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ORIGINAL RESEARCH ARTICLE
COMPARATIVE CLINICAL STUDY ON SHODHANANGA AROHANA AND SADYO SNEHANA

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Abstract:

**Background:** Oleation therapy used in the preoperative of shodhana (purification) is shodhanaga snehana (pre purification oleation therapy). Generally sneha is administered in arohana (increasing) manner for 3 to 7 days or till the appearance of proper oleation features. In the present days it is being observed that though many of the patients require shodhana (purification), but it is not feasible as about seven days period is required for oleation therapy. In addition texts also mention instant pre purification oleation therapy, which can be done in one day. If instant oleation is also equally effective, then the duration of preoperative procedure may be reduced remarkably. With this idea it was planned to study the effect of instant oleation therapy and arohana (increment) oleation therapy on proper oleation features.

**Objectives:** To compare the effect of increment oleation and instant oleation in attaining proper oleation features.

**Methods:** 20 volunteers were assigned into increment oleation group & instant oleation therapy group consisting of 10 each.

**Results:** The oleation grade showed in increment oleation group was 75 %, where as in instant oleation therapy group it was 24.2%. The mean of 66.7% and 44.4% of laingiki lakshana (features of proper purification) was observed in increment and instant oleation therapy group.

**Conclusion:** On the basis of the results of this study it can be concluded that increment oleation therapy method should be choice for oleation therapy prior to purgation therapy as in this group less discomfort during digestion, more oleation features and more benefits by purgation therapy were noticed.

**Keywords:** snehana, oleation, arohana, sadyo virechana, shodhana, snigdha

**Introduction**

First requisite or indication for panchakarma (pentabio purificatory measures of ayurveda) is upashitha dosha avastha (~ready stage of doshas for eviction). Panchakarma are indicated when vitiated doshas have become utkliksha (~evidently visible) and when they have acquired a central position and are not scattered in remote places from where their ousting through penta-biopurificatory measures is not attainable.1,2 Oleation acts in every respect of the processes to bring doshas to koshta and bring utklesha of the dosha.3 The oleation therapy is the main preparatory procedure to be performed before purification. The effect of oleation therapy prior to purification can be achieved by following one of the available methods such as, matranusara (as per dose) oleation therapy, arohana (increment) oleation therapy, Sadyo snehana (Instant oleation therapy) and pravicharana (~mixed with food article) oleation therapy.4

In the present days it is being observed that though many of the patients require purification, it is not feasible as about 7 days
period is required for oleation therapy. Generally unctuous substance is administered in increment manner for 3 to 7 days or till the appearance of proper oleation features. Instant Oleation therapy is a procedure of administration of unctuous substance within shorter duration. It is based on the principles of pravicharana oleation therapy. Many references regarding instant oleation therapy recipe are available in the classics but their dosage and method of administration is not clearly mentioned. While explaining pancha prasratika peya (special recipe for instantaneous oleation) dosage is mentioned in the numerical value. As an example few instant oleation therapy yogas are mentioned hereunder, pippali, saindhava, four unctuous substances and curd water all this taken together. Increment oleation can be defined as an oral administration of unctuous substance in the increment dosage.

In the present days it is being observed that though many of the patients require purification, but it is not feasible as about seven days period is required for oleation therapy. In addition texts also mention Instant oleation therapy as pre purification oleation therapy, which can be done for one day. If instant oleation therapy is also equally effective, then the duration of preoperative days may be reduced remarkably. With this idea it was planned to study the effect of instant oleation therapy and increment oleation therapy on proper oleation features.

**Objectives**

1. To evaluate the effect of increment oleation in attaining proper oleation features
2. To evaluate the effect of instantaneous oleation in attaining proper oleation features
3. To compare the effect of increment oleation and instantaneous oleation in attaining proper oleation features.

**Materials and methods**

**Source of data**

20 healthy volunteers having madhyama koshta were selected.

**Inclusion criteria**

1. Volunteers who were not complaining of any type of illness either mentally or physically
2. Whose routine clinical examination and laboratory investigations revealed no abnormality
3. Volunteers fulfilling the criteria for madhyama koshta
4. Volunteers between the age group of 17 to 30 years.

**Exclusion criteria**

1. Mridu koshta and krura koshta volunteers
2. Volunteers with physical or mental ailments or with altered routine lab investigations.

**Laboratory investigations**

Routine blood, urine and stool examinations were carried out before selection of volunteers as screening criteria.

**Groups and management**

20 volunteers were assigned into two groups increment oleation therapy group and Instant oleation therapy group consisting of 10 each. All the volunteers were administered panchakola churna in the dose of 6 gm three times a day with hot water before food for 3 days or till the appearance of nirama lakshana (proper digestion), which ever was earlier.

I. **Increment oleation therapy group**

In this group, volunteers were given test dose (30 ml) of murchita ghee (~medicated ghee) at around 7.30 am. The second day onwards medicated ghee was administered in increasing dosage. The increase per day was decided on the basis of jiryamana (during digestion), features on digestion etc. Thus the increase was not fixed and the dose schedule in this group was variable from person to person. After attainment of proper oleation features volunteers were subjected to virechana (purgation therapy).

**Procedure of snehapana (internal oleation):**

- Volunteers were instructed to take liquid, hot, easily digestible food in proper quantity in night on the day before internal oleation
• Early morning on the day of internal oleation after going through normal routine, digestion features (but not hungry) was assessed. Then at 7.30 am, volunteers with a fresh mind, enthusiasm, courage, by remembering his favorite god, the dose of medicated ghee was administered. Hot water was given as an adjuvant followed by ghee intake
• Volunteers were instructed to follow do’s and don’ts as mentioned for internal oleation
• Volunteers were instructed not to take any type of food until he/she feels hungry
• During those days volunteers were given light diet
• The features during medicated ghee digestion as well as the time required for appearance of digestion features was assessed.

The volunteers were observed for proper oleation features daily. After getting proper oleation features internal oleation was stopped and then volunteers were subjected for virechana (purgation therapy).

II. Instant oleation therapy group:
In this group the volunteers were given 150 ml of murchita ghee (~medicated ghee) with 10 grams of saindhava lavana (rock salt) at once for one day. The volunteers were observed for proper oleation features. Then volunteers were subjected for virechana (purgation therapy).

Criteria for assessment of the results
1. Dose, duration for medicated ghee digestion:
   • Time of medicated ghee administration
   • Dosage of medicated ghee
   • Features during digestion of medicated ghee like shiroruk (head ache), bhrama (giddiness), nishtiva (~ excess salivation), murcha (~fainting), sada (~tiredness), arati (~restlessness) and klama (~lethargy)
   • Time of appearance medicated ghee digestion features

2. Proper oleation features:
The following subjective criteria were considered for assessment of proper oleation features.
   • Vatanulomana - assessed by normal expulsion of flatus, faeces and urine
   • Diptagni - based on the time and dose of medicated ghee
   • Asamhata varcha - based on the loose consistency of the faeces
   • Snigdhavarcha - confirmed by greasy/sticky/pasty stool, floating of fatty stool over water. Sense of oiliness over the fingers on washing after defecation (enquired from the volunteers)
   • Tvak snigdhata - assessed by comparing the touch, luster and texture of skin before, during and after oleation therapy
   • Glani - it was assessed by presence of exhaustion / fatigue / debility or weakness
   • Anga laghava - by enquiring with the volunteers
   • Snehodvega - confirmed by presence of aversion towards medicated ghee.

 Overall assessment of the proper oleation features was done based on percentage of the manifested proper oleation features.

3. Purgation therapy:
   • Time of onset of purgation
   • Duration of purgation
   • Number of purgation
   • Number of proper features of purgation
   • End features of purgation
   • Features of proper, improper & excess purgation

Results
Dosage and time taken for digestion of medicated ghee:
In increment group internal oleation therapy was administered to madhyama koshta volunteers in the age group 17 to 30 years. At the outset proper digestion and metabolism was achieved by giving panchakola churna in the dose of 6 gm three times with hot water before
food. Thereafter internal oleation was started with medicated ghee. First day 30 ml of medicated ghee was given to all volunteers, which was considered as hrasiyasi matra\textsuperscript{10} (~test dose). On the basis of digestion of test dose, the next day dosage was decided. The minimum and maximum time taken for digestion of test dose was 165 and 480 minutes respectively with the mean duration of 307.5 minutes. Though the test dose was equal to all volunteers, the medicated ghee digestion features appeared in different times. This indicates that though the koshta, age group, season, place and food habits are similar, the digestion of ghee had not occurred at same duration in all volunteers.\textsuperscript{11} This reveals that apart from the above factors prakrti (~body constitution), Agni bala (~digestion capacity) are also important for internal oleation. By considering all these factors the next day dose was decided which varied from volunteer to volunteer.\textsuperscript{12} The minimum second day dose was 50ml and maximum was 90 ml with mean of 65 ml and the minimum and maximum time taken for digestion was 300 and 600 minutes respectively.\textsuperscript{13} In the subsequent days also by considering all the above factors and after proper observation of sneha jirna lakshana (~features on digestion) and time taken for digestion of ghee, the next day dose was fixed.

In 10% of volunteers on 3\textsuperscript{rd} day itself proper oleation features were observed, in 20% on 4\textsuperscript{th} day and in the remaining 70% volunteers on 5\textsuperscript{th} day were found. This also suggests that even with the similar koshta and other factors the proper oleation features had not manifested at the same time. Even in classics also quoted that the appearance of proper oleation features varies from 3-7 days.\textsuperscript{14} The variation in the manifestation of proper oleation features may be because of variation of koshta and digestion capacity among individuals.\textsuperscript{15} It is interesting to note that the maximum dose of ghee was digested in comparatively lesser time in the later days and digestion time varied from individual to individual and also day to day.\textsuperscript{16} This suggests that internal oleation increased the digestion capacity on each day, though there was individual variation.\textsuperscript{17} Enhancement of digestion capacity is mentioned as one of the proper oleation features.\textsuperscript{18} Even ghee itself is mentioned as agnivardhaka (augment digestion), though it is pittahara. This property of ghee may also contribute for the increase of digestion capacity. By these observations it can be said that digestion capacity is an important factor in deciding the dosage of ghee along with other factors.\textsuperscript{19,20}

For achieving the oleation therapy prior to purification many methods have been dealt in classics. Instant oleation therapy is one such method indicated for oleation therapy. Though 1–3 days are mentioned for instant oleation therapy in this study one day internal with 150 ml of medicated ghee along with 10 gm of rock salt was fixed after conducting a pilot study. Even though there are different recipes for instant oleation therapy, ghee and rock salt was selected because of easy administration, and also mentioned as it brings oleation therapy instantaneously.

For Instant oleation therapy group also the selection criteria were the same. After the administration of fixed dosage of ghee the observation was done for its digestion and proper oleation features. Even with minimum variables, in this group the time taken for ghee digestion varied from individual to individual i.e., minimum and maximum time was 7 hours and 13 hours respectively. This difference in duration may be because of variation in digestion capacity.\textsuperscript{21} But the increase of digestion capacity cannot be assessed here as ghee was administered for one day only.

Features during digestion:

The ghee during its digestion produces some systematic effects called as features during digestion.\textsuperscript{22} These symptoms subside after proper digestion of ghee and don’t need any therapeutic intervention.\textsuperscript{23} In classics shiroruk (~head ache), bhrama (~giddiness) etc., symptoms are given under the heading of features during digestion.\textsuperscript{24}

In the present study also the above mentioned symptoms were observed during digestive phase of ghee except murcha (~fainting) and daha (~burning).\textsuperscript{25} These two
symptoms may manifest with the maximum dose. In 20% volunteers, apart from the above symptoms nausea and vomiting were also observed. The onset time and duration of symptoms varied from individual to individual and also from day to day. With the administration of minimum dosage these symptoms were subsided earlier and with increase of dosage these symptoms were present for longer duration. It has been observed that the increase of mean duration and mean onset time was not constant, may be because of the adoptability of the body to ghee. All the symptoms were not present in all the days of internal oleation and in all the individuals. The onset and duration of symptoms cannot be justified on the basis of avasthapaka (~ stages of digestion). To evaluate the relation between stages of digestion and dosage requires large sample study.

In the Instant oleation therapy group with fixed dosage too, the onset and duration of the digestion of ghee varied from individual to individual. Sada (~tiredness), murcha (~fainting) and daha (~burning) were not observed in any volunteer of this group. Even the onset and duration of digestion of ghee cannot be explained on the basis of avasthapaka. In nutshell the mean onset and duration of features during digestion was 310.51 minutes and 131.56 minutes respectively in increasing group, where as in Instant oleation therapy group it was 4 hours and 21 minutes and 2 hours and 44 minutes respectively. On the basis of this it may be said that in Instant oleation therapy group, volunteers experiences much discomfort due to longer duration of features during digestion.

**Proper oleation features:**

The aim of oleation before purification is to bring excitation of doshas; which can be assessed by observing the proper oleation features. Vatanulomana (~proper movement of vata) was observed in 100% volunteers of increment group, almost in all the days. Snigdha (~oil) and sara (~movement) quality of ghee may help in bringing vatanulomana (~downward movement of vata). Ghee acts like lubricant to the intestinal lumen; hence proper evacuation of vata takes place. Enhancement of digestive power may be there on the first day itself. But it can be better assessed after digestion of second day dose only. In 100% volunteer’s enhancement of digestive power has been observed in all the days. Hence daily dosage of ghee was increased. Otherwise excitement of dosha could not occur. Anga laghava (~lightness of body) was observed only in 40% of volunteers of increment group. During internal oleation the person was restricted to take only hot water till the ghee digestion thereafter also only light easily digestible food was advised. May be this diet restriction brings the above said features. Lightness in body parts cannot be explained on the basis of properties of ghee. Glani (~fatigue) was observed only in 40% of volunteers of increasing group in the present study. Guru (~heavy) and manda (~slow) qualities of sneha may lead to manifestation of fatigue. The physical and mental strength of the individual may be a deciding factor in the manifestation of this symptom. Asamhata - snigdha varcha (~loose greasy stool) indicate the koshta snigdhatva (~abdominal unctuousness).

This effect may be brought about by presence of drava (liquid), sara and snigdha (oily) quality of ghee. These are observed on the last days of internal oleation. Initially asamhata (~loose) stool were seen, thereafter snigdha varchas (~fatty, oily stools). When the ghee reaches saturation level in the body then only it will be expelled out in excess. That’s why on the last days only these symptoms are observed which are important to assess the proper oleation. These are assessed by observing the form of stool and stickiness, greasiness to the palm of volunteer and also by floating of fat over the water. The present study supports the above said factors. In the entire volunteers of increment group the above symptoms have been observed. Mridu (~soft) and snigdha gatra (~oily body parts) reveal the tvak snigdha lakshana (~unctuousness of body). Though the soft and oily body parts are important criteria’s in assessment of proper oleation features, it is difficult to assess because of variation in color of skin, body texture, muscularity and...
environmental factors in this region. In this study it was observed only in 50% of volunteers of increment group. Aversion towards ghee is an important symptom to assess proper oleation and to stop internal oleation. Satiety center and threshold level towards ghee plays role in achieving the aversion towards ghee. In the present study this is observed in all the volunteers (100%). On the basis of well known principle “pradvesho vriddh hetushu” (~aversion towards factors responsible for increase), aversion towards ghee can be understood. After giving instant oleation therapy downward movement of vata was observed in 100% volunteers. Sara (~movement) and snigdha (oily) properties of ghee, with sara and aruksha (~non oily) qualities of rock salt are added in getting vatanulomana (downward movement of vata) effect. Augmentation of digestive capacity cannot be assessed in this instant oleation therapy group, because of limitation of internal oleation to one day. Augmentation of digestive capacity may be there because of ghee and even rock salt is also agneya (~similarity with internal fire). Loose stool was observed in 70% of volunteers of Instant oleation therapy group. This indicates liquid, movement quality and the quantity of ghee along with sroto sravakara (~secretions in channels) property of rock salt might have helped in achieving of this outcome. Oily stool was observed only in 20% volunteers of instant oleation therapy group; this indicates that optimum level of abdominal unctuousness may not come in a single day of instant oleation therapy. Oily and soft skins were not observed in any of the volunteers of instant oleation therapy group. Which reveal that to achieve oleation of skin more days of internal oleation is essential.

Lightness of body parts was observed in 20% volunteers. In only 10% of volunteers fatigue was observed; may in others because of good physical and mental strength the manifestation of symptom was restricted. Aversion towards ghee usually seen after its maximum saturation in the body. But in this instant oleation therapy group by single day ghee administration this was not observed. In the increment group the manifestation of gradual increase in proper oleation features was observed. On the first day 1 to 2 symptoms were seen in 80% volunteers. On second day in each 50%, 1 to 2 and 3 to 4 symptoms were observed. On the 5th day in each 28.5 % volunteers 7 to 8 and 9 symptoms were observed. This shows that the gradual increase in the manifestation of symptoms with gradual increase of ghee dosage occurred. Abdominal & skin unctuousness that are essential for proper oleation can be achieved by gradual increase of dosage of ghee by considering digestion capacity, koshtha and other factors. This study reveals that, increasing dosage of ghee can achieve the optimum saturation essential for manifestation of proper oleation features. In Instant oleation therapy group, the majority (80%) of volunteers obtained only 1 to 2 symptoms followed 20% obtained 3 to 4 symptoms. Hence in obtaining the complete unctuousness instant oleation therapy is not much helpful.

The unctuousness grade showed in increment group was 75%, where as in instant oleation therapy group it was 24.2%. This shows that comparatively increment oleation therapy is better in bringing proper oleation features.

Table 1: Percentage of proper oleation features in increment group

<table>
<thead>
<tr>
<th>Complete unctuousness features</th>
<th>I day</th>
<th>II day</th>
<th>III day</th>
<th>IV day</th>
<th>V day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of volunteers</td>
<td>% of volunteers</td>
<td>% of volunteers</td>
<td>% of volunteers</td>
<td>% of volunteers</td>
</tr>
<tr>
<td>1 – 2</td>
<td>80</td>
<td>50</td>
<td>30</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3 – 4</td>
<td>-</td>
<td>50</td>
<td>50</td>
<td>45</td>
<td>-</td>
</tr>
<tr>
<td>5 – 6</td>
<td>-</td>
<td>-</td>
<td>20</td>
<td>33</td>
<td>43</td>
</tr>
<tr>
<td>7 – 8</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>22</td>
<td>28.5</td>
</tr>
<tr>
<td>9</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>28.5</td>
</tr>
</tbody>
</table>
Table 2: Percentage of proper oleation features in instant oleation therapy group

<table>
<thead>
<tr>
<th>Proper oleation features</th>
<th>Number of volunteers</th>
<th>Percentage [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>08</td>
<td>80</td>
</tr>
<tr>
<td>3-4</td>
<td>02</td>
<td>20</td>
</tr>
</tbody>
</table>

Virechana (purgation therapy):

When purgation therapy was performed after increment oleation therapy the mean onset and duration of purgation therapy was 58.5 minutes and 399 minutes respectively, where as in instant oleation therapy group these values were 63.5 minutes and 316.5 minutes respectively. The mean number of purgation produced in increment group were 16.3, while in instant oleation therapy group it was 13.3. In increment oleation therapy group 90% volunteers had expulsion of kapha dosha at the end of purgation therapy, while instant oleation therapy group kaphanta purgation therapy was found in 50% volunteers. In increment group mean features of proper purgation observed were 66.7 %, while in instant oleation therapy group it was 44.4 %. In increment group excellent purification was found in 40%, moderate purification was found in 50% and remaining 10% volunteer had least purification. On the other hand in instant oleation therapy group 50% volunteers had moderate purification and same number had least purification. On the basis of the above results it can be said that effect of purgation therapy is better in increment group on comparison to instant oleation therapy group. In nutshell it can be said that both increment and instant oleation therapy have produced proper oleation features and proper purification by purgation therapy. But some differences were observed in both the groups, they are mentioned hereunder.

In increment group mean dose of 420 ml ghee was needed, where as in instant oleation therapy group 150 ml of ghee was needed to achieve unctuousness. Hence later was cost effective. In increment group the mean onset and duration of features during digestion of ghee was 310.51 minutes and 131.56 minutes respectively, where as in instant oleation therapy group it was 252.75 and 164 minutes respectively. This shows that in instant oleation therapy group, volunteers experienced much discomfort. In increment group 43% had 5 to 6 proper oleation features, 28.5% each showed 7 to 8 and 9 proper oleation features, where as in instant oleation therapy group 80% showed 1 to 2 proper oleation features and in 20%, 3 to 4 proper oleation features were observed. While comparing the unctuousness grade it was 75% in increment group and 24.2% in instant oleation therapy group. This shows that, comparatively increment oleation therapy is superior in achieving proper unctuousness. While considering effect on purgation therapy, in increment group 40% volunteers showed excellent purification and none in instant oleation therapy group. In each 50 % volunteers of increment and instant oleation therapy group moderate purification was observed. In 10% volunteers of increment group and in 50% volunteers of instant oleation therapy group least purification was observed. The mean of 66.7% and 44.4% of features of proper purgation therapy was observed in increment and instant oleation therapy group.

This shows that in comparison to instant oleation therapy, increment oleation therapy works in better way in aiding purgation therapy properly done.
Table 3: Effect of purgation therapy on subjects of increment group

<table>
<thead>
<tr>
<th>Volunteer number</th>
<th>onset time</th>
<th>Latency period</th>
<th>Number of purgation bouts</th>
<th>Antiki lakshana</th>
<th>Percentage of laingiki lakshana</th>
<th>Grade of purification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>35</td>
<td>270</td>
<td>16</td>
<td>Kaphanta</td>
<td>66.66</td>
<td>moderate</td>
</tr>
<tr>
<td>2</td>
<td>40</td>
<td>340</td>
<td>17</td>
<td>Kaphanta</td>
<td>66.66</td>
<td>moderate</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
<td>430</td>
<td>21</td>
<td>Kaphanta</td>
<td>77.77</td>
<td>excellent</td>
</tr>
<tr>
<td>4</td>
<td>145</td>
<td>270</td>
<td>11</td>
<td>Kaphanta</td>
<td>55.55</td>
<td>moderate</td>
</tr>
<tr>
<td>5</td>
<td>110</td>
<td>380</td>
<td>10</td>
<td>Pittanta</td>
<td>33.33</td>
<td>least</td>
</tr>
<tr>
<td>6</td>
<td>70</td>
<td>435</td>
<td>18</td>
<td>Kaphanta</td>
<td>77.77</td>
<td>excellent</td>
</tr>
<tr>
<td>7</td>
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<td>600</td>
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<td>Kaphanta</td>
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<td>moderate</td>
</tr>
<tr>
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<td>350</td>
<td>16</td>
<td>Kaphanta</td>
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<td>moderate</td>
</tr>
<tr>
<td>9</td>
<td>25</td>
<td>365</td>
<td>17</td>
<td>Kaphanta</td>
<td>88.88</td>
<td>excellent</td>
</tr>
<tr>
<td>10</td>
<td>45</td>
<td>550</td>
<td>16</td>
<td>Kaphanta</td>
<td>88.88</td>
<td>excellent</td>
</tr>
<tr>
<td>Mean</td>
<td>58.50</td>
<td>399</td>
<td>16.3</td>
<td>-</td>
<td>66.7</td>
<td></td>
</tr>
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Table 4: Effect of purgation therapy on subjects of instant oleation therapy group

<table>
<thead>
<tr>
<th>Volunteer number</th>
<th>Vega onset time</th>
<th>Duration of purification therapy vega</th>
<th>Number of purification therapy vega</th>
<th>Antiki lakshana</th>
<th>Percentage of laingiki lakshana</th>
<th>Over all purely</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>75</td>
<td>420</td>
<td>16</td>
<td>Kaphanta</td>
<td>55.55</td>
<td>moderate</td>
</tr>
<tr>
<td>12</td>
<td>45</td>
<td>285</td>
<td>09</td>
<td>Pittanta</td>
<td>33.33</td>
<td>least</td>
</tr>
<tr>
<td>13</td>
<td>50</td>
<td>380</td>
<td>08</td>
<td>Pittanta</td>
<td>33.33</td>
<td>least</td>
</tr>
<tr>
<td>14</td>
<td>45</td>
<td>285</td>
<td>14</td>
<td>Kaphanta</td>
<td>55.55</td>
<td>moderate</td>
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<tr>
<td>15</td>
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<td>165</td>
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<td>Kaphanta</td>
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<td>moderate</td>
</tr>
<tr>
<td>18</td>
<td>40</td>
<td>355</td>
<td>15</td>
<td>Kaphanta</td>
<td>55.55</td>
<td>moderate</td>
</tr>
<tr>
<td>19</td>
<td>60</td>
<td>265</td>
<td>14</td>
<td>Pittanta</td>
<td>33.33</td>
<td>least</td>
</tr>
<tr>
<td>20</td>
<td>45</td>
<td>300</td>
<td>12</td>
<td>Pittanta</td>
<td>33.33</td>
<td>least</td>
</tr>
<tr>
<td>Mean</td>
<td>63.5</td>
<td>316.50</td>
<td>13.3</td>
<td>-</td>
<td>44.44</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion:
On the basis of the results of this study it can be concluded that increment oleation therapy method should be choice for oleation therapy prior to purgation therapy as in this group less discomfort during digestion, more unctuounsness and superior grade of purgation therapy were noticed. Even though instant oleation therapy has provided oleation therapy to certain extent leading to moderate or least benefits by purgation; but in routine practice it should not be encouraged as an alternate technique to increment oleation therapy. However in emergency instant oleation therapy can be used as internal oleation prior to bio-purification. Hence in routine prior to purgation therapy increment oleation therapy is better.

References:
Ashvini Kumar, Singh G, Pujar MP, Chaturvedi A. Comparative clinical study on shodhananga arohana sadyo snehana


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ORIGINAL RESEARCH ARTICLE
SINGLE BLIND PLACEBO CONTROLLED CLINICAL EVALUATION OF MAMAJJAKA GHANVATI IN PRAMEHA WITH SPECIAL REFERENCE DIABETES MELLITUS

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Abstract:

**Background:** Prameha (~diabetes mellitus) is described as one of the disease mainly caused by vitiation of tridosha. Prameha is one of the eight diseases which are tough to cure known as mahagada (merely curable disease) are numerated by Sushruta. The syndrome diabetes mellitus has been largely covered under the broad heading of prameha. According to the International Diabetes Federation (IDF), 3.8 million people worldwide die from diabetes and related illnesses annually. In only 20 years the number of people with diabetes has exploded from 30 million to 246 million. By 2025, there will be approximately 380 million people living with diabetes, with the highest increases in new cases occurring in the most diabetics at 40.9 million followed by China with 39.8 million.

**Objective:** To find out an effective and cheap remedy to combat against prameha (~diabetes mellitus).

**Methods:** The study was carried out in the 60 patients of prameha selected from the outpatient / inpatient department of Government Ayurvedic College hospital Raipur; total of 52 patients completed the full course of treatment. Out of this figure, 20 patients were studied in shamana group who were given mamajjaka ghanavati, second group with virechana karma followed by mamajjaka ghanavati and rest 20 patients were studied in control group who were given godanti bhasma as placebo treatment.

**Results:** The trial drug and virechana (bio-purification) therapy showed highly significant result on objective parameter like reduction in fasting blood glucose, reduction in post-prandial blood glucose, along with clinical improvements on subjective parameters like excessive urination, turbidity of urine, excessive thirst, burning sensation in hand and leg, excessive sweating, excessive hunger and tiredness.

**Conclusion:** The drug under study mamajjaka ghanavati was effective in diabetes mellitus.

**Keywords:** prameha, mamajjaka, ghanavati, Enicostemma Littorale Blume, virechana

Introduction:
The healthy long life is the desire of each and every one of us and this is the beginning of any medical science. In Ayurvedic texts the disease prameha (~DM) is described as one of the disease mainly caused by vitiation of tridosha. prameha (~DM) is one of the eight diseases which are tough to cure known as mahagada are numerated by Sushruta.1 The syndrome diabetes mellitus has been largely covered under the broad heading of prameha. Now-a-days prameha (~DM) has been called a great problem for society. The disease is increasing day by day because of its hereditary background, on other hand in the modern mechanized age the physical labor is enormously reduced so we can say that busy and worried life of modern era has open the door for the disease to grow in the society. It has turned out to be the biggest “silent killer” today in the world. The mortality rate due to Diabetes mellitus is very high and is ranked fifth amongst the ten major causes of death in southern part of India. According to the International Diabetes Federation (IDF), 3.8 million people worldwide die from diabetes and related illnesses annually. In only 20 years the number of people with
diabetes has exploded from 30 million to 246 million. By 2025 there will be approximately 380 million people living with diabetes, with the highest increases in new cases occurring in the most diabetics at 40.9 million followed by China with 39.8 million.²

**Objectives:**

a. To evaluate the efficacy of shamana (palliative) therapy by using mamajjaka ghanavati

b. To assess the efficacy of shodhana purvaka shaman (Palliative measures‘ after proper elimination of dosha (toxins)) chikitsa in the management of this disease

**Materials and Methods**

**Design of study:**
Randomized, single blind clinical study.

**Selection of patients:**
The patients were selected from the OPD/IPD of Govt. Ayurvedic College Hospital, Raipur irrespective of sex, religion and socioeconomic status. Patients underwent clinical examination on baseline and at 15 days intervals. They were given diaries to note incidence and severity of symptoms. Adverse effects if any were recorded. A questionnaire and clinician’s observations were used for prakriti analysis.

**Selection of drug:**
In order to find newer drugs for the health care need of the mankind. In perspective of this the present study, *Enicostemma Littorale* Blume. Called locally as 'mamajjaka' or 'nahe' an ethno medicinal plant used in the treatment of prameha, often with considerable efficacy is taken for study.

**Sampling:**
Simple random sampling technique using lottery method was used. Group allocation was done by simple random allocation (complete randomization).

**Sample size:** 60 patients

**Grouping:**
60 patients under trial were subdivided into three groups i.e. Group A, Group B and Group C (each 20 patients) to compare the effects therapies.
**Inclusion criteria**

All the patient labeled as having diabetes mellitus and those present with symptoms will be screened for diabetes i.e. blood glucose

The new patients fulfilling the diagnostic criteria of World Health Organization for DM described as under were selected\(^3\):

- Fasting blood glucose >126 mg/dl or
- Postprandial (PP) blood glucose >140 mg/dl at an interval of first 2 h during an oral glucose tolerance test.

Criteria for high blood glucose: The diagnosed patients who were taking allopathic medicine but their blood glucose was not under control were included.\(^4\)

**Exclusion criteria**

1. Patients of type-I diabetes mellitus.
2. Cases with FBS >300 mg/dl, juvenile diabetic cases.
3. Age >70 years.
4. Cases having complication like retinopathy, nephropathy etc.

**Intervention:**

<table>
<thead>
<tr>
<th>Group</th>
<th>Drug</th>
<th>PPBS (mg/dl)</th>
<th>Dose</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Shamana</td>
<td>Mamajjaka ghanavati</td>
<td>140-200</td>
<td>1BD</td>
<td>45 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200-250</td>
<td>1TDS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>250&gt;</td>
<td>2TDS</td>
<td></td>
</tr>
<tr>
<td>(B) Shodhana purvakashaman chikitsa</td>
<td>Shodhana and mamajjaka ghanavati</td>
<td>140-200</td>
<td>1BD</td>
<td>45 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td>200-250</td>
<td>1TDS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>250&gt;</td>
<td>2TDS</td>
<td></td>
</tr>
<tr>
<td>(C) Placebo chikitsa</td>
<td>Godanti bhasma</td>
<td>1BD</td>
<td></td>
<td>45 days</td>
</tr>
</tbody>
</table>

**Criteria for assessment**

After completion of the treatment, the results were assessed by adopting the following criteria:

- Fasting blood glucose (FBS) and post prandial blood glucose (PPBS) levels.
- Improvement in signs and symptoms of disease on the basis of the symptoms score.

- Cases with other complicated diseases along with DM (malignant hypertension, history of severe unstable angina, myocardial infarction, cardiovascular accidents, and renal failure.

5. Pregnant or lactating women.

**Investigations:**

- **Blood:** Routine blood investigations like complete blood count, Hb%, ESR, and PCV to rule out any other pathological condition.
- **Biochemical examination includes**
  1. Blood glucose (fasting and post prandial).
  2. Lipid profile (serum cholesterol, serum total lipids, serum triglycerides, serum HDL, serum LDL, serum VLDL) to evaluate the role of medodusti.
- **Urine:** Routine examination and microscopic examination

Apart from Blood glucose criteria other investigations are carried out only for safety of the patients. These values were recorded both before and after treatment.

**Overall Effect of Therapy**

Effect of both therapies was assessed on the basis of following parameters:

- Reduction in severity of sign & symptoms\(^5\)
- Reduction in blood glucose level

Reduction in blood glucose level: It was analyzed by following gradation pattern for blood glucose level. Results obtained for each patient with application of below mentioned
formula indicates efficiency of the drug in reducing the blood glucose level. (As compared to base line B.S.L level (in the form of %)

Reduction in FBS(%)=$\frac{(\text{Total BT}-\text{Total AT})}{\text{Total BT}} \times 100$

Reduction in PPBS (%)=$\frac{(\text{Total BT}-\text{Total AT})}{\text{Total BT}} \times 100$

Statistical analysis:
The information gathered on the basis of observation was subjected to statistical analysis in terms of mean score (x), standard deviation (SD) standard error (SE), paired t test was carried out at the level of 0.05, 0.01, 0.001 of P level. The obtained results were thus interpreted as 

\[ \text{P}<0.05 \text{ – Improvement} \]
\[ \text{P}<0.01 \text{ – Significant improvement} \]
\[ \text{P}<0.001 \text{ – Highly significant} \]

Observations and Results:
The Table 1 reveals that prabhuta mutrata (polyuria) was found in 100% patients, daurbalya (weakness) was found in 98.76% of the patients, trishnadhikya (polydipsia) was found in 84.61% of the patients, kara-pada-tala-daha (burning sensation in hand & soles) was found in 76.92% while 84.61% patients were having avila mutrata (turbid urine). (Table 1)

<table>
<thead>
<tr>
<th>Chief complaints</th>
<th>Number of patients</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A (n=18)</td>
<td>Group B (n=14)</td>
<td>Group C (n=20)</td>
<td></td>
</tr>
<tr>
<td>Polyuria</td>
<td>18</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>Turbidity of urine</td>
<td>15</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>Polydipsia</td>
<td>15</td>
<td>13</td>
<td>16</td>
</tr>
<tr>
<td>Polyphagia</td>
<td>16</td>
<td>11</td>
<td>18</td>
</tr>
<tr>
<td>Burning sensation in hands and soles</td>
<td>14</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>Numbness in hands &amp; soles</td>
<td>14</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Weakness</td>
<td>17</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td>Cramps in walking</td>
<td>14</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>Nature of sweating</td>
<td>17</td>
<td>14</td>
<td>18</td>
</tr>
</tbody>
</table>

EFFECT OF THERAPIES:

GROUP A: MAMAJJAKA GHANAVATI (SHAMANA GROUP)

Effect of mamajjaka ghanavati on chief complaints:
Prabhuatamutrata (polyuria): The initial mean score of prabhuta mutrata was 2.17 which reduced to 0.78 after treatment with 64.10% relief. The result was highly significant at P<0.001.
Avila mutrata (turbidity of urine): Mamajjaka ghanavati provided highly significant (P<0.001) reduction in Turbidity of urine by 47.6% relief.
Pipasadhikya (polydipsia): The mean score was 1.61 and reduced to 0.78 after treatment. The relief was 59.25%. This result was statistically highly significant at p<0.001.
Kshudhadhikya (polyphagia): Mamajjaka ghanavati provided statistically highly significant (P<0.001) relief in Polyphagia by 50% relief.

Karapada-daha (burning sensation in hands & soles): It was reported that initial mean score of this group was 1.56 and after treatment it reduced up to 0.89. This 53.57 % relief was statistically highly significant (P<0.001).
Karapada-supti (numbness in hands & soles): Before treatment mean score of this group was 1.28 which was reduced up to 0.78 after treatment, this way treatment provided 39.13% relief, which was statistically highly significant (P<0.001).
Daurbalya (weakness): Before treatment mean score was 1.83 which was reduced up to 1 after treatment, this way treatment provided 38.7% relief, which was statistically highly significant (P<0.001).
Pindico-dwestana (Cramps in walking): The mean score was before treatment was 1.39 which reduced up to 0.78 after treatment and thus 41.66% relief was found which was statistically highly significant (P<0.001).
Sweda-pravriti (nature of sweating): It was observed that the mean score was 1.78 before treatment and after treatment it was reduced up to 0.72. So here 59.37% relief was found which was statistically significant (P>0.001). (Table 2)

<table>
<thead>
<tr>
<th>Sl.</th>
<th>Signs and symptoms</th>
<th>BT mean</th>
<th>AT mean</th>
<th>% of relief</th>
<th>SD</th>
<th>SE</th>
<th>T</th>
<th>P</th>
<th>remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Polyuria</td>
<td>2.17</td>
<td>0.78</td>
<td>64.10</td>
<td>0.73</td>
<td>0.17</td>
<td>11.75</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>2</td>
<td>Turbidity of urine</td>
<td>1.61</td>
<td>0.67</td>
<td>58.62</td>
<td>0.77</td>
<td>0.18</td>
<td>7.43</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>3</td>
<td>Polydipsia</td>
<td>1.61</td>
<td>0.78</td>
<td>59.25</td>
<td>0.81</td>
<td>0.19</td>
<td>9.22</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>4</td>
<td>Polyphagia</td>
<td>1.78</td>
<td>0.89</td>
<td>50</td>
<td>0.76</td>
<td>0.18</td>
<td>11.66</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>5</td>
<td>Burning sensation in hands and soles</td>
<td>1.56</td>
<td>0.61</td>
<td>53.57</td>
<td>0.70</td>
<td>0.16</td>
<td>6.27</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>6</td>
<td>Numbness in hands and soles</td>
<td>1.28</td>
<td>0.78</td>
<td>39.13</td>
<td>0.81</td>
<td>0.19</td>
<td>4.12</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>7</td>
<td>Weakness</td>
<td>1.83</td>
<td>1.00</td>
<td>38.7</td>
<td>0.84</td>
<td>0.20</td>
<td>9.22</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>8</td>
<td>Cramps in walking</td>
<td>1.39</td>
<td>0.78</td>
<td>41.66</td>
<td>0.81</td>
<td>0.19</td>
<td>5.17</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>9</td>
<td>Nature of sweating</td>
<td>1.78</td>
<td>0.78</td>
<td>59.37</td>
<td>0.75</td>
<td>0.18</td>
<td>10.76</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
</tbody>
</table>

GROUP B: (MAMAJJAKA GHANAVATI + VIRECHANA KARMA):

Effect of mamajjaka ghanavati + virechana karma to the various sign and symptoms

Prabhutamutrata (polyuria): Mean score before treatment was 2.21 reduced to 0.57 post therapeutically by giving 74.19% relief. It was highly significant at p<0.001.

Avila mutrata (turbidity of urine): Virechana purvaka shaman provided highly significant (P<0.001) reduction in Turbidity of urine by 74.07% relief.

Pipasadhikya (polydipsia): The mean score in this group before treatment was 1.36, which was bought down to 0.71 with the relief of 47.36% this was highly significant at p<0.001.

Kshudhadhikya (polyphagia): The mean score o was 1.71 before treatment which reduced up to 0.64 after treatment with 64% relief, which statistically highly significant (P<0.001).

Karapada-daha (burning sensation in hands and soles): It was observed that the mean score of this group was 1.50 before treatment and after treatment it was reduced up to 0.71. So here 52.38% relief was found which was statistically insignificant (P>0.001).

Karapada-supti (numbness in hands and soles): The mean score of this group before treatment was 1.57 and after treatment 0.57 with 57.89% relief, which was statistically highly significant (P<0.001).

Daurbalya (weakness): The mean score before treatment was 2.00 which was reduced to 0.64 after treatment with 67.85. % relief it was statistically highly significant (P<0.001).

Pindico dwestana (cramps in walking): Before treatment mean score was 1.57 which was reduced up to 0.79 after treatment, this way treatment provided 50% relief, which was Statistically highly significant (P<0.001).

Sweda-pravriti (nature of sweating): It was reported that initial mean score in this group was 1.86 and after treatment it reduced up to 0.36. This 80.76 % relief was statistically highly significant (P<0.001) (Table 3).
Table 3 showing effect of therapy in Group B (paired t test)

<table>
<thead>
<tr>
<th>Sl.</th>
<th>Signs and symptoms</th>
<th>BT mean</th>
<th>AT mean</th>
<th>% of relief</th>
<th>SD</th>
<th>SE</th>
<th>T</th>
<th>P</th>
<th>remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Polyuria</td>
<td>2.21</td>
<td>0.57</td>
<td>74.19</td>
<td>0.49</td>
<td>0.13</td>
<td>12.36</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>2</td>
<td>Turbiditiy of urine</td>
<td>1.92</td>
<td>0.50</td>
<td>74.07</td>
<td>0.65</td>
<td>0.17</td>
<td>8.27</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>3</td>
<td>Polydipsia</td>
<td>1.36</td>
<td>0.71</td>
<td>47.36</td>
<td>0.83</td>
<td>0.22</td>
<td>04.84</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>4</td>
<td>Polyphagia</td>
<td>1.71</td>
<td>0.64</td>
<td>65.38</td>
<td>0.74</td>
<td>0.20</td>
<td>05.49</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>5</td>
<td>Burning sensation in hands and soles</td>
<td>1.50</td>
<td>0.71</td>
<td>52.38</td>
<td>0.83</td>
<td>0.22</td>
<td>06.75</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>6</td>
<td>Numbness in hands and soles</td>
<td>1.57</td>
<td>0.79</td>
<td>57.89</td>
<td>0.65</td>
<td>0.17</td>
<td>10.82</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>7</td>
<td>Weakness</td>
<td>2.00</td>
<td>0.64</td>
<td>67.85</td>
<td>0.74</td>
<td>0.20</td>
<td>03.94</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>8</td>
<td>Cramps in walking</td>
<td>1.57</td>
<td>0.79</td>
<td>50</td>
<td>0.80</td>
<td>0.21</td>
<td>04.36</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>9</td>
<td>Nature of sweating</td>
<td>1.86</td>
<td>0.36</td>
<td>80.70</td>
<td>0.50</td>
<td>0.13</td>
<td>03.56</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
</tbody>
</table>

HS – highly significant

GROUP C: (PLACEBO THERAPY + DIET CONTROL)

Effect of placebo with strict diet control in the various signs and symptoms

Prabhutamutrata (polyuria): The mean score before treatment in this group was 1.40 which was reduced to 0.75 after treatment by giving 46.42% relief. It was significant at p<0.01.

Avila mutrata (turbidity of urine): Placebo shows statistically highly significant (P>0.001) reduction in Turbidity of urine by 38.71% relief.

Pipasadhiyak (polydipsia): The mean score prior to the treatment was 1.20, which was reduced to 0.80, giving 27.27% relief. This result was statistically highly significant.

Kshudhadhikya (polyphagia): Initially the mean score was 1.60 before treatment which reduced up to 1 after treatment with 47.36% relief, which was statistically significant (P<0.001).

Karapada-daha (burning sensation in hands and soles): The mean score of this group before treatment was 1.15 which was reduced to 0.80 after treatment with 30.43% relief but it was statistically significant (P<0.001).

Karapada-supti (numbness in hands and soles): The mean score of total before treatment was 1.10 and after treatment it became 0.70 with 57.14% relief which was statistically highly significant (P<0.001).

Daurbalya (weakness): The mean score before treatment was 1.65 and after treatment it became 1.45 which was statistically insignificant (P<0.05).

Pindico-dwestana (cramps in walking): Initially the mean score was 1.00 before treatment which reduced up to 0.60 after treatment with 40% relief, which was Statistically highly significant (P<0.001).

Sweda-pravriti (nature of sweating): It was found that the mean score was 1.50 before Treatment and after the completion of the course it was reduced up to 0.80 this 46.66% relief was statistically significant (P<0.001). (Table 4)
Table 4 showing effect of therapy on Group C (paired t test)

<table>
<thead>
<tr>
<th>Sl.</th>
<th>Signs and symptoms</th>
<th>BT Mean</th>
<th>AT Mean</th>
<th>% of relief</th>
<th>SD</th>
<th>SE</th>
<th>T</th>
<th>P</th>
<th>remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Polyuria</td>
<td>1.40</td>
<td>0.75</td>
<td>46.42</td>
<td>0.81</td>
<td>0.18</td>
<td>3.57</td>
<td>&lt;0.01</td>
<td>SI</td>
</tr>
<tr>
<td>2</td>
<td>Turbidity of urine</td>
<td>1.55</td>
<td>0.95</td>
<td>38.71</td>
<td>0.75</td>
<td>0.16</td>
<td>5.55</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>3</td>
<td>Polydipsia</td>
<td>1.20</td>
<td>0.80</td>
<td>27.27</td>
<td>0.75</td>
<td>0.16</td>
<td>3.56</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>4</td>
<td>Polyphagia</td>
<td>1.60</td>
<td>1.00</td>
<td>47.36</td>
<td>0.79</td>
<td>0.18</td>
<td>05.34</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>5</td>
<td>Burning sensation in hands and soles</td>
<td>1.15</td>
<td>0.80</td>
<td>30.43</td>
<td>0.77</td>
<td>0.17</td>
<td>3.20</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>6</td>
<td>Numbness in hands and soles</td>
<td>1.10</td>
<td>0.70</td>
<td>57.14</td>
<td>0.73</td>
<td>0.16</td>
<td>3.56</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>7</td>
<td>Weakness</td>
<td>1.65</td>
<td>1.45</td>
<td>12.12</td>
<td>0.94</td>
<td>0.21</td>
<td>2.18</td>
<td>&lt;0.05</td>
<td>IS</td>
</tr>
<tr>
<td>8</td>
<td>Cramps in walking</td>
<td>1.00</td>
<td>0.65</td>
<td>40.88</td>
<td>0.88</td>
<td>0.17</td>
<td>3.56</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
<tr>
<td>9</td>
<td>Nature of sweating</td>
<td>1.50</td>
<td>0.80</td>
<td>46.66</td>
<td>1.05</td>
<td>0.17</td>
<td>6.66</td>
<td>&lt;0.001</td>
<td>HS</td>
</tr>
</tbody>
</table>

HS – highly significant, SI – significant improvement, IS - insignificant improvement

EFFECT OF THE THERAPY IN FASTING AND POSTPRANDIAL BLOOD GLUCOSE LEVEL:

Group A (Mamajjaka Ghanavati group):

18 patients of prameha (~DM) were treated with mamajjaka ghanavati. The initial fasting blood glucose value of 18 patients of Prameha before treatment was 1.78 decline to 0.83 after treatment by giving 53.12% relief with t value of <0.001 the statistical analysis showing highly significant result.

Before treatments mean post postprandial blood glucose value was 293.5 declined to 227.5 after treatment by giving 22.2% relief.

Table 5 showing effect of the therapy on fasting and postprandial blood glucose level

<table>
<thead>
<tr>
<th>Blood glucose</th>
<th>Mean score</th>
<th>% of relief</th>
<th>SD</th>
<th>SE</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A (n=18)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FBS</td>
<td>1.78</td>
<td>.83</td>
<td>53.13</td>
<td>0.42</td>
<td>0.09</td>
<td>9.6</td>
</tr>
<tr>
<td>PPBS</td>
<td>1.89</td>
<td>0.88</td>
<td>52.94</td>
<td>0.83</td>
<td>0.19</td>
<td>3.6</td>
</tr>
<tr>
<td>Group B (n=14)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FBS</td>
<td>1.57</td>
<td>0.57</td>
<td>63.63</td>
<td>0.75</td>
<td>0.20</td>
<td>3.5</td>
</tr>
<tr>
<td>PPBS</td>
<td>1.64</td>
<td>0.74</td>
<td>66.52</td>
<td>0.74</td>
<td>0.19</td>
<td>2.2</td>
</tr>
<tr>
<td>Group C (n=20)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FBS</td>
<td>1.4</td>
<td>1.05</td>
<td>25</td>
<td>0.51</td>
<td>0.11</td>
<td>3.2</td>
</tr>
<tr>
<td>PPBS</td>
<td>1.4</td>
<td>1.0</td>
<td>32.14</td>
<td>0.56</td>
<td>0.12</td>
<td>3.5</td>
</tr>
</tbody>
</table>

FBS- Fasting blood glucose, PPBS- Post prandial blood glucose

Overall effect of the trial therapies:

Table 6 reveals that in group A, out of 18 patients 33.3% patients had control the disease, while 11.1% patients had marked improvement and 44.7% patients had moderately improvement. 16.6% patients were found unchanged. In group B, out of 14 patients 42.8% patients had control the disease 7.14% & 35.7 patients had marked and moderately improvement. However, no patient found unchanged. In group C, out of 20 patients 20% patients had control the disease, while 10% each patients had markedly improvement and moderate improvement. 35% patients had got mild improvement however no improvement found in 5 patients i.e. 25%.
Table 6 showing overall effect of therapy in patients of prameha (~DM)

<table>
<thead>
<tr>
<th>Total effect</th>
<th>Group A</th>
<th></th>
<th>Group B</th>
<th></th>
<th>Group C</th>
<th></th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of pt.</td>
<td>%</td>
<td>No. of pt.</td>
<td>%</td>
<td>No. of pt.</td>
<td>%</td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Control</td>
<td>06</td>
<td>33.3</td>
<td>06</td>
<td>42.8</td>
<td>04</td>
<td>20</td>
<td>16</td>
<td>30.7</td>
</tr>
<tr>
<td>Marked improvement</td>
<td>02</td>
<td>11.1</td>
<td>01</td>
<td>7.14</td>
<td>02</td>
<td>10</td>
<td>05</td>
<td>9.61</td>
</tr>
<tr>
<td>Moderate improvement</td>
<td>03</td>
<td>16.6</td>
<td>05</td>
<td>35.7</td>
<td>02</td>
<td>10</td>
<td>10</td>
<td>19.2</td>
</tr>
<tr>
<td>Mild improvement</td>
<td>07</td>
<td>44.4</td>
<td>02</td>
<td>14.2</td>
<td>07</td>
<td>35</td>
<td>16</td>
<td>30.7</td>
</tr>
<tr>
<td>No improvement</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>05</td>
<td>25</td>
<td>05</td>
<td>9.61</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>100</td>
<td>14</td>
<td>100</td>
<td>20</td>
<td>100</td>
<td>52</td>
<td>100</td>
</tr>
</tbody>
</table>

Discussion:

All the Ayurvedic classics described the disease prameha (~DM) in detail. This disease has been listed under the eight mahagada (merely curable disease) which are difficult to cure. In the person having hereditary predisposition disease becomes quickly incurable due to the short circuit in the metabolic pathway. Patients starts to convert most of the food nutrients into glucose irrespective of body requirement most of the symptoms of the disease prameha occur due to defect in the functions of jathragni and dhatwagni leading to the excessive formation of deranged quality rasa, mamsa, meda, kleda etc.

Attempt has been made to explain the prameha as the synonyms of the diabetes mellitus. It has been observed that prameha has a great resemblance with disease diabetes mellitus of the modern science if we consider the prameha from the clinical point of view the kaphaja and pittaja type of prameha are nothing but the clinical progression of the same disease diabetes mellitus. Regarding the clinical features of urinary changes Sushruta has clearly mention that instead of doshas and dushyas are being the same only due to difference in their proportion(doshas–dushyas–samyoga-vishesa) different manifestation are observed.9-11

Almost all of the Ayurvedic texts have given emphasis of samsodhan (Purification), shamana (palliative) and diet & exercise in the treatment of the disease. In the pathogenesis of the prameha, the kapha and pitta are the main dosha, whereas the most important dushyas are meda and kleda. So, in its management such drugs have to be selected which are against meda and kleda as well as having hypoglycemic effect. So, the drug Mamajjaka which is widely used in rural parts of the country as a folklore medicinal plant which fulfills the above criteria has been selected. According Sushruta, The doshas in the patients of prameha (~DM) accumulates in the lower part of the body owing to the incompetence of the dhamanis. So keeping these factors in view, the virechana therapy was selected. As prameha is a drava pradhan vyadhi generally depends on the ahara-vihara (diet and exercise) without which any kind of treatment is not effective for long time.

Probable mode of action of mamajjaka ghanavati:

The drugs mamajjaka mainly having tikta, katu rasa veerya and laghu, ruksa guna, katu vipaka and kaphavatahara properties. Thus usna veerya and tikta rasa helps to normalize the function of Jathragni and dhatwagni. That in turn helps to form the dhatus in proper proportion with samyak qualities. Laghu, ruksa guna helps for the shosan of bahudrava shlesma and reduction of vitiated meda, kleda. Thus once these factor get normalized in the body they in turn make clear the Path of vata which stops the depletion of vital dhatus (tissues) and restore normal physiology.12-17

Probable mode of action of virechana:

As said by acharya Sushruta, in the patients of prameha (~DM), kapha and pitta are vitiated excessively and they remain lying in the lower part of the body virechana (purgation) has the quality to eliminate both pitta and kapha. Also, it is the best shodhana (purification) therapy for the elimination of dosha lying in the lower parts of the body. By the elimination of kapha and pitta, obstructions are removed
(avarana), which are caused by the path of vata. At the same time, the elimination of kapha also alleviates the vitiated kapha vargiya dushyas. In this way, the virechana therapy reduced the vitiation of dosha and the dushyas. In this group, the shamana therapy was given after the virechana. When the shamana drug was given to the patients whose vitiated doshas were already eliminated by the virechana therapy, it ultimately provided better relief in comparison with the shamana therapy alone. The above-mentioned facts are evident from the results of this study, as the virechana and mamajjaka ghanavati group (combined therapy) provided better relief in signs and symptoms of the patients of prameha (~DM).

Conclusion:

In the present study, better relief was observed in signs and symptoms of the patients in comparison with the biochemical parameters. After evaluating the total effect of therapies, it was observed that the virechana (purgation) and mamajjaka ghanavati (combined therapy) provided better relief in the patients of prameha (~DM) in comparison with the mamajjaka ghanavati (shamana therapy) alone.

References:


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GENERAL ARTICLE
CHARAKA SAMHITA: A CRITICAL REVIEW
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Abstract:
Charaka Samhita is a collection of various basic principles, healthy advises and directions, teaching and research methodology, anatomy and physiology of body, pharmacological actions of various drugs, description of preventive, promotive and curative aspects of various diseases along with panchakarma chikitsa etc. For these great contributions, he has been known as “father of medicine” forever. He was the only one great sage who has told about the two objectives of ayurveda i.e. 1) to maintain and promote the positive health of healthy individuals 2) to cure the disease of diseased ones. Acharya punarvasu atreya was the advisor and acharya agnivesha was the main author of charaka Samhita, whereas acharya charaka was the actual redactor and acharya dridhabala was the completer of this samhita.

Keywords: Ayurveda, charaka samhita, charaka

Introduction:
Ayurveda has been one of the ancient sciences of life of the world going back to over 4,000 years BC, which is a branch of Atharva Veda. It is an eternal science of healthy living treasures deals with physical, psychological and spiritual well being of the human being and covers all the aspect of human life. It is not a materialistic science but a philosophical and factful truth, which enhanced by our great ancient sages like Acharya Charak, Sushrut, Vagbhatt etc. through their experience, logic and power of wisdom.

Among these great sages, Acharya Charak has a great contribution towards Ayurveda by giving a great Literature i.e. “Charak Samhita”, which is a collection of various basic principles, healthy advises & directions, Teaching & Research methodology, anatomy & physiology of body, pharmacological actions of various drugs, description of Preventive, Promotive & Curative aspects of various diseases along with Panchakarma chikitsa etc. For these great contributions, he has been known as “Father of Medicine” for ever. He was the only one great sage who has told about the two objectives of Ayurveda i.e. 1) To maintain & promote the positive health of healthy individuals 2) To cure the disease of diseased ones. Here the Acharya Punarvasu Atreya was the advisor & Acharya Agnivesha was the main author of this Charak Samhita, whereas Acharya Charak was the actual redactor & Acharya Dridhabala was the completer of this Samhita.

The “Charak Samhita” consists of 8 sections (Sthan) and contains total 120 chapters, 9035 Sutras (formula) & 12,000 Slokas. Each section contains some of chapters, sutras & slokas. These 8 sections are as follows, viz. 1) Sutrasthan (30 chapters) 2) Nidanasthan (8 chapters) 3) Vimanasathan (8 chapters) 4) Sharirasthan (8 chapters) 5) Indriyasthan (12 chapters) 6) Chikitsasthan (12 chapters) 7) Kalpasthan (12 chapters) and 8) Siddhisthan (12 chapters). Acharya Dridhabala has completed the redaction process of “Charak Samhita” by...
The original Charak Samhita (Sanskrit Version) is of one volume. But the currently available Charak Samhita (Commentary of various authors) is in two parts like Purvaardha & Uttaraardha. Purvaardha contains 5 sections (Sthan), viz. 1) Sutrasthan 2) Nidanasthan 3) Vimanasthan 4) Sharirasthan 5) Indriyasthan and Uttaraardha contains 3 sections, viz. 1) Chikitsasthan 2) Kalpasthan 3) Siddhisthan. Actually these available 2 parts are the Hindi commentary of Charak Samhita, as different commentaries in different languages like English, Gujarati, Arabic, Persian etc are also available which are written by different Acharyas & learned Vaidyas.

The Sutrasthan is that section where a collection of various important Sutras (Ayurvediya formula) or Slokas related to various context are described, for which it is, also known as Slokasthan. This Sthan contains 1952 Sutras and 30 chapters which are divided into 7 Chatuskas & 1 Sangrahadhyaya. Chatuska means a division comprising of 4 chapters relating to same topic. The first Chatuska is Ausadha Chatuska comprising chapter no.1 to 4, where description about various drugs & basic principles of Ayurveda is available. Likewise the 2nd Chatuska is Swasthavritta Chatuska comprising chapter no.5 to 8, where many healthy advises is mentioned which are required for maintaining the good health of healthy individuals. Similarly the 3rd Chatuska is Nirdesh Chatuska comprising chapter no.9 to 12, where many important information & directions related to Ayurveda is described. The 4th Chatuska is Kalpana Chatuska comprising chapter no.13 to 16, where a no. of preparations or ways of preparations related to Ayurvediya drugs or various treatments are advised. The 5th Chatuska is Roga Chatuska comprising of chapter no.17 to 20, where various types & no. of diseases are mentioned. Likewise the 6th Chatuska is Yojana Chatuska comprising chapter no.21 to 24, where the various types of ways of treatment procedures of various ailments are described. Similarly the 7th Chatuska is Annapana Chatuska comprising chapter no.25 to 28, where the various types of foods, food materials & various ways of preparing food are told by Acharya Charak. The Sangrahadhyaya comprising of the last two chapter no.29 & 30, where the collection of different characteristics of life, body & physician (Vaidya) are elaborately described.

The Nidanasthan is that section which contains 247 Sutras and 8 chapters where the various Nidana (Etiology), Samprapti (Pathogenesis), Purvarupa (Prodromal signs & symptoms) and Rupa (Clinical features (signs & symptoms)) of 8 Mahavyadhis (Diseases) like Jwara (Fever), Raktapitta (Haemoptysis or Haematemesis), Gulma (Abnormal growth), Prameha (Diabetes), Kushtha (Leprosy), Shosa (Tuberculosis), Unmada (Insanity) and Apasmar (Epilepsy) are elaborately described.

The Vimanasthan is that section which contains 354 Sutras and 8 chapters where the specific knowledge (Quantitative & Qualitative) about Dosha (Ailments), Roga, Bhesaja (Drugs), Desha, Kala, Bala, Sharirah, Ahara, Sattwa, Satmya etc. as well as their characteristics is elaborately described. The detail description about Srotas, Amashaya, Krimi Roga, various Pramanas, Dasavidha Rogi Pareeksha (Ten investigations regarding patients), 44 types of Vaada (Debate), methods of study & teaching, methods of Research, details of seminars & symposium and Janapadadhvans (Epidemiology) are available in this section.

The Sharirasthan is that section which contains 382 Sutras and 8 chapters where the detail description about anatomy & physiology of Sharira (Body), Garbha (Pregnancy (Sign & Symptoms according to months), Monthly development & nutrition of fetus, causes of fetal death & treatment)), Prasava (Labour, Prenatal, Natal & Postnatal care, Sutika Roga & its line of treatment) etc. are available.

The Indriyasthan is that section which contains 378 Sutras and 12 chapters where the Arista Lakshanastus (Prognosis of death) on the basis of various descriptions regarding Swara (Voice), Gandha (Smell), Rasa (Taste), Sparsha (Touch), Swapna (Dreams), Chhaya (Shadow),
Pratichhaya (Reflected Shadowa), Prabha (Lustre) & Sadyomaran (Quick death) and Astamahagada (8 dreadful diseases) are narrated very nicely.

The Chikitsasthan is that section which contains 4904 Sutras and 30 chapters where the detail description of various diseases & their principles of treatment along with descriptions of Rasayan & Vajikaran are available. Here the 1st chapter is related to Rasayan & the 2nd is related to Vajikaran. Both chapters are described according to 4 Paada (Paada have been told, which denotes 1/4th of a chapter, so that 4 Paada comprises one chapter). The various diseases like Jwar, Raktapitta, Gulma, Prameha, Kustha, Shosa, Unmada, Apasmar, Kshatakshina, Shotha, Udara, Arsha, Grahani, Pandu, Shwas, Kasa, Atisara, Chhardi, Visarpa, Trisha, Bisa, Madatyaya, Vrana, Marma, Urusthamba, Vatavyadhi, Vatarakta & Yonivyapad and their clinical features with different principles of treatment (Shodhan (Panchakarma), Shaman (Medicines) & Nidan Parivarjan (Avoiding the causative factors)) are narrated very nice manner, that’s why Acharya Charak was famous for Chikitsasthan (“Charakastu Chikitsite”)

The Kalpasthan is that section which contains 378 Sutras and 12 chapters where the different Kalpana (Churna, Kalka, Kwath, Swaras etc.) of Vamana drugs (Emetics) like Madanphala, Jimutak, Ikshwaku, Dhamargav, Vatska (Kutaja), Kritavedhan and Virechana drugs (Purgatives) like Shyama Trivrit, Chaturangul (Aragvadh), Tilwak (Lodhra), Sudha (Snuhi), Saptala-Sankhini & Danti-Dravanti according to the stage of Dosa/Roga & Rogi along with their pharmacological action, dose, indications & contraindications are described.

The Siddhisthan is that section which contains 700 Sutras and 12 chapters where the detail description of Panchakarma Chikitsa is available. The different Karmas like Snehan, Swedan, Vaman, Virechan, Asthapan Basti, Anuvasan Basti, Uttarabasti, Shirovirechan etc and their detail procedures, indications & contraindications, advantages & disadvantages, importance of various therapies along with 36 types of Tantrayukti, the diseaese Mutraghata & Shiroroga and the importance of Charak Samhita are nicely & elaborately explained in this section.

CASE REPORT
A CASE OF FUSION OF THORACIC VERTEBRA
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Summary:
The fusion of vertebral column is a rare anomaly usually congenital in origin. The fusion of thoracic vertebrae can present many clinical signs including congenital scoliosis. Among the 165 dry specimens of vertebrae collected in the Department of Rachana Sharira, Sri Dharmasthala Manjunatheshwara College of Ayurveda and Hospital, Hassan. One atypical thoracic vertebra in which fusion between two typical thoracic vertebrae was found. Fusion of the vertebra can be congenital or acquired. Embryologically, failure of resegmentation of the vertebra is the cause. The condition is acquired in trauma, tuberculosis and juvenile arthritis. This can lead to wide complications affecting different systems of body.

Keywords: congenital scoliosis, atypical thoracic vertebrae

Introduction:
The fusion of two or more vertebrae is a congenital anomaly of vertebral column. Such fusions may occur in the cervical, thoracic or lumbar region.1 The fusion of thoracic vertebrae can present clinical signs like congenital scoliosis early in life and shortening of the trunk with scoliosis and/or lordosis in older children.2

The vertebral column is derived from the sclerotomes of somites.3 It is composed of vertebrae and inter-vertebral discs between them.4 It is one among the chief manifestations of body segmentation or metamersism. The fusion of two or more vertebrae may occur in the cervical region (Klippel-Feil’s syndrome), atlas to occipital bone (occipitalization of atlas), fifth lumbar vertebra to the sacrum (sacralization of fifth lumbar vertebra) or in the thoracic region.5

The fusion of thoracic vertebrae is the rarest among the three types- cervical, lumbar and thoracic. The fusion of two vertebrae can be congenital or acquired. The surgical fusion of two vertebrae is known as spondylodesis or spondylosyndesis. Acquired fusion can be due to diseases like tuberculosis, juvenile rheumatoid arthritis and trauma.6

The prevalence of vertebral synostosis in Lithuanian population is 2.6% of cervical vertebra fusion, 1.6% of thoracic vertebra fusion and 0.5% of lumbar vertebra fusion.7

Case report:
Methods
A study on 165 vertebral specimens collected in the Department of Rachana Sharira, Sri Dharmasthala Manjunatheshwara College of Ayurveda and Hospital, Hassan was done on the different features of specimens. They were also checked for variations from normal anatomy. The embryological and clinical significance due to variations are discussed.

Result
In the present study, an atypical thoracic vertebra with fusion between two typical thoracic vertebrae was found. The fused thoracic vertebra is typical with symmetric fusion of the bodies (Figure 1), lamina and spinous processes of the vertebra (Figure 2). Near the junction of fusion of both laminae and spinous process,
there is a groove with overhanged linear crest on both sides (Figure 3), which demarcates the fusion. As a result of fusion, there is absence of superior facet of lower vertebra and inferior facet of upper vertebra (Figure 3). The costal facets are seen on either side of the body near its junction.

The inferior facet of the body of upper vertebra (costal facet) is raised and prominent (Figure 3). The intervertebral foramen is persisting, though the size is reduced. This reduction in size is due to absence of disc between them. The size of the body of lower vertebrae is increased compared to other. Transverse process of lower vertebra is large comparatively.
Table 1 showing dimensions of atypical vertebrae (in centimeter):

<table>
<thead>
<tr>
<th>Part of vertebrae</th>
<th>View</th>
<th>Upper vertebra</th>
<th>Lower vertebra</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body</td>
<td>Antero-posterior</td>
<td>1.2</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Transverse</td>
<td>1.5</td>
<td>2</td>
</tr>
<tr>
<td>Intervertebral foramen</td>
<td>Antero-posterior</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Transverse</td>
<td>1</td>
<td>1.5</td>
</tr>
<tr>
<td>Vertebral foramen</td>
<td>Vertical</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>Fused lamina</td>
<td></td>
<td>3.1</td>
<td></td>
</tr>
</tbody>
</table>

Discussion:

Embryological significance

The vertebral column develops from paired somites, each composed of a dermatome, myotome and sclerotome. They arise initially in the cervical region (4th week), increasing in number cranio-caudally. In the 5th week, the sclerotomic cells of the somites lose their adherence and migrate to the vertebral centrum, neural processes and costal processes. Each thoracic neural process gives rise to a cartilagenous pedicle, transverse process, and lamina. The ossification centres arise, one for the centrum and one each for the neural processes. Their timing is idiosyncratic, starting in the 4th month at T10 and L1 (centra) and C2 and T1 (neural processes) and spreading up and down the column.8

The segmentation of the vertebra occurs at the time of organogenesis. The non-segmentation of the primitive sclerotome is the cause for fused vertebra or block vertebra. The embryological time period for the occurrence of synostosis can be analyzed from the anatomical features. In this case, the pedicles and transverse process are not fused indicates that the initial development was normal.9

Radiologically, three types of vertebral fusion have been described: Single fused cervical segment seen in 25% of patients, multiple, contiguous fused segments seen in 25% patients and multiple, non-contiguous fused seen in 50% patients.10

Clinical significance

Anatomically, the intervertebral discs form a fifth of the post axial vertebral column.11 The absence of intervertebral disc therefore leads to shortening of the column and thereby shortening of the trunk. The thoracic vertebrae and the intervening disc along with the ribs help to maintain the shape and length of the thorax. Fusion of the vertebrae and the absence of the disc will narrow the thorax and can lead to respiratory distress. Asphyxiating thoracic dystrophy is caused by narrow thorax and short ribs.12

Apart from the developmental anomalies the vertebral fusion can be associated with radiculopathy and myelopathy. The other associated complications mentioned are:13
1. Neural axis-diastematomyelia, tethered cord, Arnold- Chiari malformation
2. Renal-unilateral horse-shoe kidney, duplicated kidney or ureters, hypospadiasis
3. Congenital heart disease
4. Musculoskeletal-club feet, Sprengel’s deformity, Klippel-Feil syndrome, dysplasia of hip, scoliosis
5. Jaw and external deformities, cleft palate, cervical rib.

Conclusion:

Fusion of the vertebra can be congenital or acquired. Embryologically, failure of resegmentation of the vertebra is the cause. The condition is acquired in trauma, tuberculosis and juvenile arthritis. This can lead to wide complications affecting different systems of body.

References:

Diny Thomas, Kulkarni Bhagwan Gangadhar: A case of fusion of thoracic vertebra


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