

# Ethical issues in human therapeutic cloning

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**Abstract:** Human therapeutic cloning or nuclear transfer stem cells (NTSC) shows much promise in regenerative medicine. However, due to ethical issues, this activity is prohibited. This paper aims to describe the ethical issues in human therapeutic cloning. This is a narrative literature review. Literature was taken from PubMed, Science Direct, and Google Scholar. Inclusion criteria are research and review journals. Exclusion criteria are unavailable in full-text journals. The process of human therapeutic cloning is prone to abnormalities. When abnormalities develop, the cloning result has to be terminated. This is against the ethical issue because it harms human beings. The research in most mammals showed normal phenotypes and offspring. The usage of this technology is in conservation and biomedicine. In vitro of cloning process resembles in vitro fertilized embryos. Cloning is done by two techniques, namely somatic cell nuclear transfer and cell mass division. The somatic cell nuclear transfer is safe. However, the twin's growth produced by the cloning procedure causes psychological distress. It arises ethical and moral issues. Transplantation can be solved by using somatic cell cloning of the nucleus (nuclear mass/DNA). In conclusion, ethical issues in human therapeutic cloning arise related to psychological distress in the twin growth of clones.

**Keywords:** ethical issue, human therapeutic cloning, somatic cell transfer.

**Abbreviations:** NTSC: Nuclear Transfer Stem Cells; SCNT: Somatic Cell Nuclear Transfer; iPSCNT: induced pluripotent stem cell nuclear transfer.

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## Introduction

The history of cloning began with in Scotland Scientists at the Roslin Institute. The researchers cloned a sheep (Dolly) by involving the genetic material transplant of an adult sheep. Approximately 20 years after this study, monkeys were cloned. However, Dolly did not have any identical offspring. This technique is known as somatic cell nuclear transfer. There are two techniques in human cloning, namely cell mass division and somatic cell nuclear transfer/nuclear transfer stem cells (NTSC) (Iqbal *et al.*, 2020; Nasrullah *et al.*, 2020).

Human therapeutic cloning or nuclear transfer stem cells (NTSC) shows much promise in regenerative medicine. However, due to ethical issues, this activity is prohibited. NTSC is a special technique to produce several clones (Nasrullah *et*

*al.*, 2020). Some countries banned the cloning procedure based on laws. The laws define cloning as a nuclear transfer procedure. The UK includes splitting and NTSC in the same legislation. Meanwhile, the Ethics Committee of the American Society for Reproductive Medicine could accept the embryo-splitting procedure since it might improve the quality of IVF treatment (Noli *et al.*, 2017).

There are two techniques in vitro production of organism copies, namely embryo splitting (twinning) and somatic cell nuclear transfer (SCNT). Embryo splitting will create identical twins with a natural-like process, meanwhile, SCNT is an artificial process. The splitting can be done by blastomere biopsy (for cleavage-stage embryos) or bisection (for morula or blastocysts) (Noli *et al.*, 2017)

Human therapeutic cloning is the same as nuclear transfer stem cells (NTSC). This procedure

is beneficial for regenerative medicine. SCNT is prone to epigenetic problems. The mortality rate is high. However, some surviving clones revealed normal phenotypic and physiological conditions. In the process of SCNT to produce human embryonic stem cells (hESCs), it showed a higher failure rate (French, Wood and Alan O Trounson, 2006)

The success of somatic cell nuclear transfer increases the possibility of diploid embryonic stem cell generation. However, the process is very expensive. In addition, the result is not promising. Based on the combination of induced pluripotent stem cell technology with somatic cell nuclear transfer, it was revealed that therapeutic quality pluripotent stem cells will be created. It is useful for organ transplantation and reproductive cloning (Sanal, 2014).

Due to some existing ethical issues behind therapeutic cloning, this paper aims to describe the ethical issues in human therapeutic cloning.

## Materials and Methods

### Study area

This is a narrative literature review. Literature was taken from PubMed, Science Direct, and Google Scholar. Inclusion criteria are research and review journals. Exclusion criteria are unavailable in full-text journals. The selected journals are summarized and narrated descriptively.

## Results and Discussion

Therapeutic cloning could provide treatment for neurological diseases such as Parkinson's or Alzheimer's disease, leukemia, or transplantation from embryonic stem cells. However, the process of human therapeutic cloning is prone to abnormalities. When abnormalities develop, the cloning result has to be terminated. This is against the ethical issue because it harms human beings. The research in most mammals showed normal phenotypes and offspring. The usage of this technology is in conservation and biomedicine. In vitro of cloning process resembles in vitro fertilized

embryos. Cloning is done by two techniques, namely somatic cell nuclear transfer and cell mass division. The somatic cell nuclear transfer is safe. However, the twin's growth produced by the cloning procedure causes psychological distress. It arises ethical and moral issues. Transplantation can be solved by using somatic cell cloning of the nucleus (nuclear mass/DNA) (Iqbal *et al.*, 2020; Nasrullah *et al.*, 2020).

The prospect of induced pluripotent stem cell nuclear transfer (iPSCNT) is for genetic disease. The process uses gene correction and editing. The possibility of healthy offspring will be higher when doing this technique. Using this technique, combined with gene correction, and assisted reproductive technology will help the individual who suffers from inherited diseases and infertility (Sanal, 2014).

Genomes could be cloned, but individuals could not. Therapeutic cloning of embryonic/stem cells could increase the possibility of organ transplantation. However, the cloning success rate is low. The reasons are organ and other failures. In addition, human cloning is banned due to ethical reasons. Many religions object to the practice of human cloning. The character and personality cannot be precisely determined by cloning. Other considerations are ethical, religious, and social values. Since 2004, the issues of cloning have arisen. Several countries have banned them. The Canadian Parliament banned cloning. The French parliament considered human cloning a crime. Japan's Cabinet Council prohibited human cloning. The British Government gave support to experimental stem cells but not to reproductive cloning. A unique gene therapy that involves mitochondrial replacement is allowed. Therapeutic cloning has some benefits in organ transplantation and nerve cell treatment (Ayala, 2015). Stem cells could develop into autologous cells. These cells are useful in that help in tissue and organ replacement applications. The possibility of rejection will be low because it uses the patient's nucleus of the somatic cell. Therefore, it is useful for transplantation (Bahbry, Alserhani and Alsadah, 2020). The techniques of clones are improved based on stem cell culture, therefore

cloning can be used to improve fertility (Iqbal *et al.*, 2020).

Human cloning is banned due to emotional, ethical, and moral problems. The clones have some possibilities for abnormalities. The possibility of the cloned organism reaching adulthood is less than 1%. Therefore, the cloning process is seen as a wastage of embryos. When the cloning procedure is done on the human at the blastocyst stage, the woman will suffer from certain health issues and psychological distress due to the high possibility of failure. An embryo has existence since the first day of life. It has the right to live. We must not kill the embryo because it is the same as murder. This situation makes the clone has some ethical and moral issues (Häyry, 2018; Nasrullah *et al.*, 2020). Therefore, society should be involved in the evaluation of genetic engineering and cloning decisions (Häyry, 2018).

There are some limitations in the process of Human Therapeutic Cloning. Ethical and legal considerations are the main consideration in implementing cloning projects. Oocyte donors might receive compensation. However, the compensation might be banned by law in some areas. In addition, oocyte retrieval and ovarian stimulation might show some risks and discomfort (French, Wood and Alan O Trounson, 2006). The genome editing technique can be done in most eukaryotic cells. This technique can be applied to the treatment of certain diseases (Li *et al.*, 2020).

Genome editing is the same as DNA editing. There will be irreversible permanent changes in information. This process has high risks and ethical issues. However, not all cell types are easy to modify. For example, neuron cells are difficult to have DNA modification. Therefore, the use of this technique is limited to neurons in the nervous system. Genome editing is useful to comprehend the etiology of diseases, including hematopoietic stem cells (Li *et al.*, 2020).

### Conclusions

In conclusion, ethical issues in human therapeutic cloning arise related to psychological distress,

social issues, and emotional reactions in the twin growth of clones. Cloning is banned due to many ethical and moral values. Embryo might face some hazards during the cloning process.

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### References

- Ayala, F. J. (2015) 'Cloning humans? Biological, ethical, and social considerations', *PNAS*, 112(29), pp. 8879–8886. doi: 10.1073/pnas.1501798112.
- Bahbry, D. A., Alserhani, R. and Alsadah, K. H. (2020) *Therapeutic cloning and its application*.
- French, A. J., Wood, S. H. and Alan O Trounson (2006) 'Human Therapeutic Cloning (NTSC) Applying Research From Mammalian Reproductive Cloning', *Stem Cell Reviews*, (2), pp. 265–276. doi: 10.1007/BF02698053.
- Häyry, M. (2018) 'Ethics and cloning', *British Medical Bulletin*, 128, pp. 15–21. doi: 10.1093/bmb/ldy031.
- Iqbal, R. K. *et al.* (2020) 'Ethical issues of human cloning', *Journal of Medical Sciences*, 40(3), pp. 103–106. doi: 10.4103/jmedsci.jmedsci.
- Li, H. *et al.* (2020) 'Applications of genome editing technology in the targeted therapy of human diseases: mechanisms, advances and prospects', *Signal Transduction and Targeted Therapy*. Springer US, 5(1), pp. 1–23. doi: 10.1038/s41392-019-0089-y.
- Nasrullah *et al.* (2020) 'Ethical Issues of Human Cloning', *J Med Sci*, 40(3), pp. 103–106. doi: 10.4103/jmedsci.jmedsci.
- Noli, L. *et al.* (2017) 'Potential of human twin embryos generated by embryo splitting in assisted reproduction and research', *Human Reproduction Update*, 23(2), pp. 156–165. doi: 10.1093/humupd/dmw041.
- Sanal, M. G. (2014) 'A highly efficient method for generation of therapeutic quality human pluripotent stem cells by using naive induced pluripotent stem cells nucleus for nuclear transfer', *SAGE Open Medicine*, 2(1–6). doi: 10.1177/2050312114550375.