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The Mesentery as the Newly Recognized Organ: A Comparative Study with the Ayurvedic Concept of Vapavahana

[1]Harish Kumar and [2]Nirav Patel

Department of Rachana Sharir, Parul Institute of Ayurved, Parul University, Vadodara - 391760 (India)
Corresponding Author: Dr. Harish Kumar
Email: d.harishkumar19@gmail.com
Phone: +91 8668174857

Abstract

For centuries, the mesentery was regarded as a fragmented peritoneal fold of minimal importance. Recent anatomical and histological research has established it as a single, continuous organ involved in fat metabolism, immune regulation, and gastrointestinal disease mechanisms. Remarkably, classical Ayurvedic literature had already described a structurally and functionally similar entity — *Vapavahana* — mentioned by Acharya Charaka as one of the fifteen *Koshthangas* and recognized as the *Srotomoola* of *Medovaha Srotas*, responsible for fat transportation and storage.

This review aims to correlate the modern understanding of the mesentery as a newly recognized organ with the Ayurvedic concept of *Vapavahana*, highlighting their anatomical, physiological, and functional similarities.

A comprehensive narrative review was conducted using primary Ayurvedic texts including the *Charaka Samhita*, *Sushruta Samhita*, *Bhela Samhita*, and *Kashyapa Samhita*, along with their classical commentaries. Parallel information was obtained from standard modern anatomy textbooks and contemporary studies indexed in PubMed and Scopus. The analysis focused on identifying conceptual parallels between *Vapavahana* and the mesentery in terms of structure, function, and physiological role.

Both sources describe a peritoneal structure enriched with fat, vessels, and lymphatics, playing a key role in lipid transport, metabolic regulation, and visceral support. The mesentery's role in immunological

[1]Post Graduate Scholar, [2]Associate Professor,

modulation and metabolic homeostasis aligns closely with *Vapavahana's* description as a *Medodhara Kala* and *Tailavartika*.

The mesentery's recognition as an organ validates the advanced anatomical insight of classical Ayurveda. Correlating *Vapavahana* with the modern mesentery bridges traditional wisdom and contemporary science, promoting integrative anatomical understanding and cross-disciplinary education in medical research.

Key words : Mesentery; *Vapavahana*; *Medovaha Srotas*; *Koshthanga*; Ayurvedic anatomy; Peritoneum; Fat metabolism; Comparative anatomy; Integrative medicine; *Rachana Sharir.*

For centuries, the mesentery was thought to be a fragmented and mostly unimportant structure, just a fold of peritoneal tissue that connected the intestines to the posterior abdominal wall and supported them. Beyond its mechanical purpose, it was believed to have minimal functional significance. Recent advances in medical imaging, histological analysis, and anatomical dissection, however, have fundamentally changed our understanding of this. Scientists have now shown that the mesentery is a single, continuous well-organized structure with blood arteries, lymphatics, nerves, and connective tissue, highlighting its intricate physiological functions. It is becoming more widely acknowledged for its role in fat metabolism, immunological modulation, and the pathophysiology of gastrointestinal diseases like Crohn's disease and colorectal cancer. The study of human anatomy is undergoing a shift in perspective as a result of this new understanding, with the mesentery becoming more prominent in surgical planning and anatomical instruction.

Remarkably, the significance of such a structure was already hinted centuries before in classical Ayurvedic literature. Acharya Charaka, one of the principal contributors to ancient Indian medicine, described Vapavahana as one of the fifteen Koshthangas (abdominal organs) in the Charaka Samhita. Vapavahana is identified as the Srotomoola (origin) of the Medovaha Srotas, the channel system responsible for the transportation and storage of Medas (fat). Vapavahana may be associated with the contemporary knowledge of the mesentery due to its anatomical location and functional features. This article will aims to explore how the mesentery was recently identified as a new organ in modern anatomy and compare it to old Ayurvedic ideas, emphasizing how classical authors like Acharya Charaka were ahead of current contemporary science.

Aim :

This review aims to corelate Vapavahan and modern understanding of mesentery, a distinct new organ.

Objectives :

To explain structure, function and recent studies on mesentery in modern science.

To review the literary references of Vapavahana in Charaka, Sushruta, and other classical Ayurvedic texts, articles and journals. To correlate the mesentery and Vapavahana theoretically and functionally.

To demonstrate how traditional Ayurvedic knowledge enhances or precedes modern anatomical understanding.

Relevant data from both modern anatomical literature and traditional Ayurvedic texts have been obtained for this narrative review. Primary Ayurvedic sources like the Charaka Samhita, Sushruta Samhita, Bhela Samhita, and Kashyapa Samhita were reviewed, along with their reliable commentary,. Standard textbooks like Gray's Anatomy, Moore's Clinically Oriented Anatomy, and current peer-reviewed research published in PubMed and Scopus were obtained for up-to-date anatomical knowledge. Finding anatomical, functional, and conceptual similarities between the mesentery and the Ayurvedic Vapavahana was the objective of the review. There were no new clinical or experimental findings.

Early anatomical understanding of mesentery :

The mesentery (from the Greek meaning "fold of intestine") represents a vital peritoneal structure historically recognized for its role in suspending parts of the intestine within the abdominal cavity. It is a broad, fan-shaped, double-layered fold of peritoneum that connects the jejunum and ileum of the small intestine to the posterior abdominal wall. This connection permits mobility of the gut while serving as a conduit for vessels, nerves, and lymphatics[27].

Mesentery Proper :

The mesentery of the small intestine, also known as the mesentery proper, extends from the duodenojejunal flexure on the left side of the L2 vertebra to the upper part of the right sacroiliac joint, following an oblique downward and rightward path. This region, known as the root of the mesentery, is about 15 cm long and crosses important retroperitoneal structures, including:

- The third part of the duodenum, where the superior mesenteric vessels enter,
- The abdominal aorta,
- The inferior vena cava,
- The right ureter, and
- The right psoas major muscle[35].

The free or intestinal border of the mesentery is significantly longer, measuring approximately 6 meters, and is thrown into numerous pleats to accommodate the loops of the intestine. This margin is attached directly to the intestines, forming part of their visceral peritoneum (serous coat). The breadth of the mesentery is maximum in the central region (~20 cm) and gradually narrows toward its ends[41].

Fat Distribution :

Fat distribution within the mesentery is uneven. The lower part contains abundant fat extending from the root to the intestinal border. In contrast, the upper part is less fatty, with translucent, fat-free areas near the intestinal border known as mesenteric windows[22].

Contents of the Mesentery :

The mesentery encloses important structures required for the sustenance of the intestines:

1. Jejunal and ileal branches of the superior mesenteric artery,
2. Accompanying veins,
3. Autonomic nerve plexuses,
4. Lymphatics (lacteals),
5. Around 100–200 lymph nodes,
6. Connective tissue embedded with variable amounts of fat[25].

Broader Classification of Mesenteries :

Mesenteries are classified based on the parts of the gut they suspend:

- The mesentery proper for the small intestine,
- The transverse mesocolon for the transverse colon,
- The sigmoid mesocolon for the sigmoid colon[1].

All these structures are derivatives of the dorsal mesentery of the embryonic gut. Each fold serves a similar function — enabling movement and providing a structural pathway for essential neurovascular and lymphatic components[3].

The transverse mesocolon passes over the pancreas and surrounds the transverse colon, with its anterior layer adhering to the posterior layer of the greater omentum. The sigmoid mesocolon, V-shaped in configuration, anchors the sigmoid colon and conducts related vessels, nerves, and lymphatics through its peritoneal folds, with its apex near the bifurcation of the left common iliac artery[22].

Development of mesentery :

There is still a lot of anatomical and therapeutic curiosity in the formation of the mesentery. In the past, it was believed that the mesentery was made up of several disjointed sections, with gaps that formed as the embryo developed. According to this traditional concept, the adult has unique mesenteries as a result of the regress of some mesentery parts[37,38]. Recent data, however, provide evidence to the idea that the mesentery continues to function continuously during development[8].

In terms of embryology, the mesentery starts off as a double-layered peritoneal fold that is completely joined to the posterior wall of the developing coelom. It maintains its continuity as a composite structure while becoming increasingly cellular as development goes on[12]. The formation of a central fold in the mid-region, which separates the mesentery into upper (pre-fold), middle (fold), and lower (post-fold) zones[29], is a crucial morphogenetic event. This fold undergoes positional changes around the superior mesenteric artery (SMA), explaining the final positioning of the small and large intestines[8].

Mid-region structures overlap as a result of further folding that takes place at the mesoduodenum-mesojejunum junction. The upper mesenteric bursa apposition with the mid-region surface is the result of these alterations[8]. The mesentery and the wall separate at the same time as mesenchymal cells from the posterior abdominal wall move

into the intramesenteric space[13,39]. Continuity is retained only at the surface mesothelia and along vascular connections.

Significantly, the liver, pancreas, spleen, and intestines are among the digestive organs of the abdomen that develop on or within the mesentery[10]. In the adult, this topographical link is still functionally significant since the mesentery serves as the main connective channel for the arterial, neurological, and lymphatic supply of various organs.

Mesentery is an organ :

Often, the concept that the mesentery is not an organ is based on the conventional definition of an organ, which is a unique bodily portion with a vital or specific function. Critics contend that the mesentery, which joins the intestines to the abdominal wall, is not an organ because it only connects structures and contains a variety of tissues. Recent research, however, calls into question this belief. There is more than just connective tissue in the mesentery. It has a major impact on how the abdominal organs develop and function. It influences the shape, structure, and even the migration of vital cells in organs like the intestines throughout development[28]. Humans and animals, such as sea cucumbers, have demonstrated this ability to regenerate intestines from the mesentery[18].

The mesentery continues to function in adults. In response to conditions like Crohn's, it contains fat, immune cells, and stem cells. Research on organ engineering has made use of it, and it can even promote the development of new tissues. The mesentery remains intact when a portion of the intestine is removed or dies, demonstrating its independence[9]. Anatomically, it supports multiple vital life processes, participates in immunological responses, and has its own blood supply and outflow. It functions as a "circuit board" through lymphatics, vessels, and nerves that connect all of the digestive organs, and its anatomy is the same for both humans and animals.

Therefore, considering the mesentery to be merely a tissue fold restricts our school understanding of human biology. According to recent studies, it satisfies the requirements for an organ and performs essential, specialized functions all through life[30].

Vapavahan :

According to Vaidyaka Shabda Sindu, Vapavahana is Medithana roopi Koshtanga. It was one of the fifteen Koshtanga mentioned in the Charaka Samhita.[4] According to Chakrapani teeka, it is seat for Medas and quoted as Tailavartika.[6] Regarding its location, Udara is mentioned when describing Vapavahana as Medovahasrotomoola; it is also known as Snigdhavartika.[6] According to the Bhela and Kashyapa Samhitas, Vapavahana is a Koshtanga.[2,24] It' is a Matruja bhava.[5] In the second chapter of Sushruta Samhita Chikita Sthana, Medovarti is mentioned in relation to Vapavahana when describing Chikitsa for Udara.[36]

Vapavahana is referred to by the words Talavartika, Medosthana, Vapava, and Udarastha medhod harakala alternately in

Parishadya Shabdhartha Shareeram.[20] Vapavahana gets its name from Ghanekar's statement that the abdominal cavity has a covering layer that contains fat.[19] Sharma Gananathasen has brought up the concept of Vapavahana's Thana and its structural formulation. He viewed it as Audarya kala and Amashaya's support. Kshudrantra and Sthoolantra are safeguarded by it.[17]

According to Dinkar Govind Thatte, there are three different kinds of Paryudara Kala (Manava Shareera). They are Antrayojani, Snayu, and Vapa. Vapa is a layer of the peritoneum, or Paryudara Kala, which lies between Amashaya and other internal organs of the abdomen. Due to the abundance of Vasa in them, Paryudara Kala might be regarded as Medodhara Kala. Since fat is transported via Vapavahana, it is regarded as one of the Koshtanga.[15]

The Medovaha Srotas Moola refers to the organ that may have a close connection with Medo Dhatu functions or that are significant locations associated with the beginning or ending of Medo Dhatu channels. One of Medovaha Srotas' Moolasthana (root, origin, functional center, or disease or disorder expression center) is Vapavahana.[6] The organs known as srotomoola may have a direct impact on the development, source, storage, or circulation of Dhatu. That which carries Vapa is referred to as Vapavahana. Vapa is simply Medas or Shudha Mamsa Sneha by itself; Medas in Udara is referred to as Vapa.[14,32,33,35] In Medovaha Srotas, Vapavahana serves as a conduit in addition to a storage area.

Vapavahana, also known as Udarastha Medodhara Kala, serves as an abdominal fat storage.[20] Vapavahana is also known as Snigdhavartika or Tailavartika, since the names imply that it is dipped in oil, which indicates that it is entirely covered in Sneha or Vapa. According to Gananathasen, an author and scholar of Basic principles of Ayurveda, it is carriers of Vasa.[17]

Correlating mesentery and vapavahan :

Therefore, Vapavahana perceives as peritoneal folds where a lot of fat is present. In addition to the peritoneal folds, the mesentery, which forms the serous coat of the small intestine, extends toward the root where it takes the form of the dorsal mesogastrium, which conducts blood vessels, lymphatics, nerves, and restores fat abundance, as well as the omenta (greater and lesser omenta), transverse mesocolon, and sigmoid mesocolon. The presence of wick-like appendices called epiploicae, which have a shape similar to sesame seeds with oil or fat, is one of the main characteristics of the large intestine.

Physiological and pathological corelation:

Mesenteric fat actively mediates both local and systemic physiological responses. It is a large source of C-reactive protein, which plays a crucial role in controlling systemic concentrations, as well as glycemic and lipid metabolism. The mesentery acts as the greatest reserve of fat in the body, aiding lipid metabolism and transport. The arteries, veins, nerves, and lymphatics that supply the ileum and jejunum are enclosed by the adipose tissue that lies between the mesentery's two peritoneal layers. Surprisingly compared to subcutaneous or extraperitoneal fat, mesenteric fat has a higher metabolic activity. According

to King Hung Liu *et al*., mesenteric fat thickness is linked to increased carotid intima-media thickness and is an independent predictor of metabolic syndrome.[27]

In the context of diabetes linked to obesity, Ying Kui Yang *et. al*. studied human mesenteric adipose tissue and compared it with subcutaneous and omental fat. According to their research, insulin resistance in type 2 diabetes and metabolic syndrome may be mostly caused by alterations in the mesenteric fat depot's gene expression and fat breakdown (lipolysis). The study further hypothesized that diabetes-related metabolic and vascular problems may be even more significantly impacted by malfunction of mesenteric adipose tissue.[41] Similar to this, Marisa Coelho *et. al* stressed that adipose tissue is an essential endocrine organ even though its primary function is to store excess energy. They highlighted that adipocytes have the capacity to interfere with regular metabolic functions and aid in the emergence of metabolic diseases, especially those that have accumulated as visceral fat in the abdominal cavity's omentum and mesentery.[11]

In Ayurveda, *Vapa* refers to fat or lipids, and Vapavahana means the structure that carries or circulates Vapa. According to contemporary physiology, the small intestine is where lipid absorption starts. Here, dietary lipids are converted into monoglycerides and fatty acids, which intestinal cells then absorb. Within these cells, they are reassembled into triacylglycerols (TAGs). These TAGs form unique fat-carrying particles known as chylomicrons when they combine with phospholipids, cholesterol, and Apolipoprotein B. These chylomicrons travel through microscopic lymphatic capillaries called lacteals, which are found inside the villi of the small intestine. The thoracic duct is where chylomicrons enter the systemic circulation after passing through mesenteric lymphatic vessels[7]. This lipid transport is facilitated by the mesentery, a double fold of peritoneum in the abdomen, which explains why it is called Vapavahana. It holds the small intestine (Kshudrantra and Sthoolantra) in place and resembles an oil-dipped cloth (Tailavartika) due to its fat content, forming the Udarastha Medodhara Kala.

It is now understood that mesenteric adipose tissue is a unique organ that is intimately related to metabolic control. The superior mesenteric artery connects it to the pancreas. The pancreatic head exhibits a noticeable decrease in β-cell density in type 2 diabetes, suggesting that mesenteric impact affects β-cell function. Some experimental studies indicates that drugs delivered via the mesenteric artery have a direct impact on pancreatic β-cells.[31] In diseases like familial combination hyperlipidemia (FCHL), which is linked to insulin resistance and abdominal obesity, impaired lymphatic activity (for example, because of a defect in the Prox1 gene) increases the buildup of fat surrounding the mesenteric lymphatics.[23] Additionally, recent studies highlight the mesentery's systemic significance by demonstrating that it forms a continuous structure from the oesophagogastric to anorectal junctions.[8]

The mesentery has been reinterpreted as a continuous organ that is essential for disease processes, immunological control, fat metabolism, and structural support in light of

recent discoveries. Vapavahana, an ancient Ayurvedic idea that Acharya Charaka defined as a crucial structure in fat transit and storage, is closely mirrored in our contemporary knowledge. The characteristics of vapavahana match the mesentery's current functioning, demonstrating the extraordinary prescience of traditional medicine. Recognizing the mesentery as an organ not only advances anatomical science but also bridges ancient knowledge with modern research, encouraging a more integrated perspective in medical education and the exploration of historical contributions to contemporary science.

References :

1. Bardales RH, I Orellana, and GR. Lichtenstein (2015). *World Journal of Gastroenterology. 21*(23): 7235-44.
2. Bhishagacharya Satyapal. (2009). Hindi Commentary Vidyotini on Kashyapa Samhita of Vrudha Jeevaka, Shareerasthan, Shareeravichayashareeram Adhyaya. Chaukambha Sanskrit Sansthan, Varanasi; p. 76.
3. Carmichael SW, and R. McMillan (2005). Human Anatomy: The Abdomen and Pelvis. 3rd ed. New York: McGraw-Hill; p. 137-40.
4. Charaka Samhita. (2020). Shareerasthana; Shareerasanghya adhyaya: 7/10. Available from: https://niimh.nic.in/ebooks/echarak (Accessed on 03 July 2020).
5. Charaka Samhita. (2020). Shareerasthana, Khuddika Garbhavakranthi shareera adhyaya: 3/6. Available from: https://niimh.nic.in/ebooks/echarak (Accessed on 06 July 2020).
6. Chakrapani on Charaka Samhita, Vimanasthana, Sroto vimanam adhyaya: 5/8. Available from: https://niimh.nic.in/ebooks/echarak (Accessed on 03 July 2020).
7. Cifarelli V, *et al*. (2019). *Cellular and Molecular Gastroenterology and Hepatology. 7*(3): 503–513.
8. Coffey JC, DP O'Leary, KM Hardiman, PN Faul, E Meaney, and D Walsh, *et al*. (2016). *Lancet Gastroenterology & Hepatology. 1*(3): 238–47.
9. Coffey JC, MG Kiernan and SM Sahebally, *et al*. (2018). *Journal of Crohn's and Colitis. 12*(10): 1139–1150.
10. Coffey JC, and DP. O'Leary (2016). *Journal of Anatomy. 229*(4): 432–439.
11. Coelho M, *et al*. (2013). *Archives of Medical Science. 2:* 191–200.
12. Culligan K, JC Coffey, D Kavanagh, D Walsh, HP Redmond, and PR. O'Connell (2014). *Virchows Archive. 464*(5): 631–639.
13. Culligan K, S Walsh, C Dunne, D Walsh, S Ryan, PR O'Connell, and JC. Coffey (2012). *Development. 139*(16): 3131–3137.
14. Dalhana on Sushruta Samhita, (2020). Shareera Sthana, Garbhavyakaranam adhyaya: 4/12. Available from: https://niimh.nic.in/ebooks/esushruta (Accessed on 06 July 2020).
15. Dinakar Govind Thatte. (1992). Manava Shareera. 2nd Edition. Ayurvedik Evam Tibbi Academy Uttar Pradesh, Lucknow; p. 259–261.
16. Gananath Sen Sharma. (2008). Pratyaksha Shareera. Vol 2nd, Reprint Rashtriya Samskrutha Samsthanam, New Delhi; p. 199–202.
17. Gananath Sen Sharma. (2008). Pratyaksha Shareera. Vol 2nd, Reprint 2008. Rashtriya Samskrutha Samsthanam, Delhi; p. 199–202.

18. García-Arrarás JE, G Valentin-Tirado, JE. Flores (2011). *Developmental Dynamics. 240*(6): 1241–1251.
19. Ghanekar Govind Bhasker. (1997). Hindi Commentary Ayurveda Rahasya Deepika on Sushruta Samhita of Sushruta. Meharchand Lakshmandas Publication, New Delhi; p. 109–110.
20. Gowd Damodara Sharma. Parishadya Shabdartha Shareeram. Baidyanath Ayurveda Bhavan Ltd., Nagpur; p. 69.
21. Harty M. (2016). *The Peritoneum and Mesentery. Surgery (Oxford). 34*(2): 49–53.
22. Heimbach JK, and LM. Nyhus (1998). Surgical Anatomy of the Abdomen. 2nd ed. Philadelphia: Saunders; p. 82–85.
23. Konrad D, *et al*. (2014). *Physiology. 29:* 304–313.
24. Krishnamurthy KH. (2000). English translation on Bhela Samhita of Bhela, 1st ed., Shareerasthana, Shareerasankhya Shareeram adhyaya: 7/4. Chaukambha Vishwabharati, Varanasi; p. 236.
25. Langman J. (2012). Medical Embryology. 13th ed. Baltimore: Lippincott Williams & Wilkins; p. 72–74.
26. Liu Kin Hung, *et al*. (2006). *Diabetes Care. 29:* 379–384.
27. Moore KL, and AF. Dalley (2018). Clinically Oriented Anatomy. 8th ed. Philadelphia: Wolters Kluwer; p. 394–396.
28. O'Brien C M, P M O'Connor, and A W Baird, *et al.* (2014). *Seminars in Cell & Developmental Biology. 34:* 19–27.
29. O'Connor PM, RA Cahill, DC Winter, HP Redmond, WO Kirwan, and JC. Coffey (2010). *Surgical and Radiologic Anatomy. 32*(9): 731–740.
30. Robinson B. (1899). The Abdominal and Pelvic Brain. Cleveland: The Cleveland Press.
31. Saxton SN, BJ Clark, SB Withers, EC Eringa, and A M Heagerty. (2019). *Physiological Reviews. 99:* 1701–1763.
32. Sarangadhara Samhita, (2007). Prof. KR Krishna Murthy. Choukamba Orientalia, 7th Edition, p. 25.
33. Sarangadhara. Sarangadhara Samhita, with commentary Adhamalla's Dipika and Kasirama's Gudhartha Dipika. 2nd edition. Nirnaya Sagar, Bombay. p. 46.
34. Standring S. (2020). Gray's Anatomy: The Anatomical Basis of Clinical Practice. 42nd ed. London: Elsevier; p. 1397–1400.
35. Subhash Ranade, RR Deshpande, ans S. Choubhe (2020). A Textbook of Sharir Kriya Vijnana Part 2. Chaukhambha Sanskrit Pratisthan; p. 58.
36. Sushruta Samhita. (2020). Chikitsasthana, Sadyovrana Chikitsitam adhyaya: 2/45. Available from: https://niimh.nic.in/ebooks/esushruta (Accessed on 06 July 2020).
37. Toldt C. Bau und Wachsthum der Darmkanalwand. (1879). *Mathematisch-Naturwissenschaftliche Klasse. 41:* 1–56.
38. Treves F. (1885). The Anatomy of the Intestinal Canal and Peritoneum in Man. London: Cassell & Co.
39. Walsh D, SM O'Brien, PR O'Connell, and JC. Coffey (2017). *Annals of Anatomy. 211:* 59–67.
40. Williams PL, LH Bannister, MM Berry, P Collins, M Dyson, and JE Dussek, *et al*. (1995). Gray's Anatomy. 38th ed. Edinburgh: Churchill Livingstone; p. 1245–1250.
41. Yang Ying-Kui, *et al*. (2008). *Cell Physiology and Biochemistry. 22:* 531–538.