

Vessel replacement

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Vessel Replacement

Vessel replacement is a surgical treatment used in medicine if an important blood vessel of the patient is obstructed or became unusable for any reason. An example of a vessel replacement surgery is the Bypass surgery. Blood vessel replacement is basically defined as creating a way for the blood flow to reach its destination skipping the obstructed or destroyed vessel. There are different materials to choose from when replacing a vessel:

1. **Vessels of a donor:** A vessel of another person is implanted to replace the obstructed vessel. This method often fails to succeed because the body of the patient may not accept the foreign material and fight against it.
2. **Own veins of the patient:** Normally you take a vein which is not crucial for the patient (for example a part of the great saphenous vein). With that vein you then create a way for the blood flow around the obstructed vessel. This is the most common method of vessel replacement because the body will accept the own vessel easily. This method can't be used if there are no own veins available because of disease or previous vessel replacement surgeries. Also if you have to replace for example the Aorta you can't use this method because there is no vein in this size available which you could use.
3. **Vascular prosthesis:** There is the possibility to synthesize vessels. For example Polyethylene terephthalate and polytetrafluoroethylene are used to synthesize artificial vessels. However there is the possibility that the body doesn't accept this synthesized vessels. Also in case the body accepts the vessel these artificial vessel prosthesis will not fuse completely with the body's own vessels. This can become a problem over long term.
4. **Bioengineered blood vessels:** This method involves the growing of blood vessels in vitro from the patient's own cells. This makes it easy for the body to accept the vessels. Due to the fact that this method just recently got developed and is not perfect yet, this method is cost- and time-intensive (takes several months). The first successful implantation of a bioengineered vessel was done in 2013. Procedure:
 1. The patient's cells are placed in a solution of amino acids, vitamins and nutrients and grown around a tube-shaped mesh structure, causing the cells to form into the shape of a blood vessel.
 2. The mesh structure is biodegradable and dissolves as the cells grow around it into the vessel shape. Then the cells' structure gets seeded with muscle cells to strengthen it.
 3. During the growth process nutrients are pumped through the growing vessel in the rhythm of the heart beat to strengthen the vessel.
 4. Finally the vessel is bathed in a solution which turns the cells' structure into a structure of collagen which improves the chance of the body accepting the vessel.

References:

1. Biomechanics of blood vessels
2. Blood flow

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