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Critical analysis of *Srava* and *Gandha* of *Vrana* with special reference to *Madhumehajanya Dusta Vrana* vis-à-vis Diabetic Foot Ulcer

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ABSTRACT

Diabetes Mellitus is one of the major health concerns of India gradually gaining potential to become an epidemic. At present, India has a stunning population of people suffering from diabetes which goes up to 101 million and by the end of 2045 it is expected to be between 124 to 135 million. As per a Cohort study conducted by Diabetic Federation of India 2/3rd of these diabetic patients suffer from Diabetic complications. When we consider these 2/3rd of the diabetic population who suffer from Diabetic complications, majority of them tend to develop Diabetic Foot Ulcers in their lifetime due to uncontrolled glycemic status. *Madhumehajanya Dusta Vrana* vis-à-vis Diabetic Foot ulcers once formed does not only affect the patient physically but can significantly negatively impact a patient's quality of life by its presentations. Due to the non-healing nature of *Madhumehajanya Dusta Vrana* and associated infection, it discharges multiple secretions from its floor which results in morbid moisture in the ulcer further adding to its non-healing nature. The present article is intended to understand the same in detail regarding the *Srava* and *Gandha* of *Madhumehajanya Dusta Vrana* in detail as per Ayurvedic and contemporary science point of view.

Key words: *Madhumehajanya, Dusta, Vrana, Srava, Gandha, Discharge, Odour, DFU.*

INTRODUCTION

A wound is considered chronic when it fails to proceed in "an orderly and timely reparative process that results in sustained restoration of anatomic and functional integrity".[1] *Madhumehajanya Dusta Vrana* also comes under the umbrella of Chronic wound due to its delayed healing nature and complications associated with it and hence considered to be an archetypical of chronic wounds.[2-4]

Madhumehajanya Dusta Vrana can be broadly classified into two types. Viz, *Nija* and *Agantuja*.

All the *Aharaja* and *Viharaja Nidana* resulting in *Prameha/Madhumeha* can be considered as the *Nidana* for the manifestation of *Nija Madhumehajanya Dusta Vrana*.

Abhigata also plays an important role as *Nidana* in contributing to the manifestation as *Agantuja Madhumehajanya Dusta Vrana*.

In case of a *Nija Madhumehajanya Dusta Vrana, Vatadi Dosa Prakopa* takes place prior to the formation of *Vrana* whereas in *Agantuja Madhumehajanya Dusta Vrana*, *Vrana* gets manifested first followed by *Vatadi Dosa Prakopa*. Eventually, as *Madhumehajanya Dusta Vrana* is *Dirghakalanubandhi*, even *Agantuja Madhumehajanya Dusta Vrana* after a period of 7 days

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becomes *Nija Madhumehajanya Dusta Vrana* due to *Doshopaplava*.[5]

The *Laksana* of *Madhumehajanya Dusta Vrana* are included under the heading of *Dusta Vrana* itself by all the *Acarya*.

Apart from most of the *Samanya Dusta Vrana Laksana* following *Laksana* can be specifically attributed to *Madhumehajanya Dusta Vrana*- viz;

Susruta[6]

- *Krsna Rakta Pita Sukla Varnanam Anyatama Varna* - The wound can be black, red, yellow or white or any other colours.
- *Putipuya Mamsa Sira Snayu Prabhrti* - The wound is filled with purulent pus discharge, putrefied muscle tissue, blood vessels and tendons.
- *Bhairava*
- *Putipuya Srava* - Purulent discharge
- *Amanojna Darsana* and *Amanojna Gandha* - The wound has offensive appearance and odour.
- *Piḍakopadruta* - Formation of papule
- *Dirghakalanubandhi* - Chronic in nature

Charaka[7]

- *Avasanna Vartma* - Depression in the margin of the *Vrana*
- *Atisthula Vartma* - Excessive thickness of the margin of the *Vrana*
- *Atipiḍaka Vrana* - Excess *Pidaka* over the *Vrana*
- *Atipinjara* - Colour of the *Vrana* being excessively reddish yellow, Similar to the colour of *Haratala*
- *Nila* - Bluish colour of the *Vrana*
- *Syava* - Blackish brown colour of the *Vrana*
- *Rakta* - Reddish colour of the *Vrana*
- *Krsna* - Blackish colour of the *Vrana*
- *Atiputika* - Excess pus discharge from the wound
- *Ropya* - Recurrence of the *Vrana*
- *Kumbhimukha* - *Vrana* with completely pus-filled cavity having a small opening outside.

***Srava* from *Madhumehajanya Dusta Vrana* - Discharge from Diabetic Foot Ulcer**

Discharge from wound is a sequel to the local host response to the microorganisms and dissemination of microorganisms in viable tissue of the ulcer as they try to outcompete the host natural immune system. Non-viable tissues due to infection, microorganism and leucocyte debris forms the components of the discharge along with various proteins and other metabolites released during this process.

Formation of different kinds of discharge in a diabetic foot ulcer is a complex process that involves a lot of significant factors like microbial contamination, Glucose laid tissues, associated vascular pathologies like micro and macro angiopathy. All these factors cumulatively lead to the formation of a discharge in the ulcer which varies from ulcer to ulcer depending on the changes in the above mentioned factors.

Microbial contamination refers to the effect exerted by different colony of bacteria that usually affect the ulcer floor and resulting infection in the ulcer floor, which eventually leads to discharge in the ulcer. This microbial contamination may come from either endogenous or exogenous sources.

Endogenous flora includes the bacterial growth seen on patient's skin and mucous membranes. The most common endogenous causative organisms are S. aureus, coagulase-negative staphylococci, Enterococcus, and Escherichia coli. Improper wound hygiene and uncontrolled blood glucose levels that result in glucose loaded tissues are some factors that result in Bacterial contamination due to endogenous factors.

Exogenous flora may come from the theatre room, including air, instruments, materials, and staff members. The most common exogenous organisms are staphylococci and streptococci. Also, the number and the virulence of the organism are major risk factors. Improper dressing and not maintaining adequate aseptic precautions during dressing are some

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factors that result in Bacterial contamination due to exogenous factors.

Although diabetics are particularly vulnerable to bacterial infections, DFUs have a complex and highly organized polymicrobial community that frequently contributes to undesirable outcomes in DFU-affected individuals.[8] This microbiota–biofilm over the ulcer bed in a diabetic ulcer comprises of symbiotic bacteria, yeast and fungal loads. So, discharge from DFU can be a resultant of an infection varying from bacterial to viral and yeast infestation.

Description of *Vrana Srava* as per *Acharya Sushruta:*

Varna Srava	**Description**	**As per contemporary science**
Lasika	Discharge of Lymph like fluid	Serous discharge from the wound
Jala	Watery discharge	Serous discharge from the wound
Pooya	Pus discharge	Purulent discharge from the wound
Asrk / rakta	Blood discharge	Sero- Sanguinous discharge from the wound
Haridra	Discharge which is yellow like turmeric	The whitish-yellow, yellow, yellow-brown color of pus is the result of an accumulation of dead neutrophils.
Aruna	Discharge which is red in color	Sanguinous discharge from the wound
Pinjara	Discharge which is mixture of red and yellow color	Mixture of Sanguinous and Purulent discharge from the wound – Resultant of a chronic infection in the ulcer floor
Kasaya	Discharge which is brownish black in color	Discharge appears brownish black in colour due to presence of dried and senile blood cells in the discahrge.
Nila	Discharge which is blue in color	Some strains of Pseudomonas Bacteria result in blue colored discharge
Harita	Discharge which is green in color	Pus can sometimes be green because some white blood cells produce a green antibacterial protein called myeloperoxidase. A bacterium called Pseudomonas aeruginosa (P. aeruginosa) produces a green pigment called pyocyanin, which results in green color pus.
Snigdha	Discharge which is unctous in nature	Unctous discharge in the ulcer is an indicative of chronic bacterial infection
Ruksha	Discharge which is dry in nature	Serous discharge
Sita	Discharge which is white in color	Purulent discharge
Asita	Discharge which is black in color	Black discharge can be an indicative of Bacterial and Yeast/Fungal infection

For the practical purpose of understanding and assessment of the ulcer discharge, it can be categorized as following types:

Classification of *Srava*	**Description**
No discharge	Dressing is Dry
Minimal Discharge	The gauze is slightly moist
Mild Discharge	The gauze is completely wet - noticed after opening the bandage
Moderate Discharge	The gauze is completely wet - noticed even before opening the bandage
Severe Discharge	The gauze and the bandage are completely soaked - Within 24 hours

Gandha from *Madhumehajanya Dusta Vrana* - Odour from Diabetic Foot Ulcer

Among all the distressing outcomes in patients with Diabetic Foot Ulcer, Foul smelling odor stands first because it not only affects the patient but also the people surrounding the patient with its offensive and repulsive nature. This also leads to a negative psychological effect on the patient and leads to social isolation of the patient as even the close family

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members tend to avoid coming close to the patient due to the offensive nature of the ulcer odor.

Odor in the ulcer can vary from barely noticeable to offensive and foul smelling, which also indicates the nature of the wound healing. Offensive smell indicates an infected wound which causes delayed healing and vice versa.

An ulcer develops odor as a result of abnormal metabolic processes occurring at the ulcer site, which involves microbial proliferation, polymorphonuclear infiltration, cellular and tissue death at the ulcer and aerobic-anaerobic metabolic processes that happens at the tissue level in the ulcer.

A chronic ulcer like a Diabetic Foot Ulcer gives a suitable substratum for the growth of microbes over the ulcer leading to infection and odor formation. These microbes, specifically that affect the DFU can be aerobes - that require oxygen for metabolic processes and anaerobes - that don't require oxygen for metabolic processes. Majority of the times odor in the ulcer is caused by anaerobes like Prevotella, Bacteroides fragilis, Fusobacterium nucleatum, Clostridium, Beta-hemolytic Streptococci, Porphyromonas and clostridium perfringens that release foul-smelling compounds called Cadaverine, Putrescine and Sulphur due to tissue degradation as a part of putrefaction process of the tissues. Also, various other volatile metabolites such as short-chain fatty acids including n-butyric, n-valeric, n-caproic, n-haptonic, and caprylic acids also result in intense acrid smell. As Ulcer odor is an objective criterion in the assessment of the ulcer, there are no standard categorization methods of ulcer odor, as it can vary from person to person based on their sensitivity to smell.

Description of *Vrana Gandha* as per *Acharya Sushruta*:

Gandha	**Description**	**As per contemporary science**
Sarpi	Similar to the smell of Ghee	Foul smelling discharge due to Pseudomonas infection
Taila	Similar to the smell of Oil	Foul smelling discharge due to Clostridium infection
Vasa	Similar to the smell of Fat	Pungent smelling discharge due to various Bacterial infections
Puya	Similar to the smell of Pus	Foul smelling discharge usually noticed in gangrenous wounds
Rakta	Similar to the smell of Blood	Foul smelling discharge due to Sero-Sanguinous discharge
Shyava	Similar to the smell that emanates when curd is rubbed over copper Some *Acharya* also consider it as *Shava Gandha* – which is similar to the smell of a dead body	Foul smelling discharge usually noticed in gangrenous wounds and Ulcers affected by anaerobic bacteria
Amla	Similar to the smell of Sour substances	Foul smelling discharge usually noticed in gangrenous wounds
Pooti	Similar to the smell of Putrid substances.	Foul smelling discharge usually noticed in gangrenous wounds

For the practical purpose of understanding and assessment of the ulcer odor it can be categorized as following types:

Classification of Odor	**Description**
Very Strong Malodor / Offensive Malodor	This is immediately perceived on entering a room with a patient with a wound. The offensive smell can be detected at a distance of 6-10 feet, even with the wound completely wrapped in a dressing.
Strong Malodor	A strong smell can be detected at a distance of 6-10 feet only when the dressing is removed, or the wound is partially exposed.
Moderate Malodor	The odor is only noticeable close to the wound with a dressing intact.
Slight Malodor	This is similar to a moderately odorous wound however it can only

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	be detected near a partially exposed wound or one without a dressing.
No Malodor	No odor even when close to a open wound

Role of BIOFILM in manifestation of *Vrana Srava* and *Gandha*

A biofilm is composed of living, reproducing microorganisms, such as bacteria, that exist as a colony, or community. A biofilm forms when certain microorganisms adhere to the surface of some object in a moist environment and begin to reproduce. The microorganisms form an attachment to the surface of the object by secreting a slimy, glue-like substance called as an Extracellular Polymeric Substance Matrix (EPS). This EPS, along with different microorganisms consists of various other materials depending on the surface they are attached to. In DFU, the biofilms are composed primarily of microbial cells and EPS and biofilm community usually consists of a single kind of microorganism, but in DFU biofilms almost always consist of mixtures of many species of bacteria, as well as fungi, algae, yeasts, protozoa, and other microorganisms, along with non-living cellular debris and other metabolic products. The cells produce strands of EPS and are held together by these strands, allowing them to develop complex, three-dimensional, attached communities that are resistant to attacks that would destroy individual cells not part of a biofilm colony. As this microbiota biofilm over the ulcer bed in a diabetic ulcer comprising of symbiotic organisms are submerged in EPS complex, the ulcer becomes resistant to external treatments and also the three-dimensional structure of the Biofilm complex does not respond easily to any antibiotic therapy resulting in the non-healing nature of the DFU. The resulting Non-Healing DFU, due to increased load of microorganisms and resistance to the treatments offered by the Biofilm leads to excessive discharge and odor from the ulcer bed. So, eradicating the biofilm becomes an integral part in the management of DFU to control *Vrana Srava* and *Vrana Gandha*.

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