

## **EXPLANATION OF POSSIBLE MECHANISM OF ALABURAKTAMOKSHANA IN THE LIGHT OF PRINCIPLE OF PHYSICS: A HYPOTHETICAL STUDY**

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### **ABSTRACT**

*Raktamokshana* is one of the principal *shodhana* therapy explained in Ayurveda. It is a technical term employed to denote a Para-Surgical procedure to expel out the vitiated blood from selected areas of the body. This is a review study to employ the principles of physics in the process of *Raktamokshana*. *Raktamokshana Chikitsa* is emphasized as half treatment as per Acharya Sushruta in the *Shalya Tantra*. There are various methods to perform *Raktamokshana* i.e. *Shringa*, *Alabu*, *Jalauka* & *Siravedana*. In the present study we have concentrated on explaining use of *Alabu*. *Raktamokshana* through *Alabu* is done by creating vacuum and extracting the blood. A noble attempt has been made to explain the principle of *Alabu Raktamokshana* under the light of principle of physics.

**Keywords:** *Raktamokshana*, *Shodhana*, *Shringa*, *Alabu*, *Jalauka*, *Siravedana*,

**INTRODUCTION:** Acharya Sushruta has mentioned *Raktamokshana* in the treatment of various ailments in Sushruta Samhita<sup>1</sup>. This is one of the important principles of *Shodhana* therapy in Ayurveda<sup>2</sup>. *Raktamokshana* is a Para-Surgical procedure to remove the vitiated blood from the selected areas of the body. *Raktamokshana Chikitsa* is emphasised as *chikitsardha*, half treatment as per Acharya Sushruta in *Shalya Tantra*<sup>3</sup>. *Raktamokshana* is performed by *Shringa*, *Jalauka* and *Alabu* on the basis of predominance of *Vata*, *Pitta* & *Kapha dosha* respectively<sup>4</sup>. Acharya Sushruta had mentioned *Raktamokshana* a major treatment tool in the management of *Vidhradhi*, *Kustha* etc<sup>5</sup>. Acharya indicated *Raktamokshana* in the disorders where *rakta* is mainly vitiated. There are some indications of *Raktamokshana* where affliction of *Rakta Dhatu* with morbid *Kapha Dosha*, lesion involving the deepest

structure of the skin, person having delicate constitution, congestion of the blood in the localised area<sup>6</sup>. *Raktamokshana* has some contraindications too, as in *Sarvanga Shotha* (Generalised Anasarca), *Kshaya* (Emaciation), *Pandu* (Anaemia), *Arsha* (Bleeding Hemorrhoid), *Jalodara* (Ascites) and *Garbhavastha* (Pregnancy)<sup>7</sup>. In this study we tried to prove that principle of our Ayurvedic science are scientifically correct. As this is need of hour that we should stand up and prove our science. In the present study we have tried to prove that *Alabucharana* works on the principle of physics.

### **AIM & OBJECTIVE:**

In the present study we employed the Principles of Physics in the process of *Raktamokshana* by *Alabu*. Our aim is to justify that *Alabucharana* is a scientific procedure and it works on the principle of physics.

## MATERIALS & METHODS:

An effort has been made to complete the work on explanation of possible mechanism of *Alabu Raktamokshana* in the light of principle of physics. Different classical textbooks have been referred namely *Sushruta Samhita*, *Charaka Samhita*, *Astanga Samgraha*, *Astanga Hridaya* etc. Other referred books include Guyton and Hall Textbook of Medical Physiology, Textbook of Physiology by Prof. A.K. Jain, Essentials of Medical Physiology by K. Sembulingam. Different e-books and e-contents were also referred, after an extensive study on concerned topic the work was accomplished.

## OBSERVATIONS:

**Alabu Avacharana:** *Alabu* (Bitter Bottle Gourd- *Lagenaria vulgaris*) is indicated in *Kapha Dustha RaktajaVikara*<sup>8</sup>. Take the *Alabu* of longer size and remove the pulp. Now cut it at the narrow end. A provision to keep a lamp or source of fire is to be made inside it. *Alabu avacharana* procedure should be done after taking consent from the patient which is followed by the *purvakarma* viz; *snehana*, *swedana*, *abhyantara snehana* for three days, *Vaspa sweda* on the fourth day, *pracchana karma* and *Raktamokshana* on the fifth day (preferably in the morning). After performing the *Pracchana karma*<sup>9</sup> on the desired site, a cotton piece soaked in oil is lighted and is placed inside the *Alabu* (any other source of fire may be placed inside the *Alabu*)<sup>10</sup>. Soon after the mouth of the *Alabu* is applied on the puncture area to involve the lesion. *Alabu* is applied by horizontally so that the flame of the burning cotton does not come in contact with the body. Three steps can be explained during procedure;

1. The cotton inside the *Alabu* burns till the oxygen is available and then extinguished.
2. This facilitates bleeding from the *Pracchana* area.
3. After 10-15 min the *Alabu* is removed & the blood in the wound is cleaned. To establish the hypothesis on the mechanism of *Raktamokshana* it is noteworthy to consider the following points

## Factors Determining Volume of BloodFlow<sup>11</sup>

Volume of Blood flow is determined by five factors:

1. Pressure gradient
2. Resistance to blood Flow
3. Viscosity of Blood
4. Diameter of Blood Vessels
5. Velocity of Blood flow

**Pressure Gradient (P<sub>1</sub>-P<sub>2</sub>):** Pressure gradient is the pressure difference between the two ends of the blood Vessels

## Relation between flow of blood & Pressure Gradient:

Volume of blood flowing through any blood vessel  $\propto$  Pressure Gradient

## Resistance to Blood flow (Peripheral Resistance)

Volume of Blood flow (Q)  $\propto$  1/ Resistance (R)

## Formula to Determine Resistance:

Resistance = Pressure Gradient/ Volume of Blood flow = P<sub>1</sub>-P<sub>2</sub>/Q

## Determinants of Peripheral Resistance(R)

- Diameter of Blood vessels
- Pressure Gradient
- Viscosity of Blood

## Viscosity of Blood:

Volume of blood flow  $\propto$  1/ Viscosity of Blood

## Factors determining Viscosity:

- Red Blood Cells Count
- Plasma Protein-mainly Albumin

When hemo-concentration occurs as in case of burns or in polycythemia, the viscosity increases and the velocity of blood decreases, so the volume of blood reaching the organ is decreased

### Diameter of Blood Vessels

Volume of Blood flow  $\propto$  Diameter of blood Vessels

- Diameter of the blood vessel is considered in relation to the cross sectional area through which the blood flows.

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### Velocity of Blood Flow:

Volume of blood flow is directly proportional to the velocity of blood flow. Velocity of blood flow is the rate at which blood flows through a particular region.

### Principles of Physics:

Hagen-Poiseuille Equation

### HAGEN-POISEUILLE EQUATION:

Hagen and Poiseuille have worked on dynamics extensively. Equation which explains the relationship between different variables of dynamics is named after them. Variables of dynamics are applied to hemodynamic also. According to Hagen and Poiseuille equation, volume (Q) of any fluid flowing through a rigid tube is<sup>12</sup>:

- Directly Proportional to Pressure Gradient ( $P_1-P_2$ )
- Directly Proportional to the fourth power of radius ( $r^4$ )
- Inversely proportional to the length of the Tube (L)

Thus,  $Q=K(P_1-P_2) \times r^4/L$

Where, K is the constant for fluid flowing at a temperature. It is directly proportional

to temperature of the fluid. Viscosity of the fluid is also affected by the temperature. Viscosity is inversely proportional to temperature of the fluid. Therefore in the equation, the constant 'K' is expressed as the reciprocal of viscosity ( $\eta$ ).

$$So, Q = (P_1-P_2) \times r^4/L \times \eta$$

Volume of flow of fluid is always expressed in a given unit of time.  $\pi/8$  is the arithmetic value derived while determining volume of fluid flowing in a given unit of time. So, the equation has to be rewritten as:

$$Q = (P_1-P_2) \times r^4 / (L \times \eta \times \pi/8)$$

$$Thus, Q = (P_1-P_2) \times r^4 / (L \times \eta \times \pi/8)$$

**DISCUSSION:** This review intensively explores the possible mechanism of action of *Raktamokshana*. Here Hagen–Poiseuille equation has been considered to explain the possible mechanism of action. After doing *pracchanakarma* at the site of lesion, negative pressure is created inside the *Alabu* due to presence of vacuum created after complete burning of oxygen inside the *Alabu*. Pressure gradient created leads to a traction force across the skin and capillaries which lead to appearance of blood at puncture sites (also *pracchana karma* opens skin barrier). This leads to increase of volume of blood at the puncture site and the blood flow increases (follows Hagen-Poiseuille equation). This further leads to decrease in peripheral vascular resistance (follows Hagen-Poiseuille equation) and decrease in the local pressure inside the skin. Decrease in peripheral vascular resistance improves blood and lymphatic capillary circulation and the decrease in the local pressure inside the skin increases the capillary filtration and local collection of filtered and interstitial fluids. This leads to retention of fluid inside the skin, increases

the velocity of the blood flow and removes the blood congestion. As no single hypothesis of action could explain the mechanisms of action underpinning *Raktamokshana* by *Alabu* along with its multiple effects. For e.g. retention of fluid inside the skin leads to dilution of inflammatory mediators, chemical substances and nociceptive substances which helps in decrease of pain and breakage of tissue adhesions. There might be many other therapeutic effects of *Raktamokshana* by *Alabu*, such as pain reduction, anti-inflammatory and increased blood flow circulation effects, immune-modulation effects, haematological adjustment effects may be established with Pain Gate Theory<sup>13,14,15</sup>, Release of Nitric Oxide Theory<sup>16,17</sup>, Activation of Immune System Theory<sup>18</sup> & blood Detoxification theory<sup>19</sup> respectively. This review has couple of strengths. We used descriptive analysis for generating hypothesis that explained how *Raktamokshana* by *Alabu* works in providing immense therapeutic benefits. However, these hypothesis need to be verified by advanced scientific basic research. Documented data on effectiveness of *Raktamokshana* by *Alabu* and multiple outcomes found in various diseases based on the Reversed Research Strategy could be a reasonable approach to link its certain mechanism of action with the reported effects and further research is warranted to develop more hypothesis and theories concerning this technique.

**CONCLUSION:** This review identified possible mechanisms of *Raktamokshana* by *Alabu* based on certain principle of Physics. The complete procedure follows the principle of Hagen-Poiseuille. The beneficial effects of it need to be substantiated by large randomised clinical trials, systematic reviews and meta-

analysis in future. Existing hypothesis and theories of Al-Hijma in Unani Medicine, Cupping Therapy in Traditional Chinese Medicine, Negative Pressure Therapy need to be addressed co-equally in a new innovative way to reach a final conclusion.

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