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# Ayurvedic Approach to Sickle Cell Disease WSR to Sannipatika Pandu: An Overview

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## Abstract

***Background:*** *Sickle Cell Disease (SCD) is a genetic life-long blood disorder characterized by RBCs that assume an abnormal, rigid, sickle shape – sickling decreases the flexibility and results of the cell in a risk of various complications. The Valine amino acid is replaced by the Glutamic acid in the 6th position of the 11th chromosome of the Beta chain of the hemoglobin inside the RBCs. Due to that, the haemoglobin concentration of individuals is not maintained properly and there is a chance of multiple infections in seasonal variation. SCD can be compared with Sannipatika or Sahaja (hereditary) Pandu Vyadhi in Ayurveda, to understand the Ayurvedic perspective of SCD and all the related pathophysiology of Rakta Dhatu i. e. its Utpatti, Hetu, Lakshana, Samprapti, Chikitsa Siddhant, etc are taken into consideration in this context. SCD occurs more commonly in people belonging to tropical & subtropical regions in malaria-prone areas. According to Ayurveda Beeja-Dushti play a major role in its pathogenesis.* ***Aim:*** *To establish a correlation between Sickle Cell Disease and Pandu Vyadhi.* ***Material and Method:*** *A comparison of literary materials from Ayurvedic classics specially Charak and Sushruta Samhita, in relation to modern texts and their available commentary as well as different webs.* ***Discussion:*** *The genetic basis of SCD is well established so, Beeja Dushtijanya Pandu/ Kulaja Pandu/ Anuvamshika Pandu may be some similarities with SCD. In the present context, the Doshika status of the disease can be analyzed as Vata-Pitta provocation along with the depletion of Kapha.* ***Conclusion:*** *In this study Genetic basis of SCD and Beeja Dushtijanya Pandu is correlated with both Modern and Ayurvedic points of view. Both show similarity in pathogenesis and in some clinical presentation, it can be concluded that Sickle cell disease and Beeja Dushtijanya Pandu/ Kulaja Pandu / Anuvamshika Pandu appears to be appropriate for correlation.*

## Keywords

Pandu, Rakta Dhatu, genetic, blood disorders, malaria, Beejdosha.

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## 1. Introduction

The human RBCs are circular, biconcave and the diameter of the centre is less than the periphery, in a certain condition when circular RBCs undergoes sickle form due to abnormal posting of glutamicvaline amino acid in the Beta chain of adult hemoglobin, the disease is known as sickle cell disease or sickle cell disorder (SCD). SCD is a serious, inherited, autosomal recessive, lifelong blood disorder characterized by RBCs that assume an abnormal, rigid, and sickle shape. SCD is present since birth, but most infants don't show any symptoms until they are about 5-6 months of age due to more presence of fetal haemoglobin.

## 2. Aims and Objective

The current study is to establish a correlation between sickle cell disease and Pandu Vyadhi.

## 3. Material and Method

Compilation of literary materials from Ayurvedic classics, especially Charaka and Sushruta Samhita in relation to modern texts and their available commentary as well as different webs.

## 4. Prevalence

SCD occurs more commonly in the middle belt and central India, the especially western area of Chhattisgarh Madhya Pradesh Maharashtra, Gujarat States which areas are mostly populated by tribal and backward classes and the prevalence of malaria is endemic. It has been observed from statistical data that 10 to 15% population of the western tribal population of Odisha is prone to sickle cell trait and 1.27% sickle cell anemia both males and females are equally affected. The average frequency of SCD in India is 4.3% and that of Odisha is 9.1%.

**Table 1.** Prevalence of Sickle Cell Disease (HbSS) in Koraput district of Odisha 1,2

| Prevalence of Sickle Cell Disease | No. Screened | HbSS cases No. | % HbSS cases |
|---|---|---|---|
| Male | 508 | 40 | 7.87 |
| Female | 584 | 63 | 10.79 |
| Scheduled castes (SC) | 1002 | 100 | 9.98 |
| Scheduled tribes (ST) | 90 | 3 | 3.33 |
| Total | 1092 | 103 | 9.43 |

## 5. Types of SCD

There are mainly four types of Sickle Cell Disease. They are as follows:

(i)Sickle cell anemia, (ii)Sickle Hb C disease, (iii)Sickle Beta plus thalassemia, (iv) Sickle Beta zero thalassemia

### 5.1. Sickle cell anemia [3]

Sickle cell anaemia (SCA) is an autosomal recessive blood disorder, characterized by red blood cells that assume an abnormal and rigid sickle shape.

Sickling of erythrocytes decreases the flexibility of red blood cells and results in a risk of various complications.

The sickling of erythrocytes occurs as a result of hypoxia, which is a consequence of the substitution of valine in place of glutamic acid in the 6th position of mutation of β -globin chain of normal haemoglobin, for which the life span of RBCs reduced to 20 days from 120 days. Out of different types of sickle cell anaemia, sickle cell trait (HbAS) and sickle cell disease (HbSS) are found more common in tribal people of western Odisha.

### 5.2. Sickle Hb C disease [4]

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### 5.3. Sickle Beta plus thalassemia [5]

Sickle cell beta-thalassemia is a type of RBC disorder known as a hemoglobinopathy Trusted Source. These are conditions that cause abnormal hemoglobin production or a change in its structure. Hemoglobin is the protein in RBCs responsible for carrying oxygen around the body. Both sickle cell disease and beta-thalassemia are genetic conditions that affect hemoglobin. A person with sickle cell beta-thalassemia inherits a trait for both conditions, impacting the shape and number of hemoglobin

### 5.4. Sickle Beta zero thalassemia [5]

Sickle cell beta thalassemia (Hb S/β Th) is an inherited form of sickle cell disease that affects red blood cells both in the production of abnormal hemoglobin, as well as the decreased synthesis of beta-globin chains.

## 6. Signs and Symptoms

A variety of clinical features are seen in SCD patients. Only which the main features are:

- Fatigue
- Jaundice
- Severe anemia
- Acute pain crises (sickle cell/ vaso-occlusive)
- Dactylitis (swelling & inflammation of the hands and/or feet)
- Arthritis
- Acute Chest Syndrome (Fever, chest pain, coughing, difficulty in breathing and, pulmonary infiltrate on chest X-ray).
- Bacterial Infections

Aggravating factors related to SCD are:

- Cold Environment
- Infection
- Dehydration

- Hypoxia
- Vigorous exercise
- High temperature

### 6.1 Sickle cell trait (SCT)

Sickle cell trait means a person carries a sickle cell gene, but it doesn't normally cause illness, because it is genetically recessive.

## 7. Ayurvedic Correlation [7]

SCD is not described as such in Ayurveda but disease sannipatika Pandu shown the same characteristic in terms of patho-genesis and cardinal symptoms i.e. Raktalpata (Hemolytic anemia), Shithilendriya (fatigue)(8), Aruchi (Anorexia), Hatanala (re-duced digestive fire), Shwas (Acute Chest Syndrome - dyspnea), Arohana-Ayasa, (tiredness on exertion), Pindwikadweshtana (stiffness and tightness in calf muscle) and Jwara (fever)(9), Parvabheda (Arthritis like symptoms)(10) and Klama (tiredness on rest)(11), etc.

The genetic basis of SCD is well established, so the terms Kulaja, Anuvanshika or Sahaja are mentioned in our classics to denote the inheritable nature of the disease. Thus, the name given like Kulaja Pandu / Anuvamshika Pandu appears to be appropriate for exact correlation.

**Table 2.** Description on Pandu Roga in Ayurvedic literatures

| Types of Samhita | Description of Pandu | Types | | | | | |
|---|---|---|---|---|---|---|---|
| | | No. | V | P | K | S | M |
| Charaka Samhita | Chikitsa Sthana – 16 | **5** | **+** | **+** | **+** | **+** | **+** |
| Sushruta Samhita | Uttaratantra – 44 | **4** | **+** | **+** | **+** | **+** | **-** |
| Ashtanga Hridaya | Nidana Sthana - 13<br>Chikitsa Sthana – 16 | **5** | **+** | **+** | **+** | **+** | **+** |
| Ashtanga Samgraha | Nidana Sthana - 13<br>Chikitsaa Sthana – 18 | **5** | **+** | **+** | **+** | **+** | **+** |
| Harita Samhita | Tritiya Sthana – 08 | **5** | **+** | **+** | **+** | **+** | **+** |
| Bhavaprakasha | Madhyama Khanda – 08 | **5** | **+** | **+** | **+** | **+** | **+** |
| Kashyapa Samhita | Vedanadhyaya | **1** | | | | | |

## 8. Involvement of Doshas

Here the involvement of Vata and Pitta Doshas may be considered because inside the body Vata Dosha is the initiator of any changes, while the transformation or mutation is caused by Pitta Dosha. Hence, in this condition, Vata and Pitta Doshas are equally responsible for Prakriti Vaipareetya of Dhatu. Prakriti of each Dhatu is maintained by Kapha Dosha. Changes in Prakriti denote Shleshma Kshaya tending to Dhatu Vaipareetya. So, in the present context, the Doshika status of the disease may be analyzed as Vata-Pitta provocation along with depletion of Kapha resulting in various disorders.

## 9. Beeja-Dosha

SCD is also due to an abnormality in Beeja (Sperm, Ovum, and zygote), Beejabhaga (Chromosomes), and Beejabhagavayava (Gene locus: Promoter region, Exons, Introns).

- During embryonic devolvement, an abnormality is seen in that body part/component, which Beeja or Beejabhaga are affected by Vitiated Dosha. (12)
- According to Acharya Charaka, defects in Beeja, Atmakarma, Ashaya, Kala, and Matura Aahara Vihara are responsible for the defects in Samsthana, Varna, and Indriya of the fetus. (13)
- In the context of Sahaja Arsha, he also mentioned that Apachara and purvakrita karma done by both the parents are responsible for Beejopatapti. (14)
- According to Sushruta Naastikata and Ashubha karma of parents, and Vatadi Prakopa are responsible for Vikriti in the Garbha. (15)
- The disturbances of these three Dosha by Anuchita Ahara Vihara and purvajanmakrita karma in the parents affect the next progeny. (16)

**Table 3.** Concept of Beeja, Beejabhaga, and Beejabhagavayava

| Terms in classics | Nearer terms in genetics |
|---|---|
| Beeja | Sperm, Ovum and zygote |
| Beejabhaga | Chromosomes |
| Beejabhagavayava | Gene locus: Promoter region, Exons, Introns |

## 10. Samprapti of Beejadushtijanya Pandu

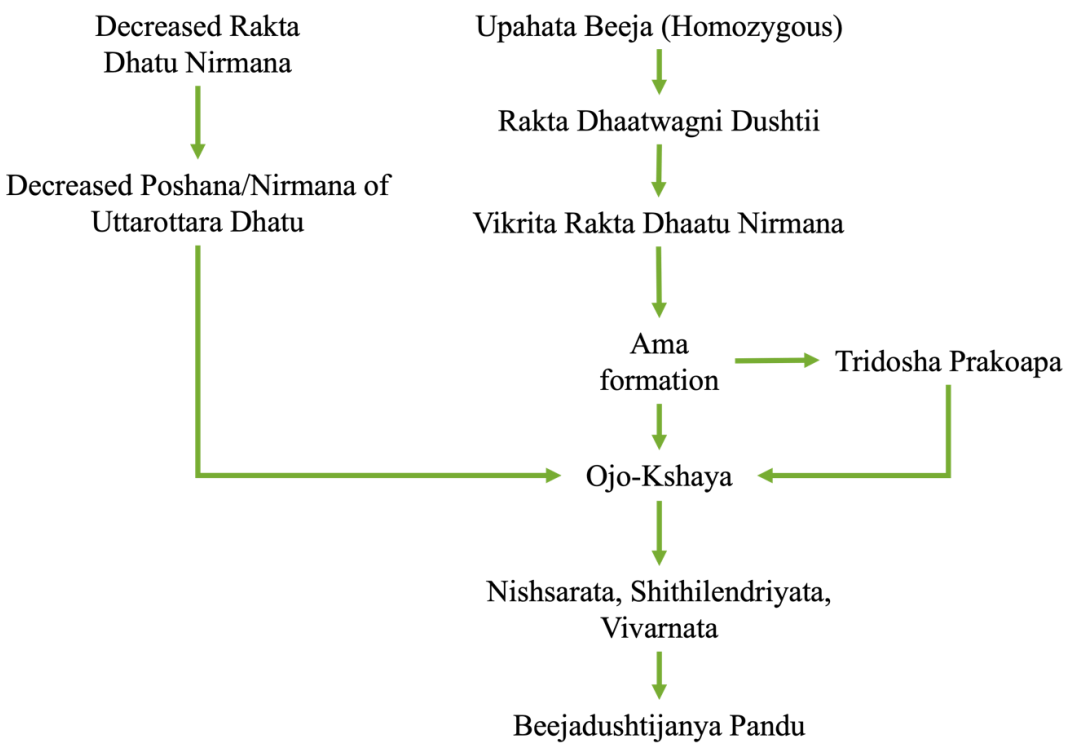


**Figure 1.** Samprapti of beejadushtijanya Pandu

## 11. Possible Samprapti of Upahata Beeja

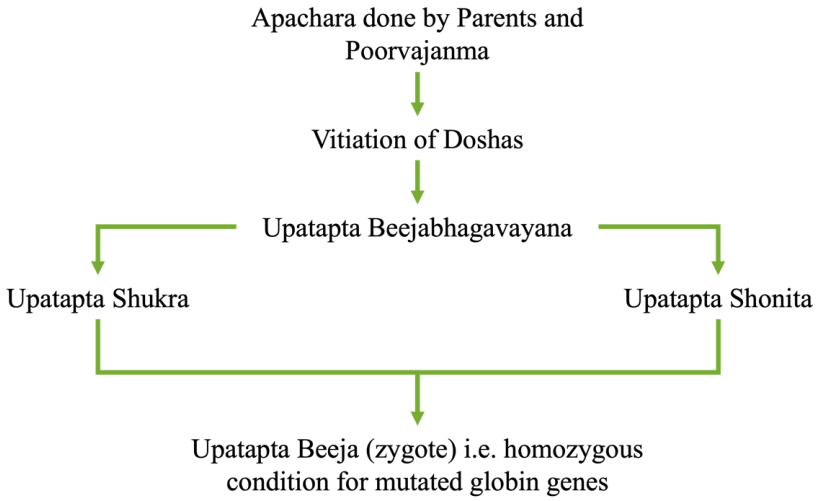


**Figure 2.** Samprapti of upahata beeja

## 12. Discussion

SCD is described in modern medical sciences in detail, in Ayurvedic classics there is no entity that may compare exactly with SCD, the genetic basis of SCD is well established. So sannipatika Pandu, Beeja Dushtijanya Pandu/ Kulaja Pandu / Anuvamshika Pandu may be some similarities with SCD. Here the involvement of Vata and Pitta Doshas can be considered because inside the body Vata Dosha is the initiator of any change, while the transformation or mutation is caused by Pitta Dosha. Hence, in this condition, Vata and Pitta Doshas are equally responsible for Prakriti Vaipareetya of Dhatu. Prakriti of each Dhatu is maintained by Kapha Dosha. Changes in Prakriti denote Shleshma Kshaya tending to Dhatu Vaipareetya. So in the present context, the Doshika status of the disease can be analyzed as Vata-Pitta provocation along with depletion of Kapha.

The sickling-positive children belonged mostly to scheduled castes and scheduled tribes. They included Raita (14.89%), Sabar (9.57%), Beera (8.51%), Mandal (8.87%), Lima (7.45%), Majhi (6.38%), Karad (6.38%), Gomango (4.6%), Dalbehera (3.9%), Raika (3.19%) and others like Karjee, Jani, Mali, Misal, Ganta, Paspureddy, Kaunri, and Desnaidu etc. (26.24%)(17).

## 13. Satellite units (Sickle cell unit at District headquarters hospital) [18]

12 such units are functioning in the district of Sambalpur, Balangir, Bargarh, Jharsuguda, Sundargarh, Deogarh, Angul, Boudh, Kandhamal, Kalahandi, Nuapada, Sonepur. Each unit is managed by one Program Associate and one Laboratory Technician.

- Various services are provided at sickle cell district units including screening for sickle cell hemoglobinopathy by sickle slide test and Hb electrophoresis, registration of sickle cell trait and sickle cell disease, providing counseling, and referring to nodal center.
- Health Camps are organized according to targets given by NHM each year. Last year (2016-17) residential school screening for sickle cell hemoglobinopathy in 12 project districts was conducted in collaboration with the RBSK program and 12511 no children were screened.

## 14. Various Clinical research outputs on Sickle Cell Anemia

As there is no exert remedial treatment in any path, some Ayurvedic researchers are trying to find out probable Ayurvedic remedial treatment for the benefit of the affected patients based on the principle of treatment of Ayurveda.

A clinical trial was conducted by P.K. Panda et al19 regarding the maintenance of hemoglobin levels and prevention of repeated blood transfusion in Sickle Cell Anemia with the classical formulation. Brihat Lokanath Rasa along with Lakshya Guggulu was trial on 30 Patients in proper dosages in two groups. Statistically significant results were inferred in fever, weakness, pain in extremities. Abdominal discomfort, Liver and spleen enlargement and Haemoglobin Gm%. Reducing the frequency of Blood transfusion was observed during the treatment schedule as well as two years' follow-up period.

Another study was conducted by Dr. C. P Sinha et al20. A 14year old male child diagnosed case of HbSS complaints of pain in the Right hip region, pallor, lassitude, and generalized body ache for the last two months relieved by rest and simple analgesics. The patient was treated with Panchtikta guggulu (PTG) ghrita sadhit Majja basti (Bone marrow of goat) in a dose of 30 ml daily for 15 days with a gap interval of 15 days, like this the medication regimen was continued continuously for a total of 45 days within the period of 90 days. Table No. Before and after treatment assessment of the Subjective and Objective parameters

**Table 4.** Sudipta Bez,Utkalini Nayak, Pradip Kumar Panda, Manoranian Sahu, Sushmirekha Panda

| Sl.No. | Objective Features. | Before Treatment | After Treatment |
|---|---|---|---|
| 1 | Hemoglobin | 7.4 g/dl,: | 8.5 g/dl |
| 2 | White Blood Cell | 15100/cumm | 8000/cumm |
| 3 | Platelet: | 2.7 lac | 2.74 lac |
| 4 | Homozygous sickle cell disease | HbSS | HbSS |
| 5 | ESR: | 30 mm/h | 15 mm/h |
| 6 | Plain radiographs (Pelvis and hip joint | hypoplasia, sclerosis, articular marginal irregularity, and subarticular cystic changes. | Less hypoplasia, necrosis area saw bony granulomatous formation, developed articular marginal regularity |

Panchtikta guggulu (PTG) ghrit is of mainly tikta and kasaya rasa which cleanses the pathway of dhatus specifically in asthi and majja dhatu and provides space for rakta dhatu to enter the minute srotas to work in tissue and cellular level. Majja having high quality sneha possessing qualitatively guru guna works as carrier of vitamins, protein and minerals. Majja sadhit PTG is a double standard (yamaka) sneha dravya where majja contributes unique qualities of sneha blended with the compound form of sneha present in PTG in ghrita form which is told as sanskarvahi in ayurveda. Hence it works at the cellular to the molecular level. Palliative care in Ayurvedic management gives effective results in handling the case of AVN of the femoral head. Progression of the disease slows down within a few months and improved quality of life in the concerned patient was observed.

A clinical study on 30 sickling patients (15 patients each in Group-A and Group-B) was conducted by P.K. Panda et al21. The Subjective and Objective parameters were assessed at 10 days' intervals in Group-A patients who were treated with Herbo-Mineral Compound (500mg) and Group-B patients with Guduchi Satwa (500 mg) twice daily on an empty stomach with honey orally for 30 days respectively 21.

It has been observed that there were 65.15% and 40.85% of improvements in signs and symptoms and 25% & 17.65% of increases in the level of Hb gm% in the patients of Group-A and Group-B were observed in this study respectively. The Statistically significant (P <0.005) result was revealed in both Group-A and Group B but improvement was noticed more in Group-A.

The overall study revealed that the trial on Herbo-Mineral Compound i.e., Group-A showed more efficacy than Guduchi satwa i.e., Group-B. The composition of the Herbo-Mineral Compound may help more to develop the body immunity as well

as maintain the haematological parameters rather than single Guduchi satwa. No adverse effects were noticed during clinical trials in both groups.

An In-Vitro study 22 to observe and understand the Anti-Sickling effect of Guduchi Satwa and its associated Herbo-Mineral Compound on Sickle RBCs (HbSS) was conducted in collaboration with the Department of Biochemistry, the University of Delhi South Campus, New Delhi. The study was primarily based on lab-based incubation with the compound microscope associated with the auto-capture CCD camera available at the GAC Balangir laboratory (Lawrence and Mayo Brand). Further confirmation was obtained by subjecting the RBCs to induced sickling process by treatment with Sodium Metabisulfite as solvent and incubating in hypoxic condition over 4 hours. This process enabled us to observe the physical changes in the cellular morphology. In order to study the anti-sickle effect of the drug, the same blood sample was mixed with Methanolic solution as per calculated value of Guduchi Satwa and Herbo-Mineral Compound at 250mg and 500mg dosage each using the same methodology of in vitro sickling and the results were observed using the microscopic technique. It was observed that both the dosage, 250mg of Guduchi Satwa and Herbo-Mineral Compound did have antisickling effect but the 500mg dosage was found to be more effective in case of Herbo-Mineral Compound sample as compared to the Guduchi Satwa.

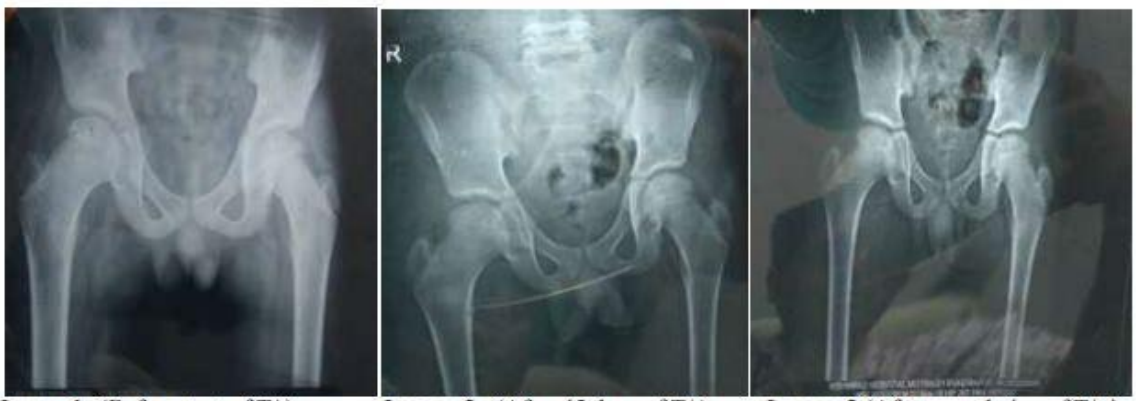

**Image 1:-**(Before start of T/t) **Image: 2** (After 45 days of T/t) **Image: 3** (After completion of T/t i.e. 90 days)

**Figure 3. (1,2,3).** Improved quality of life in the concerned patient

### 14.1. Microscopic Images: Sample A mixed with Sodium Metabisulfite

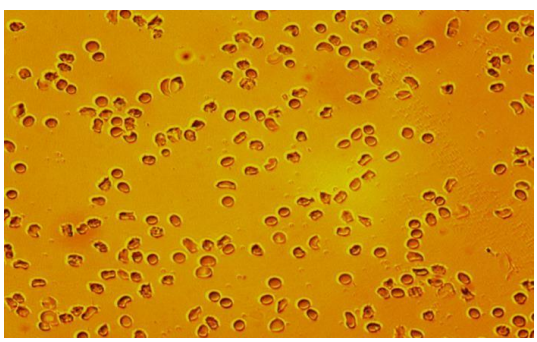

**Figure 4.** Sample-A at 0 hours

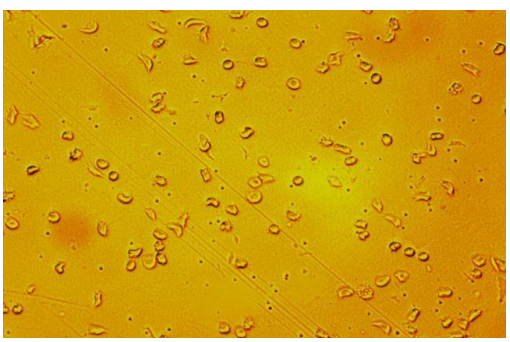

**Figure 5.** Sample-A at 4 hours

**Figure 6.** **HMC (250mg) at 4 hours**

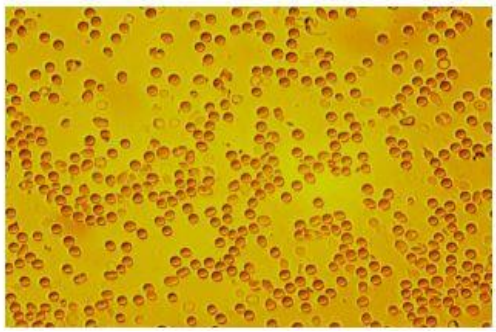

**Figure 7.** **HMC (500mg) at 4 hours**

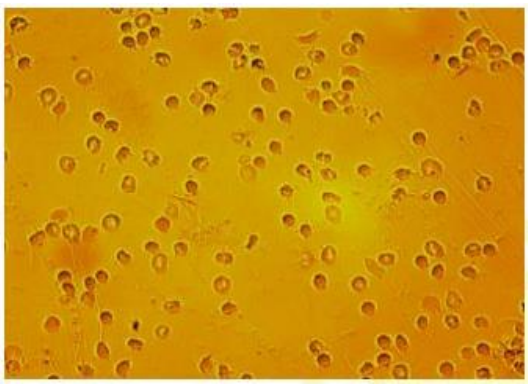

**Figure 8.** **GS (250mg) at 4 hours**

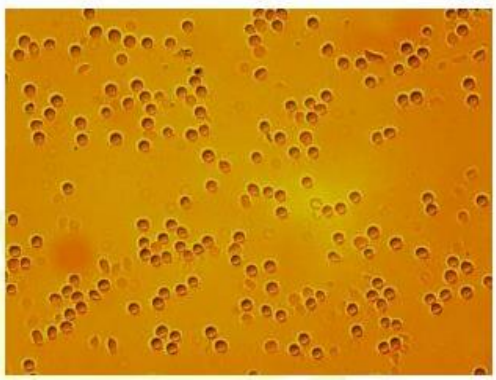

**Figure 9.** **GS (500mg) at hour**

## 15. Conclusion

In this study Genetic basis of SCD and Beejadushtijanya Pandu has been proved from both modern and Ayurvedic point of view, both shows similarity in pathogenesis and in some clinical presentation so it can be concluded that Sickle cell disease and Beeja Dushtijanya Pandu/ Kulaja Pandu / Anuvamshika Pandu appears to be appropriate for correlation.

Different clinical trials were conducted by different researchers and encouraged result were revealed, however the drugs taken for clinical research required more extensive study related to physio-chemical analysis, drug toxicity study, animal study and higher sampling studied.

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