

Chaos, impotence and market pressures:

THE STEM CELL STORY



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Stem cells treatments have come a long way since the first bone marrow transplant was performed in the 1960s. Many specialities including surgery are turning to stem cell treatments to improve therapeutic outcomes. However, this enthusiasm raises the questions: Is the use of stem cells in surgery safe and effective? What issues should surgeons be aware of?

In order to look into this issue a team from Research & Evaluation incorporating ASERNIP-S reviewed evidence for the use of stem cells treatment in surgery across the nine surgical Specialties. Ongoing clinical trials from Australia and New Zealand were identified. Stem cell treatment centres in Australia and New Zealand, and the range of treatments they provide were also assessed.

Currently, bone marrow transplantation is a recognised therapy for treatment of blood, metabolic and autoimmune diseases, and for

cancers. In Australia, these services are reimbursed through Medicare (MBS item 13760). Beyond these recognised stem cell treatments the application of stem cells is broadening rapidly for a variety of diseases and conditions.

What are stem cells?

The human body is made up of over 200 different kinds of specialist cells – all of which originate from stem cells. Stem cells are characterised by their ability to both differentiate and proliferate. In theory, they are capable of developing into any cell type, and are essential in maintaining tissue and organ health. These characteristics make stem cells a potential treatment to assist organ and tissue repair after invasive procedures such as surgery.

Human stem cells are categorised in many ways. Based on their potency or ability to differentiate, stem cells are defined by two main groups, they are; multipotent stem cells (also called adult tissue-specific or somatic stem cells); and, pluripotent stem cells.

Multipotent stem cells are limited in their potential to differentiate and are restricted to one of the germ layers (endoderm, mesoderm, or ectoderm) or adult cell lineages such as skin, muscle, brain, heart, eye, lung, pancreas, liver, intestine and bone marrow. In contrast, pluripotent stem cells have the potential to grow into any type of cell in the body. Examples are embryonic stem cells; however, their use in clinical and research settings is still the subject of significant and ongoing ethical debate.

Adult stem cells have been the cell of choice when researching and developing stem cell treatments. Treatments have utilised cells from two main origins, these being the haematopoietic and mesenchyme tissues. Adult bone marrow, peripheral blood and umbilical cord blood are sources of haematopoietic stem cells. Bone marrow stroma, adipose tissue, umbilical cord blood and the placenta are sources of mesenchymal stem cells. Irrespective of stem cell type or tissue origin, stem cell treatment is based either on recipient-derived cells (autologous) or from a separate donor (allogeneic).

For therapies based on haematopoietic stem cells, the cells are either collected from the peripheral blood after mobilisation from the bone marrow using growth factors, or collected commonly directly from the bone marrow. In contrast, mesenchymal stem cell-based treatment protocols require the isolation of stem cells in the laboratory following their harvesting from a source tissue. However, due to the low numbers of stem cells in adult tissues, there is usually a need to expand their numbers to achieve cell numbers suitable for therapeutic use.

Which stem cell treatments are available in Australia and New Zealand?

For many years, patients who were interested in stem cell treatments travelled overseas in what is termed 'stem cell tourism' to receive their