

Menstrual Blood Banking

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ABSTRACT

We adopt many habits to stay healthy. Everyone craves to protect themselves against diseases in their life. Due to age, injury or illness, the body's natural ability to regenerate itself is broken down leading to degenerative diseases. Currently available medications help manage only the symptoms of these diseases but do not attack the root cause and therefore are not very effective. Until now, menstrual blood has typically been discarded as unsanitary waste. Existing new research shows that menstrual blood is a rich source of self-renewing stem cells that have a high potential to treat ailments in the future through stem cell therapy. Discovering curative power of stem cells has been a revolutionary breakthrough in the field of surgery and medicine till date, which has actually given many- the precious gift of life.

This study is aimed to educate the public to hold the potential to save themselves from future ailments and understand that menstrual stem cells obtained from the menstrual blood offer the best potential to display high concentrations of stem cell growth factors. As investigators we are happy about this new innovation and feel that it is our duty to educate women about the most miraculous thing of contributing medically to save lives through the endometrial regenerative cells (ERC) or stem cells harvested from discarded menstrual fluid.

Keywords: Menstrual blood, menstrual blood banking, endometrial regenerative cells.

INTRODUCTION

The menstrual cycle is a normal process that happens to nearly all women during their childbearing years, from puberty till menopause. Menstrual blood is not just blood it's also made up of tissue from the uterine lining. It also contains the remnants of the egg that travel down the fallopian tube into the uterus during ovulation and wasn't fertilized. Many biochemical and histological events occur unnoticed by the fertile female; however, the monthly menstrual cycle is a repeating reminder that she is capable of conceiving and developing new life.

Earlier blood from umbilical cord was regarded as the ultimate reserve for stem cells. Only those who have given birth at anytime of their life were able to preserve the stem cells as they were obtained from umbilical cord. But, researchers have now discovered & successfully harvested stem cells from menstrual blood making it possible for all the women including those who have never given birth to preserve stem cells for themselves. Stem cells in menstrual blood have similar regenerative

capabilities as the stem cells in umbilical cord blood and bone marrow. They are highly proliferative and possess the unique ability to differentiate into various other types of healthy cells such as cardiac, neural, bone, fat and cartilage^[1]. The discovery of stem cells in the menstrual blood has given a new meaning to menstruation for women who earlier considered menstruation as nothing but a pain full and necessary evil^[2].

HISTORY

A stem cell is a cell that has the ability to continuously divide and differentiate into various other kinds of cells/tissues. In 1968, the first bone marrow transplant was successfully used in the treatment of SCID. In 1954 Enders received a Nobel Prize in medicine for growing polio virus in human embryonic kidney cells. The first mammal cloned from adult cells was Dolly, the sheep in 1996 and mice, cows and pigs were cloned subsequently in 1998 and 2000. In this 21st century cats, rabbits, mule, Bull and dogs were given life^[3]. A British research team has

reportedly grown part of human heart from stem cells for the first time. The break through has raised hope that eventually whole hearts will be grown to replace diseased organs [4]. Laws banned reproductive cloning as of 2004.

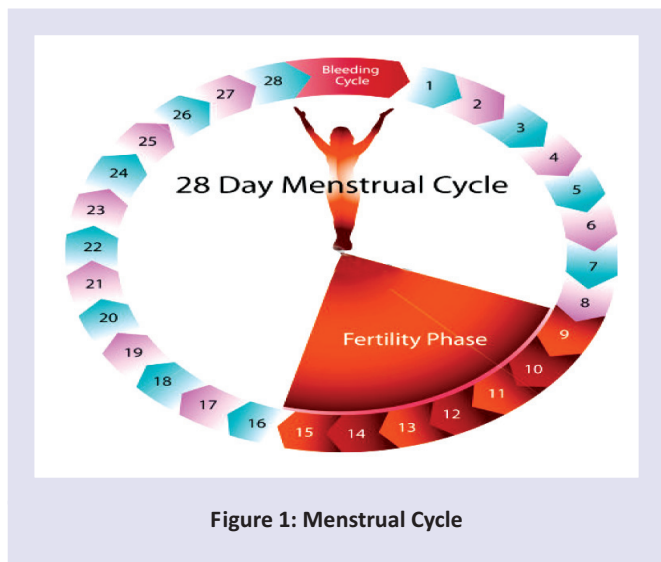


Figure 1: Menstrual Cycle

Women are Goddess after all, they give life. Life is in the blood. Through the women life continues on, heals, changes into what is needed. The life is in woman's blood. In 1700's in France, menstrual blood was viewed as a seductive scent and an indicator that a woman was fertile. In 1831 France Charles Negrier proposed the idea that menstruation controlled ovulation. During 18th century female factory workers in France were asked not to work in sugar refineries during their periods for fear that they would spoil the food. There is a short story saying that the women of tribes would save their blood clots from their menstrual cycle in a small tube that they carried around. If anybody would be seriously wounded with profuse bleeding they used to put some of the blood clot stash on the wound. The wound would heal over night and bleeding stopped because the clot coagulated the blood on the spot [5].

Although menstrual blood banking is still new and lots of research is still going on menstrual blood, if its benefits are utilized, it can prove to be very beneficial for all women who want to give themselves the gift of good health [6].

It can be said that menstrual blood banking has a vast scope in future and is the next big thing in the medical world.

Cryo-cell international, USA is the world first private stem cell bank and has 18years of experience. It is also the innovator of menstrual blood stem cell banking. Life cell is the first and only menstrual company in India established in technological collaboration with cryo- cell.

The Patient Lisa Ray an Actress & Stem cell Beneficiary, was diagnosed with multiple myeloma – a rare incurable form of blood cancer. Today she is back to her career, which is as exciting and blissful to her as before. She owes this to stem cells which made this happen and gave second life to her [7].

Benefits

Menstrual blood banking enables women to store their menstrual blood under required conditions and preserve it for future. They appear to be able to differentiate into many kinds of cells and are immunologically immature, offering them the potential to promote cell survival rather than play a cell replacement role when transplanted [8]. Human umbilical cord blood cells are limited to collection at the time of birth. Menstrual blood derived stem cells (MenSCs) could be collected once a month for 40years from women during their reproductive stage [9].

The below highlights the advantages of menstrual blood stem cells [7].

Menstrual stem cells are unique because they have many properties and characters similar to both bone marrow and embryonic stem cells.

1. Menstrual blood is a rich source of mesenchymal stem cells that have the future potential for giving rise to fat, cartilage, bone and skeletal muscle cells and may be potentially used for regenerative stem cell therapy.
2. They are more proliferative and multiply for longer duration without damages to DNA.
3. The purified mesenchymal stem cells are very valuable in the future to treat a number of critical diseases like osteoporosis, rheumatoid arthritis, spinal cord injury, Alzheimer's, Parkinson's, diabetes, heart diseases, stroke, atherosclerosis, inflammatory bowel disease, and more than 75 diseases can be treated.
4. The stem cells are well tolerated with no potent deaths, no toxicity or any adverse side effects.
5. Menstrual blood extraction is quiet, painless, natural and harmless. Menstrual stem cells can be easily harvested in an affordable, painless and non-invasive manner.
6. Stem cells from renewable menstrual blood can also be a low cost option.

Stem cells come from two main sources: embryos or adult tissues. Embryonic stem cells can give rise to virtually any cell type in the body, but they are controversial

because conventional procedures for obtaining them involve the destruction of an embryo. Adult stem cells, such as those found in bone marrow, do not pose the same ethical concerns, but they have limited powers and collecting them can require invasive procedures^[10].

While the new technique of reverting skin cells to an embryonic stem cell-like state promises to overcome the ethical dilemmas, this approach could come with safety concerns that make the cells too risky for use in humans. The technique for converting the skin cells involves using viruses to insert several genes, one of which is known to cause cancer^[11].

Compared with the stem cells from other sources, such as bone marrow and cord blood, menstrual stem cells are easier to collect, do not cause any harm or pain to the donor and can be collected for more than 35 years, from 12 years old to 47^[12].

Process of Collecting

The process for collection of menstrual blood is simple. Like tampon, a silicon cup is inserted in the vagina on the day of heaviest flow. The cup needs to be placed inside the vagina for at least three hours so as to collect approximately 20 milliliters of blood. This is then poured in the collection kit and is sent back to the menstrual blood bank laboratory where it is processed, frozen and stored. The menstrual stem cells are stored in two cryo vials that are overwrapped to safeguard them during storage^[2].



Figure 2: Equipment for testing Menstrual Blood

i. Processing

Sufficient care is taken to ensure that the sample reaches the lab within 3-4 hrs. Then the menstrual blood is tested, processed, separated and stem cells are harvested.

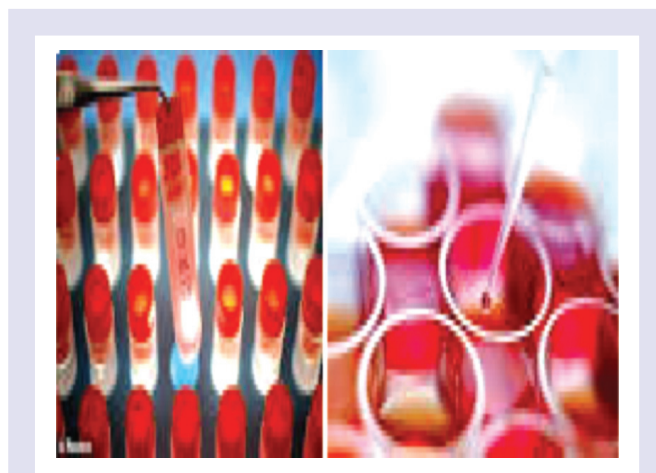


Figure 3: Cryogenic storage of Menstrual Stem Cells

ii. Storage

During the process of preservation, menstrual stem cells are frozen in time by placing them in liquid nitrogen storage containers for cryogenic preservation at -196°C . This procedure enables the stem cells to retain their potency and viability even for decades in a cryo – preserved form. The person has rights over the preserved stem cells for use at anytime during the storage period, which can be subsequently renewed upon requirement.

iii. Retrieval

For retrieving the stored stem cells the individual is requested to submit a written request accompanied by the doctor's certification as per the guidelines of ICMR for approved therapies / clinical trials^[7].

SCOPE AND FUTURE BASED ON RESEARCH LITERATURE

Regenerative Medicine: Stem cells for disease treatment?

It is now established that endometrial wall of uterus has unique quality of regeneration. There is a thick growth of blood cells which are dispelled every month and the uterus prepares a new endometrial lining and prepares itself for pregnancy. The shed blood contains varied cells with regenerative properties with serial analysis. Researchers found that these cells cannot only be harvested but also differentiated into specific cells like cartilage, neural tissue / adipose tissue^[13].

- Scientists report that menstrual blood contains adult stem cells that can develop into nine different types of cells- Heart, lung, nerve cells muscle, inside of blood vessels, pancreatic, liver & bone cells^[14].
- Wang H et al^[15] explained that menstrual blood

stem cells were isolated from the menstrual blood of two women and cloned by a San Diego company to save the legs of eight severely injured mice.

- Studies examining transplantation of Men Scs into laboratory cultures and animal models (invitro and invivo) of stroke have demonstrated a potential for protection against oxygen – glucose deprivation ^[16].

- Factors secreted by the transplanted cells were able to offer a neuro protective effect. This may relate to the cells secreting vascular endothelial growth factors (VEGF), brain – deprived growth factors (BDNF) and neurotrophin- 3 (NT-3) all of which have potential benefits for the treatment of stroke ^[17].

- Menstrual blood can overcome the problem of immune rejection during the transplant, allowing the female patients to use their own stem cells for treatment ^[18]. The menstrual stem cells seem to have an immune system – suppressing effect that could enable them to be transplanted into the people without rejection which is major problem with embryonic stem cells ^[19].

- The cells from menstrual blood termed endometrial regeneration cells (ERCs) that express CD9, CD29, CD44, CD59, CD73, CD90, and CD105. These cells have been demonstrated to differentiate into nine different cell lineages (cardio, myocytic, respiratory, epithelial neurocytic, myocytic, endothelial, pancreatic, hepatic, adipocytic and osteogenic ^[20].

- Dwaine Emerich, a section editor for cell transplantation said that transplanted MMCs also significantly restored impaired cardiac function, decreasing the myocardial infarction (MI) area in the nude rat model, with tissue of MMC-derived cardiomyocytes observed in the MI area invivo. Thus, MMCs appear to be a potential novel, easily accessible source of material for cardiac stem cell-based therapy ^[21].

- Menstrual blood – derived cells confer human dystrophy- expression in the Murine model of Duchene Muscular Dystrophy via cell fusion and myogenic trans differentiation. In -vitro analysis revealed that endometrial progenitor cells and menstrual blood – derived cells can efficiently trans differentiate into myoblasts / myocytes, fuse to C2C12 murine myoblasts by in vitro co-culturing and start to express dystrophin after fusion ^[22].

- Now, news that stem cells found in menstrual blood – along with cells from babies umbilical cords – could potentially be incorporated into treatments for stroke, Alzheimer’s disease and Lou Gehrigs disease, or amyotrophic lateral sclerosis ^[23].

- Evidence of anti – inflammatory effects and secretion of specific cytokines and growth factors that promote cell survival, rather than cell replacement, have been detected in menstrual stem transplanted cells ^[24].

- Endometrial stem cells injected into the brains of mice with a laboratory – induced form of Parkinson’s disease appeared to take over the functioning of brain cells eradicated by the disease.

- Parkinson’s disease results from a loss of brain cells that produce the chemical messenger dopamine, which aids the transmission of brain signals that coordinate movement. The findings raise the possibility that women with Parkinson’s disease could serve as their own stem cell donors. Similarly, because endometrial stem cells are readily available and easy to collect, banks of endometrial stem cells could be stored for men and women with Parkinson’s disease ^[25].

- New Research will explore potential use of stem cells from menstrual blood to treat endometriosis and female urinary incontinence. Florida-based Cryo-Cell International, a leader in stem cell cryopreservation, has partnered with Cryopraxis, a Brazil-based company known for its expertise in regenerative technology to conduct clinical studies using menstrual stem cell technology (Men SCs) to identify potential future diagnostic and therapeutic uses for endometriosis and stress urinary incontinence in women ^[26].

- The ERC’s can be processed and preserved effortlessly for future implementation. Researchers say that these cells have a higher reproduction rate, doubling every 19.4 hours, compared to the elements cells from other sources. Compared to bone marrow, menstrual blood yields almost 30 times more stem cells ^[27].

- The article plasticity of human menstrual blood stem cells derived from the endometrium” by Lin et al. (2011), described a newly identified mesenchymal – like stem cell (MSC) from human menstrual blood known as Men Sc. It clarifies the difference between human adult stem cells from menstrual blood and endometrial tissue. Until now MMSCs were derived from the bone marrow. New sources of similar MMSCs have also been discovered such as umbilical cord, adipose tissue, dental pulp, etc. MMSCs obtained from the menstrual blood offer the best potential for clinical translation as they also display high concentrations of stem cell growth factors (up to 10,000 times more) says Dr. Ajit kumar, CSO, Life cell international ^[28].

- Stem cell technology is the future of medicine. Experiments performed at the Keio University school of medicine have succeeded in growing sheets of heart muscle from connective tissue cells harvested from

menstrual blood when it comes to growing heart muscle, however, the connective tissue cells in menstrual blood have a success rate 100 times higher than the 0.2 – 0.3 percent for stem cells taken from human bone marrow^[29].

Why preserve now?

When it comes to making major life decisions, there is no time like the present and when it comes to something as important as collecting potentially life saving stem cells found naturally in menstrual blood, the ideal time Now-Today

Ability of the body to produce stem cells is higher when you are young and it decreases with age. Research show that body's ability to produce mesenchymal stem cells decreases rapidly with age. At the time of new born about 1 in 10,000 bone marrow cells are mesenchymal, whereas by the time we age to 70 only 1 in 1,00,000 bone marrow cells are mesenchymal – a reduction by a factor of 100.

Younger the age these cells have more potential to replicate and can multiply faster.

'Potency' of the stem cells is the capability of these stem cells to transform into various types of tissues in the body. Again the younger the age, these cells have a better fitness to become a larger ranger of tissues or organs^[7].

CONCLUSION

Menstruation serves an important purpose, clearing the uterus out monthly in order to prepare the womb for a potential pregnancy. Women create life, but now they will contribute medically to save lives through the Endometrial Regenerative Cells (ERC) or stem cells harvested from discarded menstrual fluid. With thorough advancements going on, medical fraternity is sure that the future of regenerative medicine has arrived. While more in – depth researches are required to establish medical employment of endometrial stem cells, the new finding is definitely a momentous achievement in the field of stem cell transplant.

Although menstrual stem cell technology has not been fully utilized to date, the collective body of ongoing research may potentially change the types of therapies used to diagnose or treat a host of significant medical conditions in the near future. There are an increasing number of companies that allow women to harvest stem cells from her menstruation and cryogenically preserve them until she needs them for medical treatment.

The process of collecting menstrual blood stem cells is quite simple and safe. Every women should explore the possibility of banking her stem cells to safeguard herself from future life threatening diseases and every woman should thank god for giving the precious gift of life (i.e)

Her "Period". Every woman should think of a pledge Now.

"My period could save my life. i will invest in banking menstrual stem cells. I will preserve my gift and let others discover my power of regeneration with strong scientific foundation. I will extend my responsibility to safeguard my family's health". OK, initiate an action of paving a road towards the development of an effective cell based therapy overcoming numerous technical, legislative, and ethical and safety issues. Today's woman must come forward and give their vital contribution.

CONFLICT OF INTEREST

The authors declared no conflict of interest.

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