

Glossary of ESRD Terms

ACCESS: A means to reach the bloodstream. In hemodialysis, fistulas, grafts, catheters, and vascular accesses are used. Access to the peritoneal cavity for peritoneal dialysis is through a peritoneal catheter.

ACCESS ANEURYSM: A thinned, bulging, pulsating area on a fistula or graft. Aneurysms can be caused by repeated puncture of an access in one spot. The trauma and stenosis can increase pressure that weakens the access wall and can cause rupture.

ACCESS FLOW: The blood flow through a vascular access. Transonic flow/dilution sensors record the ultrasound velocity of the arterial and venous blood lines. This provides a measure of changes in arterial and venous saline concentration when a bolus of saline is introduced in the venous blood line. Under Transonic's proprietary Krivitski Method®, this bolus travels through the reversed blood lines and into the patient's vascular access where it mixes with access flow. The Krivitski indicator dilution algorithm automatically calculate vascular access flow.

ACUTE RENAL FAILURE: A condition in which the kidneys suddenly stop functioning. In many cases, kidneys can recover.

ACUTE TUBULAR NECROSIS (ATN): Reversible kidney damage resulting in delayed kidney function after a kidney transplant.

ADEQUACY, DIALYSIS: The amount of dialysis to prevent uremic symptoms. In hemodialysis this is measured by Kt/V or URR. In peritoneal dialysis, this is measured by KT/V and creatinine clearance.

AF/CO: ACCESS FLOW TO CARDIAC OUTPUT RATIO: The AF/CO value is the percentage ratio of the patient's access flow to the patient's cardiac output. For example an AF/CO value of 22% would mean that 22% of the patient's cardiac output is being shunted through the patient's access. However, when access flow exceeds 25% of cardiac output, a potential cardiac problem may exist.

ALBUMIN: One of a class of proteins in the blood. A reduced level of albumin may be a sign of inadequate protein intake in the diet.

ALLOGRAFT: An organ or tissue transplant from one human to another.

ANEMIA: A common condition in patients with kidney disease when they have not enough red blood cells (RBC) in the blood to carry oxygen. Often referred to as "low blood," anemia causes weakness and fatigue.

ANGIOPLASTY: The inflation of a balloon inside a narrowing blood vessel. The inflation of the balloon makes the vessel opening bigger and allows for more blood flow.

ANURIA: A condition in which a person stops producing urine.

ARTERIAL LINE: The tube carrying blood from the body into the artificial kidney.

ARTERIOGRAM, RENAL: An X-ray involving the injection of dye into the main artery supplying the kidney. It is used to determine if the blood vessels to the kidney are normal.

ARTERIOVENOUS FISTULA (AV FISTULA): Surgical connection of an artery directly to a vein in patients who need hemodialysis. As the AV fistula matures, it grows thicker, allowing repeated needle insertions required for hemodialysis.

ARTERY: A blood vessel that carries blood away from the heart and to the body.

ARTIFICIAL KIDNEY: Another name for dialyzer.

ASCITES: Fluid retained in the abdominal cavity.

BANDING: A procedure to reduce flow in a high flow fistula by reducing the diameter of the fistula.

BATH: Another name for dialysate fluid, which is a self-cleaning salt solution. Inside the dialyzer, waste products will flow from the blood into the dialysate and are then washed away.

BILATERAL NEPHRECTOMY: Removal of both kidneys.

BLOOD FLOW RATE (BFR OR QB): The amount of blood passing through the artificial kidney (dialyzer) each minute. This is determined by the speed at which the pump is set.

BLOOD LEAK: The dialyzer fibers or membrane develop a small break or tear allowing blood to leak into the dialysate.

BLOOD PUMP: A pump that is used to bring blood from the patient and push it through the artificial kidney or dialyzer and back to the body.

BLOOD UREA NITROGEN BUN: A waste product, or toxin, that appears in the blood as protein from digested food. BUN levels are a measure of how well the kidneys are functioning as well as adequacy of dialysis and nutritional status. A high BUN indicates that the kidneys are not removing enough waste.

BLOODLINES: The arterial line and venous line used in hemodialysis.

BRUIT: The sound of blood moving through a fistula or graft that indicates the access is working. Bruits can also be heard from an artery and may indicate a blockage.

CALIBRATION: (not to be misused as a synonym for validation)
In Situ: adjustment or correction made to a measurement device for errors produced under actual conditions of use by comparing the measurement with a known standard.
In Vivo: adjustment or correction made to a measurement device during use in a "living body."

CANNULATION: The process of inserting a needle into the graft or fistula.

CARDIAC INDEX: Cardiac Index is cardiac output divided by estimated Body Surface Area (BSA). The Transonic Flow-QC® Cardiac Output Program automatically calculates CI using the patient's body height and weight. A primary criterion of cardiac adequacy, CI is useful in comparing different sized patients. Normal CI values for the general population range from 2.5 to 4.2 L/min/m². Cardiac Indexes from 6 - 8 L/min/m² may indicate high access flow. A low CI (< 2 L/min/m²) at the beginning of a hemodialysis session indicates significant deterioration of cardiac function. A decrease in CI during the hemodialysis session indi-

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THE MEASURE OF BETTER RESULTS.

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cates potential cardiac problems, inadequate dry weight estimation, and/or inadequate medication prescription.

CARDIAC OUTPUT: The amount of blood which the heart pumps in one heart beat. The Transonic Flow-QC Hemodialysis Monitor measures cardiac output through a bolus of saline quickly injected into the venous blood line where its concentration is measured by a Transonic flow/dilution sensor. This bolus is carried by the venous blood stream in the heart, where it is diluted (mixed) into the full cardiac flow. A portion of this diluted saline returns to the shunt, where it is removed by the arterial blood line, and its saline concentration is measured by the second Transonic flow/dilution sensor. Classic dilution equations are used to calculate Cardiac Output from the changes in indicator concentration between the venous and arterial line.

CARDIOPULMONARY RECIRCULATION (CPR): Is the condition when blood that flows back into the heart and lungs. CPR can be measured with the Transonic Monitor and can be separated from vascular access recirculation. This enables a true measurement of zero percent recirculation (through the access) a reality.

CATHETER: A tube inserted through the skin into a blood vessel or body cavity to draw out blood or body fluids, or to put in fluid. In hemodialysis, a catheter is a vein can be used to create a temporary or longterm dialysis access. In peritoneal dialysis, a catheter is used to put dialysis solution into the abdominal cavity and to drain it out again.

CENTERS FOR MEDICARE & MEDICAID SERVICES (CMS), an agency of the U.S. Department of Health and Human Services (DHHS).

CENTRAL BLOOD VOLUME (CBV) AND CENTRAL BLOOD VOLUME INDEX (CBVI)

Central Blood Volume (CBV) is defined as the volume of blood in the heart, lungs, and the great vessels. Normal values range from 0.8 - 1.6 L. CBVI is found by dividing CBV by the patient's weight (typical range, 11 - 17 ml/kg). Maintenance of CBV is thought to be a factor in blood pressure regulation. "CBV decreases during hemodialysis are similar to CO, and probably precede CO."10 When CBV is depleted, hypotensive episodes

may occur. Therefore, monitoring CBV repeatedly during ultrafiltration may indicate how fast a patient can be dialyzed without hypovolemic collapse. Baseline values for each parameter, their change during the hemodialysis treatment, as well as their changes over time provide valuable clinical information to the nephrologist and hemodialysis staff.

CENTRAL VENOUS STENOSIS: Narrowing of the central veins in the body that can make the arm on that side unsuitable for a vascular access.

CHRONIC RENAL FAILURE (CRF): Slow and progressive loss of kidney function over several years, often resulting in End Stage Renal Disease.

CIRCLE OF CARE: A phrase coined by Transonic to describe the entire treatment process that a patient undergoing hemodialysis could experience. Includes intraoperative placement of a fistula or graft by a surgeon during which an intraoperative measurement with transit-time ultrasound technology is used, hemodialysis surveillance with the Transonic Hemodialysis Monitor using ultrasound dilution technology and finally, access intervention via angioplasty using the HVT100 Endovascular Flowmeter and ReoCath Flow Catheter using thermal dilution technology or surgical revision with intraoperative transit-time ultrasound measurements.

CLOTTING TIME: The time it takes for blood to clot.

CONDUCTIVITY: The measure of ions in a solution. A conductivity meter measures the chemical composition of dialysate by measuring the dialysate's ability to conduct an electrical current. If the conductivity of dialysate is not correct, an alarm will go off, and the dialysate is bypassed to the drain. This means that the dialysate will not come in contact with the patient's blood.

CONGESTIVE HEART FAILURE: A condition in which a weakened heart does not pump blood effectively, resulting in retention of excess fluid in the lungs which make breathing difficult.

CREATININE: A waste product released from the muscles of the body. Creatinine is normally removed from the blood by the kidneys.

CREATININE CLEARANCE: A test that measures how well the kidneys remove creatinine from the blood. A decreased creatinine clearance reading means decreased function of the kidneys.

CROSS-MATCHING: A test used to establish blood compatibility before transfusion and transplant.

DASS: Dialysis Access Induced Steal Syndrome

DECLOTTING: Removal of a blood clot so fluid can flow through a blood vessel or tube, such as a dialysis access.

DELIVERED BLOOD FLOW: During hemodialysis matched flow/dilution sensors, clipped onto the arterial and venous dialysis lines, continuously measure the actually blood flow delivered to the patient. Comparison of this reading displayed on the Hemodialysis Monitor with the pump flow setting (i.e., the flow the pump tries to deliver) provides an opportunity to identify and correct dialysis delivery problems.

DIABETIC NEPHROPATHY: Kidney disease caused by diabetes mellitus (high blood sugar).

DIABETIC NEUROPATHY: Nerve damage caused by diabetes mellitus.

DIABETIC RETINOPATHY: Eye disease caused by diabetes mellitus that may result in reduced vision or blindness.

DIALYSATE/DIALYSATE FLUID: The solution used to remove excess fluids and waste products from the blood.

DIALYSATE FLOW RATE (DFR) OR QD: The rate at which dialysate fluid moves through the dialyzer.

DIALYSIS: The artificial process of cleaning wastes from the blood with special equipment when kidneys fail.

DIALYZER: An artificial kidney used with a hemodialysis machine. The dialyzer has two compartments separated by a membrane. One section holds dialysate fluid and the other holds the patient's blood. Waste products and fluid travel from the blood into the dialysate fluid, across the dialyzer membrane, and then are disposed.

DISEQUILIBRIUM SYNDROME: A term used to describe a condition which may result from dialysis therapy, most commonly in patients new to dialysis.

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Some symptoms may be headache, cramps, nausea, or vomiting.

DRILL: Distal Revascularization-interval Ligation, a procedure to reduce high flow fistulas by reducing inflow into the fistula.

DRY PACK: A dialyzer that has not been pre-processed for first use of hemodialysis.

DRY WEIGHT (IDEAL OR TARGET WEIGHT): The weight at which all excess fluids have been removed.

DWELL TIME: In peritoneal dialysis, the amount of time that dialysate fluid remains in the patient's abdominal cavity during an exchange.

EDEMA: Swelling caused by too much fluid in the body.

ELECTROLYTES: Salts in the body fluids including sodium, potassium, magnesium and chloride. The kidneys control the amount of these electrolytes in the body. When the kidneys fail, electrolytes get out of balance, possibly causing serious health problems. Dialysis can help correct this problem.

END STAGE RENAL DISEASE (ESRD): Any irreversible kidney disease that requires dialysis therapy or kidney transplant in order to live. The term "end-stage" means that the renal disease is permanent and irreversible, and not that the person's condition is terminal.

ESRD SEAMLESS CARE ORGANIZATIONS (ESCO): a partnership among groups of health care providers and suppliers including Medicare certified dialysis facilities, nephrologists and other Medicare enrolled providers and suppliers located in a contiguous geographical area. Through the ESCO model, these partners are able to work together to enhance patient-centered care, improve communication and coordination of care and access to services. In addition, these partners test a new payment model and care delivery method specifically for Medicare beneficiaries with ESRD.

ERYTHROPOIETIN: A hormone which stimulates the body to produce red blood cells. With renal failure, the kidney can't produce this hormone, resulting in anemia.

EXCHANGE: In peritoneal dialysis, the draining is used dialysate fluid solution from the abdomen, followed

by refilling with a fresh bag of solution.

EXIT SITE: The site at which the catheter exits the body.

FEMORAL CATHETER: A temporary catheter placed in the femoral vein in the groin.

FERRITIN: The amount of iron stored in the body.

FIRST-USE SYNDROME: Symptoms that may occur after starting hemodialysis with a dry pack or dialyzer that has not been pre-processed for first use of hemodialysis. Symptoms may include chest pain, back pain, nervousness, and itching.

FISTULA (AV Fistula): Surgical connection of an artery directly to a vein in patients who need hemodialysis. As the AV fistula matures, it grows thicker, allowing repeated needle insertions required for hemodialysis.

FISTULA FIRST/CATHETERLAST: A national vascular access improvement initiative to increase the number of fistulas in the US and decrease the number of catheters.

FISTULOGRAM: An X-ray, using dye, to evaluate the blood flow through a fistula. Performed in the Radiology Department of a hospital, the procedure can detect problems such as a clot or narrowing in the fistula. Early detection and treatment of problems with a fistula can improve its performance and limit future complications.

FLOWMETRY: Measurement of flow parameters.

FLOW/DILUTION SENSOR: A device which measures volume of a liquid passing through tubing by flow/dilution technology.

Fluid Overload: Excess sodium (salt) and fluid retained in the body between dialysis treatments; may cause shortness of breath and swelling.

FLUID RESTRICTION: The amount of fluid a patient is allowed to drink in a 24-hour period to avoid adding extra weight that would cause fluid overload and undue stress to the heart.

FOLIC ACID: A vitamin necessary for red blood cell protection.

GLOMERULONEPHRITIS: Also called Bright's Disease or Nephritis. It is an inflammation of the glomeruli. It usually affects both kidneys and generally first occurs in early childhood. Recovery from the acute form may take one year. Those with the chronic form suffer low, progressive damage which may ultimately lead to ESRD.

GLOMERULUS (GLOMERULI PL.): A tiny site of looping blood vessels in the kidney where the blood is filtered.

GRAFT: In hemodialysis, a vascular access surgically created using a synthetic tube to connect an artery to a vein. In transplantation, a graft is the transplanted organ or tissue.

HARDI: Hemodialysis Access-Induced Distal Ischemia

HEMATOCRIT: A measure that tells how many red blood cells are present in a blood sample. Low hematocrit suggests anemia or increased blood loss.

HEMODIALYSIS: The use of a machine to clean wastes from the blood after the kidneys have failed. The blood is circulated through tubes to a dialyzer, which removes wastes and extra fluid. The cleaned blood then flows through another set of tubes back into the body.

HEMOGLOBIN: The substance in red blood cells that carries oxygen around the body. Low hemoglobin suggests anemia or increased blood loss.

HYPERGLYCEMIA: Too high a level of glucose (sugar) in the blood; a sign that diabetes is out of control.

HYPERKALEMIA: A high level of potassium in the blood; can cause irregular heartbeat and, if severe, cardiac arrest.

HYPOGLYCEMIA: Low blood sugar.

INFILTRATION: The leakage of a substance into body tissues. In hemodialysis patients, infiltration of blood into the tissues surrounding the access can occur if the needle punctures the back of the vessel wall or is partially dislodged from the access.

INTERNAL JUGULAR CATHETER (IJ): A temporary dialysis catheter that is placed in the internal jugular vein of the neck.

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INTRAVENOUS: Within a vein.

IRON DEFICIENCY: lack of enough available iron to produce red blood cells.

KDOQI OR NKFDOQI GUIDELINES: Kidney Disease Outcomes Quality Initiative (NKF KDOQI) guidelines for dialysis care including Hemodialysis Adequacy, Vascular Access and Cardiovascular Disease in Dialysis Patients. (<https://www.kidney.org/professionals/KDOQI/guidelines>)

KIDNEY FAILURE: Loss of kidney function.

KIDNEY TRANSPLANTATION: The replacement of a diseased kidney with a healthy one.

KIDNEYS: Two bean-shaped organs located on either side of the spine, just above the waist. The rid the body of waste materials and maintain fluid balance through the making or urine.

KRIVITSKI METHOD®: A way to measure vascular access flow directly, pioneered by Nikolai Krivitski PhD, DSc by reversing the dilaysis bloodlines at their needle connections and injection a volume of innocuous saline into the venous port.

Kt/V: A measurement of how much urea is being removed form the body during dialysis. The measurement takes into account the efficiency of the dialyzer, the treatment time, and the total amount of urea in the body.

LIPID: A term for fat. The body stores fat as energy for future use. When the body needs energy, it can break down the lipids into fatty acids and burn them like glucose (sugar).

MEMBRANE: A thin sheet or layer of tissue that lines a cavity or separates two parts of the body. A membrane can act as a filter, allowing some particles to pass from one part of the body to another while keeping others where the are. The artificial membrane in a dialyzer filters waste products from the blood.

MILLER BANDING: Minimally Invasive Limited Ligation Endoluminal-Assisted Revision: Method of endovascular banding of a high flow access using an endoluminal balloon as a sizing dowel to shrink a fistula's inner diameter to an exact size.

MODALITY: Methods of treatment for

kidney failure. Modalities for ESRD include transplant, hemodialysis and peritoneal dialysis.

NEEDLE GAUGE: Refers to the size of the needle. The larger the number, the smaller the size of the needle.

NEGATIVE PRESSURE: The method of removing extra water and salt from the blood by creating pressure inside the blood compartment of the dialyzer, allowing the process of ultrafiltration to take place.

NEPHROLOGIST: A medical doctor who treats patients with kidney problems or hypertension. The head of a dialysis care team.

NEPHRON: A tiny part of the kidneys. each kidney is made up of about one million nephrons, which are the working units, removing waste and extra fluids from the blood.

NATIONAL KIDNEY FOUNDATION (NKF): An advocacy organization for persons with kidney disease

OCCCLUDE: Obstructed or blocked flow in a blood vessel, graft or catheter.

OSMOSIS: Passing fluid through a semipermeable membrane from a solution with low solute concentration to a solution with a higher solute concentration until there is an equal concentration of fluid on both sides of the membrane.

QUALITY INCENTIVE PROGRAM (QIP): An incentive program administered by CMS to promote high-quality services in outpatient dialysis facilities treating patients with End-Stage Renal Disease (ESRD). Known as "pay-for-performance" or "value-based purchasing" (VBP) programs, the program changes the way CMS pays for the treatment of patients with ESRD by linking a portion of payment directly to facilities' performance on quality of care measures.

PAI: Proximalization of Arterial Inflow, a procedure that converts the arterial supply of an AV access to a more proximal artery with higher capacity.

PALPATE: To examine by touching.

PATENT: Unblocked flow of blood in a blood vessel, graft, or catheter.

PERCUTANEOUS TRANSLUMINAL ANGIOPLASTY OR ANGIOPLASTY: The inflation of a balloon inside a narrowing blood vessel. The inflation

of the balloon makes the vessel opening bigger and allows for more blood flow.

PERFUSION MACHINE: A machine that keeps a donor kidney in the best possible condition outside the body until such time as it can be transplanted into a recipient.

PERIPHERAL RESISTANCE (PR): Total Peripheral Resistance is the average resistance to systemic blood flow and is approximated as Mean Arterial Pressure divided by Cardiac Output. If pressures are measured in mmHg, PR will be in units of mmHg/L/min. Normal values range from 12 - 20 mmHg/L/min. "Peripheral Resistance is the Holy Grail of people studying hypertension... We all measure pressure but what we really want to know is peripheral resistance. We cannot measure this in the outpatient but now we can measure it in hemodialysis patients. Patients diagnosed with diabetes may have substantially higher PR. Because CO generally decreases during hemodialysis and pressure is maintained, PR will increase during hemodialysis for most patients. Dr. Depner suggests that patients whose PR does not increase during treatment may have fluid overload. The Depner study correlated an increased 1-year mortality risk with a failure of PR to increase in response to the stress of hemodialysis, combined with higher initial PR and lower initial CO.

PRIMING: Filling and rinsing the bloodlines and the dialyzer with a solution of saline.

PROCESS OF CARE: a phrase used to describe work flow through a dialysis clinic.

RECIRCULATION: Is the condition when blood that flows back into the arterial line through the vascular access without circulating through the patient's circulatory system. Recirculation is also measured with the Transonic Monitor. Saline is introduced into the venous blood line. If any of this saline reaches the arterial blood line immediately after its release into the venous blood line, it must have traversed the vascular access in reversed direction ("recirculation").

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The % amount of recirculation is accurately calculated from the ratio of arterial to venous saline concentration registered between the two Transonic flow/dilution sensors.

RENAL: Pertaining to the kidneys.

RUDI: Revision Using Distal Inflow, a procedure to reduce high flow fistulas by reducing moving inflow into the fistula into a more distal site.

SALINE: A salt solution containing sodium and chloride.

SHUNT: Another word for fistula or graft.

SOLUTE: A substance dissolved in another substance.

STEAL SYNDROME: Occurs when a fistula or graft "steals" too much blood away from the distal (farthest from center of body) part of the arm usually the hand.

STENOSIS: The narrowing of a blood vessel which can lead to a clot.

SUBCLAVIAN/SUBCLAVIAN VEIN: Means "beneath the clavicle (collarbone)." The subclavian vein is a large vein behind the collarbone which is sometimes used for hemodialysis.

SUBCLAVIAN CATHETER: A catheter placed in the subclavian vein.

SUTURE: The material used to surgically close a wound or join tissues.

TENCKHOFF CATHETER: A type of catheter used in peritoneal dialysis.

THE DIALYSIS FACILITY COMPARE (DFC) STAR PROGRAM: The "Dialysis Facility Compare (DFC) Star Program" is a rating system developed by Medicare that assigns 1 to 5 stars to dialysis facilities by comparing the health of the patients in their clinics to the patients in other dialysis facilities across the country. It is intended to help a patient find and compare dialysis facilities in his or her local area

THRILL: The buzzing sensation that can be felt by touching a fistula or graft. This indicates that the access is working.

THROMBUS: A clot formed in a blood vessel.

TISSUE TYPING: A laboratory test done on your blood to find the degree of matching between a potential donated kidney and the patient waiting for transplant.

TOXINS: Waste products, harmful to the body, that accumulate in the blood of ESRD patients.

TRANSPLANT: Replacement of a diseased organ with a healthy one.

TRENDELENBURG POSITION: A body position in which the head is placed at 45 degrees with the legs up (feet above the head). This position helps when a person has hypotension.

TUNNELED CUFFED CATHETER: A dialysis catheter that is inserted into a blood vessel through a tunnel created under the patient's skin. Inside the tunnel tract, surround tissue grows into an attached cuff to help stabilize the catheter and provide a physical barrier to bacteria.

ULTRAFILTRATION: The process of removing excess water from the blood during dialysis.

ULTRASOUND: A technology that bounces safe, painless sound waves off organs to create an image of their structure.

ULTRASOUND INDICATOR DILUTION: a technology pioneered by Transonic which unites dilution and ultrasonic transit time to measure the changes that occur in the velocity of a liquid when diluted with isotonic saline; measures recirculation, access flow and cardiac output during hemodialysis.

UREMIA OR UREMIC SYNDROME: Changes in the body caused by the build-up of waste products in the blood when the kidneys fail to function.

URETER: The tube that carries urine from the kidney to the bladder. Urea: A waste product found in the blood and caused by the normal breakdown of protein in the body. urea is normally removed from the blood by the kidneys and then excreted as urine.

UREA REDUCTION RATIO (URR): A blood test that compares the amount of blood urea nitrogen (BUN) before and after dialysis to measure the effectiveness of the dialysis prescription.

VASCULAR ACCESS FLOW: Transonic flow/dilution sensors also record the ultrasound velocity of the arterial and venous blood lines. This provides a measure of changes in arterial and venous saline concentration when a bolus of saline is introduced in the venous blood line. Under Transonic's proprietary Krivitski Method®, this bolus travels through the reversed blood lines and into the patient's vascular access where it mixes with access flow. The Krivitski indicator dilution algorithm automatically calculate vascular access flow.

VAMP®: A vascular access monitoring program created by L. Spergel, MD, to improve patient outcomes by lengthening the life of the vascular access through routine monitoring and surveillance.

VASCULITIS: Inflammation of the wall of blood vessels.

VEIN: A blood vessel that carries blood toward the heart.

VENOUS LINE: The tube that carries blood back into the body from the artificial kidney machine.