The use of stem cells to cure Leukaemia, and Moral and Ethical issues surrounding the use of stem cells to cure such diseases

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Abstract

Our research is on Leukaemia and how stem cells can help cure such diseases. Leukaemia is a disease that affects the blood-forming cells in the body. Leukaemia is a cancerous condition, and it is characterised by abundance of abnormal blood cells. The disease Leukaemia begins in the bone marrow of the human body and then spreads to the other parts of the body. We use the blood in the umbilical cord stem cells in order to treat leukaemia, because it is both easy to obtain, and easy to differentiate the stem cells in the umbilical cord into what you want. Both adults and children are able to get the four different types of leukaemia. The central idea of this research is using bone-marrow to cure leukaemia.

What is leukaemia?

Leukaemia is a type of cancer that affects the bone marrow and blood. Marrow is the tissue found within the hollow spaces of your bones where "haematopoiesis" or blood cell formation takes place.

There are different types of leukaemia. Leukemia can be divided into four different types. It is first classified as acute or chronic.

Chronic leukaemia cells come from mature, abnormal cells. These cells thrive for too long and are able to accumulate. These types of cells slowly multiply.

On the other hand, acute leukaemia develops from early cells, named "blasts," which are young cells that are able to divide frequently. In acute leukaemia cells, the cells don't stop dividing like their normal counterparts.

Myelogenous vs. Lymphocytic

After being classified as either acute or chronic, they classify them by the type of cells in which the leukaemia disease started off in. It can either be Myelogenous or Lymphocytic.

Myelogenous leukaemia develops from myeloid cells, and the disease can either be chronic or acute, and they are referred to as chronic myelogenous leukaemia (CML) and acute myelogenous leukaemia (AML).

Lymphocytic leukaemia develops from cells called "lymphocytes" (a type of white blood cell produced by the lymph gland) in the blood marrow. The disease can be acute or chronic, referred to as chronic lymphocytic leukaemia (CLL) and acute lymphocytic leukaemia (ALL).

Causes and Risk Factors of Leukaemia

Researchers have identified several causes and risk factors for leukaemia. It happens in:

- People older than the age of 60, but it can occur in younger people
- People who smoke
- People who have undergone previous chemotherapy or radiation therapy
• People infected with the human T-cell leukaemia virus, a virus that infects T-cells that is spread by sharing syringes and used to inject drugs; through blood transfusions; through sexual contact; and from mother to child at birth or through breastfeeding
• People with myelodysplastic syndrome, a blood disorder
• People with Down syndrome

Symptoms of Leukaemia

Leukaemia symptoms can occur all of a sudden or gradually. The symptoms are broad, but there are specific signs of leukaemia to keep an eye out for:

• Fever
• Infection
• Excessive bruising
• Fatigue
• Physical exercise intolerance
• Abdominal pain or generally feeling fullness
• Weight loss
• Abnormal bleeding
• Enlargement of the lymph nodes, spleen and/or liver
• Weakness

Treatment for leukaemia

Treatment for leukaemia greatly varies depending on the type and stage of the disease. In most cases, leukaemia is treated with one or more types of treatment.

• Chemotherapy: Chemotherapy is the use of drugs that either kill cancer cells or prevent the cells from dividing. Chemotherapy can be given in a variety of ways, with IV infusion and pill being more common. The type of chemotherapy given to a patient depends on the stage and type of the leukaemia cancer they have.
• Radiation Therapy: Radiation therapy is the use of certain wavelengths of electromagnetic radiation to kill cancer cells and shrink tumours. This energy can be waves or particles like protons, electrons, x-rays and gamma rays.
• Biologic Therapy: Biologic therapy is treatment that uses the knowledge specific to the cancer to eliminate it. Substances made by the body or made in a laboratory are used to boost, direct or restore the body’s natural defences against cancer or to specifically shut down its division.
• Surgery: Surgical removal of the spleen is also a treatment option for chronic leukaemia. The spleen collects leukaemia cells, and they accumulate, causing the spleen to enlarge. An enlarged spleen can cause many complications.
• They already use bone marrow transplant. A hematopoietic transplant is a procedure to replace normal marrow production that has been destroyed by treatment with high doses of anticancer drugs or radiation. Transplantation may be autologous (an
individual’s own stem cells saved before treatment), allogeneic (stem cells donated by someone else) or syngeneic (stem cells donated by an identical twin).

The above are all valid ways of treating leukaemia; however they are old ways and have side effects that can cause even more harm to the body. If we use stem cells to treat such diseases as leukaemia it will be much safer on the patient and will cause less harm.

The University of Minnesota Medical School (USA) was the pioneer of stem cell therapy. In 1968 the first ever bone marrow transplant was performed, and in 1975 the first bone marrow transplant to treat lymphoma. 1990 the first use of umbilical cord blood to treat leukaemia and, the first multi-unit umbilical cord blood transplantation to treat adults in 2000.

**Stem Cells**

Stem cells are biological cells that have not yet taken a specialised form. These cells have the ability to become many different types of cells, replicated many times thus forming colonies of cells to be used all around the body for repair and growth. Stem cells are mainly used to repair damaged tissues, replace infected cells and in the growth of tissues and organs.

**Embryonic Stem Cells**

The most useful stem cells are found in undeveloped embryos. Because the body of the embryo is not developed it mainly consists of stem cells, which have a very high plasticity thus making it easy to create cells for almost any need from such sources. Embryos are easy to create/obtain, for example, if someone wishes to abort a child, that embryo may be used, and also artificially we can create many embryos to fit our needs.

**Adult Stem Cells**

Stem cells can also be found in adults too. Though they do not have as high plasticity as those of an embryo, they can still be used in a variety of fields. There are many sources for obtaining stem cells, many of which are tissues and organs as they each have their own supply of unspecialised cells. The part of the body from which they originate usually determines how these cells develop. The main sources of adult stem cells include: bone marrow, umbilical cord blood, and the placenta. There are a multitude of stem cells in every human being, but not many of which we can manipulate into a wide variety of cells.

**The way to get embryonic stem cells**

When a zygote is formed from gametes it undergoes mitosis. The resulting group of cells are all genetically identical and are known as a morula. After 4-5 days, the morula is about 16 cells large. The outer cells are known as trophoblast and the inner cells are called the embryoblast. These cells now keep duplicating by mitosis. When the group gets bigger the space between the cells is filled with fluid called blastocoel, and at this point the morula becomes a blastocyst. The inner cell mass will become the embryo and the outer trophoblast will become the placenta. The embryoblast consists of embryonic stem cells which can be extracted and used for research, however the process gives rise to ethical between scientists
and people in the “prolife camp” (the different organisations that are against this process). To extract the stem cells they remove them from the inner cell mass and place in culture. Embryonic stem cells can be grown as small colonies on layers of skin cells in the presence of serum. The skin cells are known as "feeder cells" and together with the serum, provide unknown factors that nourish and support the embryonic stem cells. While culturing, the stem cells can be subjected to different factors that influence their development into different types of cells.

The main objection towards embryonic stem cell research is the destruction of the pre-implanted embryo, which is generally based on the objector’s belief that the early pre-implanted embryo is considered a person. Therefore they believe ‘person-hood’ starts at fertilisation. With this in mind there are a number of arguments and counter arguments that we will explore along with ideas and thought of our own.

As said by the sacred congregation of the doctrine of faith (scdf) in 1975, “it is objectively a grave sin to dare to risk murder.” (Genovesi, Vincent J. Pursuit of love: catholic morality and human sexuality (Google books 15/04/09))

“Therefore if a deer hunter sees a bush moving he cannot shoot until he is morally certain that it is a deer and not a person who is moving it.” (Fr Dylan, James new science backs the early embryo’s personhood.) http://fatherdylanjames.blogspot.com/2007_01_01_archive.html (15/03/05)

The oxford dictionary gives the definition of a person as being “An individual human being; a man, woman, or child.” The concept of ‘person’ is a philosophical issue rather than a scientific one; however it is important to give scientific relevance to this question, because it is science that helps us to decide whether or not the embryo in question meets the criteria that is used to define a person. (Fr Dylan, James, New science backs the early embryo’s personhood). The main scientific argument that pro-life parties use, is that personhood starts at fertilisation. When the sperm meets the egg, fertilisation takes place; this creates a gradual fusion of the two cells over a period of a few hours. The zygote now contains the full 2n complement of human chromosomes and thus contains all of the genetic information that is needed for the development and life of a human being. (Bryant, John. Searle, John. Life in your hands 53-54).

The argument is that the early pre-implanted embryo contains all the genetic material required to make an individual person, so therefore if the embryo is proven to be individual then how can an individual not be considered a person? However, if you were to take carbon, oxygen, and hydrogen - all the things that the human body is made of - you have all of the components necessary but it would not create a human being. With an embryo, all the material necessary to make a human being are present, however, alone, it again could not create a human being. We know that this will not happen, and therefore you cannot say that as fertilisation occurs the zygote is a person. As the oxford dictionary define the term person as “a man, woman, or child” and the zygote does not match any of those descriptions, it has not matured into a person yet.
Another view could be that only fifty percent of pregnancies will result in live childbirth, and most miscarriages occur before implantation. Therefore before implantation there is no telling which embryos will become the foetus (Bryant, John. Searle, John. Life in our hands. 53-54). If all pre-embryos are ‘persons’ and have immortal souls, is heaven really full of people, who never achieved birth or even implantation?

In conclusion, we came to the agreement that stem cell research should be allowed worldwide, because it is a very good way of curing illnesses, and diseases such as cancer (leukaemia). It is true that the embryo deserves a chance to become a full human, however if we can sacrifice a few embryos in order to save the lives of our growing population, and find cures for cancer and other such diseases it is worth it. (Peters, Ted, “Embryonic stem cells”. 130. It is important to mention that stem cells at this moment in time are pluripotent rather than totipotent. Ted Peters said that “pluripotent stem cells do not have the actual potential for becoming human being. They should therefore not be compromised or wasted”, so we should make use of them, and try to improve the lives of people who are already alive, and living on this planet. In future, scientist should be able to make whole new organs using stem cells, and can use them in organ transplants in order to help to save lives. Not every woman that gets pregnant wants to keep their child, and so they abort it, which is a waste, and instead those women can help save lives, and help scientists to find cures.

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