Case Report

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

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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
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 janapada-dodhwamsa-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 medicines for COVID-19 were prescribed taking into account their co-morbidities and 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 (SpO2) 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 medicines were given.

Table 1

| Case Number | Gender | Age (years) | BMI | Co-morbidities | Allopathic Therapy |
|-------------|--------|-------------|-----|----------------|-------------------|
| 1           | F      | 57          | 25.9| Type 2 DM (23 yrs), hypertension (22 yrs), CAD (5 yrs), 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 | |
| 3           | M      | 92          | 18.9| Hypertension, CAD (bypass grafting), treated for TB, enlarged prostate, urinary catheterization, previous burn injury | b-blocker, statins |
| 4           | F      | 48          | 26.2| Type 2 DM, hypertension (10 yrs), Ca breast | |
| 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 | insulin, mastectomy, radiation, chemotherapy |
| 6           | M      | 80          | 22.3| COPD (25 yrs) | linagliptin 2.5 mg, glipizide 60 mg, statin drug, and an ACE inhibitor. |
| 7           | F      | 63          | 37.1| DM (15 yrs) | levsalbutalmon (50 mcg) + ipratropium (20 mcg) nebulisation twice a day 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.
| Day | Symptoms | Ayurvedic Therapy |
|-----|-----------|-------------------|
| Case 1 | Afebrile, cough 4–5 times a day, semi-solid stools | Pippalyadi Churna [16], Dhanvantara Gutika [17], Vidaryadi ghrita [7], Chikitsa Shana 3/164, 165, 167–168 |
| 1 | Afebrile; pm: 99 °F (37.2 °C) | Medications as above |
| 2–5 | Afebrile, heaviness, ↑ ud, ↑ wt, nl appetite, semi-solid stools | Discontinued Pippalyadi Churna |
| 6–7 | ↑ loose stools, ↑ uo, supine cough; (-) fever/pain/phlegm/dyspnea, ↑ wt (1.2 kg) | Discontinued Ayurvedic medications |
| 8 | Afebrile | Veshti Swasa [6], Abhraka bhasma [22], Jwara Chikitsa [7] |
| Case 2 | Cough, dyspnea, loose stools, nausea & vomiting, drowsiness | Medicated with dadimadi ghrita [45], Vidaryadi ghrita [7], and Kanakasava [19], Vettumaran gutika [44] |
| 1 | Wet cough, belly pain, loose stools | dadimashataka churna [7] |
| 2–5 | ↓drowsiness, ↓ cough, Spo2 88%–94% | Continued above medications |
| 6 | Weakness & other symptoms resolved | Admitted to a hospital for observation |
| Case 3 | Loose stools resolved | dadimashataka churna |
| 1 | No symptoms | Pippalyadi Churna |
| 3 | No change in therapy | Ashwagandhadi churna [17], Churna Prakarana/8 |
| 4 | No change in therapy | Dhanwantara Gutika [17], Vattumaran Gutika [17], Vidaryadi ghrita [7], Chikitsa Yogam/60 |
| Case 4 | Persistent headache & low-grade fever in am & pm | Ashwagandhadi churna [17], Churna Prakarana/8, Dasamoolarishta [17], Arishi Prakarana/13 |
| 1 | Frequent cough, mild fever | dadimashataka churna [7], Chikitsa Shana 8/145–148, Sudarsan churna tablets [18], Dhanvantara Gutika [17], Vidaryadi ghrita [7], Chikitsa Yogam/60 |
| 2 | Same as above | Medications as above |
| 3–7 | Afebrile, felt well | dadimashataka churna |
| 8–15 | Afebrile, mild cough, active | dadimashataka churna |
| 16 | Afebrile, dramatic ↓ in cough | dadimashataka churna |
| 17 | Afebrile, dramatic ↓ in cough | dadimashataka churna |
| Case 5 | Fever 102 °F (38.8 °C), continuous cough, semi-solid stools | dadimashataka churna |
| 1 | 102 °F (38.8 °C) | dadimashataka churna |
| 2 | No fever, pm: 100 °F (37.7 °C) | dadimashataka churna |
| 3 | Temperature at 4 am: 100 °F (37.7 °C) | dadimashataka churna |
| 4 | Dadimadi Ghrita [45] | dadimashataka churna |
| 5 | Pippalyadi Churna | dadimashataka churna |
| 6 | Discontinued dadimashataka churna | dadimashataka churna |
| 7 | No symptoms | dadimashataka churna |
| 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 | dadimashataka churna |
| 13 | RT-PCR for COVID was negative | dadimashataka churna |
| Case 6 | Temp: 101 °F (38.3 °C) – 102 °F (38.8 °C), mild body pain, Spo2: 89–90 | dadimashataka churna |
| 1 | Temperature at 4 am: 100 °F (37.7 °C) | dadimashataka churna |
| 2 | Dadimadi Ghrita [45] | dadimashataka churna |
| 3 | Pippalyadi Churna | dadimashataka churna |
| 4 | Dadimashataka churna | dadimashataka churna |
| 5 | Discontinued Pippalyadi Churna | dadimashataka churna |
| 6 | Discontinued Ayurvedic medications | dadimashataka churna |
| 7 | Discontinued dadimashataka churna | dadimashataka churna |
| 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 | dadimashataka churna |
| 13 | RT-PCR for COVID was negative | dadimashataka churna |

**Table 2**
Course of SARS-CoV-2 and Ayurvedic intervention.
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 SpO₂ 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 for 3 days prior to Ayurvedic treatment.
4.4.1. Clinical progression

An antibody test was read as reactive, suggesting the patient had resolution of symptoms. On day 13, the result of the antibody test was instead recorded as negative. However, they agreed to take an antibody test 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.

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 the Ayurvedic intervention. The patient, who reported with fever, loss of smell and taste, runny nose, general weakens 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 anti-diabetic 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 Ayurvedic 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).
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 SpO2 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 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 SpO2 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 SpO2 which was 79% also progressively improved to 92%–96% by day 6 without complications and without requiring an admission into a hospital.

The SpO2 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, SpO2 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 SpO2 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 SpO2 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 yrs), 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 | Positive | Not done | Positive | Positive | Positive | Not done |
| Treatment Started | 04-06-2020 | 05-06-2020 | 02-07-2020 | 26-06-2020 | 28-07-2020 | 25-09-2020 | 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) | Not done | Positive | Not done | Not done | Not done | 11-08-2020 | 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 outpatient 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 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, 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

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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/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 Innov Res June-2020;7(5):635–42 (www.jetir.org), ISSN:2349-5162, http://www.jetir.org/papers/JETIR200540.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/ S097594762030109X.

[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/345317130_Outcomes_of_Ayurvedic_care_in_a_COVID-19_patient_with_hypoxia_-A_Case_Report

[7] Srikantha Murthy KR, editor. Ashtanga Hrdayam of Vagbhata. Varanasi: Krishandas Academy; 2003.

[8] Sharma Ram Karon, Dash Vaidya Bhugwan, editors. Charaka Samhita of Agnivesha, text with English Translation of Ayurveda Dipamika commentary of Chakrapandita. Varanasi: Chowkambha 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 Med 2020;8:9–10.

[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-covid-19-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, Bouligne Luuk, Brink Monique, Cali 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.2020204239. 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] Dondeop AM, Hayat M, Aynal 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. Sargadharas Samhita of Sharangadhara, Madhyamakhand, Churna Kalpana, chapter 6, verse 37. 2nd ed. Varanasi: Chowkhamba Orientalia; 1995. p. 88.

[17] Krishnan Vaidyan KV, Gopal Pillai S, editors. Sahasra Yogam, commentary of Sujanapriya, Alappuy. 16th ed. Vidyaranyam Publishers, 1895.

[18] Himasagara Chandra Murthy P. Sargadharas Samhita of Sharangadhara, Madhyamakhand, Churna Kalpana, chapter 6, verses 26–36. 2nd ed. Varanasi: Chowkhamba Krishnadas Academy, 2001.

[19] Arumanon Parameswaran, Ramamurthy Varier KV. In: Murali K, editor. Ashvamediyant PTN Vasudevan Moos, Yoga Manjari (Malayalam), Part 2, No. 16, Thrisur. 1st ed. Unnimossin Foundation; 2019. p. 86.

[20] Rastanstraar, Sangraha Siddhaprayog, Part 1.Karaliya Rasayan, No. 134, Ajmer, Krishna Gopal Ayurved Bhawan, 21st ed. 2000. p. 274.

[21] Sarma Sri Sadananda, Tarangini Rasa. Dasama Taranga, verse 74. 11th ed. New Delhi: Motilal Banarasidass; 2000. p. 235.