Stem Cell Research Ethical Issues

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ABSTRACT: ***Stem cell research has tremendous potential in terms of understanding fundamental processes of human development and differentiation, as well as novel therapies for illnesses including diabetes, spinal cord injury, Parkinson's disease, and myocardial infarction. Human stem cell (HSC) research, on the other hand, is fraught with ethical and political issues. The process of creating pluripotent stem cell lines from oocytes and embryos is riddled with debates about when a person becomes a person. The ethical issues associated with embryonic stem cell research are avoided by reprogramming somatic cells to create induced pluripotent stem cells. However, sensitive downstream research, permission to contribute materials for HSC research, early clinical trials of HSC treatments, and supervision of HSC research all present tough issues in HSC research. To guarantee that stem cell research is carried out in an ethically acceptable way, these ethical and policy concerns must be addressed alongside scientific difficulties. This essay examines these problems critically and how they are handled in current policy.***

KEYWORD: Adult Stem Cells, Ethical Issues, Human Stem Cell, Induced Pluripotent Stem Cells, Stem Cell.

1. INTRODUCTION

Stem cell research has tremendous potential in terms of understanding fundamental processes of human development and differentiation, as well as novel therapies for illnesses including diabetes, spinal cord injury, Parkinson's disease, and myocardial infarction. Pluripotent stem cells may develop into a variety of specialized cells and can self-replicate in culture. Pluripotent cells will be differentiated into specialized cells that may be utilized for transplantation, according to scientists. Human stem cell (HSC) research, on the other hand, is fraught with ethical and political issues. The development of pluripotent stem cell lines from oocytes and embryos is riddled with debates about when a person becomes a person and when they may reproduce. Several alternative ways of obtaining stem cells are less fraught with ethical issues. The ethical issues associated with embryonic stem cells are avoided by converting somatic cells to create induced pluripotent stem cells (iPS cells)[1]. However, there are tough issues with any HSC research, including permission to contribute materials for HSC research, early clinical trials of HSC treatments, and HSC research oversight. Multipotent Stem Cells (MPSCs) are a kind of stem cell that may:

- Adult stem cells and cord blood stem cells are extensively utilized in research and therapeutic treatment and do not pose any ethical issues. These cells, however, cannot be grown in vitro and have yet to be shown to be pluripotent.
- Stem cells from cord blood
- Hematopoietic stem cells from cord blood may be stored and are extensively utilized as an alternative to bone marrow transplantation in pediatric hematological disorders.

1.1 Adult Stem Cells:

Adult stem cells are found in a variety of organs and may differentiate into specialized cells in their original tissue as well as transdifferentiate into specialized cells from different tissues. Hematopoietic stem cells, for example, may develop into all three kinds of blood cells, as well as neural stem cells, cardio myocytes, and liver cells. Plasmapheresis may be used to isolate adult stem cells. They're already being utilized to treat hematological cancers and reduce the adverse effects of cancer treatment. In addition, autologous stem cells are being tested in clinical studies in individuals who have had a heart attack. Despite some claims to the contrary, their use in a variety of different diseases has not been validated or is exploratory.

1.2 Research On Embryonic Stem Cells:

The inner cell mass of a 5- to 7-day-old blastocyst may be used to create pluripotent stem cell lines. However, since it entails the killing of human embryos, human embryonic stem cell (hESC) research is morally and politically contentious. The issue of when human life starts has sparked heated discussion in the United States, and it has been connected to abortion controversies. It is undeniable that embryos have the capacity to become human beings; if placed into a woman's uterus at the right hormonal stage, an embryo may implant, grow into a fetus, and give birth to a living kid[2].

Some individuals, on the other hand, think that an embryo has the same moral standing as an adult or a born kid. They think that "human life starts at conception" and that an embryo is therefore a person out of religious faith and moral conviction. An embryo, according to this viewpoint, has rights and interests that must be protected. Taking a blastocyst and removing the inner cell mass to create an embryonic stem cell line is murder from this viewpoint. Many others have a different perspective on the embryo's moral status, believing, for example, that the embryo becomes a person in a moral sense after conception.

Few individuals think, on the other hand, that an embryo or blastocyst is just a clump of cells that may be utilized for study without limitation. Many people believe that the early embryo deserves particular respect as a future human being, but that it is permissible to utilize it for some kinds of study if there is strong scientific reason, rigorous supervision, and informed permission from the woman or couple. Opposition to hESC research is often linked to anti-abortion sentiment and the "pro-life" movement. Opposition to stem cell research, on the other hand, is not uniform. A number of pro-life leader's favor stem cell research utilizing frozen embryos that have been left over after a woman or couple has finished infertility treatment and have chosen not to donate to another couple[3].

1.3 Somatic Cells Nuclear Transfer (SCNT):

Pluripotent stem cell lines with nuclear DNA that matches a particular individual offer a number of scientific benefits. In vitro models of illnesses, elucidating disease pathogenesis, and screening possible novel treatments may all be done using stem cell lines matched to people with particular diseases. Personalized autologous stem cell transplantation is also possible using lines that are matched to particular people.

SCNT, the method that created Dolly the sheep, is one way to create such lines. Reprogramming is accomplished in SCNT by transferring nuclear DNA from a donor cell into an oocyte that has had its nucleus removed. Creating human SCNT stem cell lines, on the other hand, has shown to be not only technologically unfeasible but also morally problematic.

1.4 Fetal Stem Cells:

After an abortion, pluripotent stem cells may be extracted from fetal tissue. However, the utilization of fetal tissue is fraught with ethical issues since it is linked to abortion, which many people oppose. According to federal laws, fetal tissue research is allowed as long as the gift of tissue for study comes after the choice to terminate the pregnancy. This criterion eliminates the potential that the promise of donating tissue to research could influence a woman's choice to terminate her pregnancy. Using neural stem cells generated from fetal tissue, a phase 1 clinical study in Batten's disease, a fatal degenerative illness affecting children, is under underway.

1.5 Induced Pluripotent Stem Cells (iPS Cells):

Induced pluripotent stem cells are somatic cells that have been altered to become pluripotent stem cells (iPS cells). These iPS cell lines will contain DNA that matches that of the somatic cell donors, making them valuable as disease models and perhaps allogenic transplantation candidates.

Retroviral vectors were used to introduce genes encoding transcription factors into early iPS cell lines. Researchers have been working to address safety concerns regarding insertional mutagenesis and oncogenes. Without known oncogenes and utilizing adenovirus vectors rather than retrovirus vectors, reprogramming has been successfully achieved. The recent demonstration that human embryonic fibroblasts may be reprogrammed to a pluripotent state utilizing a plasmid containing a peptide-linked reprogramming cassette was a significant step forward. Not only was reprogramming achieved without the use of a virus, but the transgene was also eliminated following reprogramming. The ultimate aim is to achieve pluripotency without using genetics. Most experts advocate for continuing study with hESC due to unsolved issues with iPS cells, which presently prohibit their use for cell-based treatments[4].

Because no embryos or oocytes are utilized, iPS cells sidestep the contentious ethical issues surrounding embryonic stem cell research. Furthermore, compared to oocyte donation, a skin biopsy to collect somatic cells is generally benign, thus there are less worries regarding hazards to donors. IPS cells were deemed "ethically unproblematic and appropriate for use in humans" by the President's Council on Bioethics. Neither the donation of resources nor the generation of iPS cells poses any ethical concerns.

1.5.1 Downstream Investigation:

Some of the possible downstream applications of iPS cell derivatives may be so sensitive that the original somatic cell donors may not have consented to them. iPS cells will be widely distributed among researchers, who will use them to conduct a variety of studies with iPS cells and derivatives, following standard scientific practices such as:

- Cellular genetic alterations
- Injections of generated cells into nonhuman animals to show function, including injections into nonhuman animals' brains.
- Genome sequencing on a large scale
- Sharing cell lines with other researchers while maintaining acceptable levels of confidentiality, and
- Developing commercial tests and treatments based on scientific discoveries, with no revenues shared with contributors.

Different kinds of fundamental research, such as study using stem cells from other sources, make extensive use of these conventional research methods. In general, biological material donors are not told explicitly of these research methods, but this disclosure is currently being suggested for whole genome sequencing.

For example, characterizing the lines and demonstrating their pluripotency are important tasks in stem cell research. Genome sequencing on a large scale will provide new information about the etiology of disease and point to potential therapeutic targets. Preclinical testing of cell-based treatments for numerous diseases, such as Parkinson's disease, Alzheimer's disease, and stroke, will need the injection of human stem cells into the brains of nonhuman animals.

Some downstream studies, on the other hand, may create ethical issues. Genome sequencing on a wide scale, for example, may raise questions regarding privacy and confidentiality. If scientists knew about a donor's future propensity for a wide range of hereditary illnesses, they would consider it a breach of their privacy. More than that, information from forensic DNA databases or an online business that provides personal genetic testing may be used to re-identify a de-identified large-scale genome sequence contributor. There are other donors who may oppose to having their cells used in animals. They may, for example, be opposed to all animal experimentation or have religious objections to mixing human and animal species, etc[5].

Nonhuman animals have been injected with human brain progenitor cells, raising ethical questions regarding the development of traits believed to be distinctively human in nonhuman creatures. Another possibility is that donors don't want proprietary cell lines generated from their biological components used to create novel diagnostics and treatments. Even if the cell lines were de-identified or if many years had elapsed since the initial gift, people are unlikely to abandon such concerns. Donor autonomy and scientific gain from study may be at odds, however this may be worked out when permission is obtained for the initial gift of resources.

In the end, it would be inconvenient if scientifically valuable iPS cell lines could not be utilized because the somatic cell donor protested, even though they grew well in tissue culture. Using somatic cells from donors who are prepared to accept all of this fundamental stem cell research, as well as being contacted for future sensitive research that cannot be predicted at the time of permission, is one way to avoid this problem altogether. A donor may be given the choice of agreeing to more sensitive downstream research, such as allogenic transplantation into other people and reproductive research including the production of totipotent creatures, if they choose to provide their organs[6].

It would be wise to implement comparable criteria for permission for the donation of materials for the derivation of other kinds of stem cells in light of these consent issues for critical downstream research. Concerns about the ethics of iPS cells are especially pressing, given the general belief that these cells pose no ethical issues and their expected growing importance in stem cell research.

2. DISCUSSION

New therapies based on pluripotent stem cells are on the horizon thanks to cell transplantation. However, such transplantation comes with a lot of danger and uncertainty. Epithelial stem cell-based burn and corneal therapy has been proven to be successful and safe, for example he-matopoietic stem cell transplants for leukaemia. The problem with this is that "certain clinics across the globe currently abuse patients' hopes by claiming to provide successful stem cell treatments for severely sick patients, usually for significant amounts of money, but without convincing scientific justification," according to the article. Medical innovation is supported by

the International Society for Stem Cell Research, although the use of unproven HSC transplantation has been criticized[7].

Ethics should govern these clinical trials, including proper risk-benefit analysis, informed permission, and other elements common to all forms of clinical research. Additional ethical criteria are also required to improve trial design, coordinate scientific and ethical review, verify that participants comprehend important aspects of the study and guarantee disclosure of unfavorable results. Due to the intervention's novel nature, the limited amount of human experience, and the high expectations of patients who have no successful therapies, these precautions are necessary.

"Tumor development, immunological responses, unanticipated cellular activity, and uncertain long-term health consequences" are some of the dangers of novel stem cell-based treatments. Preclinical research in applicable animal models or human trials of comparable cell-based treatments should provide evidence of safety and proof of concept. If cells have been substantially modified in vitro or generated from pluripotent stem cells, further proof of concept and safety should be required.

Despite these precautions, however, because of the intervention's novel nature and lack of prior human experience, unexpectedly severe side effects may still occur. Clinical results for patients with Parkinson's disease were not improved by fetal dopaminergic neuron transplantation during earlier clinical studies. Approximately 15% of transplant recipients had late-onset debilitating dyskinesia's, and some required ablative surgery to alleviate these side effects. Even though the transplanted cells engrafted and produced the intended neurotransmitters after they had been placed in the target regions of the brain, the desired physiological function was not attained. Phase I study participants may not be fully aware that hESC transplantation has the potential to worsen their condition[8].

Phase I clinical studies have a history of having issues with informed consent. Despite the fact that the main aim of phase I studies is to evaluate safety rather than effectiveness, many cancer patients who enroll in clinical trials believe that they will directly benefit from participating in the study It's been called the "therapeutic myth" that people in clinical research think they'll gain personally from it. The information on consent forms, according to analyses of cancer clinical trials, is usually sufficient. For the most part, researchers were unclear and opaque when describing how gene transfer would directly help patients in early phase I clinical studies.

Second, in hESC clinical trials, researchers should speak with prospective participants about a wider variety of facts than in previous clinical studies. Researchers are required under the concept of informed consent to share relevant facts with prospective participants before they participate for a clinical study. Generally speaking, the essential information pertains to the intervention's nature, dangers, and potential benefits. Non-medical factors, on the other hand, may be significant or even crucial for certain patients undergoing hESC transplantation. People who believe an embryo has the same moral standing as a human being are likely to be against hESC transplantation. Despite the fact that this intervention may have a medical advantage for them, some people may see it as being involved in an unethical conduct. Patients should be informed that the transplanted cells came from human embryos while participating in clinical studies using hESCs[9].

The third and most crucial step is for researchers to make sure that participants have a clear grasp of the clinical trial's goals. Clinical trial participants' comprehension is more important than what researchers reveal in permission forms or conversations as the key ethical problem surrounding informed consent. In other cases, researchers have assessed the understanding of trial participants to make sure they are aware of the most important aspects of the study. While conducting HIV clinical trials in poor nations, many researchers are testing each participant to ensure that they grasp the study's key components after allegations that participants did not understand the experiment. In situations when misconceptions are probable, such direct evaluation of participants' comprehension of the research has been suggested more widely. We believe that comprehension assessments like these should be included in HSC transplantation phase I studies. Clinical studies that use cutting-edge technology with careful attention to informed consent are less likely to encounter problems in the road. Adverse occurrences in early trials of organ transplantation, the implantable complete artificial heart, and gene transfer prompted claims from researchers that study participants did not understand the research's purpose. Clinical trials were delayed and negatively publicized as a consequence of the ethical debates that arose[10].

3. CONCLUSION

The evaluation method should concentrate on the kinds of HSC derivation that cause ethical concerns. Because of concerns regarding the medical hazards of oocyte donation, undue influence, and setbacks to a woman enduring infertility therapy, HSC lines generated from fresh oocytes and embryos need in-depth evaluation. When donors of research oocytes get compensation in excess of their costs, problems arise since such payments are illegal in the jurisdiction where the HSC cells will be utilized. After public deliberation and discussion, the United Kingdom, for example, established an explicit policy allowing such payment and gave justifications for its decision. Payment bans should be accepted as a legitimate difference of opinion on a difficult subject by jurisdictions that prohibit payments. If lines were generated from frozen embryos left over after IVF treatment and donors were compensated in the reproductive context, there should be less concerns regarding payment. Such payments, which were made before any consideration of donating hESCs for study, are not an incentive for hESC research.

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