

CLASSIFICATION SYSTEMS FOR ORAL SUBMUCOUS FIBROSIS- FROM PAST TO PRESENT: A REVIEW

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ABSTRACT:

Oral Submucous Fibrosis (OSMF) as a disease remains an enigma to the clinicians due to elusive pathogenesis and less well defined classification systems. Over the years, different authors have classified this condition based on clinical, histopathological or functional aspects. But none of these classifications have achieved universal acceptance. Each classification has its own merits and demerits that supersede the other leading to confusion. This review is presented with the aim to compile all the classification systems available in the literature for the better understanding of the disease among the clinicians.

Keywords: Oral Submucous Fibrosis, Classification Systems, Staging and Grading.



INTRODUCTION:

Oral Submucous Fibrosis (OSMF) is an insidious, chronic, resistant disease characterised by inflammation and progressive fibrosis of the submucosal tissues [1]. The disease is regarded as a precancerous and potentially malignant condition [2,3]. Sushruta in 600 B. C described a condition similar to OSMF as "Vidari" [4]. OSMF was first described in the modern literature by Schwartz in 1952 who coined the term "atrophic idiopathic mucosae oris" to describe an oral fibrosing disease, he discovered in 5 Indian women in Kenya [5]. Joshi subsequently coined the term "OSMF" for the condition in 1953 [6]. The condition is also referred by other names, "diffuse oral submucous fibrosis" [7], "idiopathic scleroderma of the mouth" [8],

"idiopathic palatal fibrosis" [4] and "sclerosing stomatitis" [9].

The aetiology, once thought to be idiopathic, is now confirmed to be multifactorial in origin with possible etiological factors been capsaicin in chillies, deficiencies in iron, zinc and essential vitamins [10,11,12,13]. However various epidemiological studies, large cross-sectional surveys, case control studies, and cohort and intervention studies have provided overwhelming evidence that areca-nut is the main aetiological factor in OSMF [12-21]. Recent studies have focussed on changes in the extracellular matrix to have a key role in the pathogenesis [15]. These studies indicate an increased synthesis or reduced degradation as possible mechanisms in the development of

the disease. Thus, OSMF is now considered a collagen metabolic disorder.

The signs and symptoms of OSMF are due to fibrosis and hyalinization of sub epithelial tissues. The most frequently affected locations are the buccalmucosa and the retromolar areas. It manifests as a burning sensation in the mouth, intolerance to eating hot and spicy foods, blanching and stiffness of the oral mucosa, trismus, vesiculation, excessive salivation, ulceration, pigmentation change, recurrent stomatitis, defective gustatory sensation, dryness of the mouth, gradual stiffening and reduced mobility of the soft palate and the tongue leading to difficulty in swallowing and hyper nasality of voice, hoarseness of voice (with laryngeal involvement) and occasionally, mild hearing loss due to blockage of Eustachian tube [22].

The characteristic histologic features of OSMF consist of atrophic epithelium often keratinized, generally without rete ridges, and in advanced cases it may be ribbon-like with juxtaepithelial hyalinization and collagen of varying density [23].

The diagnosis and staging of OSMF is an important aspect for a clinician as it affects the treatment and the prognosis [24,25]. Over the years, OSMF has been classified based on either clinical or histological or both features of the disease. The advantages or disadvantages of these classifications supersede one another leading to confusion. The purpose of this literature review is to compile and analyse the classifications of OSMF available at different databases so as to assist the

clinicians, researchers and academicians in categorization of this potentially malignant disorder according to its biological behaviour and hence its subsequent medical and surgical treatment.

DIFFERENT CLASSIFICATION, STAGING AND GRADING SYSTEMS

The different classification systems existing in literature can be broadly categorised as follows:

A: Classifications based on clinical aspects of the disease:

1. Desa J. V (1957)
2. Wahi P.N. and Kapur V.L. et al (1966)
3. Ahuja S.S. and Agarwal G.D. (1971)
4. Bhatt A. P. and Dholakia H.M. (1977)
5. Gupta D.S. and Golhar B.L. (1980)
6. Pindborg J.J (1989)
7. Katharia S.K. et al (1992)
8. Bailoor D.N. (1993)
9. Racher S.K (1993)
10. Lai D.R. et al (1995)
11. Maher R. et al (1996)
12. Haider S.M. et al (2000)
13. Ranganathan K. et al (2001)
14. Rajendran R. (2003)
15. Bose T. and Balan A. (2007)
16. Kumar K. et al (2007)
17. Mehrotra D. et al (2009)

18. More C.B. *et al* (2011)

19. Kerr A.R.*et al*(2011)

20. Patil S. and Maheshwari S. (2014)

21. Prakash R. *et al* (2014)

B:Classifications based on histopathological aspects of the disease:

1. Pindborg J.J. and Sirsat S.M. (1966)

2. Utsonumiya H. *et al* (2005)

3. Kumar K. (2007)

C:Classifications based on clinical and histopathological aspects of the disease:

1. Khanna J.N. and Andrade N.N. (1995)

A: CLASSIFICATIONS BASED ON THE CLINICAL ASPECTS OF THE DISEASE:

1. **Desa J.V.**^[26] divided OSMF into 3 stages:

Stage I: Stomatitis and vesiculation

Stage II: Fibrosis

Stage III: As its sequelae

2. **Wahi P.N. and Kapur V.L.** ^[27] *et al* classified OSMF based on the clinical features, severity and extent of involvement into 3 groups:

Group I: Usually there are no symptoms referable to mucosal involvement. The lesion affects one or other commonly involved anatomical site, is focal in character, shows pallor or whitish coloration, wrinkling of mucosa and minimal induration.

Group II: Cases present with symptoms like soreness of mucosa or increased sensitivity to chillies. The lesion is diffuse, white, extensive and indurated, involving one or more anatomical sites.

Group III: symptoms are mostly due to restricted mobility like trismus, stretching at the angles of the mouth altered pronunciation and inability to protrude the tongue. Firm submucosal bands are palpable. Surface may be fissured or ulcerated.

3. **Ahuja S.S. and Agarwal G.D.**^[28]classified based on the extent and type of fibrosis as:

Class I: Localised fibrous bands in the cheek extending from the superior to the inferior fornix on one or both sides. In order of frequency, the bands are mostly found on the lips, the premolar region or the second molar region.

Class II: Generalised diffuse hardening of the sub epithelial tissues extending from the cheek and hard palate to the soft palate, uvula and the faucial pillars. Occasionally, the hardening might extend to the lining mucosa of the pharynx.

Class III: Combination of the above two types where the fibrous bands are associated with a generalised diffuse form of submucous fibrosis.

4. **Bhatt A. P. and Dholakia H.M.** ^[29]clinically grouped the patients into three grades as:

Grade I: Comprised of mild and early cases with a very slight fibrous bands and little closure of the mouth.

Grade II: Moderately pronounced symptoms with fibrous bands extending from the cheek to the palate.

Grade III: Excessive amount of fibrosis involving the cheek, palate, uvula, tongue and the lips with narrow opening of the mouth.

5. **Gupta D.S. and Golhar B.L.** [30] classified into four stages based on the increasing intensity of trismus as:

Very early stage: The patients complain of burning sensation in the mouth or ulceration without difficulty in mouth opening.

Early stage: Along with burning sensation, the patients complain of slight difficulty in opening the mouth.

Moderately advanced stage: The trismus is marked to such an extent that the patient cannot open his/her mouth more than two fingers width therefore experiencing difficulty in mastication.

Advanced stage: Patient is undernourished, anaemic and has a marked degree of trismus.

6. **Pindborg J.J** [31] divided OSMF into 3 stages as:

Stage I: Stomatitis includes erythematous mucosa, vesicles, mucosal ulcers, melanotic mucosal pigmentations and mucosal petechiae.

Stage II: Fibrosis occurring in the healing vesicles and ulcers is the hallmark of the stage.

- Early lesions demonstrate blanching of the oral mucosa.
- Older lesions include vertical and circular palpable fibrous bands in the buccal mucosa and around the mouth opening or lips resulting in mottled marble like appearance of the mucosa because of the vertical thick fibrous bands in association with blanched mucosa.
- Specific findings include reduction of mouth opening, stiff and small tongue, blanched and leathery floor of the mouth, fibrotic and depigmented gingiva, rubbery soft palate with decreased mobility, blanched and atrophic tonsils, shrunken bud like uvula and sunken cheeks, not commensurate with age or nutritional status.

Stage III: Sequelae of OSMF as follows:

- Leukoplakia is found in more than 25 % of the individuals with OSMF.
- Speech and hearing defects may occur due to involvement of the tongue and eustachian tubes.

7. **Katharia S.K. et al** [32] described a scoring system based on the mouth opening present between upper and lower central incisors as:

Score 0: Mouth opening is greater than 41 mm

Score 1: Mouth opening between 37 to 40 mm

Score 2: Mouth opening between 33 to 36 mm

Score 3: Mouth opening between 29 to 32 mm

Score 4: Mouth opening between 25 to 28 mm

Score 5: Mouth opening between 21 to 24 mm

Score 6: Mouth opening between 17 to 20 mm

Score 7: Mouth opening between 13 to 16 mm

Score 8: Mouth opening between 09 to 12 mm

Score 9: Mouth opening between 05 to 08 mm

Score 10: Mouth opening between 00 to 04 mm

8. **Bailoor D.N.** [33] classified on the basis of diagnosis as:

Stage I: Early OSMF

- Mild blanching.
- No restriction in mouth opening (normal distance between central incisor tips: Males 35 to 45 mm, Females 30 to 42 mm).
- No restriction in tongue protrusion (normal mesioincisal angle of the upper central incisor to the tip of the tongue when maximally

extended with the mouth wide open: Males 5 to 6 cm, Females 4.5 to 5.5 cm).

- Cheek flexibility: $CF = V_1 - V_2$ where V_2 is a point measured between at one-third the distance from the angle of the mouth on a line joining the tragus of the ear to the angle of the mouth. The patient is then asked to blow his cheeks fully and the distance between the two points is marked on the cheek as V_1 . Mean values for cheek flexibility: Males 1.2 cm and Females 1.08 cm.
- Burning sensation on taking spicy or hot foods only.

Stage II: Moderate OSMF

- Moderate to severe blanching.
- Mouth opening reduced by 33%.
- Cheek flexibility also demonstrably reduced.
- Burning sensation in absence of stimuli.
- Palpable bands felt.
- Lymphadenopathy either unilateral or bilateral.
- Demonstrable anaemia on haematological examination.

Stage III: Severe OSMF

- More than 66% reduction in the mouth opening, cheek flexibility and tongue protrusion.

- Tongue may appear fixed.
- Severe burning sensation, patient is unable to do day to day work.
- Ulcerative lesions may appear on the cheek.
- Thick palpable bands.
- Bilateral lymphadenopathy.

9. **Racher S.K** ^[34] classified into 3 stages based on habits as:

Stage I: Stage of Stomatitis and Vesiculation

- Characterised by recurrent stomatitis and vesiculation. Patient complains of burning sensation in the mouth and inability to eat pungent food.
- The examination reveals vesicles on the palate that may rupture and a superficial ulceration may be seen. Some amount of fibrosis can be seen.

Stage II: Stage of fibrosis

- There is inability to open the mouth completely and stiffness in mastication. As disease advances, there is difficulty in blowing the cheeks and protruding the tongue.
- On examination, there is increasing fibrosis in the submucosal. Mucosa is blanched and white. Lips and cheeks are stiff. Dorsum of the tongue may show atrophy of papillae. Blanching and stiffness of the mucosa of the floor of the mouth is less marked than that

seen in the lips, cheeks and palate. Larynx is free from disease and respiration is not affected.

Stage III: Stage of sequelae and complications

- Leukoplakia changes in the mucosa.
- An ulcerating malignant lesion may be seen involving the cheeks, oropharynx or the tongue.
- Patients are predisposed to develop oral cancer under the influence of carcinogens.

10. **Lai D.R.** ^[31] grouped OSMF on the basis of interincisal distance as:

Group A: Interincisal distance greater than 35 mm.

Group B: Interincisal distance 30 to 35 mm.

Group C: Interincisal distance 20 to 30 mm.

Group D: Interincisal distance less than 20 mm.

11. **Maher R.** *et al* ^[35] classified on the basis of area of involvement in the oral cavity. He divided the intra-oral regions into eight sub regions viz palate, posterior one-third of the buccal mucosa, middle one-third of the buccal mucosa, anterior one-third of the buccal mucosa, upper labial mucosa, tongue and floor of the mouth and looked for disease involvement in each to assess the extent of clinical disease. This was

further grouped into three categories as:

1. Involvement of one-third or less of the oral cavity
2. Involvement of one-third to two-third of the oral cavity (if 4 to 6 intra-oral sites are involved)
3. Involvement of greater than two-third of the oral cavity.

12. **Haider S.M.** [36] classified on the basis of severity of disease taking objective parameters like mouth opening into consideration.

I: Clinical staging

1. Faucial bands only.
2. Faucial and buccal bands.
3. Faucial, buccal and labial bands.

II: Functional staging

1. Mouth opening greater than 20 mm.
2. Mouth opening between 11 to 19 mm.
3. Mouth opening less than 10 mm.

13. **Ranganathan K. et al** [37] divided OSMF based on mouth opening as follows:

Group I: Only symptoms with no demonstrable restriction of mouth opening.

Group II: Limited mouth opening 20 mm and above.

Group III: Mouth opening less than 20 mm.

Group IV: OSMF advanced with limited mouth opening. Precancerous or cancerous changes are seen throughout the mucosa.

14. **Rajendran R.** [38] reported the clinical features of OSMF as follows:

Early OSMF: Comprises of burning sensation in the mouth, blisters especially on the palate, ulceration or recurrent generalized inflammation of oral mucosa, excessive salivation, defective gustatory sensation and dryness of mouth.

Advanced OSMF: Comprises of blanched and slightly opaque mucosa, fibrous bands in the buccal mucosa running in vertical direction. Palate and faucial pillars are the areas first involved with gradual impairment of tongue movement and difficulty in mouth opening.

15. **Bose T. and Balan A.** [39] classified based on clinical features as:

Group A: Mild cases

Only occasional symptoms, pallor, vesicle formation, presence of one or two solitary palpable bands, loss of elasticity of mucosa, variable tongue involvement with protrusion beyond vermillion border. Mouth opening is greater than 3 cm.

Group B: Moderate cases

Symptoms of soreness of mucosa or increased sensitivity to chillies, diffuse involvement of the mucosa, blanched appearance, buccal mucosa tough and inelastic fibrous bands palpable, considerable restriction of mouth opening

(1.5 to 3 cm) and variable tongue movement.

Group C: Severe cases

Symptoms are more severe, broad fibrous bands palpable, blanched opaque mucosa, rigidity of mucosa, very little opening of mouth (less than 1.5 cm), depapillated tongue and protrusion of tongue very much restricted.

16. **Kumar K. et al** ^[40] categorised OSMF based on mouth opening as follows:

Stage I: Mouth opening greater than 45 mm.

Stage II: Mouth opening between 20 to 44 mm.

Stage III: Mouth opening less than 20 mm.

17. **Mehrotra D. et al** ^[41] suggested a clinical grading of the disease and treatment methods as:

Grade I: Stomatitis, burning sensation in the buccal mucosa and with no detection of fibres. Suggested treatment is abstinence from habit and medicinal management.

Grade II: Symptoms of grade I, palpable fibrous bands, involvement of soft palate and maximal mouth opening of 26 to 35 mm. Suggested treatment is abstinence from habit and medicinal management.

Grade III: Symptoms of grade II, blanched oral mucosa, involvement of tongue and maximal mouth opening of 6 to 25 mm. Suggested treatment is abstinence from habit and surgical management.

Grade IV: Symptoms of grade III, lip fibrosis and mouth opening of 0 to 5 mm. Suggested treatment is abstinence from habit and surgical management.

18. **More C.B. et al** ^[42] gave the following classification based on clinical and functional parameters as:

I: Clinical staging:

Stage 1 (S1): Stomatitis and/or blanching of oral mucosa.

Stage 2 (S2): Presence of palpable fibrous bands in buccal mucosa and/or oropharynx, with/without stomatitis.

Stage 3 (S3): Presence of palpable fibrous bands in buccal mucosa and/or oropharynx, and in any other parts of oral cavity, with/without stomatitis.

Stage 4 (S4):

A: Any one of the above stage along with other potentially malignant disorders e.g. oral leukoplakia, oral erythroplakia, etc.

B: Any one of the above stage along with oral carcinoma.

II: Functional staging:

M1: Inter-incisal mouth opening up to or greater than 35 mm.

M2: Inter-incisal mouth opening between 25 to 35 mm.

M3: Inter-incisal mouth opening between 15 to 25 mm.

M4: Inter-incisal mouth opening less than 15 mm.

19. **Kerr A.R. et al** [43] gave the following grading system for OSMF as:

Grade 1: Mild: Any features of the disease triad for OSMF (burning, depapillation, blanching or leathery mucosa) may be reported and inter-incisal opening greater than 35 mm.

Grade 2: Moderate: Above features of OSMF and inter-incisal limitation of opening between 20 to 35 mm.

Grade 3: Severe: Above features of OSF and inter-incisal opening less than 20 mm.

Grade 4A: Above features of OSMF with other potentially malignant disorders on clinical examination.

Grade 4B: Above features of OSMF with any grade of oral epithelial dysplasia on biopsy.

Grade 5: Above features of OSMF with oral squamous cell carcinoma.

20. **Prakash R. et al** [44] assessed the morphologic variants of soft palate by conducting a clinic-radiological study. The authors based on these variants assessed the severity of OSMF to establish it as a basis for staging of OSMF. Six morphologic variants were delineated as follows(Figure 1):

- Type 1: Leaf shaped
- Type 2: Rat tail shaped
- Type 3: Butt shaped
- Type 4: Straight line
- Type 5: Deformed S
- Type 6: Crook shaped

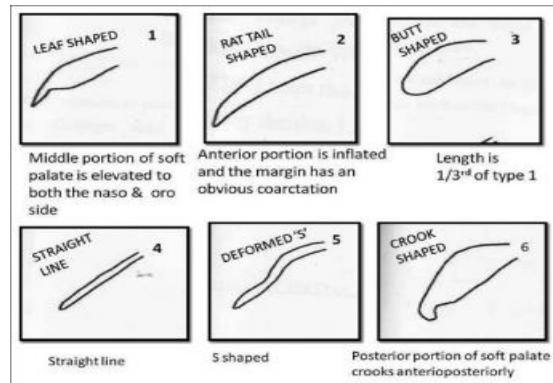


Figure 1: Diagrammatic representation of various shapes of soft palate.

It was observed that type 1 variant was the most common, seen in stage 2 OSMF (based on More C.B. et al classification⁴²) and type 3 variant was common in stage 3 OSMF. The authors concluded that in OSMF, type 1 and 2 are commonly seen but as the diseases advances, these are replaced by type 3 and 6 variants.

21. **Patil S. and Maheshwari S.** [45] suggested a new classification based on cheek flexibility. Here, cheek flexibility was measured as a distance in millimetres, from maxillary incisal midline to the cheek retractor during retraction. Normal cheek flexibility observed was: Males 35 to 45 mm, Females 30 to 40 mm.

Grade 1 (Early): Cheek flexibility of 30 mm and above.

Grade 2 (Mild): Cheek flexibility between 20 to 30 mm.

Grade 3 (Moderate): Cheek flexibility less than 20 mm.

Grade4 (Severe): Any of the above condition without concurrent presence of potential malignant lesions.

Grade 5 (Advanced): Any of the above condition with concurrent presence of oral carcinoma.

B: CLASSIFICATIONS BASED ON HISTOPATHOLOGICAL ASPECTS OF THE DISEASE:

1. Pindborg J.J. and Sirsat S.M. [9]

Very early stage: Finely fibrillar collagen dispersed with marked oedema with plump young fibroblasts containing abundant cytoplasm. Blood vessels are dilated and congested. Inflammatory cells, mainly polymorphonuclear leukocytes with occasional eosinophils are found.

Early stage: Juxta-epithelial area shows early hyalinization. Collagen is still in separate thick bundles. Moderate numbers of plump young fibroblasts are present. With dilated and congested blood vessels. Inflammatory cells are primarily lymphocytes, eosinophils and occasional plasma cells.

Moderately advanced stage: Collagen is moderately hyalinised. Thickened collagen bundles are separated by slight residual oedema. Fibroblastic response is less marked. Blood vessels are either normal or compressed. Inflammatory exudate consists of lymphocytes and plasma cells.

Advanced stage: Collagen is completely hyalinised. A smooth sheet with no separate bundles of collagen is seen. Oedema is absent. Hyalinised area is devoid

of fibroblasts. Blood vessels are completely obliterated or narrowed. Inflammatory cells are lymphocytes and plasma cells.

2. **Utsonumiya H. et al [46]** divided OSMF based on the concept of Pindborg J.J. and Sirsat S.M. and modified it as follows:

Early stage: Large number of lymphocytes in the sub epithelial and connective tissue zones along with myxedematous changes.

Intermediate stage: Granulation changes close to the muscle layer and hyalinization appears in sub epithelial zone where blood vessels are compressed by fibrous bundles. Reduced inflammatory cells in sub epithelial layer are seen.

Advanced stage: Inflammatory cell infiltrate hardly seen. Number of blood vessels dramatically less in the sub epithelial zone. Marked fibrous areas with hyaline changes extending from sub epithelial to superficial muscle layers are seen. Atrophic, degenerative changes start in muscle fibres.

3. **Kumar K. et al [40]** graded OSMF as follows:

Grade I: Loose, thick and thin fibres.

Grade II: Loose or thick fibres with partial hyalinisation.

Grade III: Complete hyalinisation.

C: CLASSIFICATIONS BASED ON CLINICAL AND HISTOPATHOLOGICAL ASPECTS OF THE DISEASE:

1. **Khanna J.N. and Andrade N.N. [47]** developed a group classification system

to aid in the surgical management of OSMF. It is the most accepted classification by the clinicians.

Group I: Very early cases:

Clinically: Common symptom is burning sensation in the mouth, acute ulceration and recurrent stomatitis and not associated with mouth opening limitation.

Histology: Fine fibrillar collagen network interspersed with marked oedema, blood vessels dilated and congested, large aggregate of plump young fibroblasts present with abundant cytoplasm, inflammatory cells mainly consist of polymorphonuclear leukocytes with few eosinophils. The epithelium is normal.

Group II: Early cases

Clinically: Buccal mucosa appears mottled and marble like, widespread sheets of fibrosis palpable, interincisal distance of 26 to 35 mm.

Histology: Juxta-epithelial hyalinization present, collagen present as thickened but separate bundles, blood vessels dilated and congested, young fibroblasts seen in moderate number, inflammatory cells mainly consist of polymorphonuclear leukocytes with few eosinophils and occasional plasma cells, flattening or shortening of epithelial rete-pegs evident with varying degree of keratinization.

Group III: Moderately advanced cases

Clinically: Trismus, interincisal distance of 15 to 25 mm, buccal mucosa appears pale firmly attached to underlying tissues, atrophy of vermilion border, vertical fibrous

bands palpable at the soft palate, pterygomandibular raphe and anterior faucial pillars.

Histology: Juxta-epithelial hyalinization present, thickened collagen bundles, residual edema, constricted blood vessels, mature fibroblasts with scanty cytoplasm and spindle-shaped nuclei, inflammatory exudate which consists of lymphocytes and plasma cells, epithelium markedly atrophic with loss of rete pegs, muscle fibres seen with thickened and dense collagen fibres.

Group IVA: Advanced cases

Clinically: Severe trismus, interincisal distance of less than 15 mm, thickened faucial pillars, shrunken uvula, restricted tongue movement, presence of circular band around the entire lip and mouth.

Group IVB: Advanced cases

Clinically: Presence of hyperkeratotic leukoplakia and/or squamous cell carcinoma.

Histology: Collagen hyalinised smooth sheet, extensive fibrosis, obliterated mucosal blood vessels, eliminated melanocytes, absent fibroblasts within the hyalinised zones, total loss of epithelial rete pegs, presence of mild to moderate atypia and extensive degeneration of muscle fibres.

The authors are of the view that patients in group I and group II can be managed by symptomatic treatment, whereas those in group III and group IV definitely require surgical management.

CONCLUSION:

In OSMF, the initial diagnosis is of utmost importance, as the treatment and its prognosis greatly depend on its staging. An attempt is made to update the knowledge on classification schemes for OSMF so as to assist in categorisation of this premalignant condition and to aid in early diagnosis thereby leading to timely management. An increased emphasis is placed on clinical

staging as clinical appearance holds the most important value in staging OSMF. Treatment if done according to the staging and grading helps in management & better prognosis for the patient. Hence treatment should be done as per the staging and grading. We hope this review helps academicians, clinicians as well as researchers in getting a broad view on various classification systems and contribute to optimal patient management.

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