Transport of materials across capillary wall:

•capillaries are vessels with thin wall found between (arterioles and venules) materials transported through it by 3 mechanisms:

1. Diffusion: diffusion depends on concentration gradient (from high concentration to low concentration), solubility, molecular size of diffusing substance,permeability of capillary
2. Vesicular transport(endocytosis &exocytosis): concerned with transport of large molecules like protein
3. Filtration (bulk flow) هتتشرح بالتفصيل

Trans-capillary filtration (bulk flow):

•it is passive process of transport of water, electrolytes and crystal solids like NaCL across capillary wall.

Forces affecting filtration

A) forces tending to move fluid outside capillary:

1. **Hydrostatic capillary pressure it's 35 mmHg at arterial end and 15 mmHg At venous end of capillary ضغط السوائل في السوائل داخل الوعاء الدموي كل ما بيزيد كل ما يطلع السؤال برا الوعاء**

So it produces filtration of blood

2. **Interstitial fluid osmotic pressure is 3 mmHg at arterial & venous ends**

الضغط الأسموزي في السوائل الموجودة بين الاوعية الدموية تسحب السوائل من دخل الوعاء لي برا عشان كدا تعتبر بتفلتر الدم الي جوا الوعاء

So it produces filtration blood

B) forced tending to move fluid inward:

1. **Interstitial fluid hydrostatic it 3 mmHg at arterial & venous ends**

ضغط السوائل الموجودة بين الأوعية الدموية لو زاد هيدخل السؤال دي جوا الوعاء الدموي نفسة

So it produces resorption

2. **Colloidal osmotic plasma proteins :**

Caused mainly by albumin, it 25mmHg in at arterial venous end

الضغط الاسموزي بسبب الالبيومين الذي يوجد داخل الوعاء الدموي يسحب السوائل ليه جوا الوعاء

So it produces resorption

•Net force of filtration at arterial end of capillary =
[35 mmhg of hydrostatic capillary pressure+3 mmHg of Interstitial fluid osmotic pressure]—[25 mmHg of Colloidal osmotic plasma proteins+ 3 mmHg of Interstitial fluid hydrostatic] = 10 mmHg

•Net force of absorption at venous nd of capillary =
[15 mmHg of Hydrostatic capillary pressure+3 mmHg of Interstitial fluid osmotic pressure]—[25 mmHg of Colloidal osmotic plasma proteins+ 3 mmHg of Interstitial fluid hydrostatic] = 10 mmHg
**filtered fluid is sightly more than absorbed fluid leaving some excess fluid to be absorbed by lymphatic vessels

Edema

•it excessive accumulation of tissue fluid
Causes:
1-Increase hydrostatic capillary pressure in cases of:

- Pregnancy lead to pressure on pelvic veins so this leads to increase the hydrostatic pressure so increase in inflation (من برا الوريد)
- Venous thrombosis (من جوا الوريد)
- Cardiac edema: Generalized edema as the right sided heart failure

عشان لما الجانب الأيمن من القلب مش هيقدر يضخ الدم تراكم الدم دا هيعمل الايديما

2- decrease colloid osmotic pressure (decrease in plasma proteins)

- Nutritional edema يعني مش باكل بروتينات
- Hepatic edema:decreases synthesis of plasma proteins مشكلة الكبد
- Renal edema:due to loss proteins in urine (proteinuria)مشكلة الكلية

3-increased capillary permeability:

- Allergy and inflammation due to histamine

4- lymphatic obstruction:

- Elephantiasis or cancer cells caused lymphatic obstruction لان احنا في مس هتمتصهم فا هيُمتصوا عن طريق العقد الليمفاويه venous شويه سوائل ال

5-salt and water retention:

- Corticosteroids (cortisone) and contraceptive pills حبوب منع الحمل

اعادة امتصاص المياه و الأملاح بتزود ضغط الدم فا بتزود عملية الترشيح

Circulatory shock

•inadequate tissue perfusion (يعني الدم الي واصل للعضو قليل)as a result of inadequate cardiac output (or vasodilatation)

Types and causes of shock:

1- Hypovolemic shock:

caused by hemorrhage or dehydration as in burns (حروق)

لان الدم 90% منه مايه فا الحروق بتخلي الدم يفقد المايه دي فا بتقلل حجمه

2- low resistance shock (due to vasodilatation):

- Neurogenic shock
- Anaphylaxis (in case of allergy)
- Sepsis (in case of inflammation and bacterial toxins)

*histamine which formed due to response of inflammation and allergy leads to vasodilation so the peripheral resistance decrease

3- cardiogenic shock بسبب مشاكل في القلب

- Myocardial infarction تضخم عضله القلب
- Congestive heart failure
- Arrhythmia ضربات قلب غير منتظمه

4- obstructive shock:

- Pulmonary embolism

جلطات في ال pulmonary vessels

Hemorrhagic shock

Manifestation:

- Rapid weak pulse
- Cold pale skin but it sweaty due to stimulation of sympathetic nervous system

- Rapid respiration (tachypnea)
- Low blood pressure
- Thirst and oliguria (decreased urine volume & increase concentration)

Compensatory reactions: (يعني عمليات الجسم بيعملها عشان يحاول يتخلص من ال shock)

- These are reactions aiming at restoration of normal(Arterial blood pressure),blood volume
- There are two compensatory reactions :
  1.rapid compensatory reactions
  2.long-term compensatory reactions

Rapid compensatory reactions: بتحصل بسرعه عشان توصل الدم للقلب والدماغ

A)Nervous:

decreased the impulses of baroreceptor due to decrease in arterial blood pressure,thats lead to stimulation of pressor area and inhibition of depressor area

•stimulation of pressor area include :

- Stimulation of vasoconstrictor center: that lead to arteriolar constriction—-> increases resistance——>elevates Arterial blood pressure
- venous return increase—>cardiac output increase——>Arterial blood pressure increase

•stimulation of cardiostimulatory center:

- Increased heart rate and force of contraction —> increase cardiac output and Arterial blood pressure

B)humoral factors:(done by chemical substances and hormones)

1. Increased catecholamines secretion from adrenal medulla leads to raise ABP

2. Increase Angiotensin(II) due to renin secretion caused by ischemia leads to 1.raise ABP

2.stimulate thirst

3.increase aldosterone secretion leading to Na retention which raise ABP

3. Increased secretion of ADH (vasopressin):
   - It produce vasoconstriction and water and Na retention

Long-term compensatory reactions: بتاخد وقت علي ماتحصل

1. Correction of plasma volume:

This takes place in 12-72 hours by following mechanisms :

- Tissue fluid shift (retention of water to capillary) بتسحب السوائل والمايه من الانسجه المحيطه عشان ترجع حجم الدم the fluid shifting done due to decrease in capillary hydrostatic pressure يعني الضغط برا أكبر من جوا فا عشان كدا السوائل بتخش لبلازما الدم كن برا لجوا

- thirst due to angiotensin
- Aldosterone and ADH secretion leads to water and Na retention

2.correction of plasma proteins:

- There's rapid Addition pre-formed albumin يعني الكبد كان مخزن شويه البيومين فا هيطلعهم دلوقت
- Then liver synthesis plasma proteins in 3-4 days

3.correction of red blood cells:

- Kidney due to ischemia (low blood pressure in kidney)it secrets erythropoietin which increase rbcs formation, it takes 4-8 weeks.

Fate of patient with hemorrhagic shock :

1. Recover in mild hemorrhage ,the treatment and compensatory mechanisms succeed

2. Die in severe hemorrhage the treatment and compensatory mechanisms failed

3.some Patients exposed to irreversible shock due to ischemia and dilatation of splanchnic area leads to entry of toxins to circulation and cerebral ischemia, toxins lead to more dilatation and so on.

يعني بعض المرضى بتدخل في irreversible shock بيحصل اتساع في الاوعيه الدمويه الموجوده في منطقة الامعاء فا بتوفر مكان للسموم انها تخش للدم .

Treatment of shock:

1. Removal causes of shock
2. Elevation of lower limbs which leads to increase venous return
3. Drugs like adrenaline in anaphylactic shock,vasopressin,dopamine,noradrenaline,glucocorticoids which decrease capillary permeability
4. Blood transfusion in case of hemorrhagic shock
5. Plasma transfusion in case of burns

لان الحرق بيعمل dehydration للمايه الموجوده في البلازما فا حجم الدم بيقل فا لازم ننقل بلازما للمريض