



Umbilical Cord-Derived Stem Cells for Tissue Repair and Regeneration

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Abstract:

Stem cells are the next frontier in medicine. Stem cells are thought to have a wealth of biotechnological and therapeutic opportunities. Along with replacing damaged or malfunctioning cells, once generated therapeutic proteins will be rescued or supplied. The widespread use of embryonic and fetal stem cells is currently restricted due to ethical and scientific issues. However, postnatally recovered umbilical cord stem cells, also known as the umbilical cord vein, amnion/placenta, umbilical cord blood cells, or umbilical cord matrix cells include are a widely available and affordable source of cells that can produce a wide range of cell types, hence the term "multipotent." This review aims to juxtaposition adult stem cells with umbilical cord-derived ones.

■ **Keywords:** Mesenchymal stem cells, umbilical cord blood umbilical cord, matrix cells cells.

❖ Introduction:

One kind of cell capable of self-renewing and lineage differentiation is a stem cell ^[1]. Developmental plasticity explains how stem cells could grow into one or more different cell types ^[2]. The allantois and yolk sac allow blood to pass into the umbilical cord between the two circulations and act as the interface separating the growing baby from the placenta ^[3]. Two arteries and a vein make up the umbilical cord; Wharton's jelly, a gelatinous substance that envelops capillaries and lymphatics, is made up of sulphated proteoglycans and other collagenous filaments but lacks elastic fibers. Wharton's jelly's resistance to twisting and compression shields the blood vessels from clotting and provides cord flexibility. The amniotic membrane epithelial layer then coats the chord creating a thin epithelial layer ^[4].

The ability of pluripotent stem cells to differentiate into tissues from the ectoderm, endoderm, and mesoderm germ layers is known as pluripotency. ESCs, or embryonic stem cells, are the best instance of pluripotent stem cells. They originate from the inner cell masses of the early embryo. Since the majority of

clearly identified stem cells are multipotent, they can differentiate into derivative of two of the three germ layers, in contrast to ESCs. The stem cells' third characteristic is their ability to rebuild the tissues in which they reside. Every tissue compartment contains cells fit with in the description of "stem cells"^[5]. At birth, the umbilical cord weights around 40 grammes, is 30 to 65 cm long, and has a 1.5 cm diameter ^[6].

❖ **Umbilical cord blood:**

After birthing, umbilical cord blood was once thought to be waste ^[7]. Never the less, it has been discovered in recent decades to contain useful biomaterials such stem cells ^[8-11]. Hematopoietic stem cells (HSCs) are the potentially life-saving cells seen in umbilical cord blood ^[12-13]. There are mesenchymal stem cells (MSCs) in this blood ^[14-15].

➤ **History of umbilical stem cell transplantation:**

- When Gluckman and colleagues demonstrated that umbilical cord blood (UCB) contains enough hematopoietic stem cells (HSCs) for efficient hemological repair, the very first accomplished umbilical cord blood stem cell transplant took place in 1988^[16].
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- The first umbilical cord blood transplant was performed in the US a year later ^[18].
- Haematopoietic stem and progenitor cells were discovered in human umbilical cord blood by Dr. Hal Broxmeyer in 1985.
- A six-year-old kid with Fanconi's anemia received the first successfully related cord blood transfusion in 1988 in Paris, France.
- With support from the National Heart, Lung, and Blood Institute (NHLBI) of the National Institutes of Health, Dr. Pablo Rubinstein opened the first public umbilical cord blood bank at the New York Blood Centre in 1992.
- The world's first incompatible cord blood transplant was performed in 1993 by Dr. Joanne Kurtzberg at Duke University's Paediatric Blood and Marrow Program.
- As part of the Cord Blood Transplantation Study (COBLT), the FDA designated cord blood as an Investigational New Drug (IND) in 1996.
- The National Heart, Lung, and Blood Institute provided funding for the study. The National Marrow Donor Program (NMDP) launched a cord blood program in 1998.
- The Stem Cell Research and Therapeutic Act of 2005 (H.R. 2520), passed by the US Congress in 2005, established a nationwide bank of 150,000 diverse, superior cord blood samples. Nearly 30,000 irrelevant cord blood infusions were carried out in 2012^[19].

❖ **Anatomy of umbilical cord:**

The placenta grows as a transient organ in your uterus during pregnancy. Attaching to the uterine wall, it supplies nutrients and oxygen to your body via the umbilical cord. Problems during pregnancy might result from certain placental defects.

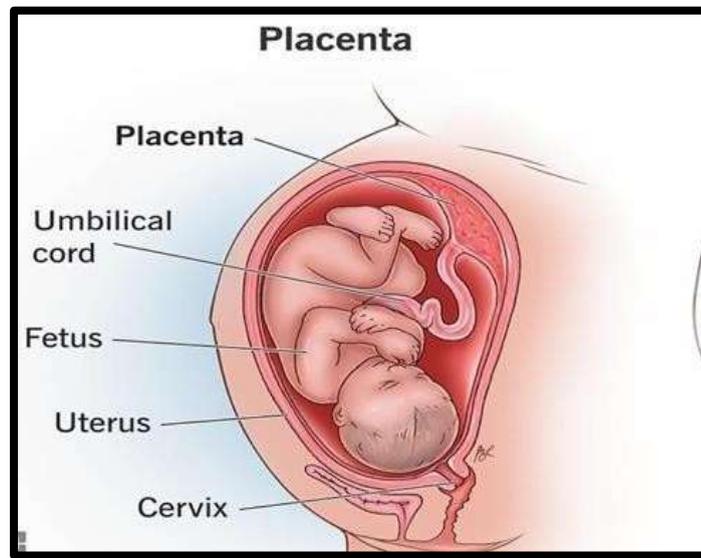


Fig1.Developingplacenta

- **What is placenta?**

Developing soon after conception, the placenta hooks itself to the uterine wall. The umbilical cord connects baby to the placenta. The placenta and umbilical cord taken together provide baby's lifeblood in the uterus.

- **When does the placenta form?**

About seven to ten days after conception, a fertilised egg implants in the uterus and starts the placenta to develop. It keeps developing to help the unborn child throughout pregnancy. From a few cells at first, the placenta becomes many inches long.

- **When does the placenta take over?**

By the conclusion of the first trimester that is, twelve weeks of pregnancy the placenta controls hormone production. The corpus luteum produces most of the hormones upto this point. Many people's first-trimester nausea and tiredness disappear in the second trimester when the placenta takes control.

- **Function of the placenta:**

- Passes generates hormones to support baby development; immunity from mother to the child; helps to safeguard the infant.
- The placenta's job during pregnancy is to keep the fetus alive and healthy.
- It functions as the baby's liver, kidneys, and lungs until delivery
- Blood crosses the placenta through the umbilical cord, providing the fetus with oxygen, glucose, and nourishment. Additionally filtering dangerous trash and carbon dioxide from newborn blood is the placenta.
- The placenta facilitates the transmission of nutrients and oxygen between the mother's and the baby's bloodstreams without ever mixing them.
- As the birth date approaches, the placenta provides the baby with antibodies to strengthen her immunity. The newborn retains this immunity for its initial six months of life.

- The placenta produces several important hormones during pregnancy, such as progesterone, oestrogen, and lactogen. These pregnancy hormones are beneficial to both the mother and the fetus. The placenta generates a hormone, for instance, that reduces milk output during pregnancy.

➤ **Where is the placenta formed?**

In your uterus, the placenta can develop anywhere. It grows wherever your uterine wall receives the fertilized egg. The placenta can be found in the following positions:

- **Posterior placenta:** On the rear wall of your uterus, the placenta develops.
- **Anterior placenta:** The uterine wall nearest to your abdomen is where the placenta develops.
- **Fundal placenta:** The placenta develops at the uterine top.
- **Lateral placenta:** The placenta develops on either the left or right uterine wall. Prior to approximately 32 weeks of pregnancy, the placenta may migrate. As your baby becomes larger, it's normal for the placenta to shift upward and separate from your cervix ^[20].

❖ **Anatomy of umbilical cord:**

The fun is, also known as the umbilical cord, acts as a conduit between the fetus and the placenta, allowing fetal blood to flow both ways. It extends from the fetus's placental surface to its umbilicus.

➤ **Development:**

The umbilical cord originates from the connective stalk, a band of mesoblastic tissue that extends between the embryonic disc and the chorion. Initially, it is affixed to the caudal end of the embryonic disc; however, due to cephalocaudal folding of the embryo and concurrent expansion of the amniotic cavity, the amnioectodermal junction converges on the ventral surface of the foetus. As the amniotic cavity expands disproportionately relative to the embryo and gets filled with fluid, the embryo is more positioned inside the amniotic cavity, accompanied by the elongation of the connective stalk, which will develop into the umbilical cord.

❖ **Structures:**

When the umbilical cord is fully developed, its components areas follow:

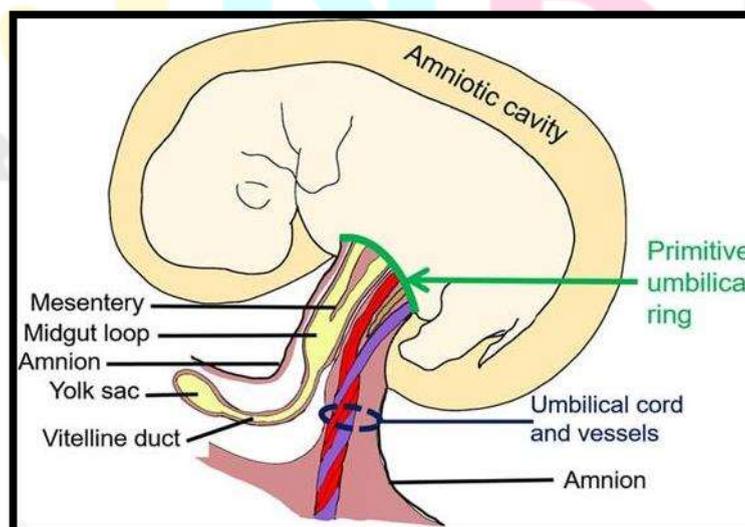


Fig2. Primitive umbilical cord of 10-week embryo

- **Covering epithelium:** Although the amniotic epithelium lines it in as in single layer, it exhibits stratification similar to the fetal epidermis at term.
- **Wharton's jelly:** It is made up of lengthy cells suspended in a gelatinous fluid that is the product of extraembryonic mesodermal cells' mucoid degeneration. It has a protective impact on the umbilical vasculature and is rich in mucopolysaccharides.
- **Blood vessels:** Two arteries and two veins make up the first four vessels. The arteries carry venous blood from the fetus to the placenta, and they start from the internal iliac arteries of the fetus. During the fourth month, the right of the two umbilical veins stops functioning, leaving just one vein to carry oxygenated blood from the placenta to the fetus. Congenital defects in foetuses are frequently associated with the presence of a single umbilical artery.

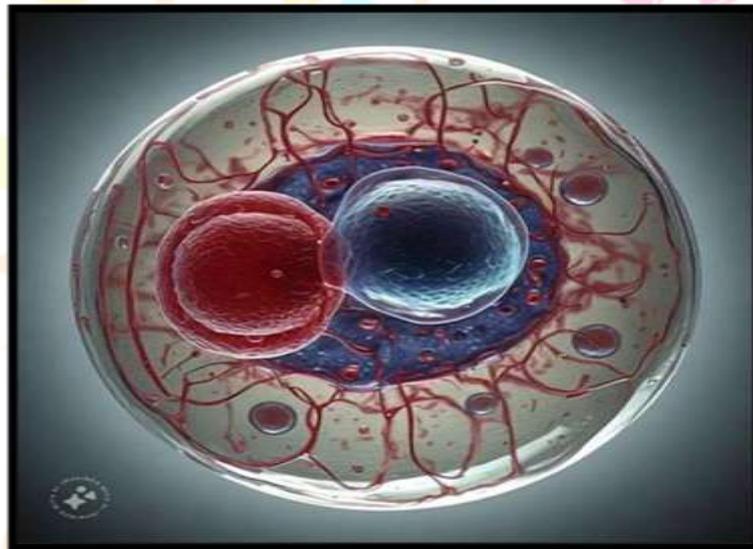


Fig 3. T.S of Umbilical cord

- **Remaining vitelline duct and umbilical vesicle (yolk sac):** In rare cases, the proximal section of the duct may continue as Meckel's diverticulum, or a remnant of the yolk sac may appear as a small yellow body adjacent to the cord's attachment to the placenta. As Meckel's diverticulum, the duct continues to exist.
- **Allantois:** Occasionally, a blind tubing structure that is persistent inside the developing embryo with its bladder and urachus may be seen close to the fetal end.
- **Obliterated extraembryonic coelom:** Early on, the midgut's intestinal coils herniate and the intraembryonic and extraembryonic coeloms are continuous. The condition may continue as exomohalos or a congenital umbilical hernia.

❖ **CHARACTERISTICS:**

It measures around 40cm in length, with a typical variance ranging from 30 to 100 cm.

The diameter averages 1.5 cm, with a variance of 1 to 2.5 cm.

The thickness is irregular, exhibiting nodes or swellings in some areas. The swellings, known as false knots,

may result from the kinking of umbilical arteries or localised accumulation of Wharton's jelly. The knots (1%) are in frequent. Extended cable may create a loop around the neck (20-30%) It demonstrates a spiral twist from left to right as early as the 12th week, according to the spiral configuration of the veins surrounding the arteries. The umbilical arteries lack an internal elastic lamina but retain a well-developed muscular covering. These facilitate the efficient closure of the arteries due to reflex spasm immediately after the infant's delivery. Neither the arteries nor the vein contains vasa vasorum.

➤ **Attachment:**

The chord is initially attached to the embryo's ventral side toward the caudal end; but, by the fourth month, the attachment site has been permanently moved to the center of the abdomen as the coelom closes and the yolk sac degenerates.

Unlike the fetal bond, the placental attachment is irregular. It often adheres to the foetal surface of the placenta at a location between the centre and the periphery, referred to as eccentric insertion.

The attachment may be central, marginal, or located on the chorion at varied distances from the placenta's edge. referred to as velamentous insertion ^[21].

● **What is cord blood?**

The term "cord blood" describes the blood that remains in the umbilical cord after delivery and is rich in life-saving stem cells. The use of cord blood for hematopoietic stem cell transplantation has been approved by the US Food and Drug Administration (USFDA) for the treatment of immunological deficiencies, metabolic disorders, blood illnesses, and blood malignancies.

Cord blood banking is less complex than it seems, which may be surprising. In fact, sample collection is a simple and expeditious process. As the sample is collected post-clamping and severing of the umbilical cord during delivery, neither the mother nor the newborn endures any pain or harm. Moreover, the initial stage in the cord blood banking process is selecting the appropriate cord blood bank.

Making the appropriate selection is not as straight forward as it may seem, although it is not very challenging either. To make a selection, among other things, one could begin by contrasting the advantages provided by various banks, the processing technologies they employ, or their level of industry experience. Life Cell has been involved in stem cell banking for more than 20 years. The procedure offers a smooth experience that includes registration, storage, and instant access to the stem cells from your baby's cord blood. Today, we'll explain the five simple steps Life Cell takes to gather, prepare, and preserve cord blood.

❖ **Steps of Cord blood banking journey:**

1) **Collection:**

Once you enrol with Life Cell for cord blood banking, you will receive a cord blood collection kit, which you need to carry at the time of delivery. The collected samples are then carefully labelled & packed in a sterile, puncture-proof, and temperature-controlled collection kit and handed over to the Life Cell paramedic.

The umbilical cord blood collection process is quick and painless. Shortly after delivery, the baby's umbilical cord is clamped at both ends and cut.

Using a sterile needle, the attending healthcare professional/gynaecologist will then draw out the blood into a cord blood collection bag. About 90 ml- 100ml (collection bag has a vol. capacity of 150ml) of blood is collected and sealed before the placenta is delivered. Then other's blood sample will also be collected and tested for infectious agents.

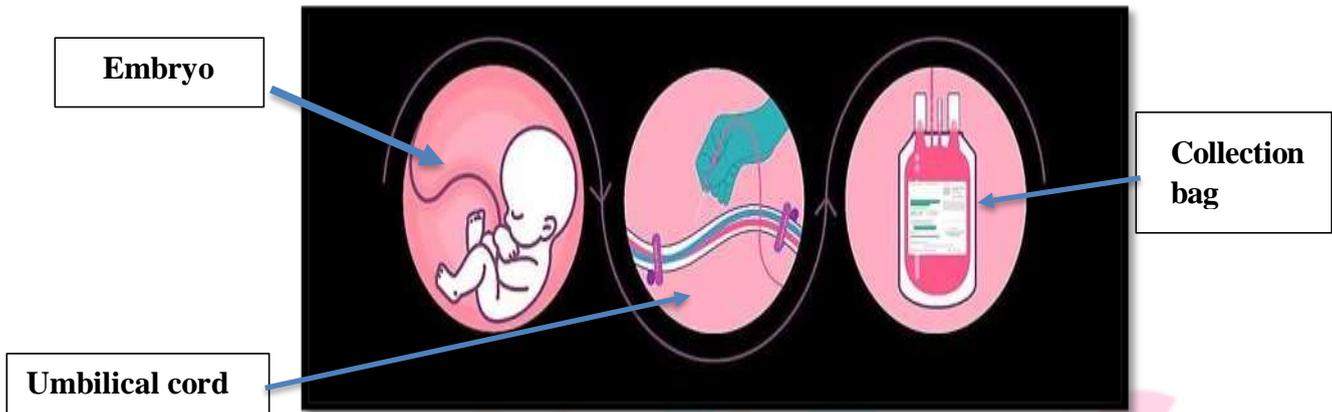


Fig4. Step of collection

2) Shipment:

The sample collection kit box is then transported from the hospital in a return-free shipment to Life Cell's Chennai processing facility.

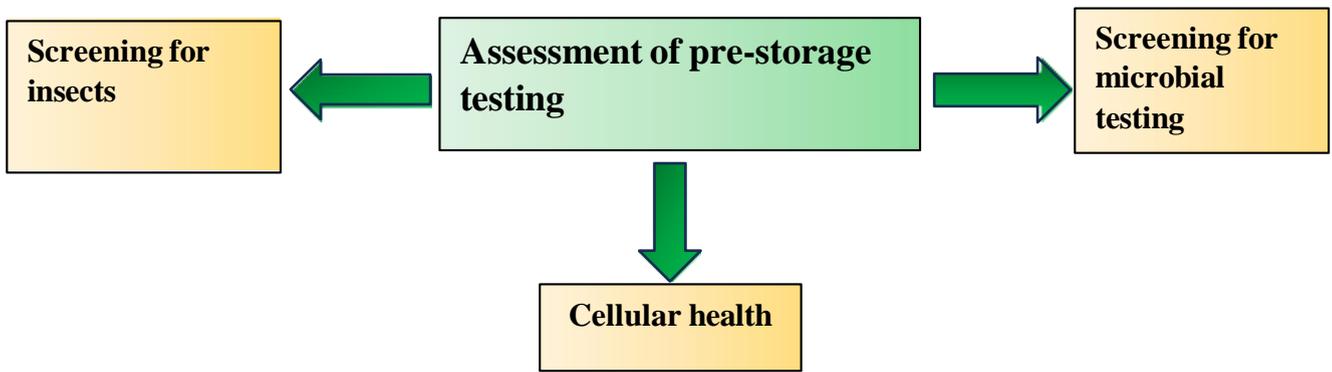


Fig5 step of shipment

3) Testing:

Once the shipped consignment reaches the Life Cell laboratory, it undergoes a thorough quality check. The consignment might be checked for leakages if any.

Thereafter each cord blood bag received at the processing unit is evaluated by lab technicians for a cellular health check and a series of biochemical screening as a part of pre-storage processes. Pre-storage testing parameters for all samples also include assessment of:



4) Processing:

After it passes the primary testing criteria, lab technicians perform processing. The cord blood processing needs to be completed within 48 hours of collection to maximize the recovery of stem cells. The first processing step is to extract the stem cells. At Life Cell, Pentastarch technology is used to process cord blood units. It helps extract the maximum viable stem cells from the sample while reducing the Red Blood Cell (RBC) contamination. This means that each collection yields more stem cells.



Fig6. Step of processing

5) Storage & sample retrieval:

Finally, the processed cord blood unit is prepared for cryopreservation. It is wrapped and sealed in cryo-bags (volume capacity:25ml), which are then frozen and transferred to cryo-vessels. The cells are frozen under -196°C and preserved in vapor-phase liquid nitrogen within stainless steel cryo tanks. Life Cell carries a reputation for having the highest retrieval experience. Before release, the cryo bags undergo several pre-release tests which include recipient HLA typing and a genetic screening test that covers sequence checks for 1000+ Inherited Genetic Disorders as part of the safe transplantation program. It has successfully released 57 samples in India (across 13 hospitals in metro

and non-metro cities) and 76 samples overseas. It also has a worldwide shipment experience with the US, Singapore, Thailand, and India where released samples are delivered free of cost, right at your doorstep ^[22].



Fig7. Step of storage and sample retrieval

➤ **BENEFITS OF UMBILICAL CORD BLOOD BANKING:**

- Utilizing umbilical cord blood to extract stem cells is straight forward and poses no risk to the mother or infant.
- Long-term cryo preservation capabilities for stem cell storage.
- Cord blood stem cells are immediately accessible for utilisation.
- Abundant source of haematopoietic stem cells that can address various diseases.
- Cord blood stem cells are immunologically naïve, allowing for the possibility of transplantation with a donor cord blood match as low as 75%, unlike other sources that need a complete match. It serves as a dependable option for individuals lacking a full stem cell match with their siblings.
- Significant proliferative potential capable of generating extensive colonies of stem cells
- Minimal risk of transmitting clinically significant infections during transplantations.

➤ **Disadvantages Of Umbilical Cord Blood Banking:**

- Adults seeking a transplant will need cord blood stem cells from many donors as cord blood may not have enough of stem cells.
- Given inadequate stem cell counts or insufficient volume, all the gathered cord blood units may not satisfy storage requirements.
- Cord blood stem cells engrave themselves more slowly than bone marrow stem cells. solely privatised companies where parents have to pay a charge for holding cord blood and also restrict access solely to members gather and harvest cord blood [23].

✓ **Potential uses:**

Umbilical cord blood stem cells can be used to treat a number of illnesses, including:

- ◆ Degenerative illnesses
- ◆ Damage to tissue

- ◆ Blood Conditions
- ◆ Some types of cancer
- ◆ Disorders of Metabolism
- ◆ Immunological Conditions ^[24]

❖ Stem Cell Transplants in Cancer Treatment:

Stem cell transplantation is an option for people whose blood stem cells have been destroyed by excessive levels of radiation or chemotherapy therapy used to treat specific cancers, blood disorders, and autoimmune diseases. Blood-forming stem cells are vital because they can differentiate into a wide variety of blood cell types. The main categories of blood cells are:

- I. Platelets, which aid in blood coagulation and stop bleeding.
- II. Your body uses red blood cells to carry oxygen.
- III. White blood cells aid in the body's defense against infection and are a component of the immune system.

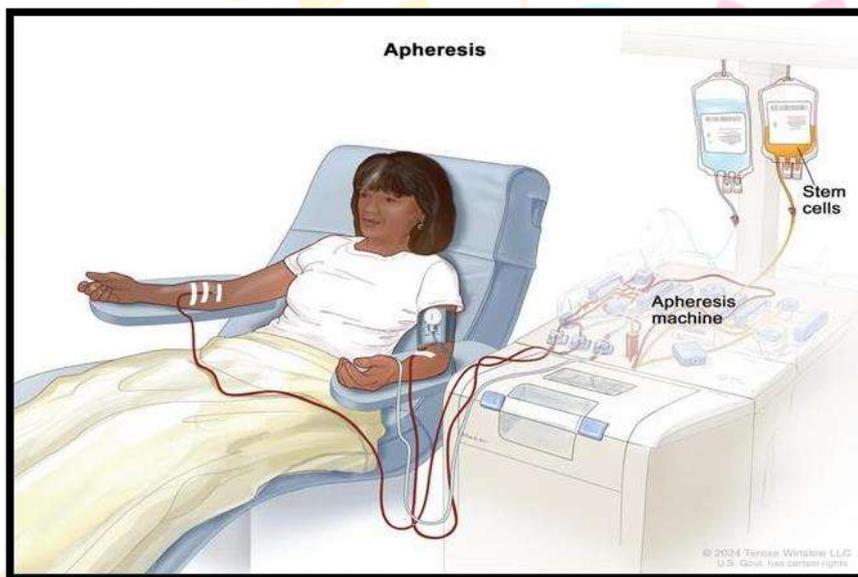


Fig 9: To collect stem cells for a stem cell transplant, the donor is connected to an apheresis machine. After the machine collects blood stem cells from the donor, it returns the rest of the blood to their body.

❖ Cancer types that stem cell transplants can treat:

Most frequently, stem cell transplants are used to treat patients with blood cell-related malignancies, including:

- i. Multiple myeloma.
- ii. Lymphoma.
- iii. Leukemia.
- iv. Myelodysplastic syndromes ^[25].

- ◆ **Leukemia:** The malignancy of the blood or bone marrow that generates blood cells is leukaemia. Leukaemia results from an issue with blood cell generation. Usually, it influences the leukocytes—that is, white blood

cells [26].

- ◆ **lymphoma:** Lymphoma is one type of lymphatic system cancer. The body's immune system, which fights sickness and germs, the lymphatic system is Lymphoma starts when lymphatic system healthy cells transform and proliferate out of control [27].
- ◆ **Multiple myeloma:** Monoclonal plasma cells proliferating in bone marrow produce an excess of monoclonal paraprotein (M protein), which causes the malignancy known as multiple myeloma. Other haematopoietic cell lines are shifted and bone is damaged [28].
- ◆ **Myelodysplastic syndromes:** A class of cancers known as myelodysplastic syndromes occurs when bone marrow's immature blood cells do not mature into healthy blood cells. The diagnosis of the numerous myelodysplastic syndromes is guided by different changes in the bone marrow and blood cells. Age and previous radiation or chemotherapy treatments affect the likelihood of myelodysplastic syndrome. A myelodysplastic condition manifests in shortness of breath and tiredness. Myelodysplastic disorders are diagnosed using tests of blood and bone marrow. Many factors influence therapy choices and prognosis, or possibility of recovery [29].

❖ **The mechanism by which stem cell transplants combat cancer:**

The process by which stem cell transplants can prevent cancer. Typically, stem cell transplants don't directly affect cancer. Instead, they aid in the production of new blood cells by your body following treatments with very high levels of chemotherapeutic and maybe other treatments, such as radiation therapy, that are intended to kill cancer cells.

However, the stem cell transplant may directly combat the malignant tendency of leukemia. Graft-versus-tumor, often referred to as graft-versus-leukemia, is a phenomenon that can arise following on or stem cell transplants. This impact happens when leukemia or tumor cells, which are cancer cells that are still in your body, are targeted by white blood cells from your on or, the graft. The likelihood of a successful transplantation is increased by this propensity.

□ **Types of stem cell transplants:**

While during a stem cell transplant, a needle is inserted into your vein to supply healthy stem cells for the production of blood. Circulating blood contains the majority of the stem cells that form blood used in transplants. The transplant may be referred to as a peripheral blood stem cell transplant, or PBSCT, once the stem cells are extracted from the blood. However, neonatal blood from the bone marrow or the umbilical cord can also be used to create blood stem cells. The procedure may be referred to as a bone marrow transplant, or BMT, if the stem cells origin ate from the bone marrow. It could be referred to as a cord blood transplant if the process begins using cord blood.

After entering the blood stream, the stem cells travel to the bone marrow to replace the cells that the therapy had damaged. Two types of transplantation exist:

- Auto logous, in which the cancer patient's stem cells are used.
- Allogeneic stem cells are sourced from a different individual. If the cells closely resemble those of the cancer patient, the donor could be an unrelated person or a blood relative.
- Syngeneic refers to stem cells derived from identical twins.

Both autologous and allogeneic stem cell transplantation include distinct benefits and drawbacks. The donor cells will be compatible with autologous transplants. Nonetheless, the transplantation of cancer cells entails a little danger.

It is essential for the cells to exhibit enough compatible in allogeneic transplants to stop the immune system of the recipient from identifying the blood stem cells as alien substances and rejecting them.

A type of allogeneic transplant known as a mini-transplant employs less cancer therapy than a conventional transplant. Certain cancer cells are eradicated, although not all blood-forming stem cells are eliminated. This kind of allogeneic transplant may prevent your body from suppressing your immune system and rejecting the stem cells from the donor.

One type of autologous transplant is a tandem transplant. In a tandem transplant, the patient has a stem cell transplant after a course of intensive chemotherapy. Subsequently, some weeks or months later. They have a further round of intensive chemotherapy prior to undergoing a stem cell transplant.

The following will depend on a number of circumstances, including the type of cancer the patient has.

- Determining the suitability of a stem cell transplant and identifying the specific type applicable to them.
- What is the stage of the cancer?
- Can the patient use their own stem cells?
- Are there any accessible appropriate donor stem cells?
- Are there any alternative therapies that may be efficacious for their cancer?
- Should they possess more substantial health complications, and if you are capable of tolerating high doses of chemotherapy
- The physician will meticulously evaluate these issues about the advantages and disadvantages of every kind of stem cell transplant and talk to them about their previous treatments.

❖ **How blood-forming stem cells are matched**

Stem cell compatibility for blood production is determined by analysing a donor's human leukocyte antigens (HLAs) to assess suitability for transplantation. The majority of cells in your body possess HLAs, which are protein complexes recognized as markers. Each person has a unique array of HLAs. The probability of your body accepting the donor's stem cells rises with the quantity of shared HLAs between you and the donor. A sibling is often the optimal donor for an allogeneic stem cell transplant.

The substantial doses of cancer therapy used before a stem cell transplant may lead to complications such as haemorrhaging, increased susceptibility to infections, and profound weariness. Stem cell transplantation may present both acute and chronic complications.

Short-term issues could include:

- ✓ fatigue,
- ✓ lack of appetite,
- ✓ mouth sores,
- ✓ skin reactions,
- ✓ nausea,
- ✓ vomiting,
- ✓ fatigue.

The following are possible long-term issues with stem cell transplants:

- ✓ Infertility; cataracts (clouding of the eye's lens, which results in vision loss);
- ✓ New secondary malignancy.
- ✓ Damage to the heart, lungs, kidneys, or liver
- ✓ Weakness in the bones and muscles
- ✓ The patient should discuss potential side effects, their severity, and how to handle them with the physician or nurse.
- ✓ If they experience difficulties eating while receiving a stem cell transplant, speak with the physician or nurse. Talking to a dietitian could be beneficial for the patient ^[30].

❖ **Stem cell treatment in metabolic disorder:**

Adrenoleukodystrophy (ALD): A genetic condition known as adrenal leukodystrophy (ALD) damages the myelin sheath that surrounds nerve cells in the brain and spinal cord. Around nerve fibers, myelin acts as an insulating coating. Reduced bodily functioning or paralysis can occur when this insulating barrier is breached because nerve impulses from the brain cannot travel through the body efficiently.

Because ALD cannot break down Very Long Chain Fatty Acids (VLCFAs), they build up in the brain, neurological system, and adrenal glands. It is believed that the buildup damages the myelin sheath by causing inflammation in the body.

❖ **How is ALD Inherited?**

One or both parents may pass on ALD, which is a genetic condition. ALD primarily impacts men. Manifesting either in infancy or adulthood. Female carriers of ALD show a less severe variant of the illness in maturity.

□ **ALD Symptoms:**

ALD symptoms can appear much later in life however they often start around the ages of 4 and 10.

Symptoms of ALD include:

- Vision loss
- Learning impairments
- Dysphagia, or trouble swallowing
- Convulsions

- Deafness
- Insufficient balance and coordination
- Weariness
- Frequent episodes of vomiting
- Loss of weight
- Absence of appetite
- Feeling queasy
- Skin darkening
- Dementia progression
- Weakness in muscles
- Low blood sugar(glucose)
- Morning headaches caused by adrenomyeloneuropathy

Adrenomyeloneuropathy is a kind of adrenoleukodystrophy that manifests in adulthood and proceeds gradually over many decades. Symptoms may include a rigid gait during ambulation and malfunction of the bladder and intestines. A considerable number of male patients often use a wheelchair. The adrenal glands often inadequately synthesise steroid (cortisol) in individuals with ALD, resulting in Addison's disease.

❖ **ALD Diagnosis:**

If doctors believe the patient may have ALD after carefully reviewing the patient's medical history, they will order further testing: Initially, a blood test is conducted to determine the VLCFA levels. Elevated VLCFA levels may indicate an ALD diagnosis. A genetic test is required to confirm this diagnosis. In the event that ALD is identified, the physician might advise genetic testing for the patient's relatives. Newborns are now being screened for ALD in many jurisdictions.

❖ **ALD Treatment:**

ALD symptoms can be reduced with pharmacological treatments and physical therapy. If the patient is identified early on or in childhood, a stem cell transplant could be a practical strategy to stop the progression of ALD. ^[31]

- There are several therapies and treatments all over the world that can be used to treat Adrenoleukodystrophy. But, at Stem Cell Care India, our professional team of doctors and researchers use the regenerative power of stem cells to treat this rare disease. Different kinds of specialized cells can be produced from stem cells to cure the symptoms of this medical condition from the roots and provide patients the quality of life they want.
- In stem cell therapy, healthy stem cells which are taken by allogeneic or by autologous method will be transplanted to the patient's body. After that these cells divide themselves into different types of cells which are needed to repair the damaged cells and tissues. If a patient of ALD comes to our clinic hospital, then our main focus is to replace the damaged cells with the healthy and new ones which will be beneficial to produce the protein needed to cut down the fatty acid.

- One common method is a bone marrow transplant. In this procedure, the patient receives an injection of healthy stem cells from the bone marrow of a donor. This can help rebuild the patient's immune system and give the needed cells to stop ALD from getting worse. While this treatment gives hope, it is still being tested and has risks, like the chance that the body might reject the new cells ^[32].

❖ CONCLUSION:

The outcomes can be catastrophic when standard medications are used to treat diseases including neurological, tissue damage, blood problems, some malignancies, metabolic disorders, and immunological disorders. Current developments in stem cell treatment research offer effective and encouraging methods for treating a range of illnesses. Although much more needs to be done, the recent transition of several of these medications to clinical trials and the heightened focus on preclinical research have set the stage for future progress. Future therapeutic approaches to treating diseases are anticipated to heavily rely on stem cells since they have the potential to replace damaged neurones, tissues, and provide neuroprotective and neurorestorative effects for a variety of disorders. Furthermore, recent technological developments in stem cells that use hydrogels and nanoparticles have improved the efficacy of drug delivery and regeneration therapies. Thus, it is expected that regenerative and neuronal replacement therapies would soon be successfully used in clinical settings.

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