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Daily Mail
24 HOURS A DAY

08/07/07 - Science & tech section

Blood vessels made from bones offer hope for bypass patients

Blood vessels made in the laboratory from bone marrow have been successfully tested in sheep, paving the way for trials in human patients.

In future similar implants could be used to give heart by-pass patients a new lease of life.

Like natural arteries, the tissue engineered vessels (TEVs) contract or dilate in response to different conditions.

They also demonstrate the ability to proliferate, and make collagen and elastin, which give blood vessels their strength and elasticity.

The vessels functioned normally for five weeks in the sheep. US scientists at the University of Buffalo, New York State, are now working on ways to make them stronger and longer lasting.

Heart by-passes normally involve using a piece of vein to divert blood around a blocked section of coronary artery.

Without the by-pass, the patient would be at risk of the heart being starved of blood, leading to a heart attack. In some cases of severe artery disease double or even triple by-passes have to be performed.

However suitable venous grafts can be difficult to find and have a high 10-year failure rate. Patients may also suffer pain and discomfort at the site from where the graft is taken.

Growing new vessels from scratch and using them to re-route blood to the heart could potentially offer a better solution.

The experimental TEVs were produced from adult stem cells found in the bone marrow. Stem cells are immature cells which can develop along a number of different routes and are easy to grow in the laboratory. Scientists hope to use them to treat a wide range of different diseases.

The Buffalo team made cells earmarked to become both smooth muscle cells and the endothelial cells which make up the inner wall lining of blood vessels.

Short stretches of the vessels were generated in the laboratory and transplanted into sheep. The study was reported in the journal Cardiovascular Research.

Dr Stelios Andreadis, who co-led the team from the university's Department of Chemical and Biological Engineering, said: "Our results show that bone marrow is an excellent source of adult stem cells containing smooth muscle and endothelial cells, and that these stem cells can be used in regenerative medicine for cardiovascular applications.

"These are the first tissue-engineered vessels to demonstrate the ability to make elastin in vivo (in

live animals or patients)."

Recent research has shown that smooth muscle stem cells in bone marrow may be immunoprivileged, which means they will not trigger an immune reaction if transferred from one individual to another.

"If true, this means that you may be able to develop a universal cell source for smooth muscle cells, so that you could potentially make these vessels into an 'off-the-shelf' product," said Dr Andreadis.

Dr Mike Knapton, director of prevention and care at the British Heart Foundation (BHF), said: "Research into how we can harness our own bone marrow stem cells to replace diseased blood vessels is exciting and brings fresh hope for new heart disease treatments.

"This study on animals has a long way to go before it may offer practical help for heart patients, but it does help us gain a better understanding of how stem cells may be used in patients in the future.

"The BHF is currently funding almost £2 million of research to help us understand how new blood vessels grow and we look forward to seeing developments in this field that could lead to better treatment for people suffering from heart disease."
