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THE DISCOVERY OF ABDOMINAL PARACENTESIS: RECOGNIZING THE CONTRIBUTIONS OF AYURVEDIC SCHOLARS.

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Abstract: India's traditional healthcare system, Ayurveda, is a rich source of well-documented ancient medical knowledge. While the origins of this knowledge can be traced to the Vedic and post-Vedic periods, it is generally believed that a dedicated branch for healthcare was gradually established approximately between 400 BCE and 200 CE. The reason for the lack of recognition of Ayurveda's substantial contributions in medical history literature could be that these early textbooks were written in Sanskrit, a language not often spoken by the general public, not even in India. In this communication, the discovery of paracentesis has been taken up as a case, and a few important references from the representative Ayurveda compendia that hint at a preliminary understanding of the paracentesis have been reviewed. The central argument of this review is that these contributions from Ayurveda too must be recorded and acknowledged when reviewing the milestones in the history of medicine, as Ayurveda may still be able to influence a number of contemporary scientific fields, if revisited with this spirit.

Keywords: Ayurveda, Paracentesis, Medical history, Ancient medicine

Introduction:

The Ayurvedic tradition, the Indian traditional medical system, is believed to be eternal. Its roots go back to Vedic literature. Later, several Samhitas were created in which Charaka Samhita and Sushruta Samhita are prominent. The medicinal knowledge expounded in these compendia was further expanded through a vast number of commentaries written on them. Hippocrates recognized hydrops, which occurs when water seeps into the tissues, that is swelling into a body cavity (ascites), and he certainly appreciated the fatal prognostic implications of the latter. For that he opines that as an acceptable means of treating ascites was the use of abdominal paracentesis. *Paracentesis* is derived originally from Ancient Greek, which means “pierce at the side,” whereby the peritoneal cavity is punctured.[i] Ascites is a clinical sign, and the most common complication, of decompensated liver cirrhosis and indicates worse prognosis and higher mortality[ii] Ascites is usually treated with a low-sodium diet and

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administration of diuretics such as furosemide and spironolactone, and with paracentesis to physically remove the accumulated fluid in the peritoneum.[iii] Therapeutically abdominal paracentesis is performed for refractory or symptomatic ascites.[iv] The knowledge base of Ayurveda is documented in the form of compendia known as "Samhitas." These compendia are composed in Sanskrit, a language that is not in day-to-day use among the general population, even in India. Therefore, one needs to have a working knowledge of Sanskrit, along with the associated sociocultural contextual understandings to comprehend and interpret the documented material sensibly. Ascites can be considered in *Ayurveda* under the broad spectrum of *Udararoga* (diseases of abdomen). *Udara* is manifested because of vitiated *Rasa Dhatu* portion which gets extravagated from *Koshtha* and *Grahani* gets collected in *Udara* being influenced by *Prakupita Vata* the disease is called as *Jalodara*.[v] Various acharyas of Ayurveda explained *Udarapatana* (paracentesis) briefly for the management of *Jalodara* (Ascites). However, the many unclear and confusing translations and interpretations of Ayurveda texts have given rise to a general perception that the basic facts related to paracentesis were largely unknown when these texts were documented. This probably is also the reason why some of the important contributions of Ayurveda have gone unnoticed and unrecognized in the process of documentation of the history of medicine. In this communication, the discovery of paracentesis has been taken up as a case, and it is argued that Ayurveda masters, who authored different compendia, such as the Charaka Samhita, Sushruta Samhita, Ashtanga Sangraha and Hridaya too need to be credited for their contributions in this area along with personalities like Hippocrates, Aristotle, Erasistratus, Aulus Celsus, Galen and others

Methods: This research is a review one. As source materials, the classical Ayurveda texts along with the commentaries available in the library of National Institute of Ayurveda are referred. Other than this, various related research articles published have also been studied. All the relevant matter is further compiled and analysed for the discussion and attempt to draw a conclusion regarding the relevance of *Udarapathana* in contemporary science.

Results:

Table 1: detailed description of *Udarapatana* (paracentesis) procedure by various Ayurveda Acharyas

CALSSICAL TEXTBOOK	Charaka Samhita	Sushruta Samhita	Ashtanga Sangraha	Ashtanga Hridaya
AUTHOR	Agnivesha	Sushruta	Vruddha Vagbhata	Laghu Vagbhata
TIME PERIOD	Composed between 500 BCE and 500 CE in several stages	Composed between 500 BCE and 1000 CE in several stages	500 CE	600 CE
INDICATION	*Jatodaka* (Ascites)	*Dakodara* (Ascites)	*Jatodakesu Jatharesu* (Ascites)	*Sajale Udare* (Ascites)

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SITE	*Vamaparshva, Nabhyadhaschaturangula* (4 finger's breadth ≈ 8 cm below umbilicus on left side)	*Adhonabhevamataschaturangula* (4 finger's breadth ≈ 8 cm below umbilicus on left side)	*Nabhyaradho Vamaaschaturangula* (4 finger's breadth ≈ 8 cm below umbilicus on left side)	*Nabhyaradho Vamaaschaturangula* (4 finger's breadth ≈ 8 cm below umbilicus on left side)
DEPTH OF PUNCTURE	--	*Angusthodara Pramana Avaghadam* (width of thumb)	*Angusthodaramavaghadam* (width of thumb)	1 *Angula* (≈ 2 cm)
INSTRUMENT	*Nadiyantra* (Blunt instrument with hollow interior and tubular structure having opening both sides.)	*Vrihimukha Shastra* (instrument similar to trocar & canula), *Nadiyantra* made up of *Trapvadi* (metals)	*Nadi Yantra*	*Vrihimukha Shastra, Nadi Yantra*
PROCEDURE	During the aspiration procedure, compress the abdomen to facilitate the removal of fluid. After the aspiration is complete, wrap the abdomen tightly with a cloth to provide support and prevent re-accumulation of fluid.	*Snehana* (oleation) should be performed using *Vatahara Taila*, followed by *Swedana* (sudation) with hot water. During fluid aspiration, the patient should be firmly held under the armpits by reliable individuals surrounding him to ensure stability. This procedure should be repeated on the 3rd, 4th, 5th, 6th, 8th, 10th, 12th,	*Snehana* (oleation) should be performed using oil that alleviates *Vata*, followed by *Swedana* (sudation) with hot water. The abdomen should be wrapped with cloth up to the level of the armpits (*Kakshamudare Pattavestite*) to facilitate the aspiration of fluid. This procedure should be repeated on the	*Snehana* (oleation) and *Swedana* (sudation) should be administered, followed by wrapping the abdomen up to the level of the axillae (*Kakshamudare Pattavestite*) with cloth. Fluid should be drained to half its quantity during each session, repeating the procedure every

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		and 16th days to prevent conditions such as thirst (*Trushna*), abdominal distension (*Anaha*), diarrhea (*Atisara*), and breathlessness (*Swasa*). After fluid aspiration, apply *Sneha* (oil) and *Lavana* (salt) to the puncture site, then bandage it with sheep's wool, silk, or leather for protection and healing	3rd, 4th, 5th, 6th, 8th, 12th, and 16th days. After aspiration, apply oil and salt (*Taila* and *Lavana*) to the wound site (*Nadivrana*) and bandage it properly for protection and healing	3rd or 4th day until the 16th day. After each drainage, apply *Taila* (oil) and *Lavana* (salt) to the punctured site (*Nadivrana*) and properly bandage it for healing
PATHYA	For the initial 6 months, the patient should consume milk. For the subsequent 3 months, the diet should consist of *Peya*, a gruel prepared from milk. Following this, for the next 3 months, *Peya* should be made from *Shyamaka Kodrava*, a type of millet	For the initial 6 months, the patient should consume milk or *Janghala Rasa* (meat soup of wild animals). Following this period, for the next 3 months, Peya, a liquid gruel, is advised. Subsequently, for the subsequent 3 months, the diet should consist of *Laghu Anna*, (light and easily digestible solid	For the initial 6 months, the recommended diet for patients is milk. For the subsequent 3 months, the diet should consist of *Ksheerapeya*, a type of gruel prepared from milk. Following this, for the next 3 months, the diet should include *Shyamka Kodrava Sadhita Ksheera*, which refers to a gruel made from a	For the first 6 months, patients are advised to consume milk. Following this period, for the subsequent 3 months, their diet should include *Peya Payasa*, a nutritious gruel prepared from cereals or pulses and milk. Subsequently, for the next 3 months, the recommended

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		foods.)	specific type of millet known as *Shyamka Kodrava*, cooked in milk.	diet shifts to *Laghu Bhojana*, comprising light and easily digestible foods.

According to Acharya Charaka; If someone has fluid in the stomach (*Jatodaka* stage), the doctor should use a special tool called a *Nadi Yantra* to tap the left side of their abdomen below the umbilicus. While removing the fluid, the doctor should gently press on the abdomen and wrap it with a cloth afterward. After removing the fluid, the patient should eat a simple gruel called *Peya* with very little or no salt and *Sneha* (oily preparations), along with *Langhana* treatment (a type of fasting therapy). Then, the patient should only drink milk for six months. For the next three months, they can have milk-based *Peya*. After that, they can start eating light cereals like *Shyamaka* or *Koradusha* cooked with milk for an additional three months. These light meals should not contain any salt. By managing the patient in this manner for one year one can get cured of *Jalodara* (accumulation of fluid in the body)[vi]

According to Acharya Sushruta; For managing ascites, the patient should undergo *Snehana* (oleation) and *Swedana* (sudation) treatments to pacify the *Vata Dosha*. They should stand and be supported firmly in the armpits by trustworthy individuals. A small incision, about the width of a thumb, is made below the navel, four fingers away from the midline on the left side. A tubular instrument, typically made of tin or a similar metal, is inserted to drain the ascitic fluid. Removing all fluid at once can lead to adverse effects like thirst, fever, body ache, diarrhea, asthma, cough, and a rapid re-accumulation of fluid. Therefore, the fluid should be drained gradually, with intervals ranging from three to sixteen days. After draining, the wound is treated with oil and salt and then bandaged firmly. For the first six months, the patient's diet should consist of milk or meat soup from wild animals. In the following three months, the diet can include diluted milk, citrus fruit juices, or meat soup from wild animals. For the last three months, light and nutritious foods are recommended. Following this regimen for a year can lead to complete recovery from the disease[vii]

According to Acharya Vruddha Vagbhata; To treat abdominal fluid accumulation, the patient should receive oil massage to pacify *Vata* and undergo sudation with hot water. The abdomen should then be wrapped with cloth up to the level of the armpits. A puncture is made below the umbilicus, about four *Angula* (4 finger's breadth ≈ 8 cm) in length and as deep as one thumb's breadth. A tube is inserted to drain half the fluid, then removed. The wound is bathed with oil mixed with salt and bandaged. Fluid should be drained gradually over intervals of three to sixteen days to avoid complications. After drainage, firm bandaging with sheep's wool, silk, or leather over the abdomen so that gases may not cause distension. For six months, the patient's diet should include milk or wild animal meat soup. In the next three months, diluted milk, citrus fruit juices, or wild animal meat juices can be added. The final three months should consist of light and nutritious foods. Following this regimen for a year leads to complete recovery from the disease.[viii]

According to Laghu Vagbhata; To address abdominal fluid accumulation, the patient should receive an oil massage to calm *Vata* and sudation with hot water. The abdomen is then wrapped with cloth up

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to the armpits. A puncture is made below the umbilicus, four *Angula* (four finger width ≈ 8 cm) in length and one finger width deep. A tube is inserted to drain half the fluid, then removed. The wound is bathed with oil mixed with salt and bandaged. Fluid should be drained gradually over intervals of three to sixteen days. After complete drainage, the abdomen is tightly wrapped with loose cloth. The patient is given *Peya* without fats or salt to drink. For six months, the patient consumes only milk. For the first three months, they drink Peya mixed with milk, followed by food prepared from old *Syamaka* or *Koradusa* with milk, sour fruit juice, and meat soup in small quantities without fats or salt for the next three months. Following this regimen for one year leads to recovery from *Jalodara.*[ix]

Modern: For the treatment of ascites, Hippocrates cautioned against too aggressive and rapid drainage.[x] Erasistratus of Cappadocia (325-250 BCE), the renowned third/fourth-century BCE physiologist and physician. knew about the potential problems of overaggressive paracentesis, and therefore suggested monitoring the patient's pulse during the procedure, which should be aborted if the pulse weakens.[xi] There is well-documented evidence that the Romans performed trephination for ascites sometime before 50 CE, using a bronze or lead tube with a flanged collar, as described by Aulus Celsus.[xii] Galen of Pergamon (130-210 CE), the preeminent Greek physician of Rome in those years, whose reputation and teachings endured for centuries, listed several causes of dropsy, including a "hardened liver" in agreement with Hippocrates, and reluctantly with Erasistratus before him.[xiii] [xiv] Paul of Aegina (625-690 CE), a Byzantine Greek physician, documented in his Medical Compendium his method to puncture the peritoneal cavity by the use of a special pin or needle known as a *skolopion* (from the Greek, meaning a "little stake") that was borrowed from urology instruments used in relieving phimosis. A trocar was inserted through the skolopion to evacuate the abdominal fluid.[xv] In 1625, the original puncture pin was replaced with an instrument imported from his studies in Padua to the Netherlands, by the Dutch surgeon Jacob Block.[xvi] Block's puncture pin was later modified by the Alsatian surgeon Paul Babette, who also had settled in Amsterdam. This upgrade was received with worldwide acclaim. Like Hippocrates, Paul also cautioned against draining excessive fluid off too rapidly because "it evacuates the vital spirit," and he too recommended monitoring the patient's pulse during the procedure. His writings became the guiding principles for the treatment of ascites. Thus was established abdominal paracentesis, together later with salt and water restriction, as the standard treatment of ascites for nearly 2000 years, even though there were many complications, including infection and renal failure.

Table 2: Detailed description of paracentesis procedure by various modern authors

AUTHOR	TIME PERIOD	CONTRIBUTIONS
Hippocrates	460BC-370BC	Cautioned against too aggressive and rapid drainage
Erasistratus	304BC- 250BC	Suggested monitoring the patient's pulse during the procedure, which should be aborted if the pulse weakens.
Aulus Celsus	25BC-50 AD	Trephination for ascites sometime using a bronze or lead tube with a flanged collar
Galen of Pergamon	129AD-216AD	Similar opinion with Hippocrates and Erasistratus.

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Paul of Aegina	625AD-690AD	Advised to puncture the peritoneal cavity by the use of a special needle known as a *skolopion* (from the Greek, meaning a "little stake") that was borrowed from urology instruments used in relieving phimosis. A trocar was inserted through the skolopion to evacuate the abdominal fluid.
Jacob Block	1625	original puncture pin was replaced with an instrument

Discussion:

Indication: *Jatodaka* by acharya Charaka, *Dakodara* by acharya Sushruta, *Jatodakesu Jatharesu* by Vriddha Vagbhata and *Sajale Udare* by Laghu Vagbhata can be compared with Ascites which is characterized by the abnormal accumulation of fluid in the abdominal cavity. This fluid buildup causes abdominal swelling and distension. Ascites can develop due to various underlying causes, including liver disease (such as cirrhosis), heart failure, kidney disease, certain cancers (such as ovarian cancer), infection (such as tuberculosis), and other conditions that affect fluid balance in the body.

Site: *Vamaparshva, Nabhyadhaschaturangula* (4 *Angula* below umbilicus on left side): Acharyas have suggested to do puncture 4 *Angula* below *Nabhi* in *Vama Parshva*, and in the contemporary science also Paracentesis, or abdominal fluid tapping, is often performed in the left lower quadrant of the abdomen because this area typically has the highest concentration of ascitic fluid. Ascitic fluid tends to accumulate in dependent areas of the abdomen due to gravity, and the left lower quadrant is one of the most dependent regions. By tapping into this area, one can access a larger volume of fluid, making the procedure more effective for diagnostic and therapeutic purposes. Additionally, the spleen is located in the left upper quadrant, so avoiding that area reduces the risk of accidental puncture during the procedure and also This approach avoids puncture of the inferior epigastric arteries.

Depth of puncture: Acharyas have mentioned the depth of the puncture to drain the fluid accumulated that is about *Angushtodara Pramana* acc. to Sushruta, Vridda Vagbhata and 2 *Angula* acc. to Laghu Vagbhata, *Anguli Pramana* is individualistic and it varies from person to person, typically around 1 to 2 cm. This depth may allow access to the peritoneal cavity while minimizing the risk of injuring deeper structures

Instrument: Acharyas have mentioned *Vrihimukha Shastra, Nadi Yantra:* **Vrihimukha Shastra** may have been chosen for puncturing due to its precision and effectiveness in creating a controlled opening to drain excess fluid from the abdomen. Additionally, Ayurvedic texts often emphasize the importance of using specific techniques tailored to each condition, and *Vrihimukha Shastra* may have been considered appropriate for addressing the unique characteristics of *Jalodara*. **Nadi Yantra** may offer precise control over the puncturing or incision process, allowing for accurate placement and depth of the instrument into the abdomen to access the accumulated fluid without causing unnecessary damage to surrounding tissues. *Nadi Yantra* may be designed to minimize trauma to the abdominal wall and

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internal organs during the drainage procedure, thereby reducing the risk of complications and promoting faster healing. The design of *Nadi Yantra* may facilitate efficient drainage of fluid by optimizing the flow rate and direction, ensuring thorough removal of accumulated fluid while minimizing the risk of re-accumulation. *Nadi Yantra* may have been chosen for its ability to minimize the risk of complications such as infection or bleeding during the drainage procedure.

***Trapvadi* (metals):** Tin, or metal, instruments are known for their durability and resilience. They can withstand repeated use without significant wear and tear, making them suitable for surgical procedures that require precision and reliability, such as draining fluid from the abdomen. Metal instruments can be effectively sterilized, reducing the risk of introducing infection during the surgical procedure. This is particularly important in surgical interventions where maintaining a sterile environment is crucial for the patient's safety and recover. Metal instruments can be shaped and crafted to specific dimensions and designs, allowing for precise manipulation and control during the drainage procedure. This enables surgeons to navigate through anatomical structures with accuracy, minimizing the risk of unintended damage. Certain metals have good thermal conductivity properties. This can be advantageous during surgical procedures as it allows for efficient heat transfer, which may help cauterize or coagulate blood vessels, reducing bleeding during the drainage process. Ayurvedic texts and traditional surgical practices often prescribe the use of metallic instruments for various procedures, including surgical interventions. The use of metallic instruments in draining fluid from the abdomen may stem from historical precedent.

Procedure: Aspiration of Ascitic fluid can provide symptomatic relief by reducing abdominal distension and discomfort associated with ascites. By removing excess fluid from the abdomen, aspiration can improve breathing, appetite, and overall comfort for individuals with ascites. The fluid should be drained out in small quantities, with intervals of rest, till a period of sixteen days may be because, Removing large volumes of fluid at once can lead to sudden shifts in fluid and electrolyte balance, potentially causing complications such as hypotension (low blood pressure), electrolyte imbalances, or kidney dysfunction and impair venous return to the heart and lead to circulatory collapse. Removing fluid slowly allows the body to adjust gradually to changes in fluid volume and minimize symptoms such as dizziness, nausea, or discomfort and maintain hemodynamic stability. *Taila*, *Lavana* application at *Nadivrana*: Taila has lubricating and emollient properties that can help soothe the puncture site and promote tissue healing. It forms a protective barrier over the wound, preventing drying and reducing friction during movement. This can contribute to faster wound closure and reduced discomfort. *Sneha* and *Lavana* may have antimicrobial properties that help prevent infection at the puncture site. By creating an unfavourable environment for bacterial growth and reducing the risk of infection. *Lavana* (salt) has been traditionally used for its anti-inflammatory properties. Applying *Lavana* to the puncture site may help reduce inflammation and swelling, thereby alleviating discomfort and promoting faster healing. *Udara Veshtana* (abdominal bandaging or compression) provide support and stabilization to the abdominal wall and internal organs following drainage. This can help prevent the abdominal cavity from collapsing and promote proper healing of the tissues. and minimize the risk of postoperative complications such as hematoma formation, fluid accumulation, and opening of the surgical incision. It helps maintain pressure on the surgical site, which may reduce the likelihood of these complications occurring. Properly applied abdominal bandaging can facilitate the drainage of any

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residual fluid and promote circulation in the abdominal area. This can aid in the removal of inflammatory by-products and enhance tissue healing. This can reduce movement-related pain and improve the patient's overall comfort during the recovery period. *Udara Veshtana* creates a conducive environment for tissue healing. It helps prevent excessive stress on the surgical site, allowing the body to focus its resources on the healing process. Bandage with sheeps wool, silk or leather: Silk, wool, and leather bandages were commonly used to cover and protect the puncture site after paracentesis. They may act as a barrier against external contaminants, reducing the risk of infection and promoting wound healing. Wool bandages, in particular, have absorbent properties that can help soak up any residual fluid or blood oozing from the puncture site. This can help keep the area clean and dry, preventing the accumulation of fluid and reducing the risk of infection. Leather bandages, when wrapped snugly around the abdomen, can provide gentle compression, which may help reduce post-procedural swelling and discomfort. Compression can also promote haemostasis by applying pressure to the blood vessels near the puncture site. Hence, It's important to note that while these materials may have been historically used in paracentesis procedures, modern medical practices typically rely on sterile gauze or other medical-grade materials for wound care and dressing after paracentesis. These materials offer superior hygiene, absorbency, and compatibility with modern healthcare standards.

Pathya: 6months-milk or *Janghala Rasa*, 3 months-*Peya* and 3 months-*Laghu Anna;* After surgery, the digestive system may be sensitive, and consuming light, nourishing foods can help facilitate digestion and prevent discomfort or complications such as indigestion or bloating. The diet prescribed by Acharya Charaka may prioritize foods that are rich in nutrients essential for healing and recovery. Adequate intake of protein, vitamins, and minerals can support tissue repair, strengthen the immune system, and promote overall well-being. Pathya explained by Acharya Charaka after surgical management of *Jalodara* may promote healing, support the body's natural recovery processes, and minimize the risk of complications, ultimately leading to a faster and smoother recovery for the patient.

Conclusion: Despite some gross inadequacies pertaining to the paracentesis, it can be said that the ancient Ayurveda masters had acquired considerable understanding related to the paracentesis. Therefore, these masters deserve to be recognized for their contributions in this area. It is also suggested that efforts should be made to review and recognize other contributions of Ayurveda to various streams of surgery and medicine in a systematic manner, as Ayurveda may still be able to lead future advancements in surgical procedures, if revisited with this spirit.

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