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International Journal of Complementary & Alternative Medicine

Review Article

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Chaaya adhyaya of Bhela indriya sthana - An explorative study

Abstract

Background: '*Bhela samhita*' is an ancient *Ayurvedic* textbook of medicine composed by '*Maharshi Bhela*'. '*Maharshi Bhela'* is one among the six disciples of '*Acharya Punarvasu Atreya'* and colleague of '*Maharshi Agnivesha*' (author of *Charaka samhita*). *Bhela samhita* consists of 120 chapters and 8 sections. *Indriya sthana* is one among the 8 sections of '*Bhela samhita*', which consist the description of '*Arishta lakshanas*' (fatal signs and symptoms, which indicates an impending death). *Bhela indriya sthana* consists of 12 chapters and '*Chaya adhyaya*' is the name of the 10th chapter.

Purpose: The contents of '*Chaya adhyaya*' are unique and least explored. No studies have been conducted on '*Chayaadhyaya*' of *Bhela indriya sthana* till date. Previous works on '*Charaka indriya sthana*' and '*Bhela indriya sthana*' have explored their prognostic potential and clinical utility. The present study is aimed to explore the prognostic significance of the contents of '*Chaya adhyaya*' chapter of '*Bhela indriya sthana*'.

Methods: Various databases have been searched to collect relevant data regarding *Ayurvedic* and contemporary medical literature by using appropriate keywords. Only full text articles published in English language were considered.

Results: Various concepts or conditions such as estimating prognosis based on the abnormal body shadows, visual perceptual distortions with an underlying organic brain diseases, streptococcal sore throat and its fatal outcomes such as septic shock, systemic inflammatory response syndrome and multiple organ dysfunction syndrome, temporal arteritis with bilateral temporal necrosis, ophthalmic manifestations and renal failure, extra-pulmonary tuberculosis, gastroesophageal reflux disease and its complications, carcinomas, hematemesis and/or hemoptysis with fatal outcomes, upper gastrointestinal bleeding, perforation of visceral organs, thermoregulatory disorders, central cyanosis with intracranial pathology, diarrhoea predominant irritable bowel syndrome, protein energy malnutrition, hepatocellular carcinoma, cirrhosis of liver and characteristics of an expert physician having profound knowledge in prognostication are documented in this chapter.

Conclusion: The conditions or concepts documented in '*Chaya adhyaya*' of '*Bhela indriya sthana*' possess great prognostic significance.

Keywords: *bhela indriya sthana*, *bhela samhita*, *charaka indriya sthana*, *charaka samhita*, *indriya sthana,* prognosis

Volume 14 Issue 3 - 2021

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Received: April 29, 2021 | **Published:** May 17, 2021

Abbreviations: DLB, dementia with lewy bodies; CBS, charles Bonnet syndrome; CJD, creutzfeldt-Jakob disease; PD, parkinson's disease; CPS, complex partial seizures; PH, Peduncular hallucinosis; AIWS, alice in wonderland syndrome; SAH, subarachnoid haemorrhage; URTI, upper respiratory tract infection; LRTI, lower respiratory tract infection; SIRS, systemic inflammatory response syndrome; MODS, multiple organ dysfunction syndrome; GCA, giant cell arteritis; TA, Temporal arteritis; ESRD, End-stage renal disease; CKD, chronic kidney disease; BUN, blood urea nitrogen; NSTIs, necrotizing soft tissue infections; NF, necrotizing fasciitis; GI, gastrointestinal; EPTB, extra-pulmonary tuberculosis; GERD, gastroesophageal reflux disease; TB, Tuberculosis; UGIB, Upper gastrointestinal bleeding; MWS, mallory-Weiss syndrome; ED, emergency department; DKA, Diabetic ketoacidosis; AAA, abdominal aortic aneurysm; VPDs, Visual perceptual distortions; ANS, autonomic nervous system; SCI, spinal cord injury; CNS, central nervous system; WE, wernicke's encephalopathy; ICH, intracranial haemorrhage; COPD, chronic obstructive pulmonary disease; CHD, congenital heart disease; VHD, valvular heart disease; OSA, obstructive sleep apnoea; TBI, traumatic brain injury; IBS, irritable bowel syndrome; IBS-D, diarrhoea predominant IBS; IBS-C, constipation predominant IBS; PEM, protein energy malnutrition; MUAC, middle-upper arm circumference; HIV, human immunodeficiency virus

Background

Ayurveda (an ancient Indian system of medicine) has had a long history traceable to the *Vedas* (oldest Sanskrit literature originating in ancient India) whose age is regarded of late as about 10,000years back approximately. *Maharshi Bhela* was a direct disciple of '*Acharya Punarvasu Atreya*' (the great preceptor/progenitor of *Ayurveda*) and colleague of *Maharshi Agnivesha*, *Jatukarna*, *Parashara*, *Harita* and *Ksharapani*. '*Maharshi Bhela*' has composed an *Ayurvedic* treatise known as '*Bhela samhita*' (1000 - 2000 BC) which consists 120 chapters divided among 8 sections. Arrangement of the contents of '*Bhela samhita'* is similar to that of '*Charaka samhita*'. *Bhela samhita* has a number of unique concepts and vast majority of scientific literature that were neglected and unexplored till date.[1]

'*Indriya sthana*' is one among the eight sections of '*Bhela samhita'* and it consists of 12 chapters. '*Indriya sthana'* deals with the description of various '*Arishta lakshanas'* (fatal signs and symptoms) which indicates an imminent death.[2] '*Chaya adhyaya*' is the 10th chapter of '*Bhela indriya sthana*' which consists of 13 verses. This chapter also deals with *arishta lakshanas* like other chapters of *indriya sthana*.[3,4] Previous works conducted on '*Charaka indriya sthana*'[5–18] and '*Bhela indriya sthana*'[19–24] have explored their prognostic significance. The contents of '*Chaya adhyaya*' are unique and needs further exploration. The present study is aimed to evaluate the contents of '*Chaya adhyaya*' in terms of their prognostic significance (Table 1).

Table 1 Verses of 'Chaya adhyaya' with their relevant clinical conditions

Verse	Relevant clinical conditions
'Anuchaya athavaa -- na sa jeevati taadrusha' (B. I. 10/1)	Study of human Aura or body shadows/Kirlian photography
'Yo vidyut mivaakaasho -- yasya naasteeti tam vidu' (B. I. 10/2)	Visual hallucinations or Visual perceptual distortions (VPDs) associated with organic brain diseases
'Laakshaa raktam yathaa -- raktapittena hanyate' (B. I. 10/3)	Complex visual hallucinations/Charles Bonnet syndrome/Peduncular hallucinosis/Central nervous system pathologies;
'Yo hrushta roma purusha -- yasya naasteeti tam vidu' (B. I. 10/4)	Streptococcal sore throat/Septic shock/Systemic inflammatory response syndrome/Multiple organ dysfunction syndrome
'Yasya shankhaat chyutam maamsam -- paretam tasya jeevitam' (B. I. 10/5)	Giant cell arteritis/Temporal arteritis with bilateral temporal necrosis, ophthalmic manifestations and renal failure
'Yasya hastaat chyutam maamsam -- na sa jeevati maanava' (B. I. 10/6)	Necrotizing soft tissue infections; Necrotizing fasciitis
'Avipakvam vipakvam vaa -- naasti tasya chikitsitam' (B. I. 10/7)	Pulmonary tuberculosis/Extra-pulmonary tuberculosis such as gastic or duodenal or ileocecal tuberculosis/Gastroesophageal reflux disease with complications
'Hrudayam purvamaavaati -- tasya jeevitam naativartate' (B. I. 10/8)	Carcinomas/lymphomas/infections/inflammatory conditions
'Urdhwa shwaasa hato yastu -- na sa jeevati maanava' (B. I. 10/9)	Hematemesis or hemoptysis associated with fatal outcomes/Upper gastrointestinal bleeding/Perforation of visceral organs/Abdominal aortic aneurysm etc
'Antardaaho adhiko yasya -- yo na sa jeevati' (B. I. 10/10)	Autonomic neuropathies or Ganglionopathies/Thermoregulatory disorders due to impaired autonomic and/or central nervous system pathways
'Yasya pakwaavubhaushtau -- paretam tasya jeevatim' (B. I. 10/11)	Central cyanosis with intracranial or intracerebral pathology/Secondary brain injury with central cyanosis
'Yasya ucchoonam bhavet madhya -- pretastadhaiva sa' (B. I. 10/12)	Diarrhoea predominant irritable bowel syndrome/Kwashiorkor/ Marasmus/Protein energy malnutrition/Hepatocellular carcinoma/ Cirrhosis of liver/Celiac disease/Malabsorption syndrome
'Yetat indriya vignaanam -- nrunaam vidyaat bhishagvara' (B. I. 10/13)	Expert physician having proper knowledge of prognostication

(B. I. 10/XX): B - Bhela samhita; I - Indriya sthana; 10 - Tenth chapter; XX - Verse number

Methodology

A literature search has been undertaken and *Ayurvedic* literature pertaining to '*Bhela Indriya sthana*' and '*Charaka indriya sthana*' has been collected from different versions of *Bhela samhita* & *Charaka samhita* (along with their commentaries). Relevant other classical texts of *Ayurveda* have also been referred. Relevant key words have been used (both *Ayurvedic* and terms related to contemporary emergency medicine) for literature search. Only full text, open access articles published in 'English language' were considered. Both 'Google' and 'Google scholar' databases have been used for search. Articles published until April 2021, were only considered irrespective of their publication year or date of appearance. Articles related to emergency medicine and having prognostic importance have been searched from electronic databases by using relevant key words. No filters were applied during search.

Results & discussion

Total 13 verses have been documented in '*Chaya adhyaya*' of *Bhela indriya sthana*. Each and every verse has been explored in the following sections along with their meaning, prognostic importance and their similarity with contemporary emergency medical conditions (Table 1).

'Anuchaya athavaa -- na sa jeevati taadrusha' (*Verse 1*)[3]

An individual whom an aura or shadow (*Chaya*) follows after (*anu*) or whose aura is steady or strong or dense (*dridha*) or whose aura is cut up or broken (*vichhinna*), such a person will die soon (*na sa jeevati taadrusha*). The word '*Chaya'* in the present verse denotes either a shadow or an image or an aura of body or body parts.[3] Studying of shadows or reflections or mirror images of body or body

Citation: Mamidi P, Gupta K. Chaaya adhyaya of Bhela indriya sthana - An explorative study. *Int J Complement Alt Med.* 2021;14(3):117–124.
DOI: 10.15406/ijcam.2021.14.00544

parts of an individual to diagnose a hidden pathology and/or to assess the prognosis of a clinical condition is a unique concept of *Ayurveda*. Analysis of shadows or images (*Chaya*?) has been the target of an increasing number of studies in recent years. Previous works have demonstrated that shadows provide additional information regarding body biometrics that enhances identification of a person and gait recognition. Body shadows (*Chaya*) are potentially capable of contributing to the construction of the internal representation of body shape and its extension in space. In the absence of radiodiagnosis in ancient India, *Ayurvedic* practitioners have developed their own methods to diagnose deep seated, invisible and subtle pathologies by analysing the body shadows or reflections of the patients' body parts. Study of body shadows or reflections may provide additional information, improves attention towards interoceptive signals and helps in the diagnosis of a hidden or deep seated internal pathology that may not be easily visible otherwise. Any abnormalities found in the shadows or reflections of body or body parts denote an underlying pathology (undetectable or unidentifiable by direct examination) and an imminent death (*na sa jeevati taadrusha*).[11]

The human aura (*Chaya*?) may be described as a fine, ethereal radiation or emanation similar to that of electromagnetic field surrounding each and every living being which can be seen only by trained eyes. Aura not only made from energy and colour, but also has shape or dimensions. The Aura energy system has the seven colours (violet, indigo, blue, green, yellow, orange and red) and each colour is associated with seven *Chakras* respectively. The Aura colour is dependent on the negative and positive energies of the individual. Mental health and emotions can influence the colour, brightness (*dridha Chaya*?) and patterns of light in Aura. Kirlian photography is used to capture the aura. Kirlian camera can measure human energy levels and examine changes in the subtle energy distribution of the individual. Kirlian photographs can provide information regarding psychological, emotional and physical stipulation of an individual. Kirlian photographic images have the capability to detect diseases.[11] '*Anushchaya'* (shadow or aura that follows), '*dridhashchaya'* (strong or dense or persistent shadow or aura) and '*vichinnashchaya'* (broken shadow or aura) mentioned in the present verse denotes various abnormalities of body shadows or aura and indicates an imminent death (*na sa jeevati taadrusha*).

'Yo vidyut mivaakaasho -- yasya naasteeti tam vidu' (Verse 2)[3]

A man who sees (*pashyati*) a lightening (*vidyut*) in a cloudless sky (*aakaashe vyabhre*) and on whose head the aura is appearing as if it is smoking out (*dhoomaayate shirashchaya*) that person will die soon (*yasya naasteeti tam vidu*). Perceiving lightening (either in the absence of clouds or in its actual absence) denotes visual hallucinations (*pashyati vidyut aakaashe*). Hallucinations are defined as the perception of an object or an event (in any of the five senses) in the absence of an external stimulus (*pashyati vidyut aakaashe*). Visual hallucinations have numerous etiologies and are associated with conditions that span several fields such as neurology, psychiatry and ophthalmology (*yasya naasteeti tam vidu*?). Numerous hypotheses such as psycho-physiologic (disturbance of brain structure), psycho-biochemical (disturbance of neurotransmitters), and psychodynamic (emergence of the unconscious into consciousness) have been suggested to explain the genesis of visual hallucinations. Visual hallucinations (*pashyati vidyut aakaashe*) can be seen in various conditions such as psychosis (schizophrenia/schizoaffective disorder), delirium, dementia (especially dementia with Lewy bodies - DLB), Charles Bonnet syndrome (CBS), Anton's syndrome, seizures, migraines, PH, sleep disturbances, drug effects, inborn errors of metabolism, tumours, and Creutzfeldt - Jakob disease (CJD).[25] The condition '*dhoomaayate shirashchaya*' (aura appearing as smoking out from the head) denotes abnormalities of aura or shadows as discussed in the *Verse* 1.

'Laakshaa raktam yathaa -- raktapittena hanyate' (Verse 3)[3]

The person who perceives the entire earth (*maheem*) as covered by a red garment (*laksha raktam yathaa vastram*) and or perceives sky as blood red colour (*raktamaakaasham*) will die (*hanyate*) soon with a disease called '*Rakta pitta*' (bleeding diathesis). Similar verse was quoted in '*Purva rupeeyam indriyam*' (5th chapter) of '*Charaka indriya sthana*' and it was correlated with various conditions such as vitreous haemorrhage, CBS, hepatic/WE, rupture of cerebral aneurysms, vascular dementia, hypertensive encephalopathy, and vascular neuro-ophthalmological pathology.[9] Abnormally perceiving everything (*maheem & aakaasham*) as red colour (*rakta varnam*) may also denote visual hallucinations. Visual hallucinations can be seen in various medical, neurological, ocular, and psychiatric disorders. Simple type of visual hallucinations includes photopsia (flashes of light), lines or patterns (i.e., fortification spectra, circles, or zigzags) and they may be multicoloured (*rakta varnam*?). Simple hallucinations may occur in ophthalmological conditions such as vitreous detachment, optic neuritis, migraine, occipital lobe seizures, occipital lobe tumours, and other structural lesions. Complex visual hallucinations are well formed and often involve animals and figures in bright colours (*rakta varnam*?) and dramatic settings. Complex visual hallucinations can be seen in conditions such as delirium tremens, dementias, Parkinson's disease (PD), Complex partial seizures (CPS), schizophrenia, Peduncular hallucinosis (PH), migraine coma, and Alice in wonderland syndrome (AIWS).[26] The content of the visual hallucinations range from coloured shapes & patterns to well defined recognizable forms such as faces, animals, objects and scenes.[27]

Undescribed types of hallucinations such as formed percepts of distorted faces and multiple images can be seen in CBS patients. Undescribed hallucinations such as 'hyperchromatopsia' (*rakta varnam*?) or the perception of unnaturally vivid colors (*rakta varnam*?) as amorphous blobs or regular patterns (tessellopsia) can be seen in CBS patients. Some other works have reported hallucinations of hyperintense colour (*rakta varnam*?) in CBS patients. Patients hallucinating in red (*rakta varnam*), green, or a combination of red and green (red-green hallucinators) have been diagnosed as CBS. Acquired alteration in colour perception (acquired dyschromatopsia) (*laksha raktam yathaa vastram & raktamaakaasham*) is a well-recognized feature of anterior visual pathway disease. Cerebral problems with colour perception can manifest as problems with hue discrimination (*rakta varnam*?).[28] PH is characterized by vivid visual hallucinations (*rakta varnam*?) and associated with a range of different pathologies of the central nervous system such as vascular and infectious lesions of the pons, midbrain & thalamus, local subarachnoid haemorrhage (SAH) (*raktapittena*), compression by tumours, basilar migraines and basilar vascular hypoplasia.[29] The hallucinations in PH often involve colourful (*rakta varnam*?), vivid scenes with people, animals, and other patterns.[25]

'Yo hrushta roma purusha -- yasya naasteeti tam vidu' (Verse 4)[3]

A person who has been suffering with piloerection (*hrushta roma*), productive cough (*kaasena sleshmanaachita*), and itching or sore throat (*kanthashcha shookaanugata*) will die soon (*yasya naasteeti tam vidu*). The word '*hrushta roma*' denotes 'piloerection' or 'goosebumps' seen in hypothermia (temperature less than 35ºC).

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DOI: 10.15406/ijcam.2021.14.00544

'*Kaasena sleshmanaachita*' denotes productive cough or cough with sputum (upper and lower respiratory tract infections - URTI & LRTI?) and '*kanthashcha shookaanugata*' indicates feeling of thorns in throat or sore throat (can be seen in pharyngitis). Hypothermia, pharyngitis and URTI & LRTI together can be seen in septic shock developed due to pharyngitis and associated with high mortality rate. *Kantha shookairiva* (sore throat), *kshane sheeta* (hypothermia) and *kaasa* (cough) are the features of '*Sama sannipata jwara*'. *Sama sannipata jwara* denotes a condition of an URTI & LRTI that gradually lead to pneumonia, sepsis, systemic inflammatory response syndrome (SIRS), multiple organ dysfunction syndrome (MODS), septic shock and ultimately death in susceptible individuals (i.e., individual with compromised immunity or low vitality or elderly).[30] The present verse denotes a condition of sore throat (streptococcal?) causing septic shock or SIRS or MODS and ultimately death.

'Yasya shankhaat chyutam maamsam -- paretam tasya jeevitam' (Verse 5)[3]

A person who has been suffering with peeling skin & falling-off flesh at temporal region (*shankhaat chyutam maamsam*), darkening or discoloration of eyes/orbits (*shyaava netra*), and powdery coating on face (*mukhe churnaka*), that person will die soon (*paretam tasya jeevitam*). '*Shankhaat chyutam maamsam*' denotes falling-off flesh from temporal region seen in bitemporal scalp necrosis. '*Shyaava netra*' denotes ophthalmological manifestations such as optic nerve ischemia, retinal artery occlusion, proptosis, chemosis, orbital inflammation, and conjunctival injection seen in giant cell arteritis (GCA) or temporal arteritis (TA). '*Mukhe churnaka*' denotes powdery coating on face or uremic frost seen in end-stage renal disease (ESRD). The present verse denotes a condition of GCA or TA characterized by bitemporal scalp necrosis, ophthalmic manifestations and renal failure.

Shankhaat chyutam maamsam

Scalp necrosis (*shankhaat chyutam maamsam*?) is an outstanding complication of GCA. Apart from leading to infection, pain, and prolonged healing wound (*shankhaat chyutam maamsam*?), scalp necrosis associated with GCA is considered as a prognostic factor for major morbidity and higher mortality (*paretam tasya jeevitam*). Scalp necrosis can spread in depth resulting in a significant loss of substance with a risk of skull bone necrosis (*shankhaat chyutam maamsam*?), irreversible visual loss, and severe tongue necrosis.[31] Bilateral scalp necrosis (*shankhaat chyutam maamsam*?) with impending necrosis of lip and tongue has been reported in GCA patients. The formation of scalp necrosis (*maamsa chyuta*) may be due to occlusion of four arteries supplying the temporal area of the scalp (*shankha*) and depends on the degree of anastomoses between these vessels. More number of vessels may get involved as the disease progress which may result in necrosis of the skin (*chyutam maamsam*) of that particular area (*shankha*).[32] Scalp necrosis or forehead necrosis (*shankhaat chyutam maamsam*?) has been reported in some cases of GCA.[33] GCA has an association with polymyalgia rheumatica and can result in severe complications (*paretam tasya jeevitam*) such as bilateral scalp necrosis.[34]

Shyaava netra

The classic ophthalmological symptom (*shyaava netra*?) in GCA is vision loss that can be preceded by episodes of amaurosis fugax. This is secondary to ischemia of the optic nerve or retinal artery occlusion. TA can also cause symptoms secondary to ischemia and inflammation within the orbit (*shyaava netra*?). It can manifest as an orbital infarction syndrome (*shyaava netra*?) and lead to ophthalmoplegia, diplopia, and vision loss from arterial occlusion. Orbital inflammation (*shyaava netra*?) characterized by proptosis, chemosis, and conjunctival injection can also be seen in GCA patients.[35] Bilateral orbital inflammation (*shyaava netra*?) is a type of clinical presentation of GCA.[36]

Churnakashcha mukhe

A case of TA and polymyalgia rheumatica with subsequent renal failure has been reported. Focal segmental necrotizing glomerulonephritis with crescents and small vessel vasculitis are seen in kidney biopsy of a TA patient.[37] Kidney injury usually by ischaemia secondary to vasculitic involvement of the renal arteries or abdominal aorta is seen in GCA and Takayasu arteritis. When renal involvement occurs in GCA, transient microscopic or intermittent haematuria, red cell casts, proteinuria, nephrotic syndrome, membranous glomerulonephritis, and acute renal failure can be found.[38] Uremic frost can be seen in chronic kidney disease (CKD) and/or severe uremia. When the blood urea nitrogen (BUN) level is high, the concentration of urea in sweat increases greatly. Evaporation of sweat with high urea concentration causes urea to crystallize (*churnakashcha*) and deposit on the skin. The frost consists of a white or yellowish coating of urea crystals on the beard area and other parts of the face (*churnakashcha mukhe*), neck and on the trunk.[39] Renal failure due to ischemia of renal arteries in GCA can cause uremic frost (*churnaka mukha*) or powdery coating on face.

'Yasya hastaat chyutam maamsam -- na sa jeevati maanava' (Verse 6)[3]

The person who has been suffering with skin disease (*kushta*), from whose hands (*hastaat*) flesh is seen falling-off (*chyutam maamsam*) along with suppuration or oozing (*visraava yuktasya*), that person won't survive (*na sa jeevati maanava*). The present verse denotes a condition of necrotizing soft tissue infections (NSTIs) or necrotizing fasciitis (NF). NSTIs arise primarily in the dermis and epidermis, but they can also affect the deeper layers of adipose tissue, fascia, or muscle (*maamsam*). NSTIs are caused by bacteria and are characterized clinically by very rapid progression with significant local tissue destruction (*chyutam maamsam*?). Varying amounts of early or late systemic toxicity (*na sa jeevati*?) can be seen in NSTIs. NSTIs are explained based on their anatomical locations (i.e., Fournier gangrene), the depth of infections (i.e., cellulitis, adipositis, fasciitis and myositis), and the associated microbes. NSTI are often characterized by progressive and potentially fatal (*na sa jeevati*) soft tissue infection that requires radical and often multiple surgical debridement of all affected tissue.[40] NF is a severe and potentially lethal soft tissue infection (*na sa jeevati*) that develops in the scrotum and perineum, the abdominal wall, or the extremities (*hasta*). The infection progresses rapidly, and septic shock may ensue (associated with high mortality) (*na sa jeevati*). The clinical status of the patient varies from erythema, swelling, and tenderness in the early stage to skin ischemia with blisters and bullae (*visraava yuktasya*?) in the advanced stage of infection. In its fulminant form, the patient is critically ill with signs and symptoms of severe septic shock and MODS (*na sa jeevati*).[41]

'Avipakvam vipakvam vaa -- naasti tasya chikitsitam' (Verse 7)[3]

The person who has been suffering with impaired indigestion or other gastrointestinal (GI) symptoms (*avipakvam vipakvam vaa bhuktam bhuktam yathaa bhavet*) along with cough (*kaasa*), dyspnoea (*shwaasa*) and fever (*jwara*) will not survive (will die) (*naasti tasya chikitsitam*). The present verse denotes conditions like pulmonary and/or extra-pulmonary tuberculosis (EPTB) (especially

abdominal tuberculosis) or gastroesophageal reflux disease (GERD) and its complications. The term dyspepsia is meant for bad digestion (*avipakvam*). Dyspepsia syndrome is characterized by bloating, distension, anorexia (*avipakvam vipakvam vaa*), post-prandial fullness or nausea. Dyspepsia syndrome in advanced stages may cause dangerous organic disease such as esophageal cancer and other complications (*naasti tasya chikitsitam*). The symptoms of GERD are burning sensation in the chest area, sour or bitter tongue taste, nausea and hypersalivation. The patients in Asia with GERD usually present with severe epigastric pain, difficult breathing (*shwaasa*), dysphagia (due to stricture), bleeding, and perforation (*naasti tasya chikitsitam*?). Extra-esophageal symptoms of GERD are sore throat, laryngitis symptoms, cough (*kaasa*), and caries teeth. The symptoms of laryngeal disorder associated with GERD include husky voice, laryngeal stricture, apnea (*shwaasa*). The bronchopulmonary symptoms associated with GERD include difficult breathing (dyspnea) (*shwaasa*), asthma (*shwaasa*), apnea (*shwaasa*), infant sudden death syndrome, pneumonia (*shwaasa* & *jwara*?) and bronchiectasis (*kaasa* & *jwara*?).[42] Cough (*kaasa*), pleuritic chest pain, and dyspnea (*shwaasa*) often constitutional symptoms such as fever (*jwara*), weight loss, and anorexia (*avipakvam vipakvam vaa*) can be seen in pleural tuberculosis or tuberculous emphysema. Patients with Abdominal tuberculosis often have fever (*jwara*), weight loss, abdominal pain, abdominal distension, diarrhoea, and constipation. Fatigue, malaise and anorexia (*avipakvam vipakvam vaa*) are also seen. Gastric tuberculosis (TB) may mimic peptic ulcer disease or gastric carcinoma (*naasti tasya chikitsitam*). Duodenal TB may present with dyspepsia (*avipakvam vipakvam vaa*) or duodenal obstruction (*naasti tasya chikitsitam*?). Abdominal pain, nausea and vomiting, and symptoms of malabsorption (*avipakvam vipakvam vaa*) may be seen in ileocecal TB (*naasti tasya chikitsitam*?).[43]

'Hrudayam purvamaavaati -- tasya jeevitam naativartate' (Verse 8)[3]

After taking bath (*snaatasya dehina*), if a person's chest or cardiac region (*hrudayam*) dries out quickly (*purvamaavaati*) compared to other body parts, that person won't survive (*jeevitam naativartate*) more than 15 days (*ardha maasaat param*). Similar verse was quoted in '*Gomaya choorneeyam indriyam*' (12th chapter) of '*Charaka indriya sthana*'. The chest or cardiac region drying off early indicates regional vasodialtion or hyperthermia or hyperperfusion or hypermetabolism or hypervascularity either due to inflammatory pathology or underlying carcinoma. Various fatal conditions (*jeevitam naativartate*) such as carcinomas, lymphomas, melanomas, bacterial infections etc can cause regional hyperthermia. Quantification of sensitive changes in skin temperature and measuring subtle physiological changes can be done by using infrared thermography.[16]

'Urdhwa shwaasa hato yastu -- na sa jeevati maanava' (Verse 9)[3]

The person having *urdhwa shwaasa* (dyspnoea?) and *rakta pracchardana* (hematemesis/hemoptysis) along with *koshtha shula* (visceral pain) & *bhinna koshtha* (rupture of visceral organ or diarrhoea) will not survive. The present verse denotes fatal conditions associated with hematemesis and/or hemoptysis having poor prognosis. Hematemesis (*rakta pracchardana*) consists in the emission of blood in concomitance with vomit. GI bleeding may be a life-threatening condition (*na sa jeevati*). Upper gastrointestinal bleeding (UGIB) can be divided into variceal (due to portal hypertension & formation of gastric and oesophageal varices) and non-variceal bleeding (Mallory-Weiss syndrome - MWS, peptic esophagitis, Boerhaave syndrome, upper GI tumours, gastric/duodenal idiopathic ulcers, angiodysplasias, Rendu-Osler-Weber syndrome, Aorto-enteric fistulas and gastritis). Peptic ulcer is the most common cause of UGIB (*rakta pracchardana*). Duodenal ulcers are more common than gastric ulcers associated with bleeding risk (*rakta pracchardana*).[44] Esophageal perforation (*bhinna koshtha*?) is a potentially life-threatening (*na sa jeevati*) clinical condition. Chest pain (*koshtha shula*?) is regarded as the cardinal symptom of oesophageal perforation. In some patients this pain is followed by vomiting and shortness of breath (*urdhwa shwaasa*). There is sometimes acute abdominal or epigastric pain (*koshtha shula*) in patients with perforation of the gastroesophageal junction (*bhinna koshtha*). Perforations (*bhinna koshtha*) (perforated bleeding peptic ulcer) may manifest with hematemesis (*rakta pracchardana*).[45]

Hemoptysis (the expectoration of blood from the lower airways) (*rakta pracchardana*) can be a sign of many different diseases and its most common recognized causes include infectious and inflammatory airway diseases and cancer (bronchial carcinoma and metastases) (*na sa jeevati*?). Massive hemoptysis (100-1000 ml of blood coughed up in 24h) (*rakta pracchardana*) carries a worse prognosis (*na sa jeevati*). Death (*na sa jeevati*), usually from asphyxia (*urdhwa shwaasa*), occurs long before detectable blood loss or the onset of hemorrhagic shock (*na sa jeevati*). Cardiovascular causes such as pulmonary edema/mitral stenosis and pulmonary artery embolism can also cause hemoptysis. The clinical signs of impaired exchange of gases such as cyanosis, dyspnea (*urdhwa shwaasa*?), tachypnea (*urdhwa shwaasa*?) and increased work of breathing (*urdhwa shwaasa*?) can be seen in hemoptysis (*rakta pracchardana*).[46] Abdominal pain (*koshtha shula*) is the most common reason for a visit to the emergency department (ED). Blood or coffee ground emeses (*rakta pracchardana*) are usually caused by gastric diseases or complications of liver disease (*na sa jeevati*). Diarrhoea (*bhinna koshtha*) is common in mesenteric ischemia, appendicitis and colonic or early small bowel obstruction. In one series of 1000 ED patients presenting with abdominal pain (*koshtha shula*), 18% presented with diarrhoea (*bhinna koshtha*). Cardiopulmonary symptoms such as cough and dyspnoea (*urdhwa shwaasa*) may denote a non-abdominal cause of abdominal pain (*koshtha shula*). Syncope may denote disease originating in the chest (pulmonary embolism, dissection) or abdomen (acute aortic aneurysm, ectopic pregnancy). Tachypnea (*urdhwa shwaasa*) should prompt consideration of chest disease or metabolic acidosis from conditions like ischemic bowel or diabetic ketoacidosis (DKA). Conditions such as abdominal aortic aneurysm (AAA), massive pulmonary embolus, rupture of (*bhinna koshtha*) an ectopic pregnancy or spleen or hemorrhagic ovarian cyst etc should also be considered while evaluating abdominal pain (*koshtha shula*).[47]

'Antardaaho adhiko yasya -- yo na sa jeevati' (Verse 10)[3]

Person feeling burning sensation inside (*antardaaha*) along with cold on the outside (*sheetaarti baahyata*) and perceives the sky as if filled to the brim visual perceptual distortions (VPDs?) (*aakaasham paripurnam vetti*) will die soon or won't survive (*na sa jeevati*). The word '*antardaaha'* denotes elevated core body temperature, '*sheetaarti baahyata*' denotes decreased surface body temperature or anhidrosis or piloerection and '*aakaasham paripurnam vetti*' denotes various visual illusions or hallucination or VPDs due to altered sensorium. The temperature of the vital internal organs (brain, heart and liver) is referred to as the core temperature (*antardaaha*?). Other internal sites at which core temperature (*antardaaha*?) has been measured include the intestines, oesophagus, bladder, and rectum. Thermoregulation is a vital function of the autonomic nervous system (ANS) in response to heat and cold stress. Thermoregulatory disorders of the ANS (autonomic neuropathies and ganglionopathies)

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DOI: 10.15406/ijcam.2021.14.00544

impair the pathways involved in thermoregulation. Heat production and dissipation (*antardaaha & sheetaarti baahyata*) are dependent on a coordinated set of autonomic responses. Hypothermia (core temperature < 35.0°C), may present with shivering (*sheetaarti baahyata*?), respiratory depression, cardiac dysrhythmias, impaired mental function (*aakaasham paripurnam vetti*?), mydriasis, hypotension, cardiac arrest or coma. Hyperthermia (core temperature > 40.5°C), may present with sweating, flushing, tachycardia, fatigue, light headedness, headache, and paresthesia (*antardaaha & sheetaarti baahyata*?), agitation, hypotension, syncope, confusion (*aakaasham paripurnam vetti*?), delirium (*aakaasham paripurnam vetti*?), seizures, and coma. Mental status changes (*aakaasham paripurnam vetti*?) and core temperature (*antardaaha*?) distinguish potentially fatal heat stroke from heat exhaustion.[48]

Disorders such as non-diabetic small fiber sensory and autonomic neuropathies (due to idiopathic, autoimmune, paraneoplastic, hereditary, toxic, degenerative and drug related causes), impair thermoregulatory autonomic pathways and cause heat or cold related illness (*antardaaha & sheetaarti baahyata*?). Sjögren syndrome commonly impairs sudomotor function and can cause generalized anhidrosis (*sheetaarti baahyata*?). Neurologic disorders such as PD, stroke, spinal cord injury - SCI, myoapthy etc can potentially impair the patient's response to cold (*sheetaarti baahyata*?). Central nervous system (CNS) disorders such as wernick encephalopathy (WE) may impair the generation of a thermoregulatory response (*antardaaha & sheetaarti baahyata*?) in the hypothalamus. Hypothermia (*sheetaarti baahyata*?) can be seen in hypothalamic demyelination in multiple sclerosis and dementia. Autonomic disorders can cause widespread anhidrosis resulting in a compromised ability to liberate heat (*antardaaha & sheetaarti baahyata*?). Widespread anhidrosis can be seen in cholinergic neuropathy.[48] The present verse denotes thermoregulatory disorders due to impaired ANS and/or CNS thermoregulatory pathways causing *'antardaaha & sheetaarti baahyata'* along with '*aakaasham paripurnam vetti'* (altered sensorium causing VPDs such as perceiving sky as if filled to the brim).

'Yasya pakwaavubhaushtau -- paretam tasya jeevatim' (Verse 11)[3]

The person having bluish (*neela*) or dark bluish (*neela*) or purplish coloured (*jambu phalopama*) lips (*oshta*) and scalp or head oedema (*ucchoonam shira*) should be considered as dead (*paretam tasya jeevitam*) (or will die soon). The present verse denotes a condition of central cyanosis with scalp or head oedema having poor prognosis. Cyan means 'blue' (*neela*) and the abnormal bluish discolouration (*neela*) of the skin and mucous membrane is called 'cyanosis' (*pakwa jambu phalopama varnam*). Cyanosis can be best appreciated in areas such as lips (*ubhau oshthau*), nose, earlobes, oral cavity, extremities, and tips of toes and fingers. The prime sites of the bluish discoloration (*neela/jambu phalopama*) in central cyanosis are lips (*oshthau*), tongue, hands, feet, and mucous membranes of the oral cavity. Causes of central cyanosis include conditions affecting the CNS (Intracranial haemorrhage - ICH - *ucchoonam shira*), pulmonary causes (asthma, pulmonary embolism, pneumonia, bronchiolitis, pulmonary hypertension, hypoventilation, and chronic obstructive pulmonary disease - COPD), cardiovascular causes (heart failure, congenital heart disease - CHD, and valvular heart disease - VHD), haemoglobinopathies, polycythemia, high altitude, hypothermia and obstructive sleep apnoea (OSA).[49] Central cyanosis (*neela/jambu phalopama*) with scalp or head oedema (*ucchoonam shira*) can be seen in traumatic brain injury (TBI) and secondary brain injury (intra cranial hematomas, cerebral oedema, ischemia, infection, epilepsy/seizures and metabolic/endocrine disturbances) (*ucchoonam shira*).[50]

'Yasya ucchoonam bhavet madhya -- yatha pretastadhaiva sa' (Verse 12)[3]

The person having swollen or oedema of middle body (abdomen) (*ucchoonam bhavet madhya*), emaciated shoulders (*ubhau amsau krushau*), and abdominal bloating after purging (*virikta punaraadhmaati*) should be considered as dead (or will die soon) (*yatha pretastadhaiva sa*). The present verse denotes various conditions such as diarrhoea predominant irritable bowel syndrome (IBS-D), marasmus, kwashiorkor, protein energy malnutrition (PEM), malabsorption syndrome, hepatocellular carcinoma, liver cirrhosis, hepatosplenomegaly, celiac disease and ascites etc. Bloating (*aadhmaana*) is the second most common reported symptom in patients with IBS following abdominal pain. Bloating (*aadhmaana*) is comparatively more commonly found in constipation predominant irritable bowel syndrome (IBS-C) than IBS-D (*virikta punaraadhmaati*?).[51] Marasmus is still associated with high mortality (*yatha pretastadhaiva sa*). Higher frequency of infections such as diarrhoea (*virikta*) can be seen in malnutrition cases. The general appearance is shrunken and wasted (*ubhau amsau krushau*) due to reduced levels of subcutaneous fat in malnutrition cases. Middle-upper arm circumference (MUAC) of less than 115 mm is one of the diagnostic features of marasmus. Marasmic kwashiorkor presents with the features of both marasmus and kwashiorkor and the child will have growth stunting associated with wasting (*ubhau amsau krushau*) and oedema (*ucchoonam bhavet madhya*). Abdominal distension (*aadhmaana*), oedema (*ucchoonam bhavet madhya*) and an enlarged fatty liver can also be seen. HIV (human immunodeficiency virus) wasting syndrome (*ubhau amsau krushau*?) refers to the involuntary weight loss associated with chronic diarrhoea (*virikta*) in a person suffering from HIV.[52] Malnutrition is common in cirrhosis and it is associated with increased morbidity and mortality (*yatha pretastadhaiva sa*). Severe muscle wasting (sarcopenia) (*ubhau amsau krushau*) can be found in some patients with cirrhosis and hepatocellular cancer (*ucchoonam bhavet madhya*?). The most common GI symptoms reported in cirrhotic patients include abdominal bloating (*aadhmaana*), abdominal pain, belching, and diarrhoea (*virikta*).[53]

'Yetat indriya vignaanam -- nrunaam vidyaat bhishagvara' (Verse 13)[3]

The physician (*bhishak*) who is having proper knowledge and experience (*samyak anupashyati*) in *indriya vignaana* (prognostic science) can properly estimate the prognosis of a condition of his patients (*jeevitam cha mrutyum cha nrunaam*) and he is considered as best among physicians (*bhishagvara*). Proper knowledge of *Arishta lakshana's* (*indriya vignaana*) or prognostication makes the physician (*bhishak*) confident while estimating the prognosis (*jeevitam cha mrutyum cha nrunaam*) and approaching the patient. It has been found that clinically experienced physicians (*samyak anupashyati*) have shown better performance (*bhishagvara*) than less experienced physicians while estimating the prognosis.[5]

Conclusion & implications

'*Chaya adhyaya'* is the tenth chapter of '*Indriya sthana*' of '*Bhela samhita*' which deals with various conditions having poor prognosis or fatal outcomes. There are total 13 verses quoted in the '*Chaya adhyaya*'. The chapter named '*Chaya adhyaya*' because the first verse of the chapter denotes abnormal body shadows (*chaya*) and their

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prognostic significance. Most of the content is unique (though some similarities have been found with *Charaka samhita* especially verse no 1, 3 & 8) and not explained in any other classical *Ayurvedic* texts. Various concepts or conditions such as estimating prognosis based on the abnormal body shadows, visual hallucinations or VPDs with an underlying organic brain diseases, streptococcal sore throat and its fatal outcomes such as septic shock, SIRS and MODS, TA with bilateral temporal necrosis, ophthalmic manifestations and renal failure, EPTB, GERD and its complications, carcinomas, hematemesis and/or hemoptysis with fatal outcomes, UGIB, perforation of visceral organs, thermoregulatory disorders with ANS or CNS pathology, central cyanosis with intracranial pathology, IBS-D, PEM, hepatocellular carcinoma, cirrhosis of liver and characteristics of an expert physician having profound knowledge in prognostication are documented in this chapter. '*Antar daaha*' and '*Bahir sheeta*' mentioned in this chapter denotes core temperature and surface body temperature respectively along with their prognostic significance has been documented by '*Maharshi Bhela*'. '*Maharshi Bhela'* has provided a set of signs and symptoms having prognostic significance based on which the physician can estimate the condition of specific organ/body systems as well as to diagnose or rule out hidden diseases. Questionnaire or screening methods can be developed to estimate the prognosis based on the signs and symptoms mentioned in this chapter by '*Maharshi Bhela*'. Though further research is still required to substantiate the claims, the descriptive results of the present study provide fundamental understanding on potential ideas and pave the path for future research directions.

Acknowledgments

None.

Conflicts of interest

Author declares there are no conflicts of interest.

Funding

None.

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