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AVABAHUKA VIS-A-VIS FROZEN SHOULDER: A REVIEW

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ABSTRACT

Avabahuka is a disease of amsa sandhi (shoulder joint) and it has been described under eighty types of vata vyadhi by Acharya Sushruta. Being a disease of shoulder joint, which has greatest range of motion, is of vital importance to the activities of daily routine and work, this disease is a hindrance in one's productivity. Clinical presentation and pathogenesis of Avabahuka is almost similar to Frozen Shoulder. It is one of the commonest musculoskeletal disorder visited in orthopedic clinics, often annoyed both patients as well as doctors. This article aims to provide an overview of the nature and the widely accepted management of this condition based on other studies.

KEYWORDS: Frozen shoulder, avabahuka, adhesive capsulitis.

INTRODUCTION

Avabahuka, a term coined by Acharya Sushruta in 600BC- 400BC is a disease of skanda (shoulder) commonly encountered in general practice. Human body has six parts (shadanga)[1] and shakha (upper limb) is one among them, where as skanda is the root of shakha. He used this term in his treatise "Shruta Samhita" to describe a condition with symptoms[2,3] of "Ansadeshasthitovayu shoshayitvam ansabandhanam, shiracha aakunchaya tatrasto janayatava avabhahukam," where as in Astanga Hridya[4] (5thcentury) and Astanga Sangrah[5] it is described as "Ansamulasthito vaayu sira sankochaya tatraga, bahupraspanditaharam janayatvam avabahukam" means the condition in which the vata gets lodged at the root of the shoulder, subsequently constricting the veins and producing the loss of movements of the shoulder has been identified as Avabahuka. In Madhava Nidana[6] two conditions of the disease has been mentioned, Ansashosha and Avabahuka, as former can be considered as preliminary stage of later. Charaka Samhita (200BC-300BC) in Sutra Sthana[7]

and Chikitsa Sthana[8] bahushosh and bahuvata respectively has been mentioned. In Chakradutta[9] only bahushosha has mentioned in vatavyadhi Chikitsa. According to Acharya Sushruta[10] vitiated vata in and around shoulder causes shosha (dryness) of ansabandhan (shoulder ligaments, tendons and connective tissue or capsule leading to pain and stiffness) and constriction of blood vessels (reduced blood supply) resulting in avabahuka. This article aims to provide an overview of the nature and the widely accepted management of this condition based on other studies.

Etymology of Avabahuka

It is made up of two words ava + bahuka, the prefix ava means away, down[11], vikrita[12], off, away.[13] All that means like dysfunction or physiological separation not anatomical resulting in movement restriction hampering one's all activities of that particular part, as if there is real separation. Therefore avabahuka means immobile shoulder.

Etiology (Nidana)

Cause of Avabahuka is mainly vata dosh as it is described under vatavyadhi and in later stage kapha dosha is also associated with vata dosha.[6] The causes of avabahuk may be classified in to three groups:

1) Abhighataj (trauma) or marmabhighata:[14,15] injury to ansa marm (shoulder region) leads to stiffness of shoulder.

2) Aaharaj[16] (unwholesome food): tikta (bitter), ushana, kashaya (astringent), alpa, ruksha, pramita bhojanae (food) cause vitiation of the vata.

3) Viharaja (activities or improper life style): due to over indulgence in things like excessive physical exercise, sudden fear, grief etc lead to depletion or loss of tissues and vata gets aggravated, other few factors are as below:

i) Plavana (swimming more than 40minutes).

ii) Bharavahan (carrying heavy loads).

iii) Balvat vigraha (wrestling with a more powerful person).

iii) Dukha shayya (improper posture in bed).

Pathogenesis (Samprapti) of Avabahuka

According to Acharya Sushruta vitiated vata around the shoulder joint depletes (shosh of shleshamaka kapha) structures or tissues in and around it and vasocontriction of vessels leading to pain and stiffness of the joint ultimately resulting in restricted shoulder movement.

Prodromal Symptoms (Purva Roopa)

Avayakta (minimal or no prodromal symptoms) in vatavyadhi.

Sign and Symptoms (Roopa) Avabahuka

1. Pain (as main feature of vitiated vata) in shoulder region.
2. Shoulder stiffness.
3. Restriction in shoulder joint range of motion.
4. Sosha (muscular atrophy).

Treatment

The general line of treatment mentioned for vatavyadhi (avabahuka) in Ayurvedic texts includes:

i) Snehana (oleation both internal and external with medicated oils).

ii) Swedana (sudation with steam made from vatashamaka drugs).

iii) Basti (decoction or oil given through anal route like enema).

iv) Agnikarma and oral medications (in the form of guggul, decoctions etc.)

v) Nasya (medication given through nasal route) as Acharya Vagbhata has mentioned nasyakarma in the udarvajatrugata roga.

Astanga sangraha mentioned[17] Navana nasaya and snehapana for avabahuk where as Acharya Sushruta[18] advises vatavyadhi chikitsa except siravyadha, in Astanga Hridyam[19] first nasya then basti, Baladi or dashmooladi kwath[20,21] by Chakradatta for avabahuka and in Yoga Ratnakar[22] bahuparivartana (movements of shoulder joint as "Masha tail rasonabhyam bahuvoch parivartanam, dashangim masha kwathaena jayata avabahukam". Sahasrayoga mentions Prasaraniyadi Kashaya in treatment of Avabahuka.[23]

A broad over view of some of the well recognized methods today is provided below:

1) Nidana parivarjana (avoidance of the causes) and pathya ahar-vihar (wholesome diet and activities).

2) Abyanga (massage, applying pressure with warm medicated oil) like stretching.

3) Sweden (sudation with dosha shamak steam) is deep heating and Upnaha.[24]

4). Pizhichil[25]: streaming of hot oil along with simultaneous massage.

5). Elakizhi[25]: herbal poultice prepared with vata balancing herbs tied in a cloth and is dipped in hot medicated oil, this is applied over the local affected part.

6). Njavarakizhi[25]: useful in degenerative conditions and this is like shastikashali pinda sweda, first abhyanga is done and rice pack dipped in certain decoction is applied over the affected part.

7). Podikizhi[25]: in this herbal powder taken in a linen bag, dipped in oil and applied over.

8). Pichu[25]: cotton swab soaked in hot medicated oil applied to the part affected.

9). Nasaya karma[26,27]: as this comes under udravajatrugat roga.

10). Sanshamana aushadhi: vatashamak drugs, kwath and oils like Yograj Guggul, Rasna Erandadikshayaya, Mahanarayanadi oil etc.

11). Yoga and aasana[25] like surya namaskara etc.

12). Bahu parivartanam[22] (shoulder exercise or physiotherapy).

13). Agnikarma.[28]

12) Marma therapy[29]: stimulating marma points nearby ansa sandhi gives promising results and even it can be practiced life long without any side effects.

Modern Perspective of Frozen Shoulder

Introduction

In frozen shoulder it is believed to involve synovial inflammation and fibrosis of the shoulder joint capsule.[30] The exact etiology of the primary frozen shoulder is still unknown, one of the causes may be partial loss of blood supply and three phases of clinical presentation like painful phase, frozen phase and thawing phase (recovery) has mentioned.

The first recorded description of Frozen shoulder was reported by Duplay in 1872 in his description of a ‘periarthritis scapulohumeral’, though the term frozen shoulder was first used in 1934 by Codman, who described the common features of a slow onset of pain felt near the insertion of the deltoid muscle, inability to sleep on the affected side and restriction in both active and passive elevation and external rotation, yet with a normal radiological appearance.[31] True frozen shoulder is a clinical diagnosis; the three hallmarks of frozen shoulder are insidious shoulder stiffness, severe pain, even at night and near complete loss of passive and active external rotation of the shoulder.[32] The condition can be broadly divided in to two categories: primary, in which there is no obvious cause and secondary where a cause is identified (from history, clinical examination and radiographic appearance).[33] In clinical practice, the tendency is to label any patients with a stiff, painful shoulder as a case of frozen shoulder and this should be restricted. Frozen shoulder is a specific condition that has a natural history of spontaneous resolution and requires a management pathway that is

completely different from such distinct shoulder conditions as rotator cuff tear or osteoarthritis.[3]

Epidemiology

Research has shown a prevalence rate of 3% - 5% in the general population and up to 20% in those with Diabetes.[31] Its peak incidence in between the ages of 40-60 and is more common in women.[31,34] In 6-17% of patients, the other shoulder becomes affected, usually within 5 years and after the first has resolved.[32] The non-dominant shoulder is slightly more likely to be affected.[32]

Pathology of Frozen Shoulder

Neviaser noted that the pathology of this condition was actually located in the capsule of the shoulder joint and therefore called 'adhesive capsulitis'. Therefore the pathophysiological process is believed to involve synovial inflammation and fibrosis of the shoulder joint capsule. With microscopic examination of the tissue one will find the majority of the cells to be fibroblasts with some mast cells also present. Cytokines such as transforming growth factor β and platelet-derived growth factor may contribute to the inflammatory process. Although the glenohumeral joint, synovial capsule is involved, much of the disease also involves structures outside the glenohumeral joint. These structures can include the coracohumeral ligament, rotator interval, subscapularis, musculotendinous and the subacromial bursa.[33]

Etiology

The cause of the idiopathic form of the disease is unknown whereas the conditions that can lead to secondary frozen shoulder are systemic diseases (diabetes mellitus, hypothyroidism, hyperthyroidism, hypoadrenalism), extrinsic condition (cardiopulmonary disease, cervical spine pathology, stroke, Parkinson's disease, humerus fracture) and intrinsic factors (rotator cuff tear, rotator cuff tendinitis, biceps tendinitis, calcific tendinitis, acromio-clavicular joint arthritis).

Clinical Picture

The diagnosis is made on the basis of the medical history, clinical and radiological examination and the exclusion of other shoulder pathologies. Codman proposed the following diagnostic criteria for frozen shoulder[30] :

i) Shoulder pain with slow onset.

ii) Pain felt at deltoid insertion.

iii) Inability to sleep on affected side.

iv Atrophy of the supra and infraspinatus muscle.

v) Sometimes minimal local tenderness.

vi) Restriction of active and passive ROM.

vii) Painful and restricted: elevation and external rotation.

History

Proper history taking includes the onset and duration of symptoms, site, function and preceding trauma. Past medical and surgical history is relevant and should be obtained. Most patients with primary frozen shoulder have no history of shoulder trauma. They usually give a history of insidious onset of pain followed by a loss of motion. Night and rest pain are common in the early stages. Patients who suffer from secondary frozen shoulder often give a history of known diabetes mellitus. Other conditions that have shown an association with frozen shoulder and which might give clue to the diagnosis are hypothyroidism, hyperthyroidism, hypoadrenalism, Parkinson's disease, cardiac disease, history of stroke and a history of recent surgery.[30]

Clinical Examination

The only sign found in the early stages of the disease process is pain experienced at the end range of shoulder motion. Patients presenting with stages 1 and 2 have pain on palpation of the anterior and posterior capsule and describe pain radiating to the deltoid insertion. Later on in the disease process, one can note mild disuse atrophy of the deltoid and supraspinatus muscles. On palpation a diffuse tenderness over the glenohumeral joint can extend to the trapezius and interscapular area. It has been shown that a complete loss of external rotation is a pathognomic sign of frozen shoulder. It is important to distinguish whether this loss of external rotation occurs both actively and passively. If passive external rotation is full but active external rotation is absent, a possible rotator cuff tear should rather be considered. Most of the movement in a severely affected frozen shoulder occurs at the scapulothoracic joint. The disease process least affects extension and horizontal adduction motion.[30] On inspection mild disuse atrophy of the deltoid and supraspinatus in long standing cases is usually observed. The arm may be adducted and internally rotated. Tenderness would be positive on palpation of the glenohumeral joint. Both active and passive range of motion are affected, especially that of abduction and external rotation. Movement in the thoracoscapular

joint, which may aid abduction, should be noted.[33] The signs and symptoms of rotator cuff tendinitis overlap with those of frozen shoulder. However in contrast to the former, where pain is the main limiting factor, patients with pure frozen shoulder may complain of chronic pain, however symptoms stiffness predominates. In addition, the sign symptoms cervical radiculopathy and upper limb neurology should be evaluated, as cervical Spondylosis or other cervical disc disease may lead to or coincide with frozen shoulder.

Special Examination[30]

The diagnosis should be based on clinical examination findings with a plain x ray. Often these might be reported as normal but some may show periarticular osteopenia due to disuse. These x-rays can also assist in excluding other potential cause of a stiff shoulder such as glenohumeral arthritis, calcific tendonitis or rotator cuff disease. MRI orthography is not routinely needed for the diagnosis of adhesive capsulitis but if performed will show a slight thickening in the joint capsule and the coracohumeral ligament. MRI alone can also be helpful in identifying other causes of a stiff shoulder such as infections or tumors. Lab investigations don't contribute to the diagnosis of frozen shoulder, however, with regard to secondary frozen shoulder certain tests such as immunological studies (such as human leucocytes antigen B27)[32], full blood count, erythrocyte sedimentation rate, C- reactive protein, thyroid function test, lipid levels and fasting glucose may be ordered if an undiagnosed co-morbidity is suspected based on the history.[33] Research conducted in Switzerland concluded that thickening of coracohumeral ligment and joint capsule in the rotator cuff interval, as well as the subcoracoid triangle sign (complete obliteration of the fat triangle between the coracohumeral ligment and the coracoids process) are characteristic findings in frozen shoulder. Nonetheless, MR imaging is performed mainly to exclude rotator cuff tear or intra-articular pathology and not for diagnosis per se.[33]

Natural History

This condition is self limiting and therefore improves with time. The majority of the literature states that this period lasts for between 18-24 months. Shaffer et al showed in their group of 61 patients with frozen shoulder that some degree of pain and stiffness was present in 51% of patients at an average of seven years after onset. Poor prognosis has been associated with factors such as insulin dependent diabetes and associated intrinsic pathology such as calcifying tendonitis.

In 1987 Neviaser and Neviaser described four stages in the disease process. Hannafin et al subsequently used these four stages and were able to correlate the clinical examination with the histological appearance of capsular biopsy specimens for the first three stages. It is important to note that these stages represent a continuum of disease rather than discrete, well defined stages.[30]

Stage 1 (inflammatory)

The patients complain of pain with active and passive range of motion. The pain is described as an ache at rest and sharp with motion and is usually worse at night. Range of motion is still well maintained. These symptoms are usually present for less than 10 weeks.

Stage 2 (freezing)

The patient gives a history of chronic nagging pain over the previous 10-36 weeks. The pain is worse at night. No history of injury is present. There is progressive loss of range of motion. Arthroscopic findings include diffuse pedunculated synovitis and rubbery/dense feel at insertion of arthroscopy canula.

Stage 3 (frozen)

This occurs at 4-12 months. Pain gradually subsides and is only present at the extreme range of movement. Gross reduction of movement is present with almost no external rotation possible.

Stage 4(thawing or resolution)

This occurs usually from 12 months after onset and can last for up to 42 months thereafter. A spontaneous improvement in range of movement occurs with minimal pain.

Management

Generally this disease is a self limiting condition. However, about 10% of patients experience long term problems.[32] Patient education is most important as it encourages compliance.[32] Informing the patient about the phases, course and duration of the condition usually aids in alleviating frustration. It is also imperative to emphasis that while the range of motion would improve, it may never be complete.[32]

Treatment

According to the modern science a decision regarding the best treatment option depends on the stage of the disease and clinical symptoms.[30] Intra-articular steroids and physiotherapy

in stage-1, intra-articular steroids and arthroscopic release in stage-2, arthroscopic release in stage -3 and monitoring progress and active physiotherapy in stage-4.[30]

Non-Surgical Treatment

1) Medication: oral non- steroidal anti-inflammatory drugs can be initiated in painful freezing phase.

2) Intra-articular steroids.

3) Physiotherapy: during stage1, the focus should be on interrupting the cycle of inflammation and using modalities that can relieve the pain. Physical therapy and stretching are most effective in patients presenting with stage-2 frozen shoulder. The goal should be to stretch the capsule sufficiently to allow normal glenohumeral biomechanics.

4) Hydrodilation: intra articular injection of large amount of normal saline to distend and rupture the capsular adhesions.

5) Oral steroids.

6) Electric stimulation.

Surgery

1) Manipulation under anaesthesia.

2) Arthroscopic selective capsular release: it has become the main surgical option in the treatment of adhesive capsulitis.

DISCUSSION

This article aims to provide an overview of the nature and the widely accepted management of this condition based on other studies. As described in Sushruta Samhita and Madhav Nidan Avabahuk and Bahu Shosh can be considered as continuum not as separate diseases or two different conditions. It is extremely important to consider the patient's symptoms and condition when selecting a treatment method as each patient's treatment should be individualized. Marma therapy stimulating marma points nearby ansa-sandhi gives promising results and even it can be practiced life long without any side effects. Marma therapy can be used along with oral vatashamaka medicines and medicated oils to further enhance the results. Bahuparivartan (shoulder exercises) can be used in all stages of avabahuka. There is limited evidence to show that marma therapy will truly change the natural course of this disease, the key area for future research in particular, with regard to marma therapy as a treatment comparing it with an adequately powered high quality randomized controlled trial.

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REFERENCES

1. Sushrut: Sushruta Samhita, edited with Ayurvedatatvasandeepika Hindi commentary by Shastri Kaviraj Ambika Dutta. Varanasi India: Chaukhambha Sanskrit Sansthan; part-1; 2014; Nidan Sthana 1/82:304.
2. Sushrut: Sushruta Samhita, edited with Ayurvedatatvasandeepika Hindi commentary by Shastri Kaviraj Ambika Dutta. Varanasi India: Chaukhambha Sanskrit Sansthan; part-1; 2014; Shareera Sthana 5/3:54.
3. Sharangadhara: Sharangadhara Samhita, edited with Amala's Dipika & Kashiram's Gudartha-Dipika Sanskrita commentary by Shastri Parshuram, Vidyasagar. Bombay: Pandurang Jawaji Nirnaya-Sagar Press; 2nd edition; 1931; Pratham Khand, 7; 105.
4. Vagbhata: Astanga Hridaya, edited by Lochan Kanjiv, English commentary. New Delhi India: Chaukhambha Publications; vol-2; 2017; Nidhana Sthana 15/43:140.
5. Vagabhatta Vridha: Astanga Sangrah, Induvyakhya sahit sutra sharer nidhan sthan, edited by Pandey Ayodhya, Rao D.V. Pandita. New Delhi India: Kendriya Ayurveda & Sidha Anusandhan Parishad; part-1; Nidhan Sthana 15/30: 650.
6. Madhavakar: Madhava Nidhan, edited with Madhukosha Sanskrit commentary by Vijayarakshita and Dutta Shrikantha. Varanasi India: Chaukhamba Sansakrita Sansthana; part-1; 1996; 22/64:443.
7. Charaka: Charaka Samhita of Agnivesh, edited with vidyotini hindi commentary by Shastri Pandit Kashinatha and Chaturvedi Gorakhanatha. Varanasi India: Chakhumbha Bharati Academy; part-1; 1992; Sutra Sthana 20/11:399.
8. Charaka: Charaka Samhita of Agnivesh, edited with Charaka Chandrika hindi commentary by Tripathy Bramhanand. Varanasi India: Chakhumbha Surbharati Prakashan; part-2; 1998; Chikitsa Sthana 28/98: 956.
9. Chakrapani: Chakradutta, edited with Bavartha Sandipani Bhashatika by Tripathi Jagdishwar Prasada. Varanasi India: Chakhumbha Sanskrit Series Office Vidyavilasa press; 1947; Vatavyadhi Chikitsa 100.

10. Sushruta Samhita of Sushrut Nibandha Sangraha, Sanskrit commentary of Dalhan, edited by vaidya Jadhavji Trikamaji Acharya. Varanasi India: Chaukhamba Orientalia; 2002; Nidhan Sthana1/82:268.
11. Monier Williams, Sanskrit English dictionary. 1st edition reprint, oxford University press, Delhi; 2002; 96.
12. Taranath Takravachapati, Vachapatyayam Sanskrit dictionary. Varansi india; Chakumbha Sanskrit Series; 1970; 35.
13. Sanskritdictionary.com. Accessed on 62/02 18.
14. Sushruta Samhita of Sushrut, edited with Ayurvedatatvasandeepika Hindi commentary by Shastri Kaviraj Ambika Dutta. Varanasi India: Chaukhambha Sanskrit Sansthan; part-1; 2014; Shashirara Sthana 6/27:74.
15. Sushruta Samhita of Sushrut, edited with Ayurvedatatvasandeepika Hindi commentary by Shastri Kaviraj Ambika Dutta. Varanasi India: Chaukhambha Sanskrit Sansthan; part-1; 2014; Sutra Sthana 25/ 34-35:137.
16. Vagbhata: Astanga Hridaya, edited by Lochan Kanjiv, English commentary. New Delhi India: Chaukhambha Publications; vol-2; 2017; Nidhana Sthana 5/14-15:5.
17. Astangasangraha.
18. Sushruta Samhita of Sushrut, edited with Ayurvedatatvasandeepika Hindi commentary by Shastri Kaviraj Ambika Dutta. Varanasi India: Chaukhambha Sanskrit Sansthan; part-1; 2014; Chikitsa Sthana 5/23:43.
19. Astanga Hridaya of Vagbhata, edited by Lochan Kanjiv, English commentary. New Delhi India: Chaukhambha Publications; vol-2; 2017; Chikitsa Sthana 21/44:460.
20. Chakrapani: Chakradutta, edited with Bavartha Sandipani Bhashatika by Tripathi Jagdishwar Prasada. Varanasi India: Chaukhumbha Sanskrit Series Office Vidyavilasa press; 1947; Vatavyadhi Chikitsa 100.
21. Sain Govinddass: Baishaijaya Ratnavali by Mishra Sidhinandana. Varanasi India: Chaukhambha Surbharti Prahashana; part-1; 2017, 26/28:520.
22. Shastri Laxmipati: Yoga Ratnakara, edited with Vidyotini Hindi commentary byShastri Brahma Shankara. Varanasi India: Chaukhumbha Sanskrit Series Office; 1955, 445.
23. Sahasrayoga, edited by Arya Mahendrapala Singh, translated by Rao D B Pandit. New Delhi: CCRAS; reprint2011;621.
24. Divya Kajaria: Management of frozen shoulder with upanah (poultice sudation) – A case study. Available from: https://www.researchdesk.net. Accessed on April 26 / 02/2018.

25. Frozen shoulder: Ayurveda treatment, medicine, exercise - easy Ayurveda. Available from https:/easy ayurveda.com > froze. Accessed on 26 /02/ 2018.
26. Das Banamali at al: A study on avabahuk (frozen shoulder) and its management by Laghumashadi tail nasya. Available from: https://www.ncbi.nlm.nih.gov/PMC3202264. Accessed on April 22nd, 2017.
27. Shilpa L S et al: clinical evaluation of avabahuka through nasaya and nasapana. Available from: PIJAR/volume-1/issue-111/jan-feb-2017. Accessed on 26/2/18.
28. Maan Archana at all: Pilot study on effect of agnikarma by gud in avabahuka. Available from iamj.in > post .images. Accessed on February 26/2/ 2018.
29. Prasad Shishir et al: Clinical evaluation of marma therapy in avabahuka W.S.R. to frozen shoulder. Available from: https://www.jmscr.igmpublication.org. Accessed on 10/11/ 2017.
30. Laubscher PH, Rosch TG. Frozen shoulder: A review. S A orthopaedic Journal Spring 2009 a clinical article. Available from: SA Orthopedic Journal Spring 2009. Accessed on April 22nd, 2017.
31. Uppal Harpal Singh, Evans Jonathan Peter, Smith Christopher. Frozen shoulder: A systemic review of therapeutic options. World J Ortho., 2015 Mar 18; 6(2): 263-268. Published online 2015 Mar 18. Doi: 10.5312/wjo.v6.i2.263. PMCID:PMC4363808. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles Accessed on 22/4/2017.
32. Dias Richard, Cutts Steven, Massoud Samir. Frozen shoulder. BMJ., 2005 Dec. 17; 331(7530): 1453-1456 doi: 10.1136/bmj.331.7530.1453. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1315655. Accessed on April 22nd, 2017.
33. Wong PLK, Tan HCA, Andrew Hwee Chye Tan. A review on frozen shoulder. Article in Singapore Medical Journal September 2010. Available from: https://www. Research gate net > publication. Accessed on April 22nd, 2017.
34. M Sriram Bhat: S RB's clinical method in Surgery. New Delhi India: JAYPEE The Health Sciences Publisher. 2nd edition, 762.