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ORIGINAL CONTRIBUTION

Stem Cell Preservation- An Emerging Trend in Medical Science

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ABSTRACT

From the dawn of civilization mankind is mostly devastated by deadly diseases. Those events make them realize the necessity to find out the way to prevent those. From the beginning, People are fascinated about the human body to explore the causes and the necessity to control diseases. Science shows different ways to fight against those diseases, but unfortunately new kinds of diseases are showing their existence and they are more complicated, and more deadly. Even significance advancement in the medical science most of these diseases remained uncontrolled. In this scenario concept of stem cell preservation came into existence. It shows new way of cure. But lots of controversies are associated around it. In this paper we are trying to find out the advantages and disadvantages of Stem cell preservation and the level of acceptance of it by the population. We have collected Secondary data from recent online journals, articles on history and pros and cons of stem cell preservation.

Key words: deadly diseases; stem cell; stem cell preservation; medical science, human body.

1. INTRODUCTION

Stem Cell:-

The research on stem cell leads to a mind boggling breakthrough in bio science. It tells how our entire body has developed from a single cell. Embryology shows the way of development of organ inside the mother's womb. Proper development of each organ inside the womb is very important and to do it in right way, it needs a special instrument. Stem cells are those sets of equipments. Stem cells are possessed of some unique and remarkable characteristics. The stem cell is the only cell which can change themselves into other kinds of cells or tissues. The lungs, heart, skin, sperm etc are formed by the transformation of stem cells. The stem cell can also multiply into several numbers for the renewing purpose. The stem cell can easily get on with active state from their long inactive status. The differentiation is the process of conversion of stem cell into other types of tissues. Inside the 3 to 5 days old embryo called blastocyst, stem cells begin to act. The body

parts are begin to form inside the embryo. That is how we grow.

Genetics and its relation with stem cell:-

The scientists have studied genetics a lot. Genetics tells the root cause of our characteristics. It can also predict the level of probabilities of every disease could occur because the root causes of each disease are hidden inside our genetic code. Different tissue in our body have same gene but have a different expression. Like in case of gene of lung tissue is having same gene as in heart tissue but gene are expressed differently. Also lung cell cannot be heart cell. That is why they are specialized cell. Like lung cell, heart cell, RBC all is specialized cell. But stem cells are unspecialized cell. They can be transformed into any cell.

If we could comprehend the cause of the disease and the process of renewing the damaged body; we could treat nearly every diseases. The Studies on genetics and stem cell together are showing

us the future way of treatments which will be completely different from now. The concept of Cell Based Regenerative Therapy is unusual and interesting terminology. It is a kind of treatment which is done by the use of cell regeneration. Cell based regenerative therapy is not possible without using stem cell in treatment process. So we could say that in the near future the Stem cell and genetics will play an important role in the treatment.

Types and Use of Stem Cell:-

The stem cells have two types, embryonic stem cells and non embryonic or somatic or adult stem cells. The term embryonic stem cell suggests that the cell is related with embryo, they are found in embryos. Embryonic stem cells can remain undifferentiated until under appropriate condition they can start to grow again. The embryonic Stem Cells became differentiated and gives rise to different tissues. In the previous time the adult stem cells are thought to be undifferentiated kinds of stem cells but research suggests that they turn out to be differentiated in different tissue of that organ they are living, under favorable condition. The adult stem cell repairs and maintains the tissue of the organ within which they are living. Discovery of adult stem cell is truly incredible achievements. Scientists have found stem cell in all fundamental organs like heart; brain, bone marrow, blood, blood vessel, teeth etc which was quite unexpected before. After that the researcher started to think for transplantation by using stem cells.

The scientists are doing relentless research on the field of stem cell and genetics to find out the ways to use them in the treatment. In fact, they already have started to treat some diseases by this process, but not every disease. Most of the diseases are still in experimental stage so it needs some time. Scientists already knew that the main cause of every disease lies in genetics and now they are trying to identify the cause, influencing factors of transformation of undifferentiated stem cells to differentiated stem cells. Combination of these two they are going to develop a new way of treatment. Stem cells are

also used in testing of new drugs. We can easily predict that in the future, treatments of the different complicated diseases like macular degeneration, spinal cord injury, stroke, burns, heart disease, diabetes, osteoarthritis, and rheumatoid arthritis; will be possible by stem cell. Study is also showing that different heart diseases like coronary heart disease, hypertension, congestive heart failure etc will also be treated by cell based therapy soon. The other health problem such as immune rejection will also be treated by stem cell therapy. Collecting and storing the umbilical stem cell is the only way to do it, because we cannot produce stem cell in the laboratory or we will not find umbilical stem cell from anywhere other than umbilicus.

Collecting and Storing the Umbilical Stem Cell:-

Collecting and storing the umbilical stem cell is important topic to be discussed. The umbilical cord is attached baby with the mother. The nutrients are passes through the umbilical cord from mother to baby. Also the excretory substance are passing through the umbilical cord from the baby to mother. The umbilical cord and the blood inside it, are rich with stem cells. After delivery the umbilical cord and the placenta are detached from the mother. So if we want to collect the umbilical stem cells we have to collect it from the umbilical cord and blood soon after delivery. That is what is actually done. After delivery the part of umbilical cord, umbilical and mothers blood are collected and send it to the laboratory for testing. Testing is necessary because it reveal the data regarding the stem cells count, viability and sterility of the sample. Also the blood of mother is also telling whether the mother is having any blood borne disease or not. From site of collection to the laboratory, samples are transferred in extreme caution, like the box containing the sample is kept aside of sunlight, X rays etc. After getting green signal from the laboratory the samples are then sent for the preservation. The stem cells are preserved with extreme caution for decades in -200°C. It should be noted that collecting and preserving the stem cells are not creating any

danger for the mother or the child because they are collected after the delivery and the umbilical cord, blood in it and the little amount of mothers will have no use except collecting and storing of stem cells. In fact previously the umbilical cord as well as placenta is handled as bio medical waste until they have found they are extremely important.

The process of preservation of private and public cord blood banking differs some ways. In case of private cord blood bank there are charges for collection and storage of cord blood. Donors of Private cord blood bank do not have any choice; the cord blood is used by the family only. No one except the family who has donated it can use it for their purpose. It is not used by the community. Infected or contaminated or blood with inherited diseases, are not sent for storage. In case of public cord blood bank the collection and storage is free of cost. As the public cord blood banks are used for the general people so once it is stored it can be used by anyone from anywhere in the world because most of the time the patient did not find the right match among the relatives so in that case they can have huge options.

Motivating the people to donate:-

Motivating the people to donate the cord blood for the purpose of future use is a challenging job because it needs to look after all the factors associated with it like race, religion, corruption, level of education, level of economic conditions, political situation and many more. It should be noted that if we want to make them donate their cord blood they need to be educated. Proper education will throw away the stigma and will create the awareness and motivation. Many of the country in world are able to motivate them, but still lots of people are not interested as they have very little or wrong conception on stem cell banking. In India mixed awareness levels are there among the people. Though many private and public sectors are working on stem cell preservation and also they are trying to motivate the people for stem cell preservation.

Purpose of the Study:-

So it is becoming crucial to analyze the level of awareness regarding stem cell preservation among the Indian people. The types of researches which are going on in India regarding stem cells and genetics are needed to explain. The market value of research on stem cell is also necessary to describe and ultimately the pros and con of stem cell will be discussed as well.

A study done by Deeksha Pandey, Simar Kaur, and Asha Kamath in a peer reviewed open accessed journal named PLOS one. They have studied the level of awareness of pregnant women in India. They have found that the awareness level is poor among Indian mothers. The mothers have expectations from their doctors to be informed regarding that. 26.5% of Indian pregnant women have clear concept on cord blood banking. Level of awareness is closely related with level of education the mother is having. Study also showed that level of awareness and willingness to donate is far more in USA and UK than India. The study brings a terrifying picture; it tells that 58% of Indian doctors are either unaware or misinformed about the indication of Umbilical Cord Blood transplantation for that reason only 40% of doctors and 69% of general populations is showing interests on Umbilical Cord Blood Banking.

A research paper named “Stem Cell Banking-Awareness and Acceptance by Expecting Mothers in Mumbai Region” by Abha Ashish Wankhede & Kavita Laghate published in International Journal of Business and Management; Vol. 10, No. 12; 2015. According to the study the level of awareness is depending upon age group, education level, type of family (nuclear or Joint) the mother belongs to, and the house-hold income of the family. The study also shows the highest age group is showing maximum awareness level and higher the family income greater is the level of awareness. The study also shows a striking result. It is said that only 34.4% of mother are aware of Stem Cell Banking but after being informed 79.4% of them accepts to donate their umbilical cord blood. The study portrays other kind of picture. It is said

there are huge misconception regarding the cost of private stem cell banking. 33.4% of them think it costs more than 3 lacks and 44.5 % of them think it is around 1 Lacks to 3 Lacks. When they are asked what will be their affordable price they said between 10,000 to 1 Lacks. Practically it costs around 75,000 and also they have EMI facilities which are completely remained unknown to them.

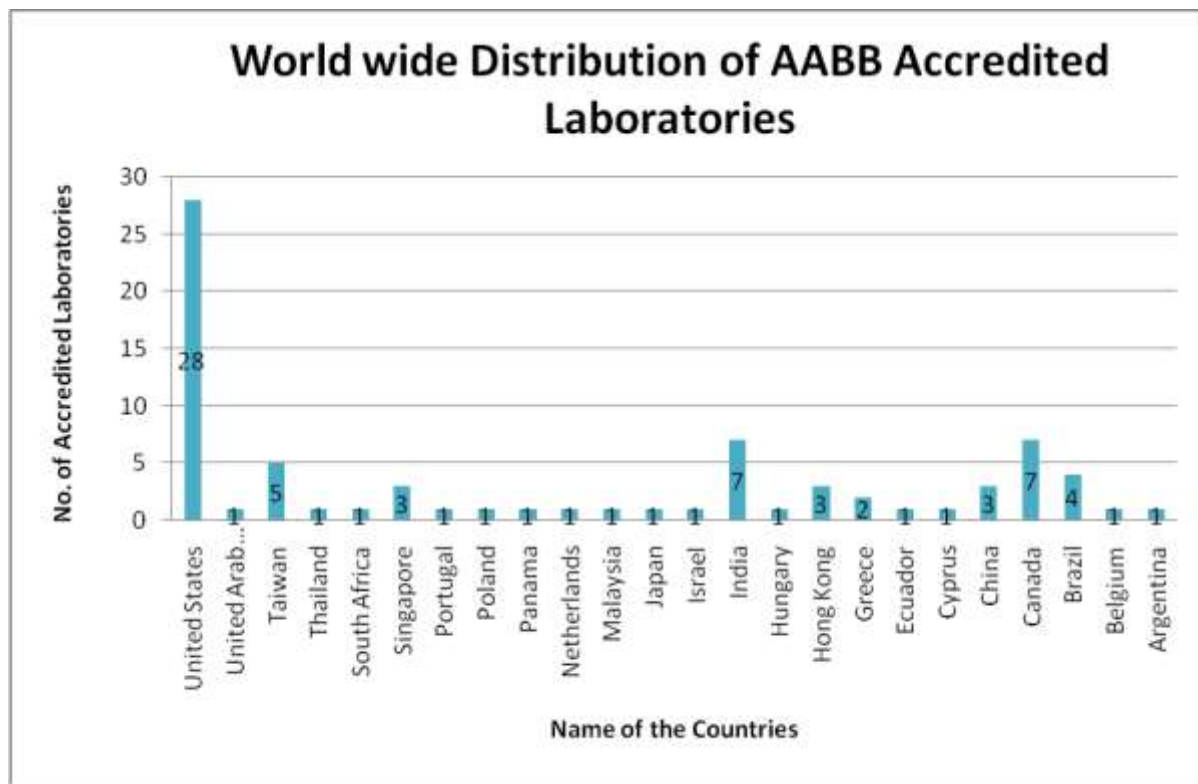
A research paper named “Religious Perspectives on Umbilical Cord Blood Banking” written by Christopher FC Jordens, Michelle AC O’Connor, Ian H Kerridge, Cameron Stewart, Andrew Cameron, Damien Keown, Rabbi Jeremy Lawrence, Andrew McGarrity, Abdulaziz Sachedina and Bernadette Tobin. According to the study the Catholic tradition, Anglican tradition, Muslims, Hindu, Jainism are accepting the cord blood banking but Judaism does not allow it.

A paper named “A study on Cryo stem cell Banking in Mumbai- Awareness and Acceptance by Customer” by Shivaji Duttatraya kadam. In the paper it is said that daily birth rate in India is about 80,000 that makes India a largest market place in Cord Blood Banking Industry.

Different private and public stem cell banking are motivating the people to donate the cord blood. The companies are publishing different online ad, blog, videos. They are maintaining their website by which the people can be educated and ultimately attracted towards it. The social media are included too. They are posting advertisements in the social network so that the portions of the people can be attracted towards it. Presently 15 companies are preserving stem cells privately in India. They are as follows

1. M/s. Path Care Labs Pvt. Ltd
2. M/s. Stemcyte India Therapeutics Private Limited
3. M/s. Best Wellcare Management Services Pvt. Ltd. (Indu Stem Cell Bank)
4. M/s. Cryobanks International India Pvt. Ltd
5. Unistem Bio Sciences Pvt. Ltd
6. Lifecell International Pvt. Ltd
7. TotipotentRX Cell Therapy Pvt. Ltd
8. Narayana Hrudayalaya Tissue Bank & Stem Cells Research Centre
9. Cryo Save (India) Pvt. Ltd., 183, Gayathri Tech Park, EPIP
10. Reliance Life Sciences Pvt. Ltd., at Dhirubhai Ambani Life Science Centre
11. M/s. Ree Laboratories Pvt. Ltd.
12. Regenerative Medical Services Pvt. Ltd
13. Lifecell International Pvt. Ltd
14. Jeevan Blood Bank and Research Centre
15. Cord Life Sciences India Pvt. Ltd

Ordinary laboratory can’t be able to examine the cord blood before storage. Supreme quality is needed for that reason an accreditation body is needed. AABB (American Association of Blood Bank) is a united state based worldwide professional body and standard organization. It is now an international organization including 80 different countries and they are working in the field of haemopoetic stem and transfusion medicine. It also provides accreditation to the laboratories which perform educational programs, publications and accreditation for Cord Blood programs. There are 78 numbers of AABB Accredited Cord Blood (CB) banks, in the US and throughout the world. Here in the following chart we are trying to show the total number of AABB accredited laboratories throughout the world in the year 2013-14.



The above chart is showing that United States has maximum number of accredited laboratories. They are 28 in numbers which means USA covers about 36% of the total number of accredited lab throughout the world. In case of India, there are 7 AABB Accredited laboratories. It is mere satisfactory in comparison with other countries. From the above chart it is clear that many countries have not enough number of laboratories

The demand is sky rocketing for that reason we can assume easily that more companies will come into the business in the near future. Government of India is taking good steps to facilitate the purpose. Three major regulatory bodies are functioning; Indian Council of Medical Research (ICMR), Department of Biotechnology (DBT) and Drug Controller General of India (DCGI). In the year 2015 fifteen stem cell banks formed an association named The Association of Stem Cell Banks of India (ASBI). The primary purpose of this association is to create awareness regarding the

benefits of stem cells to the general people by arranging different awareness campaigns and develop preservation of stem cells as an essential healthcare service. The association is also facilitating the research. The ASBI and the government of India together involved in the process of implementation and amendments of the rules associated with the stem cell banking. In the year 2014 the Government of India has decided to release the service tax up to 12.36% for the purpose of the preservation of umbilical stem cells.

A report published by The Hindu on January 10th 2016, it said that field of research on stem cell will provide a lucrative career for researchers. India has invested Rs. 1000 crore in the stem cell research. The report also stated that market of stem cell therapy in India was Rs. 1 billion in 2013 and in 2018 it will most likely to reach Rs 2 billion. Global Market value of research on regenerative medicine will reach US \$ 40 billion by 2016. A post graduate on this field can earn up to Rs. 30,000 per month and a PhD holder

can earn more than Rs. 50,000 per month in India and around US \$ 35,000 to 40,000 annually.

Another report published in UK India Business Council on 2nd January 2013. It said that though research on stem cells has just started but still India is showing a potential market on stem cell banking as the country is having skilled workforce at low cost. India has already got 25% FDI CAGR so if foreign policies are become more favorable then huge number of foreign investments may come in the future. Two major foreign health care sectors already came in a partnership like: Johnson and Johnson tied up with Neuronix and Novo-Nordisk tied up with Zymogenetics.

But still in India the Cord Blood banking is not acceptable by many people. Large numbers of people and the doctors are not encouraging their patient for the process. Most of the doctors do not have proper knowledge on stem cell preservation. The patients of India have good faith on doctors so if doctors are not motivated then this will be negative situation. But apart from misconception some reasons explained by the doctors, may have some potential they are as follows

- In most of the time the private cord blood banks are giving false hope.
- The uses of stem cell in most of the treatments are still under experimental level.
- No scientific proof is found which can tell they can treat spinal cord injury, cerebral palsy and even diabetes. Only blood disorder can be proved till now.
- The people are not properly informed that most of the claims are in experimental stages.

Disadvantages:-

Though the cord blood banking has huge benefit but still some disadvantages are also associated with Cord Blood Banking. Some of them are identified by the doctors who are discouraging

the Umbilical Cord Blood Banking. These factors are also taken care of they are as follows

1. Most of the treatments by cord blood stem cell are still under experimental stage.
2. It shows slow engraftment. That means it requires more time to be accepted by human body after it is being administered for the purpose of treatment.
3. Umbilical cord blood has limited cell dose. As the cord blood is containing very small amount of blood as it contain few number of stem cells
4. Once stem cells are donated, the donor cannot check how their stem cells are preserved; the quality maintaining in the storage process is totally beyond their control. Though many private cord blood banks are showing their customer how they are maintaining the storage process but still it is not enough. Private companies are making a legal agreement to its customer, that the company will compensate their customer if the sample get damaged but it is nothing to be compared if life and death situation arises.
5. Autologous donation may have limited benefit owing to hereditary disorders as they contain same genetic code.
6. Private Cord Blood banking is costlier than public cord blood banking.
7. Some genetic disorders in the umbilical stem cells are not detected in the laboratory.
8. If the collectors failed to collect the stem cell from umbilical cord blood it will not be found.

2. CONCLUSION

It is quite understandable that people will show resistance towards new concept. The prove lies in History. The condition is getting more complicated when the concept is on its experimental status and when the resistance came from the people of same domain. Years

and years of experiments, devotions, and sacrifices are needed to implement a new concept. Concept of stem cell is somehow facing that kind of resistance too. So a push is required. Harder the push we give faster the result will get. The Government organization, private organization, investors, researchers, sociologists and of course the general people have such potential for that kind of push. If everyone is not included in this Nobel quest then the outcome will not be satisfactory. People of India have huge faith on doctors. So doctor should encourage the patient. Also the Government and non government sectors should reach educate and motivate the people with the help of digital technology, because digital technology helps the sectors to reach their target customer directly and the people are getting more and more tech savvy. Though umbilical cord blood banking has

some limitations, some of them are administrative, and some of them are scientific but still it will not be wrong to say that Umbilical Cord Blood Banking is the future of medical science. Who can tell after 20 years of research on stem cells, science will reach in such a level when we can think for treatment of the those diseases by stem cell what we are not able to realize now ? If we look back 100 years from now and if we compare the development of science now and then, we will easily be able to figure out the differences, how much science is capable of? If a mother does not go for donating her stem cells for the purpose of storing, she will put their child in danger because in future if the child needs that for treatment, they will never get it back because those were all wasted long ago by her own mother.

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