Transplantation

Types

Autograft

Autograftsarethetransplantoftissuetothesameperson.Sometimesthisisdonewithsurplustissue,tissuethatcan regenerate,or tissuesmoredesperately neededelsewhere(examplesincludeskingrafts,veinextractionforCABG,etc.). Sometimesanautograftis donetoremovethe tissue and then treat it or the person before returning it (examples include stem cell autograftandstoringbloodinadvanceofsurgery).

Allograftandallo transplantation

Anallograftisatransplantofanorganortissuebetweentwogeneticallynon-identicalmembersof the same species. Most human tissue and organ transplants are allografts. Due to the geneticdifference between the organ and the recipient, the recipient's immune system will identify theorganasforeignandattempttodestroyit,causingtransplantrejection.

Isograft

A subset of allografts in which organs or tissues are transplanted from a donor to a geneticallyidentical recipient (such as an identical twin). Isografts are differentiated from other types oftransplants because while they are anatomically identical to allo grafts, they do not trigger animmuneresponse.

Xenograftandxenotransplantation

A transplant of organs or tissue from one species to another. An example is porcine heart valvetransplant, which is quite common and successful. Another example is attempted piscine-primate(fish to non-human primate) transplant of islet (i.e. pancreatic or insular tissue) tissue.The latter research study was intended to pave the way for potential human use if successful.However, xenotransplantion is often an extremely dangerous type of transplant because oftheincreasedrisk ofnon-compatibility,rejection,and diseasecarriedinthetissue.

Success of transplantation between identical twins proposes that the success rate depends ontheamountofsharingofhistocompatibilitygenes.

Histocompatibility genes are responsible for the production of antigens on cell surface. Withreferencetothesurfaceantigens,thegraftsortransplantsare differentiatedintofourtypes.

Theyareasfollows:

1. AutograftorAutogenicgraft
2. IsograftorSyngraft orSyngeneticgraft,

3. allograftsorHomografts,

4. Xenograft.

1. AutograftorAutogenicgraft:

When tissue is transplanted from one site to another in the same individual, the transplant isreferredas"autograft"or"autogenicgraft" (FromGreekAuto=Self).

Immunesystemofrecipientacceptstheautograftveryeasily,becauseantigensofrecipientcellsandthetransplantedtissuearealike.

2. IsograftorSyngraftorSyngenticgraft:

ThegrafttakenfromageneticallyidenticalpersonisknownasIsograftorSyngraftorSyngenticgraft.Thiskindoftransplantationispossiblebetweentwogeneticallyidenticaltwins.

Since development of identical twins takes place from a single zygote, identical twins sharesamegenesthatareresponsibleforthe productionofantigens.

3. AllograftorHomograft:

Ifthetransplantationiscarried betweengeneticallydifferentmembersofthesamespeciesthengraftiscalledas"allograft".Theallograftisformallynamedas"Homograft".

The histocompartbility antigens of allograft are dissimilar with the host histocompartbilityantigens. Hence immune system of recipient/ host identifies the graft as foreign and induces animmuneresponseagainsttoit,resultingrejectionofgraft.

4. Xenograft:

Ifthetransplantationbetweenindividualsoftwodifferentspeciesiscarried,foreg.Transplantingmonkeyliverto human,thegraftis referredas"Xenograft".

Sincethehistocompatibilitygenesarequitedifferent,hostsbodyrejectsthegraftmorevigorously.

Bloodtransfusion

Blood transfusion is generally the process of receiving blood or blood products into one'scirculation intravenously. Transfusions are used for various medical conditions to replace lostcomponents of the blood. Early transfusions used whole blood, but modern medical practicecommonlyusesonlycomponentsoftheblood,suchasredbloodcells,whitebloodcells,plasma,clottingf

actors, andplatelets.

Red blood cell transfusion was considered when the hemoglobin level fell below 10 g/dL orhematocrit falls below 30% (the "10/30 rule"). Because each unit of blood given carries risks, atrigger levellowerthanthatat7–8g/dLisnowusuallyusedasithasbeenshownto havebetterpatient outcomes. The administration of a single unit of blood is the standard for hospitalizedpeoplewhoarenotbleeding,withthistreatmentthenfollowedwithre-assessmentandconsiderationofsymptomsandhemoglobinconcentration.Patientswithpooroxygensaturation may need more blood. The advisory caution to use blood transfusion only with more severeanemia is in part due to evidence that outcomes are worsened if larger amounts are given. Onemayconsidertransfusionforpeoplewithsymptomsofcardiovasculardiseasesuchaschestpainorshortnesso fbreath.Incaseswherepatientshavelowlevelsofhemoglobinbutarecardiovascularlystable,parenteralironisap referredoption based onbothefficacyandsafety

Blood transfusions typically use sources of blood: one's own (autologous transfusion),orsomeone else's (allogeneic or homologous transfusion). The latter is much more commonthanthe former. Using another's blood must first start with donation of blood. Blood is mostcommonly donated as whole blood intravenously and collecting it with an anticoagulant. Indeveloped countries, donations are usually anonymous to the recipient, but products in a bloodbank are always individually traceable through the whole cycle of donation, testing, separationinto components, storage, and administration to the recipient. This enables management andinvestigationofanysuspectedtransfusionrelateddisease transmissionortransfusionreaction.

Blood transfusion is generally the process of receiving blood products into one's circulationintravenously.Transfusionsareusedforvariousmedicalconditionstoreplacelostcomponentsofthe blood.Earlytransfusionsusedwholeblood,but modernmedicalpracticecommonlyusesonlycomponentsoftheblood,suchasredbloodcells,whitebloodcells,p lasma,clottingfactors,andplatelets.

Procedure

Before a blood transfusion is given, there are many steps taken to ensure quality of the bloodproducts,compatibility,andsafetytotherecipient.In2012,anationalbloodpolicywasinplacein 70% of countries and 62% of countries had specific legislation that covers the safety andqualityofbloodtransfusion.

Blooddonation

Bloodtransfusionstypicallyusesourcesofblood:one'sown(autologoustransfusion),orsomeoneelse's (allogeneicorhomologoustransfusion).

Thelatteris muchmorecommonthantheformer.

Usinganother'sbloodmustfirststartwithdonationofblood.Bloodismostcommonlydonatedaswholebloodintr avenouslyandcollectingitwithananticoagulant.

Indevelopedcountries,donationsareusuallyanonymoustotherecipient,butproductsinabloodbank are always individually traceable through the whole cycle of donation, testing, separationinto components, storage, and administration to the recipient. This enables management andinvestigationofanysuspectedtransfusionrelateddisease transmissionortransfusionreaction.

In developing countries the donor is sometimes specifically recruited by or for the recipient,typicallyafamilymember,andthedonationoccursimmediatelybefore the transfusion.

ProcessingandTesting

Donatedbloodisusuallysubjectedtoprocessingafteritiscollected,tomakeitsuitableforusein specific patient populations. Collected blood is then separated into blood components bycentrifugation: red blood cells, plasma, platelets, albumin protein, clotting factor concentrates,cryoprecipitate, fibrinogen concentrate, and immunoglobulins (antibodies). Red cells,plasmaandplateletscanalsobedonated individuallyviaamorecomplexprocesscalledapheresis.

- Alldonatedbloodistestedforinfections.Thecurrent protocoltestsdonatedbloodforHIV-1, HIV-2, HTLV-1, HTLV-2, Hepatitis B, Hepatitis C, Syphilis (*Treponema pallidum*),. Inaddition,plateletproductsarealsotestedforbacterialinfectionsduetoitshigherinclinationforcontaminationd uetostorageatroomtemperature..
- Alldonatedbloodisalso testedforABOandRhgroups,alongwiththepresenceofanyredbloodcellantibodies.
- Pathogen Reduction treatment that involves, for example, the addition of riboflavin withsubsequent exposure to UV light has been shown to be effective in inactivating pathogens(viruses, bacteria, parasites and white blood cells) in blood products. By inactivating whiteblood cells in donated blood products, riboflavin and UV light treatment can also replacegamma-irradiationasamethodtopreventgraft-versus-hostdisease(TA-GvHD).

Compatibilitytesting

Before a recipient receives a transfusion, compatibility testing between donor and recipientbloodmust be done. The first step before a transfusion is given is to Type and Screen therecipient's blood. Typing of recipient's blood determines the ABO and Rh status. The sample isthenScreenedforanyalloantibodiesthatmayreactwithdonorblood.Ittakesabout45minutesto complete (depending on the method used). The blood bank scientist also checks for specialrequirements of the patient (e.g. need for washed, irradiated or CMV negative blood) and thehistory of the patient to see if they have a previously identified antibodies and any otherserologicalanomalies.

Adverseeffects

Inthesamewaythatthesafetyofpharmaceuticalproductsareoverseenbypharmacovigalence,the safety of blood and blood products are overseen by Haemovigilance. This is defined by theWorldHealth Organization (WHO)as asystem "...toidentify andpreventoccurrenceorrecurrenceoftransfusionrelatedunwantedevents,toincreasethesafety,efficacyandef ficiencyofbloodtransfusion,coveringallactivitiesofthetransfusionchainfromdonortorecipient."

Thesystem should include monitoring, identification, reporting, investigation and analysis ofadverseeventsnear-missesandreactionsrelatedtotransfusionandmanufacturing.

Transfusions of blood products are associated with several complications, many of which canbegrouped as immunological or infectious. There is also increasing focus (and controversy) oncomplicationsarisingdirectlyorindirectlyfrompotentialqualitydegradationduringstorage.

Immunogicreaction

- *Acutehemolyticreactions* occurwithtransfusionofredbloodcells,andoccursinabout 0.016percentof transfusions,with about0.003 percentbeingfatal.Thisisduetodestruction of donor red blood cells by preformed recipient antibodies. Symptoms includefever, chills, chest pain, back pain, hemorrhage, increased heart rate, shortness of breath,andrapiddropinbloodpressure.Whensuspected,transfusionshouldbestoppedimmediately,andbloods entfortesttoevaluateforpresenceofhemolysis.
- *Delayed hemolytic reactions* occur more frequently (about 0.025 percent of transfusions)andaredue tothesamemechanismasinacute hemolyticreactions.

Most blood transfusions go very smoothly. Sometimes mild problems can occur. Very rarely,serious problems occur.
AllergicReactions-Somepeoplehaveallergicreactionstothebloodgivenduringtransfusions.This can happen even when the donated blood is the correct blood type. Allergic reactions canbemildorsevere.Symptomsmayinclude:AnxietyChestorbackpainTroublebreathingFever,Aquickpulse orlowbloodpressure,Nausea (feeling sicktoyourstomach)

A nurse or doctor will stop the transfusion at the first signs of an allergic reaction. The healthcare team will figure out the severity of the reaction, what treatments are needed, and whethertheycansafelyrestartthetransfusion.

ORGANTRANSPLANTATION

Movinganorganfromadonor'sbodytoapatient'sbody,ortocreateorgansfromthepatient'sown stem cells (regenerative medicine as an emerging field) in order to replace the recipient'sdamaged or absent organ, that is what the term Organ Transplantation refers to, including thefollowingorgans.

- Thymus
- Intestine
- Lungs
- Pancreas
- Liver
- Kidneys
- Heart

Italsoinvolvestotransplantationoftissuessuchas,

- Bones
- Muscoloskeletalgrafts
- Cornea
- Skin
- Heartvalves
- Nerves
- Veins

It is one of the most complex and challenging areas of medicine, because of the ever-presentriskthatthe recipientbodyrejectsthetransplant,makingtheremovalnecessary.

BenefitsandOutcomesofOrganTransplant

Organtransplantisthelastpossibilitytoaddressastateoforganfailure.Kidneyforinstance, isthe most frequently carried out organ transplant worldwide, and it is considered thebesttreatmentforitscosteffectivenessandlifequalityprospectsitrestores.

Organ transplantation requireslongterm healthevaluation of thepatient.Only academiccommunities and medical scientists have the right to monitor the outcomes of transplants andregulatedonations.

ThreeEssentialProcesses

In modern times, doctors and patients face an enormous demand for transplants which has longsurpassedthesupplyoforgans.Patientsmust waitalongtime,yearsinsomecases,forachancetogetholdofadonatedorgan.That'swhyscientistsareworkingal ongwithpoliticiansto solvethisproblem.

Organdistributionisthereforethefirstessentialstep,followedbythetransplantsurgeryandthefollow-uporpost-surgeryrecovery.

EvaluationProcess

Thefollowingaresomecomponentsofthetransplantevaluationprocess:

- Psychologicalevaluation–inwhichthemedicalteamassessessignificantpsychologicaland socialissuessuchasstress,financialsituationandfamilysupport.
- Blood tests – essential in the selection process to joining the donor's list. They areperformed to determine donor match, priority in the list and to improve chances againstorganrejection.
- Diagnosis–toassesshealthstatus.IncludesX-rays,ultrasound,biopsy,dentalexaminations,amongotherdiagnostictestsdependingonthetransplantsurgeryre

quired.

OrganDistribution

When a particular organ fails, transplant can be the only chance for the patient. For procedureslike kidney and liver transplant, a willing donor might be found among family members orfriends. A very small number of transplants come from people donating as a result of a good,Samaritan gesture. Nevertheless, there is still the necessity of being appropriate for donor-recipient match, a process of selection achieved through serotyping. Then it is possibletoproceedwiththesurgerystate.

Patientsmustfindatransplantteamoragroupoforgansurgeonsandhealthprofessionals, whodecide if the patient is a good candidate, based on the attitude, psychological state, medicalhistoryand otherfactors,tobeincludedinthenationalwaitinglistfortransplantation.

Whentheorganbecomesavailable,basedonthecriteriaofallrelevantinformation,arecipient,the bestmatchfor theorgan is chosen.Thenthehospitalpreparesforsurgery.

SurgicalProcedure

The fully anesthetized patient is injected with anticoagulant to keep the blood from clottingduringthetransplantationprocedure.Doctorsconnectthehearth-lungmachine,inthecaseofa heart transplant, or other life-support devices to enable the surgeon to remove the organwithoutdisruptingbodyfunctions.

Threetypesofrejection

Followingatransplantsurgery, thefollowingthreetypesofrejectionmightoccur:

- Chronicrejection–mightlast monthsoryears.
- Acuterejection–afewdaysaftertransplantanditistheimmuneresponsetoforeignmatter.
- Hyperacute rejection–assoonasthe organisconnectedtothenew body.

TypesofTransplant

- Autograft –transplantoftissuefromoneareaofthebodytoanother,usingsurplustissuewhichis regenerative.
- Allograft–transplantoftissueororganbetweennon-identicalmembersofaspecies.Thistransplantmightcauserejectionduetogenetic difference.
- Xenograftorxenotransplant–atransplantfrom onespeciestoanother.Very riskyduetorejection.

Individualorgans-kidney,liver,heart,lung,bone,skin,hairandpancreas

<u>Kidneytransplant:</u>

- Renal transplantationis thepreferredtreatmentforpatientswith end-stagerenaldisease.It offers better quality of life and confers greater longevity than long-termdialysis.
- EMPsencountertransplantptsat2criticalstages:
- Initial doctors toidentify potential donors from apool of critically ill patients whoareadmittedtohospital.
- Theycareforptsoncetheyhavebeentransplantedandpresentwithcomplicationsrelatedtotheirimmunosuppressive therapy,infectionsorARF.
- Diabeticnephropathyaccountsfor40%ofthediseasesresultinginrenaltransplantation.This subgroup of pts are also more prone to complications after renaltransplantation.
- Thespectrumofdiseasesintransplantptsisdifferentfromthegeneralpopulation.
- The classical presentation of common medical disorders may be modifiedbyimmunosuppressivemedication.

TheTransplantationProcess

- Transplantcoordinatorsshouldbecalledearlyforanyptwhomaymeetbraindeathcriteriainthenewfuture.
- AbsoluteC/IsfororgandonationincludeHIV,sepsis,non-CNSmalignancyandsevereCVSdisease.
- AgeisalsoarelativeC/I(i.e. organsnotharvestedfrompts>75yearsofage).
- Thepretransplantationworkupofapotentialdonorincludestestingfor CMV,HSV,EBV,HIV,HepA,B,C,D +EandHTLVtype1.

- Followingbraindeath, anumberofphysiologicalchangesoccurthatneedtoberectifiedifdonororganperfusionis tobepreserved.
- Increasedcerebraloedemaaftertraumaorstrokeresultsincatecholaminereleaseand HT. With brainstem necrosis, catecholamine levels drop rapidly resulting inhypotension.Thisshouldbe correctedwithfluidandvasopressors
- About75%oforgandonorsdevelopdiabetesinsipidusduetopituitarynecrosisandthisleadstohypovolaemia.
- Systemicthermalcontrolisoftenlostduetohypothalamicischaemiawhichresultsincoagulopathy,hepaticdysfunctionandcardiacdysfuction.
- Allograft:graftbetweengeneticallydissimilarindividualsofthesamespecies.

- Autograft:graftinwhichdonorandrecipientarethesameindividual.
- Xenograft:Donorandrecipientbelongtodifferentspecies.

TheSurgicalProcedure

- Wetischaemiatime(timefromcessationofcirculationtoremovaloforgananditsplacementincoldstorage)shouldnotexceed30mins.
- TransplantedkidneyisplacedintheRorLlowerquadrantoftheabdomeninanextraperitonealposition.Onexamination,the transplantiseasilypalpable.
- Thetransplantrenalaisanastomosedtotheipsilateralinternalorexternaliliaca,therenalvtointernalorexternaliliacvand the transplanturetertothebladder.
- Generallyasinglekidneyistransplanted.
- When small, paediatricor older cadaveric donor kidneys with age-related loss of renalfxn are transplanted, both kidneys from the donor might be placed in a single recipienttoprovideadequatefxnalrenalmass.
- Livingdonortransplantsfxnimmediatelyaftertransplant,+/-30%ofcadaverictransplantshavedelayedgraftfxnbecauseofmoreprolongedischaemiccoldpreservation.Theseptsneedcontinueddialysissupportuntil thekidney starts tofunction.

Livertransplant:

1960:InitialLiverTransplant(LT)techniquesdoneusingdogs.1963:FirsthumanLTattemptbyStarzl.
1967 : First successful LT by Starzl.Early1980's: LTbecameclinicalreality.
1983:Definitivetherapyforend-stageliverdisease(ESLD).
1988:DevelopmentoftheUniversityofWisconsin(UW)solution(graftpreservation).1992:FirstLiverxenotransplantsx2(baboon)byAG Tzakis

PotentialIndicationsforLT

Viralhepatitis
Malignantneoplasmofliverandintrahepatic bileductsBenign neoplasm of liver and biliary passagesCarcinomaofliverandbiliarysystem
NeoplasmofuncertainbehaviorinliverandbiliarypassagesNeoplasm of unspecified nature in digestive systemGlycogenesis
Purehypercholesterolemia
Lipidoses
Disordersofcoppermetabolism
Cystic fibrosis, disorders of porphyrin metabolism, other disorders of purineand pyrimidinemetabolism,amyloidosis,disordersofbilirubinexcretion,mucopolysaccharidosis,otherdeficiencisesofcirculatingenzymes
Congenitalfactor VIIIdisorder

CongenitalfactorIXdisorderBudd-Chiarrisyndrome
AcuteandsubacutenecrosisofliverAlcoholicfattyliver

AlcoholiccirrhosisofliverChronichepatitis
CirrhosisoftheliverwithoutmentionofalcoholBiliarycirrhosis
OtherchronicnonalcoholicliverdiseaseUnspecified liver disease without mention of alcoholOthersequelaeofchronicliverdisease
Otherspecifieddisordersofgallbladder
Biliary atresia, other anomalies of gallbladder, bile ducts, and liverPerinataljaundicedue tohepatocellulardamage
Otherspecifiedperinataldisordersofdigestive systemInjurytoliver
Encephalopathy,unspecifiedPortalveinthrombosis

LiverrecipientprocedureOrthotropicLT

TotalHepatectomy(venovenousbypass)
Cavalanastomosis(conventional, Piggybacktechnique).Reperfusion
Portalveinanastomosis
Hepatic Artery anastomosis (end to end, infrarenal aortic jump graft)Biliaryreconstruction(duct–to duct,Roux-en-Y hepatico-jejunostomy).

LivingDonor/SplitLT
Living-donorLT:partoftheliver fromalivingdonorisresectedandtransplantedintoarecipient.
SplitLT:awholeadultliveristransectedinto2piecestoprovidegraftsfor2recipients

PostoperativeCare
Liverfunctiontestsmonitoring
Fibrinogenlevelis themostimportantindicatorofgraftfunctioninfirst24hours(>100).
GradualnormalizationofALT, AST,T.Bili,PT.
Earlyelevationofliverenzymes(LEs)followedbyquicknormalizationisreflectiveofpreservationinjury(coldpreservation).
Primary non functional liver: marked increase of (LEs) and T. Bili (Tx: re-transplant).Thrombocytopenia:PlateletcountdecreaseinthefirstweekafterLTandincreaseduringthesecondweek.(Plateletsequestrationintheliverandspleen,preservationinjury).
DopplerUSLiver:intra-operatively,anddailyuntilPOD#5.(VelocityandRIofHA,PV,HVflow).
Dailymonitoringofimmunosuppressivedruglevels.

Immunosuppressant regimens

- ✓ ISP drugsnecessarytoprevent rejection.
- ✓ Theriskofrejectionishighest(upto40%)duringthefirst3-6monthsaftertransplantationanddecreases significantlythereafter.
- ✓ ISPinduction:Prograf(FK)+Steroids(OR)
- ✓ Maintenance:
  Prograf+Steroids

Prograf + Campath (steroid freeprotocol)Rapamycin+ Steroids OKT-3(severerejection)

BoneMarrowTransplant

Located in the interior of our bones, bone marrow is one of the areas that we are neverconcerned with until wehave some complaint.However, thisflexible,spongy and well-protectedtissueis essentialforourorganism.

A vital component of the bone marrow are stem cells which are immature cells that are able toform a variety of different cells in our body (e.g.: neural cells). Stem cells are responsible forthe production of the cellular elements of the blood: red blood cells (carry oxygen), platelets(ensurebloodclotting)andlymphocytes(immunefunctions).

WhatAreTheMostCommonDiseases?

Aplasticanemia(damagedbonemarrowanddroppedredbloodcellproduction)

Leukemia(abnormalwhitecellproduction)Bone marrowcancer

Moreover,cancerradiationandchemotherapycanalsoseverelydamagebonemarrow.Toavoidit, before radiation or chemotherapy treatment of cancer patients their stem cells are harvestedfrom the bone marrow to protect them and after the treatment they are re-injected to restoreimmunefunctions.

Diagnosis

Examination of bone marrow tissue can happen by biopsy and bone marrow aspiration to gaininformation about the source of blood production. The procedure is rather unpleasant butunavoidable.

BoneMarrowTransplant

Bonemarrowtransplantationcanbetheonlysolutiontotreatsomeseverediseases,suchas:bone marrowcancer leukemia
multiplemyelomacertainblooddiseasesautoimmunediseases

Intheprocedurestemcellsaretakenfromahealthydonorandinfusedintothepatienttohelpidealbloodcellproduction.

BoneMarrowTransplantProcedure

Wecandistinguishthreekindsofbonemarrowtransplants:

- Autologous (the processof removing andreinjecting thepatient’sown bonemarrowbefore cancertreatment)
- Umbilicalcordbloodtransplant(stemcellsareremovedfromthebaby’sumbilicalcordforlateruse)
- Allogenicbonemarrowtransplant(fromdonortopatient)

In allogenic procedures, first the matching donor is identified by blood tests (usually familymembers withsimilargenes).

Patients‘ownbonemarrowissuppressedbyradiationandchemotherapy.Itisimportantinorderto remove malfunctioning stem cells and to suppress the immune system that will resist thetransplantedcellsless.

Stemcellsaretakenfromadonor,whoreceivesgeneralanesthesiawhilethebonemarrowissurgicallyremovedfromhipbones.

Thestemcellsareinfused into thebloodstreamwithacatheter,similarlyto abloodtransfusion.The stem cells will find their way to the bone marrow. Bone marrow transplant has many risksandusuallyinvolves alengthypost-treatment.

HeartTransplantSurgery

Heart transplant surgery is a major procedure to replace a malfunctioning heart with a healthydonor heart. About 50% of heart transplant patients live 10 years or longer with the new heart,people who otherwise would have little chance of survival on medication or with minor heartsurgeries.Allpotentialcomplicationsconsidered,thepracticeofcardiactransplantisremarkablysuccessful.

WhoIsEligibleForHeartTransplantSurgery?

Patients who have tried all other medical and surgical options and are determined to take thenecessarylifestylechanges.Eligiblepatientsareusuallyyoungerthan65andhavenootherlifethreatening medicalproblem.Thefollowingconditionsmaycallfor hearttransplantation-

- Inheritedandcongenitalheartdefects
- Coronaryarterydisease
- Cardiomyopathy(weakeningheartmuscles)
- Diseasesoftheheartvalves

HeartTransplantProcedure

When all other medical means have failed to improve, the physican refers the patient to a hearttransplantcenctertoevaluatethe caseandthe subject’generalhealthstatus.

Then the patient is added to the heart transplant waiting list. As there is a global shortage ofdonorhearts,waitinglists areusuallylong.

When there is a recently deceased donor, doctors must consider the following aspects beforeappointinga patientforhearttransplantsurgery–

- Severityandurgencyofthe heartfailure

- Sizeofthe donorheart
- Bloodtype

The donor heart must be transplanted within 4 hours of removal so doctors and patients usuallydonothavemuchtimeforcontemplation,adecisionmustbemadeimmediately.

Thehearttransplantsurgeryitselfisnotverylong;ittakesabout4-5hours.Duringtheprocedurethe patient is connected to a heart-lung machine to maintain circulation while the diseasedheartis changed to the donor heart. The newly implanted heart receives an electric shock toinitiate its beating, but sometimes it starts automatically once the blood flows again in the veins.Forafewdaysaftertheoperationpatientsexperienceheavybreathing, painandchestpressure,but these side-effects cease after about a week or two. After patients are discharged fromhospital,constantcheck-upisnecessaryforanotherthreemonths.

During this period patients will be administered medication to repress your immune system, toreducetheriskthattheimmunesystemattackstheforeigntissues. Weakenedimmuneresponsesshouldbe compensatedwithantibacterialandantiviralmedication.

In the recovery period patients should get used to new lifestyle habits, healthy, regular eatingandphysical activity. Most cardiac transplant patients can resume their normal activities within3-6monthsbuttheyareinstructedtoavoidstress andstrenuousworkout.

TheRisksofHeartTransplantSurgery

- Immune rejection of the new heart may occur in the first year post-surgery. In order tomonitorit,regularbiopsyistakenfromtheheart.Thesignsofrejectionareverysimilartothatoftheflu: headache,fever,weakness,dizzinessand vomiting.
- Artificial weakening of the immune system can be a double-edged sword, which canresultinviralandbacterialinfections.

In spite of the efficiency of the procedure and the relatively few cases of complication, hearttransplantsurgeryhasmanydownsidesthatneedtobeaddressedinthefuture –

- Costsareextremelyhigh,usuallyseveralhundredsofdollars
- Insurers'reluctance tocoverthecosts
- Limitedeligibilityofpatients
- Scarce donorhearts
- Slowchannelsthatdonotreachthepatientintime.

wheretheintensityoftheliver'sresponseisdirectlyproportional tothemassresected.Foralmost80yearssurgicalresectionoftheliverinrodentshasbeenaveryusefulmodeltothes tudyofcellproliferation.

Futureresearchandregenerativemedicine

By defining the properties of stem cells that regenerate complex body parts, scientists arelearninghowinjurycausesthesestemcellstoregeneratethemissingpartinsteadofjustformingscartissue.

EthicalconsiderationsofTissueengineering

Differentapproachesaddressethicalconsiderationsoftissueengineering:researchethics,socioeconomicissuesandanthropologicalissues.

Researchethics

- Whenaskingtheconsentofcelldonors,itisimportanttoinformthemoftheuseoftheirtissue. But will researchers explain clearly what they will do with the cells and what kind of tests they will perform?Will the information provided be sufficient?
- Canthe humanbodyanditspartsbesubject topropertyrights?

Socioeconomicissues

- Whatwill bethecostoftissueengineeringproductsandtreatments?
- Whowillfinance theresearch?Thegovernmentortheprivate sector?
- Whowillbegivenpriority toreceivethesetreatments?Youngpeoplewithcongenitaldiseasesortheelderlywhosufferfromdegenerativediseases?

Anthropologicalissues

- Is it ethically right to fight the negative effects of ageing? Is extending life always a good thing?
- Havewethoughtabout theconsequencesofhavinganageingsociety?