple co-morbidities: A case series

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ABSTRACT

We report a case-series of Ayurvedic treatment in seven COVID-19 positive patients with multiple co-morbidities, categorized as high-risk for poor outcome from SARS-CoV-2 infection. All of them recovered completely from their illness with resolution of symptoms following Ayurvedic treatment. The data was collected from patients treated during the early months of the COVID-19 pandemic (June 2020 to September 2020) at an out-patient Ayurvedic Clinic, Chennai, India.

This is a retrospective case series from among the initial 247 COVID-19 patients out of whom 39% were found to be suffering from co-morbidities. We have chosen seven of these patients who fulfilled the criteria for high-risk category, represented by multiple co-morbidities that included cancer, chronic kidney disease (CKD), coronary artery disease (CAD), chronic obstructive pulmonary disease (COPD), diabetes mellitus (DM), hypertension, and an elderly person over the age of 90 years.

Classical Ayurvedic formulations for COVID -19 were chosen so as to avoid complicating co-morbid conditions and patients were maintained on a modified diet. All these high-risk patients were treated at an out-patient setting. The patients were under home quarantine and self-monitored their progress with daily follow-up over the phone by the treating Ayurvedic physician.

The main outcome measure included resolution of symptoms and complete recovery from COVID-19 disease in all patients.

This case series demonstrates the scope of Ayurvedic interventions in the management of high-risk COVID-19 patients with severe co-morbidities with successful outcome in an out-patient setting.

1. Introduction

COVID-19 pandemic in India has brought forth the strength of Indian Systems of Medicine (ISM) namely Ayurveda and Siddha, in handling a new, hitherto unknown disease [1–3]. A few articles on Ayurvedic theory and management of COVID-19 in medical literature have been published in the recent past [4–6]. We present seven cases describing the efficacy of Ayurvedic treatment of COVID-19 patients. The case series presented in this article is not part of a clinical trial. These patients were treated in an out-patient setting after obtaining an informed consent. They were among the initial 247 COVID-19 positive patients who were treated only with an Ayurvedic intervention.

2. Diagnostic assessment

All the canonical texts of Ayurveda, deal extensively with the disease called *Jwara* (fever). Etiology, pathophysiology, diagnosis, types, classification, management, diet, medicines, and prognosis of *Jwara* are explained. Ayurvedic theory of health and ill health rests on the premise that disease causing factors, namely, the three doshas (*Vata*, *Pitta* and *Kapha*) exist within the body. When in

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balance, the three doshas contribute to the maintenance of health; whenever this balance is disturbed, diseases take root in the body [7, Sutra Sthana 1/20]. Any new disease is identified by the imbalance of doshas, its etiology, symptomatology, signs etc. Thus, it is possible for an Ayurvedic physician to diagnose and successfully treat a new disease based on the above principle [8, Sutra Sthana 18/44-47]. After treating over 330 COVID-19 patients, without any mortality, it can be concluded that COVID-19 is one such disease, caused by a combined aggravation of two *doshas* namely *vata* and *kapha*. [ii] COVID-19, from an Ayurvedic perspective, is a *janapadodhwamsa vikara*, an epidemic disease [8, Vimana Sthana 3/6].

In allopathy there is no proven effective therapeutic cocktail to treat COVID-19 infection [9].

COVID-19 is considered more severe in those who are older than 60 years of age, or who have health conditions such as lung or heart disease, cancer, diabetes or conditions that affect their immune system [10–12].

3. Therapeutic intervention

Therapeutic management consisted of modified diet, lifestyle changes and medication. The prescribed diet was easy to digest (*laghu*), stimulated the digestive fire (*Agni deepanam*), nourished the patient, and did not aggravate the causative *doshas*, namely *vata* and *kapha* further [8, *Chikitsa Sthana* 3/142–143, 163–164]. Patients were advised to consume cooked and strained par-boiled rice, green gram lentils (*Moong Dal*), and boiled vegetables added with pepper, cumin, and coriander and avoid sleep during the day and not keep awake later than 10:00 PM. Bathing was discouraged if the patient had fever [8, *Chikitsa Sthana* 3/138–139]. Ayurvedic medicines for COVID-19 were prescribed taking into account their co-morbidities and hence, specific needs of patients were met on a case-by-case basis. Details of medication for each individual are provided in Table 2. The patients were asked not to discontinue their allopathic medication for their pre-existing conditions like diabetes mellitus, hypertension, etc.

Daily follow-up was done by the doctors, sometimes several times a day. Patients had access to the doctors for clarifications and advice any time they needed it.

4. Case presentation

We present seven high risk patients with multiple co-morbidities. The line of treatment was to address *Vata kapha jwara*. The choice of medicine was based on individual *avastha*. A summary of demography, patient details and relevant histories is given in Table 1. Presenting symptoms and therapeutic interventions and outcomes are summarised in Table 2. Patients complied with all the instructions given by the treating physicians and there were no adverse events reported.

4.1. Case 1

A female aged 57 years, who tested positive following RT-PCR for COVID-19, was referred by a senior diabetologist. A summary of her co-morbidities and treatment details are given in Table 1. In addition to co-morbidities discussed in Table 1, seven years earlier she was treated for tuberculosis and underwent anti-tuberculosis treatment. She was under allopathic medical care for all her numerous conditions except for breast lesion.

4.1.1. Clinical progression

Four days prior to Ayurvedic treatment, she was put on a course of antibiotics for cough by her allopathic health care provider. She had no fever at that time. A day prior to Ayurvedic treatment, she went in for an elective hemodialysis catheter placement by a percutaneous approach via the internal jugular vein. She developed a fever of 101.5 °F (38.6 °C) on that day with frequent semi-solid bowel movements. An RT-PCR test for COVID-19 was done which confirmed COVID-19 infection. Her urine output was approximately around 25 ml/day. Blood pressure was under control at 120/80 mm Hg and oxygen saturation by pulse oximeter (SpO_2) was 100% (Table 1).

The hospital where she normally goes for dialysis refused treatment until she turned negative for COVID-19. Patient opted for Ayurvedic treatment for SARS-COV-2 infection as she could not tolerate many of the antibiotics and other allopathic medications. As it was difficult to find an allopathic hospital which would take care of COVID-19 positive CKD cases on dialysis and yet allow patients to continue Ayurvedic medicines, she had to discontinue haemodialysis. Her last haemodialysis was a day prior to coming to us.

4.1.2. Ayurvedic therapy

At the Ayurvedic centre, diet and medicines were prescribed. Table 2 provides the sequence of events and the Ayurvedic intervention. She was advised to stop the antihistamine that was given for her cough. Ayurvedic medicines for cough, fever and diarrhoea were initiated. She had low-grade fever for one day, and her cough gradually resolved. By Day 6, she had no fever, cough, phlegm or dyspnoea. She was on no other allopathic medications for COVID-19 during the course of her illness. In this case, Ayurvedic

Table 1
Clinical details of patients with COVID-19.

Case Number	Gender	Age (years)	BMI	Co-morbidities	Allopathic Therapy
1	F	57	–	Type 2 DM (23 yrs), hypertension (22 yrs), CAD (5 years), CKD (7 yrs), hemodialysis, COPD (6 yrs), Ca breast, treated for TB	Hemodialysis three times a week eltroxin, sodium bicarbonate, insulin, sorbitrate, furosemide, vitamin supplements.
2	M	67	26.6	COPD, CAD, angioplasty	β-blocker, statins
3	M	92	18.9	Hypertension, CAD (bypass grafting), treated for TB, enlarged prostate, urinary catheterization, previous burn injury	β-blocker, angiotensin receptor blocker
4	F	48	26.2	Type 2 DM, hypertension (10 Yrs.), Ca breast	insulin, mastectomy, radiation, chemotherapy
5	M	65	20.5	Type 2 DM (10 yrs), aortic valve sclerosis with mild diastolic dysfunction of the heart, but normal ejection fraction. Elevated CRP at 28 (normal <5 mg/L) and mild hypoproteinemia	linagliptin 2.5 mg, gliclazide 60 mg, statin drug, and an ACE inhibitor.
6	M	80	22.3	COPD (25 yrs)	levosalbutamol (50 mcg) + ipratropium (20 mcg) nebulisation twice a day
7	F	63	37.1	DM (15 yrs)	metformin 1 gm, glipizide 40 mg, thyroxine 100 mcg

BMI: Body Mass Index (normal 19–25), DM: Diabetes Mellitus, number within brackets describe duration of the condition in years (yrs.), CAD: Coronary Artery Disease, CKD: Chronic Kidney Disease, TB: Tuberculosis, COPD: Chronic Obstructive Pulmonary Disease, CRP: C Reactive Protein.

Table 2
Course of SARS-CoV-2 and Ayurvedic intervention.

Day	Symptoms	Ayurvedic Therapy
Case 1		
1	Afebrile, cough 4–5 times a day, semi-solid stools	*Pippalyadi Churna* [16], *Dhanwantara Gutika* [[17], *Gutika Yogam*/29], *Sudarsan Churna* tablets [18], *Kutajarishta* [[19], *Atisara Prakaranam*/174–177]
2	am: Afebrile; pm: 99 °F (37.2 °C)	Medications as above
3–5	Afebrile, heaviness, ↓uo, ↑wt, nl appetite, semi-solid stools	*Bharngyadi Kashaya* [[17], *Kashaya Yoga*/29], *Gokshura decoction* [[20], *Purva Khanda*, 6/44–46], *Dadimashtaka Churna* [[7], *Chikitsa Sthana*, 9/113–115]
6–7	↑loose stools, ↑uo, supine cough; (−) fever/pain/phlegm/dyspnea, ↑wt (1.2 kg)	Discontinued *Pippalyadi Churna*
8	Afebrile	Discontinued Ayurvedic medications
Case 2		
1	Cough, dyspnea, loose stools, nausea & vomiting, drowsiness	*Vyaghryadi Kwatha* [[7], *Chikitsa Sthana* 1/61], *Swasakutara Ras* [[19], *Hikka Swasa*/44–45], *Talisadi Churna* [[8], *Chikitsa Sthana* 8/145–148], *Sudarsan Churna* tablets [18], *Dhanwantara Gutika* [[17], *Gutika Yogam*/29], *Vayu Gutika* [[17], *Gutika Yogam*/56]
2–5	↓drowsiness, ↓cough, SpO_2 88%–94%	Continued above medications
6	Weakness & other symptoms resolved	Admitted to a hospital for observation
Case 3		
1	Wet cough, belly pain, loose stools	*Dadimashtaka Churna* [[7], *Chikitsa Sthana*, 9/113–115], *Kutajarishta* [[19], *Atisara Prakaranam*/174–177], *Talisadi Churna* [[8], *Chikitsa Sthana* 8/145–148]
2	Loose stools resolved	Discontinued Dadimashtaka churna
3	pm: 99.5 °F (37.5 °C)	No change in therapy
4	pm: 100 °F (37.7 °C)	Discontinued *Kutajarishta*, added *Bharngyadi Kashaya* [[17], *Kashaya* Yoga/29], *Dhanwantara Gutika* [[17], *Gutika Yogam*/29]. *Sudarsan Churna* tablets [18]
5	No symptoms	No change in therapy
6	Mild phlegm	*Ashwagandhadi Churna* [[17], *Churna Prakarana*/8], *Dasamularishta* [[17], *Arishta Prakarana*/13]
Case 4		
1	Frequent cough, mild fever	*Bharngyadi Kashaya* [[17], *Kashaya* Yoga/29], *Talisadi Churna* [[8], *Chikitsa Sthana* 8/145–148], *Sudarsan churna* tablets [18], *Dhanwantara Gutika* [[17], *Gutika Yogam*/29], *Vettumaran Gutika* [[17], *Gutika Yogam*/60]
2	Same as above	Medications as above
3–7	Afebrile, felt well	Medications as above
8–15	Persistent headache & low-grade fever in am & pm	*Guduchi Kashaya* [[20], *Purva khanda*, 6/8–10], *Sudarsan churna* Tablet [18], *Dhanwantara Gutika* [[17], *Gutika Yogam*/29], *Talisadi Churna* [[8], *Chikitsa Sthana* 8/145–148], *Rasnadi Churna* [[17], *Churna Kalpana*/71]
16	Afebrile, mild cough, active	Milk and ghee were added to diet [[8], *Chikitsa Sthana* 3/164–165, 167–168]
17	Afebrile, dramatic ↓ in cough	*Indukanta ghrita* [[17], *Ghrita Kalpana*/16]
Case 5		
1	Fever 102 °F (38.8 °C), continuous cough, semi-solid stools	*Bharngyadi Kashaya* [[17], *Kashaya* Yoga/29], *Sudarsan Churna* Tablets (19), *Dhanwantara Gutika* (18) *Vettumaran Gutika* (30) with ginger juice and honey, *Talisadi Churna* (26),
2	am: No fever, pm: 100 °F (37.7 °C)	Medications as above
3	Temperature at 4 am: 100 °F (37.7 °C) SpO_2 : 79% 11.30AM: Patient stable. sleeplessness, inability to cough freely, and an obstruction in the chest, diminished appetite	An extra dose of *Vettumaran Gutika* [[17], *Gutika Yogam*/60] was given, and in half an hour the SpO_2 became 92% Add: *Kanakasava* (35), *Swasakutara Ras* [[19], *Hikka Swasa*/44–45]
4	Afebrile. Loss of appetite, sleeplessness and constriction in the chest persist	Medications as above, Advised to add Ghee and Milk in diet [[8], *Chikitsa Sthana* 3/164–165, 167–168]
5	Fever am: 100.4 °F (38 °C) SpO 2 drops to 81% if he passes bowel or urinates, and climbs to 90% in 1 h, stabilises at 95% pm: 99 °F (37.2 °C)	Medications and diet as above
6	Afebrile. SpO_2 drops to 89% if he passes bowel or urinates, and climbs to 95% and stabilises in 1 h. Constriction in the throat and chest, shortness of breath.	Medications and diet as above
7	Well. Afebrile. Constriction in the throat and chest persist.	*Ashwagandhadi Churna* [[17], *Churna Prakarana*/8], *Indukantha Ghrita* [[17], *Ghrita Kalpana*/16], *Dadimadi Ghrita* [[7], *Chikitsa Sthana* 16/2–4], *Swasakutara Ras* [[19], *Hikka Swasa*/44–45] *Dasamularishta* [[17], *Arishta Prakarana*/13]
8–13	Patient recovering well. Mild breathlessness after passing urine/bowel, or after yawning or sneezing. It has reduced by 90% after the 2nd prescription	Medications as above
13	RT-PCR for COVID was negative	
Case 6		
1	Temp: 101 °F (38.3 °C) −102 °F (38.8 °C), mild body pain, SpO_2: 89-90 Loss of appetite	*Vyaghryadi Kwatha* [[7], *Chikitsa Sthana* 1/61], *Sudarshan Churna* tablets [18], *Dhanvantara gutika* [[17], *Gutika Yogam*/29], *Vettumaran gutika* [[17], *Gutika Yogam*/60] *Swasakutara ras* [[19], *Hikka Swasa*/44–45], *Kanakasavam* [[19], *Hikka Swasa*/115–119] *Talisadi churna* [[8], *Chikitsa Sthana* 8/145–148]
4	Temp-100 °F (37.7 °C) SpO_2 went to 76%, unable to lie down, breathless. Prescribed SOS and muhur and SpO_2 increased to 89%.	*Dasamoola Rasayana* [21], *Vidaryadi ghrita* [[7], *Chikitsa Sthana*, 3/10], *Dasamoolarishta* [[17], *Arishta Prakarana*/13]. S.O.S: *Kanakasava*, *Swasakutara ras* and *Dasamoola rasayana* Diet: Milk and ghee [[8], *Chikitsa Sthana* 3/164–165, 167–168]
5	Temp-98.8 °F (37.1 °C) Bowel movement, SpO_2: 88%–89%	Added: *Indukantha ghritha* [[17], *Ghrita Kalpana*/16] with *Talisadi churna* [[8], *Chikitsa Sthana* 8/145–148] instead of *Vidaryadi ghrita* [[7], *Chikitsa Sthana*, 3/10], Combination drug: *Svarna Vasanta Malati Ras* [[19], *Jwara Chikitsa*/1205–1207], *Yashtimadhu* [[20], *Purva khanda* 6/145–146], *Laghu Sutasekara ras* [22], *Abhraka bhasma*

(*continued on next page*)

Table 2 (*continued*)

Day	Symptoms	Ayurvedic Therapy
		(1000 puta) [23] and *Pravala Panchamrita* [[19], *Gulma Roga Adhikara*/116–120]: 5 gm divided into ten doses and mixed in honey given every one and half hours.
8–11	Temp: 100.6 °F (38.1 °C) to 99 °F (37.2 °C), SpO_2: 79 to 90	Medicines as above
12–20	Temp-Normal. SpO_2 gradually increased to 91%. All the other symptoms gradually improved..	Medicines as above
Case 7		
1	Temp: am: 100 °F(37.7 °C), pm: 101.5 °F (38.6) Body pain and heaviness of the head.	*Bharngyadi Kashaya* [[17], *Kashaya Yoga*/29], *Sudarshan Churna* tablets [18], *Dhanvantara Gutika* [[17], *Gutika Yogam*/29], *Vettumaran gutika* [[17], *Gutika Yogam*/60]
2	Temp: am:100 °F (37.7 °C), pm: 101 °F (38.3 °C)	Medicines as above
3	Temp: am: 99.4 °F (37.4 °C), pm: 101.6 °F (38.6 °C)	Medicines as above
4	Temp: am: 100.6 °F (38.1 °C), pm: 102 °F (38.8 °C) Breathlessness, SpO_2- 80%, blood streaked sputum, cold extremities, watery loose stools - 5/day	Add: *Dadimashtaka Churna* [[7], *Chikitsa Sthana*, 9/113–115] in honey, pomegranate, *Kutajarishta* [[19], *Atisara Prakaranam*/174–177]
5	Temp: 101.5 °F (38.6 °C) Breathless, severe weakness and restlessness. Watery loose stools persisted S_PO_2-80%–83%,	Added *Swasakutara Ras* [[19], *Hikka Swasa*/44–45]
6	Temp: am: 100 °F (37.7 °C), pm: 100.7 °F (38.1 °C), S_PO_2-75% Watery loose stool- twice, pasty stool- once Note: Patient was given portable oxygen support. With the help of the support it increased only to 77% without significant impact.	Combination drug: *Svarna Vasanta Malati Ras* [[19], *Jwara Chikitsa*/1205–1207], *Yashtimadhu* [[20], *Purva khanda* 6/145–146], *Laghu Sutasekara ras* [22], *Abhraka bhasma* (1000 puta) [23] and *Pravala Panchamrita* [[19], *Gulma Roga Adhikara*/116–120]: 5 gm divided into ten doses and mixed in honey given every one and half hours.
7	Temp: am: 100.3 °F (37.9 °C), pm: 99.4 °F (37.4 °C) Pasty stool in the evening	Medicines as Above
8	Temp: am: 100.1 °F (37.8 °C), pm: 98.6 (37 °C) All of the symptoms persisted.	Medicines as above.
9	Afebrile, stool: well formed, breathlessness persisted, phlegm with mild blood streak	Added *Ashta Churna* [[7], *Chikitsa Sthana*, 15/35]
10	Afebrile, 1 pasty stool in the day, SpO_2 - 88%	Medicines as above
11	SpO_2: 88%–89%, stools: well formed.	Medicines as above
12–17	SpO_2 gradually increased up to 93%. Each day there was an ↑ in SpO2 by one point. All the other symptoms dramatically ↓	Medicines as above

↓ decrease, ↑ increase, nl: normal, -: no, uo: urine output, wt: weight, SpO_2: oxygen saturation.

treatment had maintained stability despite lack of haemodialysis, and prevented complications as her COVID-19 symptoms resolved. Her fever came under control quickly (in one day), cough remained mild, and SpO2 levels never dipped below 98%. The only symptom she experienced was increased frequency of watery and semi-solid stools, which resolved once she resumed dialysis.

She got admitted to a compassionate hospital for haemodialysis on Day 8 and tested negative on Day 14.

4.2. Case 2

A 67-year old male with a history of COPD and CAD and who had an angioplasty with placement of a stent, tested positive for COVID-19 by RT-PCR a day prior to starting Ayurvedic treatment in July 2020. His long-term medications included a beta-blocker and statin (Table 1).

4.2.1. Clinical progression

The patient started a cough 8 days prior to commencing Ayurvedic therapy. He was prescribed antibiotics for a week by his general physician. His cough did not resolve and he also developed loose stools. In addition, he had breathlessness, nausea and vomiting. His temperature was 98 °F (36.6 °C), pulse rate (PR) was 81 beats per minute (bpm), and SpO_2 was between 90% and 94%. He went to a pulmonologist and underwent a COVID-19 testing.

4.2.2. Ayurvedic therapy

Table 2 provides the sequence of clinical events and Ayurvedic intervention. Patient started feeling better within two days of commencement of the treatment. On day 5, patient who was unused to an Ayurvedic diet, felt weak and the next day the family admitted him to an allopathic hospital for cardio-respiratory monitoring. On admission, a lung CT was performed which showed changes consistent with SARS-COV-2 infection and post-infective sequel was observed (supplementary fig. 1a). At the hospital, patient was maintained on isotonic saline and was discharged after 5 days. Patient subsequently visited the Ayurvedic clinic and said his COVID-19 symptoms had resolved by Day 5, especially that his nausea and cough “had reduced by 90%“. He also reported that his mother and sister had also contracted the infection in the intervening period and that they had succumbed to the disease in an intensive care unit.

4.3. Case 3

A 92-year old, male patient developed symptoms of COVID-19 and had a contact history with patients of similar symptoms. He was a hypertensive with a history of undergoing coronary artery bypass grafting for CAD in 2003. Two years earlier, he was treated for tuberculosis. He also had complaints of enlarged prostate and had suffered a burn injury in April of 2020 in the lower abdomen and genital area requiring collagen grafting. He could not urinate and hence was permanently catheterised. He was on a beta-blocker and an angiotensin receptor blocker for hypertension and cardiac condition, and silodal-D (silodosin and dutasteride) for prostate enlargement.

4.3.1. Clinical progression

Patient had diarrhoea (4–5 loose stools a day) for one week. He also had a cough, feeling of feverishness and pain in the left lower abdomen for 3 days prior to Ayurvedic treatment.

4.3.2. Ayurvedic treatment

Table 2 provides the sequence of clinical events and Ayurvedic intervention. His loose stools improved in 24 h. He had a temperature between 99.5 °F (37.5 °C) and 100 °F (37.7 °C) for 2 days. On Day 4 he was afebrile. By Day 5 he was back to baseline functional activity. On day 6 he felt normal and was advised a COVID-19 antibody test.

The entire family developed COVID-19-like symptoms around the same time as our index patient. The family fearing his fragile health given his age of 92 years and underlying co-morbidities did not want to take him to a government hospital; hence the family refused COVID-19 testing. However, they agreed to take an antibody test instead after the resolution of symptoms. By day 4 the patient had resolution of symptoms. On day 13, the result of the antibody test was read as “reactive”.

4.4. Case 4

A female, aged 48 years was afflicted with diabetes mellitus for 10 years and was on insulin since a year. She was hypertensive for the past 10 years and was on medication. She was diagnosed with breast cancer in September 2019 and had completed 4 cycles of chemotherapy prior to left mastectomy. She then completed 4 cycles of chemotherapy after surgery. She was also undergoing radiation therapy since May 2020. She had completed 10 sittings of radiation therapy prior to testing positive for COVID-19 in June 2020. The radiation therapy was discontinued at that point (Table 1).

4.4.1. Clinical progression

She was febrile with a temperature of 103 °F (39.4 °C) two days prior to starting Ayurvedic treatment and a cough which was at a frequency of once in 10 min. According to the patient, she also had 80% loss of smell and taste. Her bowel movements and urination were normal. She had other associated symptoms such as diminished appetite, bodyache, headache, nasal secretions, and generalised weakness.

4.4.2. Ayurvedic treatment

Patient was advised to stop all the drugs she was taking for fever. Table 2 provides the sequence of events and Ayurvedic intervention. The patient, who reported with fever, loss of smell and taste, runny nose, general weakness and severe cough, had her symptoms resolved within 6 days. On Day 8, she developed mild symptoms such as low-grade fever with cough, which were managed with Ayurvedic medication. She was able to restart her radiation therapy for breast cancer.

4.5. Case 5

A 65-year-old male who had a contact history with COVID-19, turned positive on testing. His co-morbidities included mild anemia, type 2 diabetes, aortic valve sclerosis with mild diastolic dysfunction of the heart, but normal ejection fraction and fatty liver. He had elevated CRP at 28 (normal 5 mg/L) and mild hypoproteinemia.

The patient was a Type 2 diabetic for 10 years and was on antidiabetic medications. He was also on a statin drug for high cholesterol and an ACE inhibitor for hypertension (Table 1).

4.5.1. Clinical progression

Clinical presentation is detailed in Table 2. The CT features were suggestive of acute viral interstitial pneumonitis with a COVID −19 score of 25, which was rated as moderate, based on American Association RSNA [13]. The lung involvement was 50−55%, and CO-RADS category was 5 (supplementary fig. 1b). Based on the lung CT scan, he was advised hospitalisation. The family opted for Ayurvedc treatment with home quarantine.

4.5.2. Ayurvedic treatment

The fever was a week-old, his cough turned continuous, he developed loose stools and was very weak. He had a poor appetite. Details of his disease course and the Ayurvedic intervention are provided in Table 2. He improved steadily. His fever became low grade in 48 h and completely resolved by Day 6. His oxygen saturation levels showed remarkable improvement following Ayurvedic therapy. Discomfort that he experienced with low oxygen saturation levels of 79 resolved. He was tested negative for COVID-19 by RT-PCR on Day 13 (Table 2).

4.6. Case 6

An 80-year-old male with COPD for 25 years was treated with Ayurvedic medications for his ailment, tested positive for COVID-19 in September 2020. Table 1 provides clinical data. He was also on levosalbutamol (50 mcg) and ipratropium (20 mcg) nebulisation twice a day.

4.6.1. Clinical progression

He started with a fever, mild body pain, loss of appetite and an oxygen saturation of 89−90%. Ayurvedic medication was started from Day 1.

4.6.2. Ayurvedic treatment

Table 2 provides the sequence of events and the Ayurvedic intervention. On day 4, SpO_2 levels were found to be 76%. He had breathlessness, which was aggravated when he lay down. There was no bowel movement for 8 days. On day 7 his temperature came down to 98.4 °F (36.8 °C) and SpO_2 was between 77% and 80%. There was a mild fever for the following four days. The Ayurvedic medication given to him included a special preparation (detailed in Table 2) considering his COPD. On day 10, his SpO_2 climbed to 90%, but it oscillated between 85% and 90% for the next ten days. On day 13, there was no fever or cough. On day 20, SpO_2 was recorded over 90%.

4.7. Case 7

A 63-year old female who was diabetic for 15 years, and was on metformin, glipizide, thyroxine. She was also obese, with a Body Mass Index (BMI) of 37.1.

4.7.1. Clinical progression

The patient's family developed COVID-19 symptoms after contact with a COVID-19 positive patient. Patient developed fever 5 days prior to Ayurvedic treatment with heaviness of head, severe body pain and generalised weakness. On day 10 she developed breathlessness with SpO_2 of 75%

4.7.2. Ayurvedic treatment

Table 2 provides the sequence of events and the Ayurvedic intervention. She stopped all her allopathic medication. By day 4 she had a temperature of 102 °F (38.8 °C), breathlessness, SpO_2 at 80%, blood-streaked sputum, cold extremities, and five watery loose stools a day. On day 5, the usage of portable oxygen made no improvement to her respiratory status, as it only improved the

oxygen saturation by 2 points (77%). Special medication to improve her breathing was administered as in Case 6. By Day 10 she gradually improved and her stools became normal. By Day 13 her SpO_2 level were recorded at 90%.

5. Discussion

5.1. Limitations

Since five out of seven patients were using Ayurvedic treatment for the first time, the instructions on diet and regimen were altogether new to them, as were the medicines and the way to use them. Out of the seven patients, five of them were in touch with their treating physicians over the telephone, they were dealing with and monitoring the disease by themselves under quarantine. Cases 6 and 7 had Ayurvedic physicians who personally monitored them. The daily news report on the pandemic had caused overwhelming panic and distress among the patients. The physicians had to constantly reassure patients not to get too anxious about their symptoms and encourage them to complete the course of Ayurvedic intervention.

In India, Ayurveda is not the mainstream system of medicine. Therefore, the patients who sought Ayurvedic treatment over allopathy were under severe mental stress as to the efficacy of Ayurvedic treatment.

Limitations also include a small number of patients, retrospective nature of our study and the lack of an age-matched control group on allopathic therapy. However, our patients had co-morbid conditions that generally resulted in high mortality.

5.2. Strengths

All the patients who had multiple co-morbidities were treated entirely with Ayurveda. Three patients had COPD, four patients were diabetic, four of them had heart disease, one patient was on radiation therapy for cancer, and one patient was on haemodialysis for CKD. Two patients were 80 and 92 years of age respectively. Though they were all treated for COVID-19, each of their prescribed medications were different based on their co-morbidities and clinical presentations. During Ayurvedic treatment, their conditions did not deteriorate. Even in the case where the patient missed three consecutive sessions of haemodialysis, the clinical condition was not impaired. Table 3 gives comparative details of the patients.

None of the seven patients showed any adverse reactions due to Ayurvedic medicines. Though Case 1 patient was on haemodialysis thrice a week, she was able to withstand the lack of haemodialysis for nine days and yet important renal parameters like serum potassium and bicarbonate were maintained within normal range. At the time of resumption of dialysis, serum potassium and bicarbonate were 5.7 and 23 respectively. Case 2 patient was mildly hypoxemic with an abnormal CT scan and eventually made a full recovery. Case 3 despite an advanced age, cardiac, pulmonary and genitourinary co-morbidities made an uneventful recovery. Case 4 patient who was immunocompromised with a diagnosis of breast cancer was on radiation therapy with multiple COVID-19 symptoms such as fever, loss of smell and taste, nasal discharge, general weakness and severe cough; her symptoms resolved within 6 days. She subsequently was able to resume radiation therapy for breast cancer. Cases 5, 6 and 7 had hypoxemia with SpO_2 of 79%,76%, and 75% respectively.

It is generally observed that severe cases of COVID-19 associated with pneumonia need hospitalisation and subsequent oxygen and/or respiratory support [14,15]. Case 5 was already well into an acute and progressive phase of infection when he came for Ayurvedic treatment and despite poor prognostic features recovered completely. Fever that was observed at 103 °F (39.4 °C) and 104 °F (40 °C) despite the use of antibiotic and acetaminophen quickly resolved with Ayurvedic medications. The SpO_2 which was 79% also progressively improved to 92%–96% by day 6 without complications and without requiring an admission into a hospital.

The SpO_2 level of Case 6 dropped to 76% and was associated with breathlessness which was indicative of severe pulmonary pathology leading to hypoxemia. Ayurvedic medicines were administered once every one and a-half-hour, that is, ten times between 7 am and 10 pm. In Ayurvedic treatment, this method of administering medications at this frequency is called *muhur muhur* [7, *Sutra Sthana* 12/40] and is recommended in breathlessness. With this approach, the patient recovered steadily without complications.

In Case 7, the production of thick sputum with a tinge of pinkish colour throughout the day, SpO_2 levels of 75% combined with breathlessness could be indicative of pneumonia with possible pulmonary edema from severe SARS-CoV-2 infection. Despite poor prognostic features, she recovered completely. The SpO_2 of 75% also improved to 93% by day 14 without complications and without requiring an admission into a hospital. When the patient was administered oxygen therapy using an oxygen concentrator at home, there was no significant impact on the SpO_2 levels (it went up only by two points). The concept of *muhur muhur* in Ayurveda mentioned above was also followed in this case.

Table 3
Comparative Table of Patients' age, co-morbidities, test results and recovery time.

Patient	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Age	57 yrs	67 yrs	92	48	65	80	63
Co-morbidities	Type 2 DM (23 yrs), hypertension (22 yrs), CAD (5 years), CKD (7 yrs), hemodialysis, COPD (6 yrs), Ca breast, treated for TB	COPD, CAD, angioplasty	Hypertension, CAD (bypass grafting), treated for TB, enlarged prostate, urinary catheterization, previous burn injury	Type 2 DM, hypertension (10 Yrs.), Ca breast	Type 2 DM (10 yrs), aortic valve sclerosis with mild diastolic dysfunction of the heart, but normal ejection fraction. Elevated CRP at 28 (normal <5 mg/L) and mild hypoproteinemia	COPD (25 yrs)	DM (15 yrs)
RT-PCR (before)	Positive 04-06-2020	Positive 04-07-2020	Not done	Positive 26-06-2020	Positive 28-07-2020	Positive 25-09-2020	Not done
Treatment Started	05-06-2020	05-07-2020	02-07-2020	27-06-2020	29-07-2020	26-09-2020	14-09-2020
Resolution	12-06-2020	10-07-2020	07-07-2020	14-07-2020	04-08-2020	08-09-2020	25-09-2020
RT-PCR – Negative (after)	18-06-2020 (14 days)	Not done	Not done	Not done	11-08-2020	15-10-2020	Not done
Antibodies	–	–	Positive	–	–	–	Positive

Cases 5, 6, and 7 illustrate that using an Ayurvedic approach, it is possible to effectively treat COVID-19-induced pulmonary disease. Aggressive conventional medical approach including invasive artificial mechanical ventilation may not work for everyone without causing multiple life-threatening complications.

Our patients were also treated in an out-patient setting which likely kept the cost low, although we have not shown cost comparison.

6. Conclusion

This retrospective observational data provides some insights into the efficacy and safety of Ayurvedic intervention in COVID-19 patients who are considered vulnerable or high-risk. All the seven patients who had multiple co-morbidities and/or severely immunocompromised status, were treated entirely with Ayurveda and followed up for 2–6 months. Though they were all treated for COVID-19, each of their prescribed medications were different based on their co-morbidities and clinical presentation. During Ayurvedic treatment, these patients maintained stability. None of the seven patients showed any adverse reactions to Ayurvedic medicines. We believe this was due to the protective nature of the Ayurvedic medicines. This case series points to the potential of using Ayurvedic principles to successfully manage high-risk COVID-19 patients. All seven patients recovered without any complications and were successfully treated in an outpatient setting. Since there was no requirement for radiology, intensive care or hospitalization, the cost was very low. Despite the discussed limitations, Ayurvedic treatment resulted in a good outcome in the treatment of high-risk COVID-19 patients. A larger randomized control study of high-risk patients with multiple co-morbidities is needed to compare the outcome of COVID-19 disease caused by SARS-CoV-2 virus to confirm the beneficial effects of Ayurveda versus allopathy.

Statement of ethics

Written informed consent was obtained from the patients for publication of this case series and any accompanying images.

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Conflict of interest

None

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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.2021.06.006.

References

[1] Girija PLT, Sivan Nithya. Ayurvedic treatment of COVID-19/SARS-CoV-2: A case report. J Ayurveda Integr Med 2020. https://doi.org/10.1016/j.jaim.2020.06.001. Available online 19 June 2020.
[2] Koushik Janardhan. Siddha therapy in focus as Tamil Nadu govt authorises use in Covid treatment. Indian Express 2020 [online] Chennai, Updated: July 9, 2020, https://indianexpress.com/article/cities/chennai/siddha-therapy-in-focus-as-tamil-nadu-govt-authorises-use-in-covid-treatment-6497651/.
[3] Jenefa Rose Priya T. Siddha medicine Combat against Novel corona virus – an appraisal. Int J Emerg Technol Innovat Res June-2020;7(5):635–42 (www.jetir.org), ISSN:2349-5162, http://www.jetir.org/papers/JETIR2005400.pdf.
[4] Ref, Adluri USP, Tripathi AC. Understanding COVID - 19 pandemic - a comprehensive Ayurvedic perspective. J Ayurveda Integr Med 2020 Sep. https://doi.org/10.1016/j.jaim.2020.08.001. https://www.sciencedirect.com/science/article/pii/S0975947620300644.
[5] Rastogi Sanjeev, Pandey Deep Narayan, Singh Ram Harsh. COVID-19 pandemic: a pragmatic plan for ayurveda intervention. J Ayurveda Integr Med 2020. https://doi.org/10.1016/j.jaim.2020.04.002. Available online 23 April 2020, https://www.sciencedirect.com/science/article/pii/S097594762030019X.
[6] Joshi JA, Puthiyedath R. Outcomes of ayurvedic care in a COVID-19 patient with hypoxia - a case report. J Ayurveda Integr Med 2020. https://doi.org/10.1016/j.jaim.2020.10.006. https://www.researchgate.net/publication/345317310_Outcomes_of_Ayurvedic_care_in_a_COVID-19_patient_with_hypoxia_-A_Case_Report.
[7] Srikantha Murthy KR, editor. Ashtanga Hrdayam of Vagbhata. Varanasi: Krishnadas Academy; 2003.
[8] Sharma Ram Karan, Dash Vaidya Bhagwan, editors. Charaka Samhita of Agnivesha, text with English translation of Ayurveda Dipika commentary of Chakrapanidatta. Varanasi: Chowkhambha Sanskrit Series; 2003.
[9] Liu M, Wang T, Zhou Y, Zhao Y, Zhang Y, Li J. Potential role of ACE2 in corona virus disease 2019 (COVID-19) prevention and management. J Transl Intern Med 2020;8:9–19.
[10] COVID-19 High risk groups". World Health Organisation; 2020. https://www.who.int/westernpacific/emergencies/covid-19/information/high-risk-groups.
[11] Maragakis Lisa. Coronavirus and COVID-19: who is at higher risk?" [online] Johns Hopkins Med 2020. Updated June 2020, https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/coronavirus-and-covid19-who-is-at-higher-risk. August 7th 2020.
[12] Jordan Rachel E, Adab Peymane, Cheng KK. Covid-19: risk factors for severe disease and death. BMJ 2020;368:m1198. https://doi.org/10.1136/bmj.m1198.
[13] Lessmann Nikolas, Sánchez Clara, Beenen Ludo, Boulogne Luuk, Brink Monique, Calli Erdi, et al. Automated assessment of CO-RADS and chest CT severity scores in patients with suspected COVID-19 using artificial intelligence [In Press] Radiology July 2020. https://doi.org/10.1148/radiol.2020202439. https://www.researchgate.net/publication/343327893_Automated_Assessment_of_CORADS_and_Chest_CT_Severity_Scores_in_Patients_with_Suspected_COVID-19_Using_Artificial_Intelligence.
[14] Dondorp AM, Hayat M, Aryal D, Beane A, Schultz MJ. Respiratory support in COVID-19 patients, with a focus on resource-limited settings. Am J Trop Med Hyg 2020;102(6):1191–7. https://doi.org/10.4269/ajtmh.20-0283. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7253105/.
[15] World Health Organisation. Clinical management of severe acute respiratory infection (SARI) when COVID-19 disease is suspected, Interim guidance. 13 March 2020. https://www.who.int/docs/default-source/coronaviruse/clinical-management-of-novel-cov.pdf.
[16] Himasagara Chandra Murthy P. Sarngadhara Samhita of Sharngadharacharya, Madhyamakhanda, Churna Kalpana, chapter 6, verse 37. 2nd ed. Varanasi: Chowkhamba Orientalia; 1995. p. 88.
[17] Krishnan Vaidyan KV, Gopala Pillai S, editors. Sahasra Yogam, commentary of Sujanapriya. Alleppey. 16th ed. Vidyarambam Publishers; 1989.
[18] Himasagara Chandra Murthy P. Sarngadhara Samhita of Sharngadharacharya, Madhyamakhanda, Churna Kalpana, chapter 6, verses 26–36. 2nd ed. Varanasi: Chowkhamba Orientalia; 1995. p. 88.
[19] Lochan Kanjiv. Kaviraja Ambikadatta Shastri on Bhaishajyaratnavali of Govind Dasji, Volumes 1 and 2. 1st ed. Varanasi: Chaukambha Sanskrit Bhawan; 2006.
[20] Srikantha Murthy KR. Bhava Prakasha of Bhava Mishra, Purva Khanda, Prathama Bhaga. Varanasi: Chowkhamba Krishnadas Academy; 2001.
[21] Arumanoor Parameswaran, Ramankutty Varier KV. In: Murali K, editor. Ashtavaidyan PTN Vasudevan Mooss, Yoga Manjari (Malayalam), Part 2, No. 16, Thrissur. 1st ed. Unnimooss Foundation; 2019. p. 86.
[22] Rastantrasaar, Sangraha Siddhaprayog. Part 1,Kharaliya Rasayan, No. 134, Ajmer, Krishna Gopal Ayurved Bhawan. 21st ed. 2000. p. 274.
[23] Sarma Sri Sadananda, Tarangini Rasa. Dasama Taranga, verse 74. 11th ed. New Delhi: Motilal Banarasidass; 2000. p. 235.