

EVIDENCE BASED REVIEW ON MECHANISM OF ACTION OF *BASTI*

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ABSTRACT

Basti is a one of the well-known procedure of *Panchkarma*. In this process drug is administered through the rectal route and it acts upon the whole-body system. It is sometimes more useful than conventional oral route. Till date mode of action of *Basti* has not been fully explored with contemporary science. Probably it has a complex process which is not fully discovered till now. None the less some of its mechanism can be understood by recent discoveries of medical science such as explanation by involvement of enteric nervous system (ENS), gut micro flora. Various factors also influence the total effect of rectal drug administration or *basti*. Thus this paper is an effort to explore the probable mode of action of *basti*.

Keywords: *Basti*, Rectal route of drug administration, ENS, Microflora

INTRODUCTION

Panchkarma is well established clinical therapeutics in *Ayurveda*. It is described as a universal treatment protocol used for all types of different diseases¹ and it shows broad dimensional benefits and effects on different system of body. *Basti* can produce multiple effects and drug administration method by this route may have both anabolic (*Brihana*) as well as catabolic (*Karshana*) depending upon other factors.² Most of the Ayurvedic medication administered through oral route. But in some condition this conventional route is not preferred or feasible. Oral route and rectal route are though

different in many measures but they have similarity in their origin i.e. gastrointestinal tract. Major difference in oral and rectal route or large and small intestine functionally is that in oral route drug has to go through digestion process, which is not the case in rectal route. In contemporary scientific practices rectal use of drugs are main route of drug administration. In severe pain due to cancer therapy opioid drugs are usually given by rectal route, if given by oral route undergoes extensive first pass metabolism and has a bioavailability of 30-40%.³ Thus, this paper is focused to explore a hypothetical phar-

macological approach for the better understanding of *basti* with aid of various contemporary researches.

Transport of Basti Drug after administration-

In *Charak Samhita* it has been advocated not to administer *Anuvasana basti* in empty stomach otherwise *basti dravya* may come out up to oral cavity. *Acharya Jejjat* also advocates that *Anuvasan Basti* pervade up to *Grahani*⁴ i.e. small intestine.⁵ This implies that, *snehabasti* once administered may reach high up in the gastrointestinal tract and imparts its pharmacological actions. It is difficult to scientifically explain the reasons for not administering *Anuvasanbasti* in empty stomach. It is presumed that, *Anuvasanbasti* acts on the lower part of the intestine. In a study it was found that *basti* reaches up to ileo-caecal junction.⁶ Other studies suggest that materials of enema pass through the walls into ileum.⁷ In a study, lycopodium spores introduced into the colon by Enema have been recovered some hours later from washing of stomach which suggest the possibility of materials from even the lower bowel, reaching the mouth.⁸

Reflex Mechanism-

It is assumed that, gastroileal reflex helps uptake of *Anuvasanbastidravayas* when administered after food. The gastroileal reflex is generated when food reaches in stomach and gastric peristalsis occur. Initiation of this reflex causes peristalsis and opening of the ileocecal valve⁹ which further allow the *bastidravaya* to go beyond ileocaecal valve covering more surface area thus possible more absorption.

Amount of the drug in Basti-

Large intestine is devoid of villi and permanent folds of mucus membrane allow less absorption. It absorbs only water and certain nutrients. Thus rectal absorption is more erratic and slower than oral administration. Therefore, in rectal route drug administration in higher doses or more frequent administration may be required, to achieve and/or maintain blood concentrations of a medication, comparable to those obtained following oral administration which is fulfilled by *Basti*. *Anuvasan basti* is one fourth of *Niruha Basti* in amount which shows that *Sneha pradhana* drug can be reached in intestine in very low amount while *Niruha basti* (decoction base) has to be much higher in amount to act. *Basti dravya* may act by stimulating peristalsis due to their large volume or they cause osmotic retention of water in the bowel.

Partially avoidance of first pass metabolism-

Inferior rectal veins drain the lower part of the rectum and enter into the inferior vena cava and bypass the liver before entering the general circulation. This indicates that some of the drug administered in *basti* can bypass the liver resulting in the avoidance of hepatic first pass metabolism and increases systemic circulation. This was investigated and proved with some drugs like lidocaine and propranolol which are hepatic high clearance drug.¹⁰

Digestion and Absorption in administration of Basti-

Human colon has much less surface area than small intestine but colonic crypt cells present in colon are capable of much absorption as well as secretion. It absorbs 90% of the of ileal effluent. In *ayurveda*, *Paka* (Digestion) process is divided into three stages.¹¹ Last stage of this is known as *KatuAvasthaPaka*. This de-

notes that some residual digestive process may have been occurring in last part of intestine. As per the contemporary view, in last part of intestine, digestion occurs through bacterial action and no enzymes are secreted by colon. These beneficial bacteria or micro flora mainly resides in colon synthesize vitamin K, B and convert indigestible or partially digested saccharides (e.g. Lactose) into short chain fatty. ¹²It has been observed that, pectin is almost completely digested in the colon. ¹³Apart from this, Short-chain fatty acids (SCFAs) formed by digestion intestine are absorbed by the colon. The current knowledge on colonic metabolism and absorption of medium-chain fatty acids (MCFAs) is limited. In a study it was found that colonic epithelium serves to absorb and partially metabolize MCFAs. For patients with a compromised small-bowel function, colonic absorption of MCFAs 50-70% could represent an important way of receiving calories. ¹⁴ SCFAs also affect epithelial tissue and promote Calcium absorption from the large intestine in vitro. The enhancement of Ca transport induced by SCFAs might be absorbed from the paracellular transport mechanism. ¹⁵There are many reports about the enhancing action of fatty acids on rectal and small intestinal absorption. Medium chain length fatty acids showed the most effective action as absorption-promoting adjuvant for ampicillin and hydrophilic antibiotics for rectal delivery. It was concluded that fatty acids into rectal tissue must be a key factor in their potency as absorption-promoting adjuvants. ¹⁶

Drugs in Basti-

Drugs used in *Basti* are also important according to the patient and specific clinical condition. In this way certain limitations of oral route like unpleasant test of *Bastidravya* and to

avoid unnecessary interference of food to bypass the stages of *Madhura* and *Amla Awasthapa* (First and second digestion stage).

- a. **Honey** is used in *Basti* abundantly in practice. It is considered as functional food which has a unique composition, antimicrobial properties and bifidogenic effect. In a study on mice it was concluded that honey in processed food can inhibit the harmful genotoxic effects of mycotoxins and improves gut microflora. ¹⁷
- b. **Sneha** (different oil and ghee) are also important ingredient of *Basti*. According to Prevention of Food Adulteration in 2001 ghee is a pure clarified fat derived from, an anhydrous butter fat containing various fatty acids. ¹⁸ In a study different types of fatty acid measured as per brand and it was found that SCFA like Butyric acid, Caproic acid, Caprylic acid was found 9.51-46.50(% weight) , Medium chain fatty acids like Capric acid and Myristic acid 2.48-25.29(% weight) in different commercial brands of ghee which denotes that oils used in *Basti* are partially absorbed by colon. ¹⁹
- c. **Prakshepa Dravya**- In a comparative study Gallic acid was used as marker compound in *Lekhana Basti* (Emaciating/ Desiccating Medicated Enema) without *Prakshepa Dravya* (~substance or drug which are added after the preparation of drug is complete) and with *Prakshepa Dravya* to prove that phytochemicals used in *Basti* do get absorbed in systemic circulation. From HPLC study it was found that, phytochemicals of the *Basti* formulation do get absorbed in systemic circulation. ²⁰

- d. **Madanphala (Randiaspinosa)**-Saponin present in *Madana phala* acts as non-ionic surfactants thus increases absorption.²¹

Mechanism of absorption

Absorption of drugs from rectal epithelium involves two routes from epithelium: the transcellular route and paracellular route.²² Transcellular route depends on lipophilicity, and thus *sneha dravya* used in *Basti* promotes this type of absorption. In paracellular route, drug diffuses through space between epithelial cells thus it may be the route of absorption for decoction preparation. Rectal absorption of drugs is dependent on several drug characteristics such as partition coefficient and molecular size. Small partition coefficient, large molecular size, charge and high capability of hydrogen bond formation are the typical factors identified for poor absorption of drug. Colon contents are generally alkaline and alkaline solutions are quickly absorbed as compared to acid solutions in the colon. Thus, it is hypothesized that most of the *basti kalpana* which are alkaline in nature are better absorbed.²³

Gut Microflora-

Human gut is a natural habitat for gut microbial community or gut micro flora. In digestive process major metabolic function of colonic micro flora is fermentation of non-digestible dietary residue and mucus secreted by epithelium.²⁴ Fermentation of carbohydrates takes place and it is a major source of energy in the colon. In later part of the intestine (colon) substrate to be digested are less available, the pH is progressively becomes close to neutral, putrefactive processes become more important, and bacterial populations remains static. They

also play significant role in certain vitamin synthesis.^{25,26}

Absorption of ions like calcium, magnesium, and iron in colon is improved by carbohydrate fermentation and production of short-chain fatty acids, especially acetate, propionate, and butyrate. Differentiation of epithelial cells is also hugely influenced by colon microorganisms.^{27,28} All three major short-chain fatty acids also stimulate epithelial cell proliferation and differentiation in the large and small bowel in vivo²⁹ which may enhance the absorption and metabolic process. Thus, it can be inferred that, in last part of intestine although there is no enzyme but some of important metabolic processes conducted by the flora of colon which may play role in *basti* process also.

Gut and its systemic relation especially with brain-

Gastrointestinal tract was previously known to only have the function of digestion controlled by Central nervous system. Although Enteric Nervous System (ENS) was discovered 150 years ago, but importance of ENS was recognized in the recent 20-30 years with modern techniques and discoveries. Connections of ENS with CNS are previously thought to be only regulated by autonomic nervous system. It is a well known fact that it has same tissues as central nervous system (CNS) during fetal development. ENS has many structural and chemical similarities to the brain. Even when vagal supply is severed it continues to function³⁰ way because of its own nervous system and can operate autonomously, thus also called as Second brain. In *Phalashruti* of *basti* many systemic benefits are given, we can say that *Basti* is not just work on GIT it works on the whole system of body. Now when Gut- Brain Axis (GBA)

theory is well established, mechanisms underlying GBA communications involve neuro-immuno-endocrine mediators. Gut microflora also contributes in gut Brain axis. There is a possibility of some neuro-immuno-endocrine process induced by administration of *Basti* and thus shows systemic therapeutic effect.

In enteric nervous system 30 neurotransmitters are found, which are identical to neurotransmitter found in CNS, such as acetylcholine, dopamine, and serotonin. Almost 90% serotonin, 50% of the dopamine of body lies in gut.³¹

In *Ayurveda*, It is said all of diseases of body are generated with disturbance of digestive process. Physical health (which is achieved by proper digestion and *Dhatu* (~major forming elements of body) formation and mental health are interrelated. In other words mental disorders can provoke GIT problems, in the same way GIT disorder can lead to some neurological disorder which are evident by some researches as mentioned below:-

a) Parkinson's disease is a classic degenerative brain condition. Researchers from University of California at San Francisco have reported that the brain region known as the dorsal motor nucleus of the vagus, which connects to the gastrointestinal system, is affected very early in this disease. Gastrointestinal symptoms in Parkinson's disease include dysphagia, impaired gastric emptying, constipation, and defecatory dysfunction. Constipation may come first before several years development of somatic motor symptoms of Parkinson's disease. Neuropathological studies show early accumulation of abnormal alpha-synuclein (á- SYN) containing inclusions (Lewy neurites) in the enteric nervous system and dorsal motor nucleus of

the vagus.³² Researchers have been using colonic biopsies of Parkinson's patients to help better understand and manage Parkinson's disease.³³ Parkinson's disease patients are known to experience severe constipation due to GI tract dysfunction years before the onset of motor movement complications, which Parkinson's disease is notorious for.³⁴

- b) Schizophrenia- People with schizophrenia tends to also have GI problems.³⁵ Schizophrenia has been linked to intestinal inflammation³⁶ and gastrojejunal ulcers³⁷. Research conducted on mice by giving them phencyclidine has found changes to the gut flora of the treated mice compared with untreated mice.³⁸
- c) Autism- Around 70% of people with autism also have GI problems, The gut microbiota composition appears to differ between healthy children and those with Autistic Spectrum Disorders.³⁹ Higher prevalence seen in healthy controls of Bifidobacteria microbiota as compared to Autism patients.⁴⁰
- d) Neuromyelitisoptica- These patients have aquaporin auto antibodies against the optic nerve and spinal cord, but also more antibodies against GI antigens than healthy controls.⁴¹
- e) In a study it was found that the gut glucose sensor sends signals to the brain that ultimately control peripheral glucose utilization in a GLP-1Rc-dependent manner.⁴²
- f) Multiple Sclerosis and experimental autoimmune encephalomyelitis are precipitated or worsen by stress, which is known to also affect the gut⁴³. In fact, stress-induced gut alterations can impact the brain and behavior⁴⁴

Impaired functioning of colon leads to irregular bowel movements and lack of defecation, in this way faecal wastes start accumulating the colon. Digested and undigested food from the stomach travels to the small intestines. Here, only nutrients from the food are absorbed in the small intestine and rest of the food matter containing dead cells, unhealthy or dead microbes and other harmful bi-products then move on to the large intestine or colon. However, if these wastes are not removed from the body on daily basis, they began to putrify and material load starts to build up and in no time our colon is filled with toxic substances.⁴⁵

Certain unhealthy bacteria and microbes flourish in these waste products which will undoubtedly cause harm to body eventually⁴⁶, large volume and osmotic retention of water in *Bastidravya* introduced into the rectum may act by stimulating peristalsis. The *niruhabasti* therapy along with its therapeutic effects shows cleansing effect on the colon. Cleansing effect of colon could dilute the toxin concentration in the caecum thus facilitate the removal of toxin.⁴⁷ Thus it reduces stagnation and subsequent bacterial proliferation in large intestine and maintains harmony of the intestinal flora in promoting optimal colon health.⁴⁸

Another significant hindrance is the presence of faeces which also can alter the drug absorption. It is a well known fact that, the wall of rectum possesses the stretch receptors. Whenever stool enters into the rectum, distention of rectal wall causes initiation of defecation reflex.⁴⁹ At the same time release of catecholamines occurs during visceral distention and probably this also participate in pressor response i.e. stretch receptor response which is also called as Enteric Nervous System.⁵⁰ Interesting point is that by inserting *Basti Netra* into the

rectum, the same phenomenon happens as described above which causes initiation of defecation reflex due to visceral distension and pressure response.⁵¹

CONCLUSION

Basti is considered as the most important part of the *Panchkarma* procedures. It is generally advocated in the management of *Vataor* neurological disorder vitiated diseases. The exact mechanism of action of these *Basti* is not known till date. On the basis of research studies done recently, it can be inferred that various *Bastis* mainly act by modulation Brain-gut axis and exerting neuro-endocrino-immunological action. Apart from this, local reflex action, modulation of gut micro flora may have some role in explaining the pharmacological activities of *basti*. Further, radioisotope studies are required to study the exact pathways and distribution of *bastidravya* in the body.

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