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Is Regulation of Stem Cell Therapy and Therapeutic Cloning Needed?

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Abstract: The invent of cloning of animals in 1997, opened up a Pandora box of controversies relating to the utility of this technology verses its ethical, religious and medico-legal ramifications. Though, therapeutic cloning has shown promising results in alleviating human sufferings, ethical and medico-legal issues that needs thread bear deliberations also surround it. Some of the issues are; a) source of stem cell; b) consent; c) potential uses verses alternatives; d) commodification; e) moral and ethical principles; and f) risks involved. The paper discusses all the above issues and pleads for need of regulation to control and monitor therapeutic cloning and stem cell therapy.

Key words: Therapeutic cloning · stem cell · ethics · medico-legal

INTRODUCTION

"Global first: AIIMS pioneers stem cell injection", was the headline of The Times of India, one of the leading English daily on Feb.25, 2005 [1]. Stem cells (SC) refer to those peculiar cells those possess the ability to divide for indefinite periods in culture and give rise to specialized cells as they multiply. Stem cells were harvested from bone marrow and utilized for treating blood cancers for time. The interest generated in these has increased enormously in last few years. The cloning of sheep in 1997 opened a Pandora box of controversies relating to the utility of the technique for harvesting SC verses its ethical, religious and medico-legal ramifications.

The SC can be classified into 3 different categories, namely; a) Totipotent; b) Pluripotent and c) Multipotent. This classification is based upon the degree of ability of these cells to differentiate. Totipotent SC has the ability to turn into any type of cell and are even capable of forming whole organism. These are zygote and eight cells derived from zygote after first 3 cell divisions. Pluripotent SC has the ability to turn into any type of cell except placenta. These cells can be derived from inner cell mass (30-200 cells) of a blastula that develops 5 days after fertilization i.e. zygote formation. Multi potent SC has limited ability to turn into only few types of cells. They are adult SC found in bone marrow, neural system, mesenchymal cells and endothelial progenitor cells. All the 3 types of SC can be utilized differently.

STEM CELL THERAPY AND THERAPEUTIC CLONING

During last decade, potential areas of SC therapy have grown widely. The SC have been utilized for treating large number of human illnesses, such as:

- Neurological disorders like brain stroke, Parkinson's disease, cerebral palsy, muscular dystrophy etc.
- Cadiological like cardiac myopathy.
- Ophthalmological like degenerative diseases of eye.
- GIT like diabetes, hepatitis, cirrhosis etc.
- Hematology like leukemia, sickle cell anemia etc.
- Osteology like osteoporosis, rheumatoid arthritis etc.
- Dermatology like burns, injuries etc.

The treatment by SC is not easy and involves: a) isolation, collection, culture and storage of SC; b) Administration of the SC into the body of diseased; and c) directing the SC to produce specific cell type.

TYPES OF STEM CELL THERAPY

Depending upon the source of SC the therapies can be classified into:

- Homologous stem cell therapy
- Heterologous stem cell therapy

Homologous stem cell therapy: The source of SC in homologous SC therapy is the person himself that utilizes the SC for treatment. These adult SC can be harvested from the bone marrow, neural system, mesenchymal cells, endothelial cells [2] and even from olfactory mucosa [3] or cloned embryos (therapeutic cloning). In this technique, somatic cell nuclear transfer (SCNT) derives the embryonic SC. The nucleus from healthy SC of patient is introduced into the enucleated oocytes (donor or self in case of female patients) and these oocytes are developed into embryo [4]. This technique may also be termed as autologous cell therapy among females. Apart from this all

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other sources of SC therapy are similar to auto blood transfusion and hence are devoid of ethical and medico-legal issues but still can have religious implications. But, the limited availability of adult SC, along with short life, difficult harvesting and genetic unsuitability are major hindrances in their large-scale use [5]. Therapeutic Cloning (TC) also has lot of ethical and legal issues attached to it. This is the reason why tremendous interest has been generated in the embryonic SC harvesting [6, 7].

Heterologous stem cell therapy: The source of SC is heterologous SC therapy is any source other than patients own SC e.g. Spare embryos, aborted fetuses, umbilical cord blood and even from cadavers' [5]. The SCs are commonly harvested either from embryos of aborted fetuses. Nevertheless, what ever may be the source of SC, all possesses ethical, medico-legal and religious issues requiring detailed deliberations.

ETHICAL AND MEDICOLEGAL ISSUES

The ethical and medico-legal issues surrounding SC and TC revolves around the following spheres:

- Source of SC for therapy
- Consent
- Potential use versus alternatives
- Stem cell/ clone as commodity
- Moral and religious principles
- Risks involved

Source of sc for therapy: Adult SC harvested from living donors/ self do not raise much ethical and medico-legal issues as long as they are not offered to sale. The same may be said about umbilical cord blood. Major ethical and medico-legal conflicts are related to TC, aborted fetuses and use of un-utilized embryos from IVF clinics. Recently, US ban all types of human cloning including TC through a non-binding declaration. According to the declaration human cloning is incompatible with human dignity [8].

In TC, a clone is created with the sole goal to treat an illness. Here an embryo is grown up-to 14 days and than it is sacrificed to harvest the SC. In other words a life is extinct to save another one. Aborted fetuses and un-utilized embryos from IVF centers also share the same concerns. Stories have been published about the sale of frozen embryos from these centers in Singapore to labs and companies in Australia [8].

Consent: As far as homologous SC therapy is concerned, there appear to be not much of issue as cells from the same person are utilized and an informed consent from concerned person/ guardian may be sufficient. However, the same may not be held true to heterologous SC therapy. The consent related issues that can generate in this type of therapy are:

- Who is entitled to give consent in case of umbilical cord SC, embryonic SC and in cadaveric SCs?
- Whether the consent of next of kin/ parents/ guardian can be held valid? And if yes, under what circumstances?
- What should be the level of consent for recipient?
- Can the consent for harvesting of SC (in other words willful killing of embryos) held valid?
- Can the consent for TC withstand the acid test of present law of land?
- Is it ethically sound to consent to create some body solely for the purpose of therapy?

In the present scenario, answer to the above questions is not easy and mostly negative. So, either the present laws and ethical norms are revised or new legislation is brought about for the sea change in thinking? That appears to be a remote possibility in near future. Further, at present, SC therapy and TC are in early experimental stage and involves significant risks to the patient involved. Therefore, informed consent with full disclosure will be required, while treating patients with these technologies.

Potential uses versus alternatives: The SC therapy and TC has opened up anew window in the treatment of many illnesses especially the degenerative diseases. Presently, the treatment of choice for many of these diseases is transplant surgery. However, the experience has shown that there is perpetual shortage of the donors for transplants and the waiting list for the organs/ tissues is increasing day by day. Cost of surgery, surgical risks and complications and chances of rejection are other limiting factors for the transplant surgeries.

Embryonic SC can easily be available from IVF clinics and aborted fetuses. Their growth and differentiation is easier to control. Theoretically, SC can be collected, cultured and stored to provide a plentiful supply of healthy replacement tissue for transplantation into any body site using minimal surgical maneuver. But, it is not so easy as sounds, as to guide a SC into desired cell line requires the identification of the factors controlling the differentiation and these factors are less understood currently.

Graft-Versus-Host-Disease (GVHD) is very common and life threatening side effect that occurs during SC/ bone marrow transplant therapy [9]. But, this problem can be overcome by producing tailor made embryonic SC from patient's own healthy differentiated adult cells by SCNT technique [10].

Also, at present, an azoospermic male has no way to become biological father except human cloning. Why he should be given the chance and satisfaction of a biological fatherhood?

The opponent of human cloning looks the clone as a latter born twin with severe identity crisis. They also argue that technique simply provide another choice for the sake of choice for treatment of infertility. Moreover, in true sense, cloning can not be regarded as treatment of infertility [11].

Stem cells/ clone as commodity: Is SC/ clone a commodity that can be purchased from market? "Cloned to order: The $ 50,000 copycat" [12], " Human clone for $1 million" [13], these are not the titles from any fiction book, but are hard reality. Meaning thereby that the influential and rich can have their clone not for the treatment of infertility but can also misuse the facility. It is morally problematic and a little reprehensive. It can also create a class, who can afford to buy such technique, while others will be mere spectators. The life under such situation will become a commodity and not a gift of God. However, SC therapy using embryonic cells or adult SC can be a cost-effective tool in the hands of scientists for curing number of diseases [1, 3, 7, 9, 14].

Moral and religious principles: Cloning is among few technologies that became controversial even before its actual happening. Majority of the religious pontiffs has shown resentment on this technology especially human cloning. Eugenic reproductive human cloning have been condemned worldwide labeling it unethical and against the principle of nature [15]. The Catholic Church staunchly oppose killing of human embryos for the sake of harvesting embryonic SC as they believe that life begins at the moment of conception [9]. US Conference of Catholic Bishops have consistently spoken out against the research, which entails destroying even a day old embryo or using aborted fetal matter to harvest the SC. On the other hand some other catholic moral theologians support the research, arguing that the moral status of a human embryo is in its primitive stage- the first 14 days before it begin, does not bear the same weight as an "individual human entity". In nutshell, the religious world is as divided as the general public on the ultimate question of, when life begins? And when the moral claims of that life become paramount?

Among the other religions, Judaism offers the clearest support for embryonic SC research. Jewish law gives no legal status to a fertilized ovum outside the mother's womb, which has no potential to become a person on its own. The Islamic tradition includes views that affirm and prohibit such research. Some early Islamic jurists based rulings on indemnity for homicide on the fetus first palpable movements inside the mother's womb, about the fourth month of pregnancy. Such rulings suggest that Muslim jurists would not grant an early embryo full moral status and therefore would allow SC research [16].

Risks involved: The devastating effect of HIV transmission to people with hemophilia, the clinical and legal problems resulting from hepatitis C infection through blood or their component transfusions are some of the lessons that should be learnt from administration of human products among patients' [17]. Expansion of stem cell line could allow a single stem cell line to be used for many hundred, if not thousands of patients, exponentially amplifying the potential risk of disease transmission from a single infected donor [18]. Transmission of malignant, autoimmune and infectious diseases by organs, tissues and cells are rare but well documented events [19]. That's why EU has formulated directive on tissues and cells to be applicable from April 2006 that have standard of quality even more stringent than current requirement of the Human Fertilisation and Embryology Authority (HFEA) [20].

CONCLUSIONS

SC therapy and TC are upcoming technologies, with vast potential in alleviating human sufferings and therefore need to be encouraged. However, these techniques are not free from apprehensions and controversies, which require not only thorough deliberations but also regulations for control. The regulatory lacunae that permit any scientist to act first and consider the consequences later need to be filled. Hence, adequate safe guards must be enforced before entering into new venture that involves not only human life but is also surrounded by moral, ethical and medico-legal dimensions. It is more pertinent to countries like ours, where potential of exploitation are quite high due to multiple reasons. The drive to be first to provide cell lines for therapy could compromise safety for the recipient and could lead this technology into the realms of quackery. The fears of current regulation failure are already being realized in our country [21].

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