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Raktamokshana - A Systemic Review

Review Article

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Abstract

Raktamokshana is the important para surgical method of bloodletting incorporated by *Acharya Sushruta* in the basic plan of detoxification therapy. Though the broad utility of this therapy is extensively elaborated in Ancient Text of *Ayurveda*, it has limited use in the clinical practices of *Panchakarm*a that may occur due to apprehension about the procedure to develop any surgical or systemic complication; lack of skill for practical demonstration or knowledge regarding its efficacy. The meta-analysis of various techniques of the *Raktamokshana,* is primarily planned to study their effectiveness & safety for managing multiple disorders. On an extensive review of the literature regarding this topic, 16 studies are conducted with 469 participants at different places or states from India. A narrative synthesis of all included studies & their critical analysis was demonstrated concisely using tables. It was found that only two modes of *Raktamokshana,* i.e., *Siravedha* & *Jaoukavacharana,* which are widely used in practice for different skin and musculoskeletal disorders, while only two trials study the modified Shringa method. No clinical study was carried out to demonstrate the effect of other methods of *Raktamokshana* or modifications in various clinical entities. The efficacy of three modes of *Raktamokshana,* i.e., *Siravedha, Jalouka* & *Shringa,* can be justified based on the basic principles of *Ayurveda* & physiological actions. This study demands to conduct scientific multi-centric research studies with a large sample size in the future to embark on these conclusions & to enhance their acceptance globally.

Key Words: *Ayurveda; Raktamokshana*; unawareness, *Sirvedha, Jaoukavacharna,* leech therapy.

Introduction

Raktamokshana is one of the essential procedures among five Penta- bio purificatory procedures as per *Sushruta* School. It is the important non-pharmacological intervention through which vitiated *Rakta Dosha,* along with *Pitta,* is eliminated through the body by using different techniques such as *Sira vedha, Jaoukavacharna, Shringa,* or *Prachhana*. Though it seems to be invasive, due to miraculous results, it is highly expected to adopt in complex clinical conditions where there occurs no relief with the use of specific *Doshahara Chikitsa.* It is considered as the half treatment in surgical diseases, according to *Sushruta* (1).

However, there are relatively limited recommendations or use of *Raktamokshana* in clinical practices of *Panchakarma* that may occur due to fear associated with the procedure, lack of skilfulness, unawareness about the efficacy of *Raktamokshana* in various diseases. This review study is specially planned to compile the utility of various modes of *Raktamokshana* based on *Ayurvedic* and contemporary parameters with its detailed procedure. A total of 16 studies (Including clinical trial & observational study) conducted on various musculoskeletal & skin diseases treated with *Raktamokshana* are being evaluated in this paper.

Aims

The prime aim of this article is to compile the utility of *Raktamokshana* in various disorders on scientific & clinical background.

Objectives

To review the application of various modes of *Raktamokshana* in different local as well as systemic disorders.

Materials and Methods

All information regarding above said aim & objectives have complied from previous research studies, i.e., *Ayurvedic* Randomized & non-randomized control trials & observational studies on *Raktamokshana* within the duration year 1999 to April 2020 those conducted at different centers & published

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on various peer-reviewed Journals, & available on Pubmed, Google scholars, etc. from the year 1999-2020. *Ayurvedic* review articles on *Raktamokshana*, Case study, or case series showing the efficacy of *Raktmokshana*, modern articles on bloodletting therapy were excluded from the study.

References of key articles were hand-searched using the keywords such as "*Raktamokshana*," "*Siravedha*", "*Prachhana", "Jaoukavacharana"*, "*Ghati Yantra", "Shrungavacharana"*. Only publications having English language were eligible for inclusion. Both the screening of "title and abstract" and "full text" of the retrieved articles was conducted independently by two reviewers, and a third reviewer resolved any disagreement.

These selected studies were assessed for Inclusion &Exclusion criteria for patient recruited in the studies, type of clinical conditions, type of methodology (whether study conducted with single group/ comparative groups/placebo-controlled or open /single or double-blind, etc.), type of *Poorvakarma* & *Paschata Karma* adopted, different techniques used for *Raktamokshana*, various instruments or modification in the traditional instrument, the quantity of blood evacuated during one sitting, frequency of the *Raktamokshana* to get expected therapeutic outcome, nature of complications if arise, etc.

Observations and Results

A total of 44 articles were retrieved after searching the selected database, i.e., PubMed, Google scholars, Medknow, Web of Science, & *Shodhaganga* using a comprehensive search strategy. On extensive review of literature from the above sources, due to duplication, 14 articles were removed. Among the rest of 30 items sorted based on screening as per title & abstract, six papers were omitted as not related to the aim of the study & objectives. Full text 24 articles were identified, but among them, 08 were withdrawn as those were not related to methodology. These 08 articles were excluded due to the following reasons: 03 articles were a literature review,05 were case reports. The detailed description of the selection process of the included articles has been provided in Fig. 1 using the Prisma flow diagram.

Afterward, A systematic review synthesizing information from 16 studies (interventional & observational) were enrolled in this study. Among these 16 studies, there are 12 R.C.T., 03 non-randomized controlled clinical trials & 01 observational study. A total of 469 patients underwent various modes of *Raktatmokshana* in these trials. Among these 16 studies, six studies were carried out at I.P.G.T. & R.A. Hospital, G.A.U., Jamnagar, ten studies at different study centers throughout India [01 at B.H.U. Jamnagar, 02 at Tirupati, 03 at Bangalore; 01 study conducted each at Nanded & Mumbai, (Maharashtra), Paprola (Himachal Pradesh), & Jaipur (Gujarat)]. Details of clinical studies conducted over hypertensive patients are as follows:

Joshi F.et al. 2019 (2)

It is an open-label prospective comparative clinical study conducted on 32 patients of either sex suffering from *Kati Sandhigata Vata* (lumbar Spondylosis) from the age group of 40–70 years by dividing them into two groups by computer-generated simple random sampling method (n=16 each group). The group A& B were treated with *Agnikarma* with *Panchadhatu Shalaka* & *Raktamokshana* with modified *Shringa Yantra*, respectively. The total duration of treatment was 25 & 21days for groups A & B, respectively. Simultaneously, one placebo capsule (500mg with wheat flour) twice a day was also prescribed after a meal with lukewarm water in both the groups.

After completing the treatment, significant reductions were observed in low backache, stiffness, numbness, and painful movements in both groups. The researcher concluded that *Agnikarma* was found more effective in relieving pain ($P < 0.001$) and numbness in the lower back. In comparison, *Raktamokshana* was found better in reducing pain ($P < 0.001$) and stiffness of the lower back ($P < 0.005$). *Raktamokshana* was found highly significant ($P < 0.001$) in improving forward flexion of lumbar joint, VAS, S.L.R., Lasegue's sign, ODI scale and Schober's test measurement, improvement in lumbar joint extension. There was 65.78%, 77.78%, 54.54%, 68.96%, 53%, 54.54% relief in *Katishoola, Katisuptata* and *Akunchana, Prasarana Pravritti, Savedana,* forward flexion of lumbar joint, measurement of Schober's test, straight leg raise test respectively due to *Agnikarma* which was better than *Raktamokshana*.

Whereas 90%,50%,55.55% & 75% the improvement was observed in an extension of lumbar joints VAS, Lasegue's sign testing, and ODI scale due to *Raktamokshana,* which was comparatively better improvement than *Agnikarma*. The treatment modalities found similar improvement, i.e. (50%) in lateral flexion of lumbar joints. No significant improvement or difference was observed in radiological findings in either group.

P. N. Shilpa et al..2018 (3)

An observational study was done over 40 Patients having *Visarpa* (Herpes Zoster) with the intervention of *Jaoukavacharana* done on the 1st day and then continued for every alternate day for 15 days with following its standard operating procedure After treatment, 100%, 100%, 92.5%, 95% recovery was observed in *Sphota- Raga, Daha, Kandu* induced by *Visarpa*. The researcher concluded that *Jaoukavacharana* has a significant role in achieving symptomatic relief in Pain. It also aids the faster healing of lesions & Post Herpetic neuralgia that can be prevented through its early intervention.

Jaiswal R.Reena. 2018 (4)

It is a Single-blind comparative clinical study done with 40 patients having foot ulcers with either sex between the age group 17- 70 years divided into four groups (n=10 in each). The Group A was advised for

Jaoukavacharana preceded by the *Poorvakarma* with *Abhyanga & Nadi Sweda* for seven days & followed by the application of *Trishothadi Lepam* externally. Group B was prescribed for *Jaoukavacharana*only. Group C underwent for *Siravyadhana* from the surrounding area of Ulcer (4 *Anguli* from the Ulcer) with *Poorvakarma,* i.e., *Abhyanga & Nadi Sweda,* for seven days followed by *Lepa Prayoga*. Group D was undergone for *Siravyadhana* only. In this study, the process of *Jaoukavacharana* was found more effective for relieving vascular stasis, reducing venous congestion, and beginning of revascularization and other wound healing process than the *Siravedha*.

Foram Joshi et. al. 2017 (5)

Sixteen diagnosed cases having lumbar *Spondylosis* with sign and symptoms, i.e., *Shula*, *Katistambha, Akunchana Prasarane Pravrutti Savedna* & Age group between 40-70 years were undergone for intervention with total four sittings of *Raktamokshana* with modified *Shringa Yantra* at *the* painful or tender area of the lumbar spine at the interval of 15 days preceded by *Snigdha* and *Pichchhila Anna Pana Sevana*. This *Raktamokshana* was followed by the *Prachhna Karma* (15-20 pricks) done with disposable needle no.24. over skin below the cups. Simultaneously Placebo capsules were prescribed (500mg each) twice daily with lukewarm water after the meal throughout 60 days.

There was significant relief, i.e., 54%, 93.5 %, 60% & 81.25% in *Kati Shula, Kati Stambha, Kati Suptata* & restricted joint movements respectively due to *Raktamokshana.* There was 61.5%, 50%, 90%, 50%, 47.5%, 55.5%, 75%, 47.22%, 54% improvement was found in forward flexion of lumbosacral joint, lateral flexion, extension of lumbar joint. Visual analogs scale, straight leg raising, Laseague's test, ODI score, Schober's test, respectively. The researchers interpreted that *Raktamokshana* with *Shringavacharana* effectively manages *Sandhigata Vata,* having the origin of *Margavarana Janya Samprapti.*

Kumar Vipin et. al. 2016 (6)

This study was planned to study the efficacy of leech application over 17 patients with *Pidaka* (papules) over the face having *Medogarbhatva*, *Ruja*, *Daha*, *Srava*, *Toda &*, *Kandu*. Two patients were dropped out of this study. There was observed statistically extremely significant results i.e., 68.91%, 77.77% & 55.96% (for p values <0.001) in tenderness, Itching & burning sensation respectively after leech application. However, it was statistically insignificant in symptoms such as discharge, *Vranavastu*, *Medogarbhta* for p >0.05. Statistically extremely significant results i.e., 72.20%, 82.11%, 72.42%, 81.79% & 84.21% (for p-value v<0.001) were noted in number of *Pidaka,* its size, extent of lesion, hardness & swelling, respectively. *Jaoukavacharana*alone is very significantly effective in relieving the associated complaints like *Kandu, Daha,* and *Vedana* due to eliminating vitiated *Rakta* that indirectly corrects *Pitta Dosha's* results into the *Srotoshodhana* effect & improvement in the local blood circulation by secretion of the various bioactive substances released by *Jalauka*.

Manorma et.al. 2015 (7)

The randomized, open, prospective clinical trial was conducted with a single group with the recruitment of patients having features of *Gridhrasi* (Sciatica) & either sex between the age group 25-60 years. The *Siravedha* with sterile disposable syringe and needle from the Great Saphenous vein (Within the range of 2.5 - 5cm area, in front and proximal to medial malleolus) of the affected side above the ankle was done that was preceded by the Local *Snehana* with *Murchhit Til Taila*7 for 15 minutes and local *Swedana* with *Patta Swedana* for 5-7 minutes. It was performed at an interval of 10days (30ml in each sitting). After the third sitting of *Siravedha*, aggregate percentage relief was observed in Pain. Radiation of Pain, Stiffness, Pricking Sensations, Visual Analogue Scale (VAS), Verbal Descriptive Scale - V.D.S.), as well as Objective criteria (Passive straight leg raising test and Fajersztajn's test), was 35.11%. *Raktamokshana karma* has an influential role in the management of *Gridhrasi.*

Sonawane A. et. al.2014 (8)

It is the clinical study conducted to assess the efficacy of *Raktamokshana* with the Modified *Shringa* method over ten patients having typical symptoms of calcaneus spur & of either sex between age 18 years to 70 years. *Raktamokshana* (approximately 10cc bloodletting) with a specially designed syringing instrument based on the principle of *Shringa* was performed preceded by *Pracchan Karma* over on the marked region followed by appropriate *Paschata Karma*. The intervention was performed at the interval of weekly once for four weeks.

There was observed complete relief in symptoms, e.g., Pain (intensity & occurrence) with tenderness in calcaneus spur after third follow up due to this modified method of *Raktamokshana*.

Pratap Shankar K.M. et. al. 2014 (9)

It is an open-labeled clinical trial conducted over 27 patients having *Vicharchikā* (Eczema) with the intervention of *Jaloukvacharana* with a minimum of four sittings at the interval of 7 days. After a successful intervention, there was a significant reduction in all symptoms of Eczema. There was remarkable reduction 54.45% ($P < 0.01$), 55% ($P < 0.01$) in Eczema Area and Severity Index (EASI) score, Scoring of Atopic Dermatitis (SCORAD) Index respectively. Moreover, the Dermatology Life Quality Index (D.L.Q.I.) was also improved by 62.36% ($P < 0.01$). The researchers concluded that *Jaoukavacharana* is significantly effective & safe in the management of Eczema.

Kumar JV. et. al. 2014 (10)

In this open randomized parallel trial, 30 patients with a known case of *Gridhrasi* & between age group 25 and 65 years were divided into two groups, i.e., group A (n= 19) and Group S (n=11). *Agnikarma* with *Panchadhatu Shalaka* at lumbosacral spine and

Achilles tendon & *Siravedha* with disposable scalp vein no. 20 was done at the site of four *Angula* below *Janu Sandhi* (Knee joint) for groups A & B respectively at seven days interval for four times. During *Siravedha*, a maximum of 30-60 ml of blood was removed & it was decided according to condition and severity of the disease. Placebo starch capsules were given to all patients. No, significant changes were observed in radiological findings, i.e., X-ray of the lumbosacral spine in both groups. A total of 8 patients were dropped out of the study.

There were highly significant results i.e., 64.91%, 75.42%, 65.38%, 42.85%, 50%, 66.68% & 66.09%, 75.02%, 100%,75.02% were observed in *Ruja*, *Stambha, Suptata, Spandana, Tandra*, *Gaurava* & *Sakthinikshepanigraha,* improvement in muscle power of hip flexion (ankle dorsiflexion & great toe extension respectively due to *Agnikarma* with insignificant changes in lab investigations.

In Group S, i.e., *Siravedha*, highly significant results were seen in *Ruka* (33.32%), *Stambha* (45.82%), *Suptata* (58.62%), *Gaurav* (57.15%), and *Sakthinikshepanigraha* (46.14%), but no significant improvement was observed in *Spandana, Tandra* & muscle power. In lab investigations, there was a substantial decrease in only Hb% after *Siravedha* (4.67%). On comparing two groups, *Agnikarma* was found more effective than *Siravedha* in *Ruka*, *Stambha,* and S.L.R. *Agnikarma* gives a better effect in relieving symptoms of *Gridhrasi* than *Siravedha.*

Vaneet Kumar et. al. 2014 (11)

It is an open randomized parallel-group trial conducted over a total of 30 patients with *Gridhrasi* by dividing them randomly into two groups. Among them, one group (n=19) was treated by *Bindu* type of *Agnikarma* with *Panchadhatu Shalaka* (at lumbosacral spine and Achilles tendon region (total 5-30 *Bindu Dahan* at the lumbosacral area and 5-15 *Bindu Dahan* at ankle region of Achilles tendon) and another group (n=11) underwent for *Siravedha* with the help of disposable scalp vein no. 20 at the site of four *Angulas* below *Janu Sandhi* (Knee joint). Both interventions were done at an interval of 7 days (total of four sittings). An approximate 30-60 ml bloodletting was done per sitting, or it was decided according to the condition and severity of the disease. The Placebo starch capsule was also simultaneously prescribed to each patient.

A total of 8 patients were dropped out of the study. There was found a significant reduction in symptoms of *Gridhasi* in both groups. There was 68.42% & 21.05% of patients had marked improvement and complete relief after *Agnikarma,* while 72.73% & 27.27% of patients had moderate improvement & marked improvement due to *Siravedha*. The researchers interfered that *Agnikarma* gives a better effect than *Siravedha* in the management of *Gridhrasi* for its *Ruka*, *Stambha,* and improvement in S.L.R. The researchers inferred that *Siravedha* is useful in patients when *Avarana Janya Samprapti* of *Gridhrasi* in *Vata Kaphaja Gridhrasi*.

Umale N. et.al. 2013 (12)

It is the clinical study done over ten patients having classical signs and symptoms of *Gridharasi* with *the* intervention of *Siravedha (*average 83 ml bloodletting) at *Antara Kandara Gulpha* preceded by the appropriate *Deepana* with *Ajamodadi Choorna (*3gm B.D. with warm water), *Sasneha Tila Yavagu, Sarvanga Abhyanga* with *Tila Taila* and *Bashpa Sweda* for three days. Among ten patients, four patients got complete relief, while 8 & 1 patients got marked and moderate relief, respectively. There was found a reduction in the mean score of Pain in *Gridhrasi* from 4 to 0.7 after *Siravedha* & the 82.5% relief in both tenderness along the course of sciatica nerve & S.L.R. test.

Athreya, P., P. et al. 2013 (13)

An open, non-randomized study was conducted over patients with a confirmed diagnosis of Osteoarthritis, tendinitis, bursitis in which two leeches were applied twice at the interval of 1 day at painful peri-articular sites on the affected area of the knee joint. S.O.P. for the preservation of *Jalouka* is very well narrated in this article in a detailed manner. Follow up was taken on the 15th day & after two months.

In the follow-up period, it was found that there was rapid & significant relief after leech application in clinical features & signs, e.g., Pain, Swelling, Stiffness, restriction of movement, A.R.A. Joint Count, R.A. Index of Pain associated with conditions with its sustainable relief even after two months of therapy. This study proved the anti-inflammatory effect of *Jaoukavacharana.*

Raval H. et. al. 2012 (14)

Twenty-nine patients with classical signs and symptoms of *Vicharchika* (Eczema) were randomly divided into the two groups, i.e., A group (n=14) with *Jaoukavacharana*and group B (n=15) with *Siravedhana* with Syringe method at the median cubital vein with average blood evacuation, 63.75 ml. Leech application was carried out in four consecutive weeks (weekly once while two sittings of *Siravedhana Karma* on the affected part of the body after local *Abhyanga* and *Swedana* (on every 15 days). 1 & 2 patients were dropped out from group A & B, respectively.

*Jaoukavacharana*provided statistically high significant results (P<0.001) in the symptoms of *Vicharchika,* like *Kandu, Pidika, Raktima*, and *Daha*. Therefore, researchers concluded that *Jaoukavacharana*has better efficacy than *Siravedha* to manage *Vicharchika*.

Rai. P. K. et. al. 2011 (15)

It is a single group study conducted over 32 patients having Osteoarthritis of the knee (having idiopathic origin) with Knee pain, morning stiffness (lasting 30 minutes or less), crepitus on motion, and findings of osteophytes on radiographs. *Jaoukavacharana,* preceded by local *Snehana* & *Swedana,* was applied once in a week for six weeks. Before the leech application, the skin was pricked by a

sharp and sterile needle after cleaning the body part. After *Samyak Jaoukavacharana*, the process was followed by appropriate wound care & *Paschata* Karma of *Jalouka*. After this intervention, significant improvement was found in Pain, stiffness, and tenderness (for P value <0.001), and the quality of life of the patient was also improved remarkably. However, there were occurred no changes in radiographical findings of the patients due to this intervention.

Manoj L. Sonaje et al. .2011 (16)

It is the randomized, open comparative study *done* between group A (N=32) & group B (N=30) in patients with classical signs and symptoms of *Vicharchika &* between the ages group 10- 70 years. The group A was undergone for *Local oil Massage)* and *Nadi Swedana,* followed by *Jaoukavacharana* with bloodletting with the removal of *an* average 28 ml blood. While group B was treated with the modified method of bloodletting, i.e., optic fiber tube attached with a vacuum pump and pressure regulator with the removal of average 27 ml blood that preceded by *Local oil Massage)*, *Nadi Swedana* & then small 25 incisions with 11 no surgical blade at or near the lesion. Both interventions were done weekly once for four consecutive weeks. Significant results have occurred in both groups. However, significant results in *Kandu, Vaivarnyata, Raji, Rukshata*, Size of patches, *Pidaka* were noted in group A due to *Jaoukavacharana*for p-value <0.001. Moreover, no notorious or significant remarkable changes were observed in any hematological and biochemical parameters. Both methods of *Raktamokshana,* i.e., *Jaoukavacharana*and *Shringavacharana,* are found effective in the management of *Vicharchika*.

Sambhaji DT et al. 2010 (17)

Sixty patients with classical signs & symptoms of *Gridhrasi* were included in this study by dividing them into two groups (n=30 each). The trial group was treated with *Siravyadha* with scalp vein No-20 & maximum 100 ml. blood was evacuated from the calf region of the affected leg at 4 *Angula* (finger) below the *Janu Sandhi* at the interval of weekly once. The control group was treated with local *Abhyanga* followed by the *Nadi Swedana* two times, i.e., daily for half an hour for 15 consecutive days. The trial group was found more effective than the control group, especially in reducing symptoms, e.g., pain (50%), tingling sensation (73.90%) & loss of sensation 50% & gross improvement in S.L.R. The researchers quoted that the *Raktamokshana* by *Siravyadha* is more effective than local *Snehana*& *Swedana* to manage the signs & symptoms of *Gridhasi*. He also commented that the patients with the *Gridhrasi* having *Anubandha* of *Kapha, Pitta,* or *Rakta* as a *Dushya* were received complete relief after *Siravedha*.

A summary description of the essential characteristics of the 16 included studies based on the different heads are as follows:

Type of randomization & methodology

The type of methodology & method of randomization (for R.C.T. only) of all included studies is mentioned in table no.1 & 2. Among 12 R.C.T., 01 R.C.T. has a single-blind controlled study design (4). The rest of the 11 were open randomized studies. Only two studies mentioned the specific type of randomization, i.e., Computer-generated random numbers (7) & coding method (2). Simultaneously the rest of the seven trials have used a Simple Random sampling technique for randomization. All trials are single centric trials & there was no any multi-centric or double-blind study.

Sample size

The sample size of the studies was found to be varied based on the study design adapted. An observed study with a minimum sample size of 04 & 62 was the maximum sample size.

Inclusion-Exclusion criteria

Inclusion (Indications & age group selected)

Total 16 studies were conducted to assess the clinical efficacy of *Raktamokshana* in different clinical conditions such *as* five works in *Gridhasi*; 1 work each in *Lumber* spondylosis, calcaneus spur, Foot ulcer, *Visarpa, Pidaka* & clinical entities with acute Pain such as tendinitis-bursitis; 3 studies in *Vicharchika* (Eczema) and two works in *Sandhigata Vata* (Osteoarthritis Knee). Out of these, *Siravedha* is showed effective treatment in the clinical condition such as Lumber spondylosis & *Gridhasi*. In comparison, *Jalokavacharana* is found effective in treating the skin conditions having local pathologies such as *Vicharchika, Visarpa* (Herpes), *Pidaka* & even Musculoskeletal conditions such as Osteoarthritis, bursitis & tendinitis. The two studies were conducted with a modified form of *Shringa* in patients with lumbar Spondylosis & calcaneus spur.

Ideally, *Raktamokshana* is prescribed in patients with age group between 18 -70 years (18). However, an overview of this studies reflects that there is little bit variation regarding the age limit of the patients for different modes of *Raktamokshana,* e.g., for *Shringa* application, maximum patients were between 40-70 years while 17-70 years age group was primarily preferred were conducted to assess the clinical efficacy of *Raktamokshana*. For trials on *Siravedha*, age group 25-70 years were selected.

Exclusions

The patients with some specific physiological & pathological contraindications described in these trials for *Raktamokshana* are tabulated in table no.3.

Type of intervention (Different techniques used for *Raktamokshana*)

Out of these 16 trials, maximum studies are carried out with *Siravedha* (8 studies), followed by *Jalouka* (7 studies). Minimum, i.e., only two studies, are carried out with *Shringa* with a modified method. There is no any single study conducted over *Ghati*

Yantra or *Prachhana*. The number of studies with these different modes of bloodletting is depicted in table no. 4.

Specific *Poorvakarma* adopted for *Raktamokshana*

In these studies, *Poorvakarma* of different modes *Raktamokshana* includes assessing the indications & contraindications of *Raktamokshana*, crosschecking the suitability of the patient, selection of the appropriate method of procedure, various Laboratory Investigations, selection of pre-procedure (*Dipana-Pachana Abhyntar* or *Bahya Snehana*, Local *Swedana*), preparation of the body part & patient, diet planning, etc.

Laboratory Investigations

In this metaanalysis, laboratory investigations preferred before *Raktamokshana* are concise in tables no. 5 & 6. For *Siravedha*, only three studies have done routine investigations such as C.B.C., BT-CT before *Siravedha* (4,12,14). Only one study has done E.S.R. (14) in *Vicharchika* as there is an inflammatory process aggravated. On the other hand, urine examination (microscopic & routine) was done before *Siravedha* by Raval Hiren N. et al. .2012 (14) & Jaiswal R.Reena .2018 (4).

Among the seven studies conducted on the *Jaouka* method, C.B.C. was advised by six trials except the trial done by K.M. Pratap Shankar et al. .2014 (9). B.T. & C.T. were reported by only three trials (4,14,15). Six trials mostly recommend C.B.C. & R.B.S.

Among the four studies conducted on the *Shringa* method, only one study done by Manoj L. Sonaje et al. .2011 (16) have done C.B.C., R.B.S., E.S.R., Lipid profile, RFT & Urine examination before its application.

Dipana -Pachana

The *Poorvakarma* of *Raktamokshana* is not specifically elaborated in our *Ayurveda* in the context of *Dipana –Pachana* or *Abhyantar Snehana*. However, local *Snehana* & *Swedana* are recommended to enhance its effect in the form of *Samyaka Yoga*.

The *Dipana Pachana* with *Ajmaodadi Choorna* carried in the patients having *Gridhasi* for consecutive 3-5 days before *Siravedha* was noted in the study done by Umale et al. 2013 (12). In the rest of the 15 trials, there is no such type of *Dipana Pachana* used.

Abhynatar Snehana

There was observed a single reference showing the prescription of *Sanseha Yavagu* (a type of *Sneha Pravicharana*) for three days before *Siravedha* (12).

Bahya Snehana

In 8 trials conducted on *Siravedha*, *Bahya Snehana* was performed by four trials only. *Til Taila* or *Moorchita Til Taila* was advised for *Bahya Snehana*. Throughout these trials, it is observed that the duration of local *Snehana* varies from 3 days to 7 days for a maximum interval of 15 minutes. *Bahya Snehana* was preferred before leech application only by four studies (4,14,15,16). No specific drugs for local *Snehana* were mentioned in these trials. At the same time, Local *Snehana* used for before the *Shringa* application is quoted by the single study conducted by the Manoj L. Sonaje et al., .2011 (16).

Local *Swedana*

Local *Swedana* was prescribed before *Siravedha* by the four studies for a maximum of up to 7 days (4,7,11,14,17). In comparison, the use of local *Swedana* prior to the *Shringa* application is quoted by the single study conducted by the Manoj L. Sonaje et al., .2011 (16).

Among seven studies on *Jalukavacharana*, local *Swedana* was done before leech application by four studies (9,14,15). Preferably lukewarm water was used for that purpose (9). On the other hand, *Nadi Swedana* or *Patta Swedana* was utilized for this purpose by the study conducted by Sambhaji DT et al. 2010 & *Manorma Et Al.: 2015* (7,17).

Preparation of the body part prior to *Raktamokshana*

On the day of leech application, preparation of the part was done with rubbing of the skin with the help of either sterilized cotton bandage pad or thick thread of jute (14) or Cleaning with the lesions of the patient took place with lukewarm water (3) or with normal saline (13). Before applying leech, the part should be pricked with a sharp and sterile needle as per Athreya, P. et al. 2013 (13).

Before applying Modified *Shringa,* the part should be cleaned with an antiseptic solution (8) or painted with a povidone-iodine solution followed by drying with a gauze piece (5). Afterward, the *Pracchan Karma* in the form of multiple superficial skin incisions (8) or small 25 incisions having approximate 1mm depth was given at or near the lesion (16).

Preparation of Leech (Purification of *Jaluoka*)

In the 07 studies of *Jaoukavacharana,* purification of *Jaluoka* was done with water mixed with turmeric powder (3,9,13,14,15) by keeping them maximum for 45 minutes, followed by in fresh water (14).

Various instruments used for *Raktamokshana*

For *Siravedha*, there is observed a variation in the use of instruments for venesection such as syringe method (12,14), disposable scalp vein set no.20 (4,11,17), sterile no.24 gauze hypodermic needle (7) was primarily used. The rest of the two studies have not mentioned the type of instruments used (5,6). The conventional procedure of *Siravyadha Kutharika Shastra* was replaced by utilizing disposable scalp vein sets with 20 number, which is easily available, and there are minimum chances of sepsis (10).

Site of *Raktamokshana* in different clinical conditions

On review of the above trial, the site of *Raktamokshana* is decided based on the type of its

mode used, type of pathology (local or systemic) & textual references of the specific site of *Raktamoshana* in specific clinical conditions quoted in our *Ayurvedic* treatise.

Among all studies conducted on the *Siravedha* in *Gridhasi, Siravedha* is carried out at different sites such as lumbosacral region & at the region of Achilles tendon (10); 4 *Angula* below *Janu Sandhi O*ver calf region in affected limb (11,17); area within the range of 25-50 cm in the front & proximal part of medial malleolus in the great saphenous vein (7) or tender area of the lumbar spine (5). However, *Siravedha* was performed from the median cubital vein in *Vicharchika* (14).

On the other hand, the studies performed with local techniques of *Raktmokshana,* such as the *Jalouka* & modified method of *Shringa,* prefers the lesions of skin disease or tender region of the body affected by the musculoskeletal disorders as a site of bloodletting.

Quantity of blood evacuated during one sitting

This meta-analysis shows that the quantity of evacuated blood through per sitting of *Siravedha* varies from 30 ml-100ml. Raval Hiren N. et al. .2012 quotes that the amount of blood in each sitting of *Siravedha* should be equal to one *Anjali* of that patient, i.e., 63.75ml, which was also supported by *Acharya Sushruta* (14).

Various studies performed with *Jalouka* didn't show the quantity of blood let per sitting except for 28 ml, mentioned by Manoj L. Sonaje et al. 2011 (16)**.**

In the studies conducted with the modified *Shringa* method, the quantity of bloodletting varies from 10-27 ml (8,16). Foram Joshi et al. 2017 quoted that blood should be evacuated until the stoppage of bleeding while bloodletting with the modified *Shringa* method (5).

Frequency of the *Raktamokshana*

The minimum duration of the study was seven days (12) & the interval of 7 days was kept between the two sittings of *Jaoukavacharana* or *Siravedha*. Depending upon the severity & chronic nature of the disease, this interval & sitting of bloodletting was planned to get the expected therapeutic outcome. For pathologies with acute illness such as *Visarpa*, sitting of *Jalouka* are scheduled on an alternate day & 2-5 sitting are recommended to recover the disease altogether. In sub-chronic conditions like *Vicharchika*, a minimum of 4 sittings are planned at an interval of 7 days. On the other hand, in chronic ailments such as O.A., Tendinitis maximum of 6 sitting is planned.

***Paschata Karma* of *Raktamokshana* (Postoperative care)**

The above 16 recruited studies include the assessment of the proper symptoms of the procedures, observations for complications if developed any, the wound care, maintenance of instruments used for *Raktamokshana* including emesis & appropriate preservation of leech for further use, precautions in the form of dietary advice, behavioral restrictions as *Paschata Karma* of *Raktamokshana*. It will be narrated one by one as follows:

Assessment parameters & outcome measure

In all 16 studies, assessment parameters are kept as depending upon signs & symptomology of the patient. The outcomes reported by the included studies comprised of results in Objective &Subjective parameters of the disease conditions.

Effect of *Raktamokshana* over hematological & biochemical parameters

The increase in the proportion of serum after bloodletting with leech application is noted by Vaneet Kumar et al. .2014 (11). In the *Siravedha* group, average Hemoglobin level fall occurred from 13.027 to 12.418 g % (reduction by 4.67%) but did not have any adverse effects. The change in Hb% after *Siravedha* can be attributed to direct letting out of R.B.C.s, thus affecting the level of Hb (11).

Observations for complications

A single study noted no complication or an adverse event. Though superficially, the various modes of *Raktamokshana* seem to be invasive, these are safe & offer the maximum therapeutic benefits if we follow the proper S.O.P. of that procedure.

Wound care

Wound care after bloodletting is primarily planned to arrest bleeding & to avoid sepsis in the wound. After the expected quantity of bloodletting by *Jalouka*, the detachment of leech should be done with Turmeric powder (13,15) or sprinkling salt over them (14). Wound after leech application was cleaned with an antiseptic solution (14) or dressed with a gauze containing *Haridra* powder (3).

After *Shring* application, *Haridra Churna* dusting (2,5); application of G*oghrita* (8); dressing with antiseptic solution (8); application of *Haridra Churna* with *Madhu* (Honey) (5) is recommended over the site of bloodletting with *Shringa* for wound care.

The tight bandage was advised after *Siravedha* & *Jaoukavacharana* to arrest bleeding at the *Raktamokshana* site in most of the studies. In comparison, the application of *Haridra* and *Yasthimadhu* powder was applied for the *Vrana Sandhana*(wound healing) and to avoid sepsis after *Siravedha* (13,17).

Maintenance of instruments/*Jalouka* used for *Raktamokshana*

The study conducted with leech application includes the emesis of leech with their appropriate preservation for further use as an essential part of post-procedure care. Emesis of leech was done with turmeric water, followed by fresh water (3). S.O.P. for the preservation of *Jalouka* is extensively elaborated by Athreya, P., P. et al. 2013 in his published article (13).

Dietary advice

An unwholesome diet was advised after *Siravedha* by Jaiswal R.Reena .2018[4]. Moreover, a light, palatable diet & haematogenic food is suggested after *Siravedha* by Sambhiaji DT et al2010 (17) & *Manorma Et Al.: 2015* (7) respectively. No specific dietic or behavioral restrictions are advised after leech application by any study. The Foram Joshi et al. 2017 recommends the intake of honey and water after *Raktmokshana* with the *Shring* method (5). He further suggested avoiding *Vatavriddhika Ahara* and *Vihara* also after the procedure.

Behavioral restrictions

Bed rest was advised for at least half an hour after *Siravedha* by Sambhaji DT et al. 2010 (17). While the patient was advised to keep the foot end elevated, area dry, clean, avoid exertion, trauma after *Siravedha* by Jaiswal Reena .2018 (4) & the patient should be asked to remain to be relaxed by *Manorma Et Al.: 2015* (7). After the application of *the Shringa* method, the patient was advised to take rest and to avoid water contacts on the operated site for 24 hours (2) & was restricted to apply any oil or cream over the area of bloodletting (5).

Discussion

A total of 16 trials carried out at different centers are screened and critically analyzed to verify the necessity and assess the role of *Raktamokshana* among various disorders such as *Gridhrasi, Visarpa,* foot ulcer, *Yuvanapidaka, Vicharchika* (Eczema), Eczema, idiopathic Osteoarthritis, tendinitis, bursitis, lumbar Spondylosis & calcaneal spur. No adverse effects were reported in these trials after any type of bloodletting. A total of 469 subjects were recruited in these trials. Among these 469 patients, various modes of *Raktamokshana* were assessed in 370 subjects 117,174 & 79 patients underwent for *Siravedha, Jaoukavacharana* & modified *Shring* method, respectively). The patients between the age group, 16–70 years, were recruited in these different studies, also quoted by *Acharya Sharangadhara* for *Raktamokshana* (18).

Six trials mostly recommend C.B.C. & R.B.S. It may be justified as *Raktamokshana* is strictly contraindicated in *Pandu* & *Prameha* (19). The use of *Dipana –Pachana* prescribed in the study conducted by the Umale et al. .2013 can be justified as *Dipana – Pachana* plays a vital role to decrease the intensity of symptoms, e.g., *Agnimandya, Aruchi* & *Gauravata* due to *Kapha* & *Ama Anubandha* that commonly occurs in *Vatakpahaja Gridhrasi* (20). Therefore, *Dipana – Pachana* should be added in the pre-procedure prescription of *Siravedha* based on the assessment of the *Agni.* However, *Dipana* is not expected before the adoption of local techniques of *Raktmokshana*.

No specific drugs or its quantity or duration is mentioned for *Abhynatar Snehana* before *Raktamokshana* throughout the *Ayurvedic* literature. Still, considering the nature of diseases (acute or chronic), state of *Dosha* involvement of predominance of *Dosha* & type of constitution of the patient, use of the various aspect of *Abhynatara Snehana* should be taken into consideration. Considering the variation in the quantity of blood in different methods of *Raktamokshana*, it can be stated that the amount of blood evacuated should be decided based on the requirement of a grade of purification, pathology of the disease along with mental & physical strength of the patient. The outcomes (results in Objective & Subjective parameters) reported by the included studies conducted with various techniques of *Raktamokshana* with their probable mode of actions can be justified as follows:

Mode of action of *Siravedha*

Siravedha karma has a significant role in the management of *Gridhrasi* to relive its sign, symptoms, *i.e., Ruka*, *Stambha*, *Suptata*, *Gaurav,* and *Sakthinikshepanigraha &* improvement in *S.L.R.* (7,11). It reduces all these symptoms by relieving venous congestion, increasing venous drainage, and increasing oxygenated blood supply near the applied area. The role of the *Siravedha* is already highlighted by the *Sushruta* in the treatment principle of *Gridhasi* (1). Mostly it is highly effective in *Gridhrasi* with *Anubandha* of *Kapha* & involvement of as a *Dushya* such as *Pitta* or *Rakta* as it induces the *Anulomana* of *Vata* by removing the *Avarana* of *Pitta* and *Kapha Dosha* (10,17).

In *Siravedha*, the expulsion of morbid humor (vitiated *Doshas*) accumulated due to inflammatory reaction induces relief in Pain immediately due to its *Vata Shamana* effect, by masking the Sheet *Guna* of the *Vata* by the *Ushna Guna* of the *Rakta* as a result of increased blood circulation by *Siravedha* (17) Its analgesic effect may occur due to the reduction in intravascular volume & pressure (21). *Stambha & Suptata* in *Gridhasi* chiefly occurs due to *Sheeta* and *Ruksha Guna* of *Vata Dosha* (10) in which *Raktamokshana* is indicated by *Sushruta* (22,23). It reduces numbness by reducing peripheral resistance. Hence, in superficial nerve involvement, *Siravedha* was found effective in relieving *Suptata*. *Siravedha* also reduces the *Avarana* of *Rakta* developed in *Gridhasi*.

Mode of action of *Jaouka*

Jalouka induces significant relief in *Shoola* developed by in *Visarpa* (immediate pain relief sustained for 7-8 hrs), i.e., Herpetic neuralgia, and helps heal its lesions fastly (3). It arrests the *Paka*(further suppuration) by expelling the *Dushta Rakta & Pitta***.** It prevents a secondary infection and facilitates the healing of lesions due to the antibiotic property of Hyaluronidase secreted by leech (3).

Jaoukavacharana is also effective in the healing of foot ulcers than *Siravedha* as it relieves vascular stasis, reduces venous congestion, and initiates the revascularization & granulation tissue formation that ultimately turns into rapid wound healing. This healing may occur due to normalization and improvement in the capillary as well as collateral blood circulation. Its anti-inflammatory, analgesic, immuno-

stimulation, and Immuno-modulator properties potentiate this effect (4).

Jaoukavacharana is also significantly effective in *Yuvanapidaka* by reducing *Kandu, Daha,* and *Vedana* in it. It can be justified as it induces the *Srotoshodhana* by eliminating vitiated *Rakta* & *Pitta Dosha* & improvement in local blood circulation due to various bioactive anti-inflammatory substances released by *Jaouka* (6).

Leech application reduces Eczema Area and Severity Index (E.A.S.I.) score, Scoring of Atopic Dermatitis (S.C.O.R.A.D.) The index in *Vicharhcikā* (Eczema) & effective than *Siravedha.* It initiates the keratolysis resulting in a reduction in thickness of skin lesion of Eczema. It reduces the oozing in Eczema due to the antibiotic property of hyaluronidase secreted by the leech. Anti-inflammatory and antifungal property of eglins and bdellins secreted by the leech also enhance the anti-eczematous effect of therapy (9,14). It decreases the itching in *Vicharchika* and *Yuvanapidaka* by inducing microcirculation and reducing inflammatory components like lymphocytes.

Moreover, *Jaoukavacharana* reduces the symptoms such as Pain, Swelling, morning Stiffness, Restriction of Movement, tenderness, A.R.A. Joint Count, R.A. Index of Pain in Osteoarthritis including idiopathic origin, tendinitis, bursitis (13,15). Anti-inflammatory, vasodilator, superoxide production, and poorly characterized anesthetics and analgesic compounds released by the leech penetrate the periarticular tissue and adjacent structures & induce analgesic effect through antinociceptive effects and counter-irritation. It also reduces the inflammation in relative structures by inhibiting the chemicals such as adenosine, prostaglandin (P.G.) E1and PGF2α, leukotriene B4, and (8R-15S)-dihydroxyeicosa-(5E-9,11,132)-tetraenoic acid (8R-15S-diHETE) which are responsible for Inflammation in such musculoskeletal disorders (13).

Mode of action of *Shringa*

Raktamokshana with Modified *Shringa Yantra* is effective in lumber spondylosis than the *Agnikarma* to relieve Pain (VAS) and stiffness of the lower back & to improve in extension & forward flexion of lumbar joints, Lasegue's sign, Schober's test measurement, and ODI scale (2). This method of bloodletting is also effective in managing *Sandhigata Vata,* having the origin of *Margavarana Janya Samprapti* (5) & calcaneal spur by reliving its intensity& frequency of Pain, tenderness (8). It *reduces the Pain* by removing *Avarodha due to Vata & Kapha in Sandhigata Vata.* It also destroys *Avarana of Kapha Dosha* over *Vyana Vayu* and establishes *Prakrita Rasa-Rakta Samvahana* (normal blood circulation). It helps to develop proper blood flow and nutrition to the tissues & structures nearby, which rejuvenates the joint structures and rehabilitates the joint movement (5). Application of modified *Shringa Yantra* in *Dhatukshaya Janya Samprapti* (pathology of tissue degeneration) removes *Vata* vitiated blood from localized circulatory pathways (micro-vascular structures) and resumes adequate fresh blood flow that results in normal joint function and reduces the symptoms. By removing nutrition to osteophytes, extra bony growth, abnormal bony tissues, it reanalyzes' the nutritional pathway to the lumbar joints. *Jaoukavacharana*and *Shringavacharana* are both effective in the management of *Vicharchika* (16).

There are observed no changes in radiological findings after using any technique of *Raktamokshana* in lumbar spondylosis. Therefore, treatment duration & frequency of *Rakatamokshana* should be increased to study & observe the efficacy of various modes of *Raktamokshana* in radiological findings of musculoskeletal or rheumatological ailments such as Osteoarthritis or lumbar spondylosis (2).

Conclusion

The novel attempt is performed through this current metaanalysis to collate shreds of evidence regarding the efficacy & safety of the *Raktamokshana* in various disorders. In some studies, intervention for a short duration with a small sample also demonstrated quick significant results over signs & symptoms of the disease. However, strict monitoring of such a study is necessary for the future to embark on their conclusions.

It is also needed to undertake further studies over a large sample size with long duration to assess the sustainability of the effects of such interventions. Therefore, future studies should be planned with a rational approach given by these studies but by keeping in mind all these shortcomings of the previous studies.

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The conflict of interest: nil

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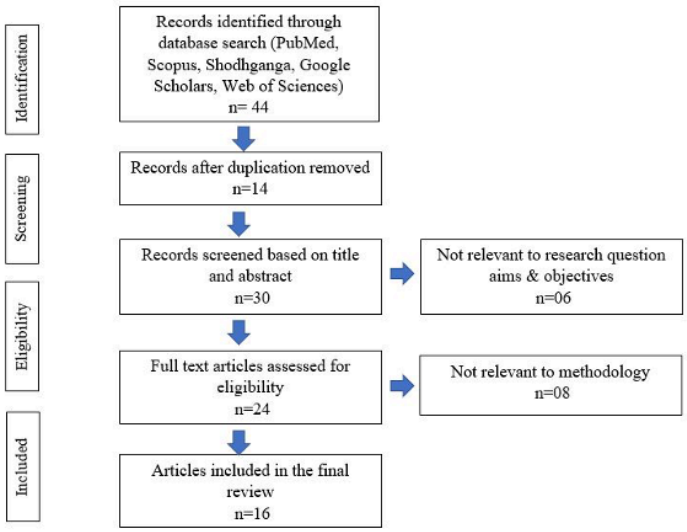
Figures:

Fig. 1: PRISMA FLOW DIAGRAM



Tables:

Table No. 1: Type of methodology of the study

S.N.	Type of methodology of the study	Number of studies
1	RCT	12
2	Non -RCT	3
3	Observational	1
4	Studies with a single group	9
5	Studies with comparative groups	7
6	Study with Placebo (2,11)	2
7	Combination with *Shamana Chikitsa* (13)	1
8	Open study	12
9	Single-blind studies (4)	1

Table No. 2: Type of method of Randomization used for RCT

S.N.	Type of method of Randomization	Number of studies
1	Coding method (7)	1
2	Computer-generated table method (2)	1

Table no.3: Patients excluded for *Raktamokshana*

S.N.	Pathological	Physiological
1	Any Hematological or bleeding disorders/Blood clotting disorders	The human with a weak constitution
2	Severe anemia (Hemoglobin % <07.00 mg/dl)	Below the age of 14 yrs and above 60 yrs
3	Allergic reaction to active substances of the leech such as hirudin, calin, hyaluronidase, e.g., line, collagenase, apyrase, destabilise, piyavit, etc.	Pregnancy
4	Uncontrolled diabetes mellitus	
5	*Vatavydhi* such as paralysis, Parkinson's disease	
6	Malignancy	
7	Patients having secondary infections	
8	Heart diseases (ischemic heart disease, coronary artery disease, myocardial infarction)	
9	Infective or immuno-compromised conditions such as tuberculosis, AIDS	
10	Leprosy	
11	Peripheral neuropathy	
12	Hepatitis A, B	
13	Use of Systemic antibiotics in the previous four weeks.	
14	Patients on non-steroidal anti-inflammatory drugs	
15	Serious Endocrine disorders	
16	Renal failure	

Table No. 4: Number of studies with a specific mode of intervention in specific clinical conditions

S.N.	Type of mode of *Raktamokshana* used	Number of studies	Specific clinical condition
1	*Siravedha*	8	Lumbar Spondylosis, *Gridhasi*, Foot ulcer
2	*Jaoukavacharana*	7	Osteoarthritis, Bursitis, tendinitis, *Pidaka, Vicharchika*, *Visarpa*, Foot ulcer
3	*Shringa* (Modified method)	2	Lumbar spondylosis, Calcaneous spur

Table no.5: Laboratory Investigations advised before *Siravedha*

S.N.	Type of Blood Investigations	*Raval Hiren N. et al.* .2012 (14)	*Kumar JV.et al.*2014 (10)	*Sambhaji DT et al.* 2010 (17)	*Manorma Et Al.: 2015* (7)	*Umale N. et.al.*2013 (12)	*Jaiswal R.Reena* .2018 (4)	*Vaneet Kumar et al.* 2014 (11)	*Forma 2017* (5)
1	**CBC**		-	-	-			-	-
2	**LFT**	-	-	-	-	-		-	-
3	**RBS**	-	-	-	-	-		-	-
4	**BT-CT**		-	-	-			-	-
5	**HIV**	-	-	-	-	-	-	-	-
6	**ESR**		-	-	-	-	-	-	-
7	**Lipid profile**	-	-	-	-	-	-	-	-
8	**RFT**		-	-	-	-		-	-
9	**Urine**		-	-	-	-		-	-

Table no.6: Laboratory Investigations advised before *Jaoukavacharana*

S.N.	Type of Blood Investigations	*Rai. P. K. et al.* 2011 (15)	*Raval Hiren N. et al.* 2012 (14)	*K.M. Pratap Shankar* et al.2014 (9)	*Manoj L. Sonaje* et al. .2011 (16)	*P. N. Shilpa et al.*.2018 (3)	*Athreya, P., P. et al.* 2013 (13)	*Jaiswal R.Reena* .2018 (4)
1	**CBC**			-				
2	**LFT**		-	-	-	-		-
3	**RBS**		-	-				
4	**BT-CT**			-	-	-	-	
5	**HIV**		-	-	-		-	-
6	**HBs AG**	-	-	-	-		-	-
7	**ESR**	-		-			-	-
8	**lipid profile**	-	-	-		-	-	
9	**RFT**	-	-	-	-	-		
10	**LFT**	-	-	-		-	-	-

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