Capillary

The arteriole Ramifies (تفرع) to capillary

"Hand out" :- * إرجعوا للهوم لي بال ← هوم

* Before every group of capillary, they are sphincters control the movement of blood through thise track.

arteriole (arterial end) → precapillary sphincter → capillary → venules.

Can blood move from the artery to vein without passes through capillary ? Yes, through thoroughfar vessels.

* Two track of brood :-

1- arteriole :- → meta arteriol → thoroughfare vessels → venule.

2- arteriol → precapillary sphincters → capillary.

- thoroughfare allow to blood passes from arterial end to venous end without passes through capillary.

- When we remember tissue activity.

If tissues don't need blood supply and don't suffer from hypoxia, hypercapnia, acidosis, the blood will pass through

arteriol → thoroughfare → venule.

How much surface area of capillaries ?
If we open this capillary the area will be about (100 m^2)

we have 10 billions capillary in our body that make network that supply the tissue.

Structure of capillary :-
- In histology , the capillary is two layers (even one single layer of endothelial cells resting on basment membrane. (نايم على غشاء قاعدي).
- according to the spaces between endothelial cells and thickness of basment membraine , we can classified capillary into (3) categorize.

1- Less permeability : there don't contain spaces between endothelial cells the basement membrane well developed thick (موجود حتى بعرف), and good connection fibers.

2- another categorize : small pores like intestinal capillary.

3- fenestrated cappillary :- it filters much fluid the famously site of it is liver . Why ? according to function of liver :- liver produce protein and do every metabolic activity such as (metabolic activity) :- glycogenesis , glycogenolysis, glyconeogensis.

aminoacides (the food that we intestine absorbed it) enters liver so that we need high vascularity. (دم كتير يوصل للخلايا) (سوائل تتغلغل).

If the blood contain microbes, the microbes will be filter in liver so that the capillary carry blood to hepatocytes in order to do processing.

the fat is digested and absorbed.

but in our body, there are site must be kept dry.

Example :-

muscls :- muscls in skeletal muscle in order to be contract - efficient contract -.

basement membrane well develop and the endothelial resting on it. (ورموبة عليه)

- Lung :- enforcedly, the lung contain highly fenstrated capillary, alveolai contain fluid instead of air and we cant take breath because the air indirect contact with alveoli wall.

- Brain :- brain in skull (bony box). so that the brain and fluid that is about it constant size (after we become adult) the much of fluid about brain is accounted size so that normally, capillary will be well develop basment membrane endo thelal cells will attach (واقفة) on basment membrane and very small pores.

يا دوب تكون في سوية سوائل عشان الأنسجة تتغذى وترجع تاخد بكمن فش لسرعة إنه يورم لأنه لما يورم يعمل (brain edema) أو يعمل (increase intracellular tension).

glomerulus Resemble capillary ~
glomerulus filter fluid ~

Forces
- Starling capillary → " 4-forces " :-
1- Capillary hydrostatic pressure.
2- tissue - Bowmans - hydrostatic pressure.
3- blood or plasma osmotic pressure.
4- tissue - Bowmans - osmotic pressure.

net filteration forces accross capillary membrane factores affecting every forces.
1- Capillary blood pressure : capillary is between arteriol and venule.
arteriole لـ Capillary تقوم بفتح لضغط داخل لـ "إذا كنت أريد زيادة (arteriolar vasodilatation) على آخر أي تكون لعلية و لعكس إذا كنت أريد تقليل لضغط داخل لـ Capillary أغلق لـ arteriole و تكون لعلية (arteriolar vasoconstriction) وبعد طالة تكون :-
"First factore is arteriolar diameter" ←
وكن هنا ↑ نسأل عن تأثير لضغط داخل لـ Capillary بال : vasoconstriction أو vasodilatation وليس عن تأثير لضغط داخل لـ arteriole نفسه).

Venous pressure :-
heart failure → heart can't pump blood → blood stagnates in vessels - arteries - → ↑ level of blood → ↑ pressure in capillary.
* blood stagnates in superior vena cava and inferiore vena cave
* blood stagnate in all systemic veins → ↑ pressure in venous end.

ΔP (arterial end — venous end).
normal physiology :- arterial end = 35.
ΔP = 15.
blood move according pressure gradient.
* if venous end ↑ → capillary pressure ↑. Why?
because, there aren't drainage so that blood is stagnant.
الدم فا بعدي عن ال pressure ↓ & pressure gradiant عالي
فالمريض يسموع (محتقن) congested ← محتقن الدم في أنسجة
الجسم ساعتها ↓ filteration force تزيد لأنه الدم راكد فبطلع
كمية أكبر من ↓ capillary لـ hydrostatic pressure ظالدم
بتفلتر من ↓ capillary لل tissue فالمريض يتجيب شغله
اسمها (edema).

Effect of gravity :-
gravity pull the blood columen to earth So that :
pressure capillary in my toe > pressure capillary in my brain

nervouse factore :-
Sympathatic regulation → arteriolar vasoconstriction → blood dosent flow to capillary → ↓ pressure inside capillary

metabolite :- local metabolic mechanism.
tissue are very active → hyporia, hyper capnia, acidosis → open pre capillary sphincters → ↑ blood to capillary.

In heat weather :-

Capillary has much blood supply in order to do sweating so that the bodys temprature de crease.

In Cold weather :-
Capillary vasoconstriction ← يحدث شيء حيوي

ال Capillary هي المسؤولة عن لون الجلد لو فتحت إيدك بتلاقيها حمراء ولو حطيتها بالفريزر - وجمد - بتصير بيضاء لأنه ال Capillary تقفل و حسب لدم من ال precapillary sphincter

- بعض شرايين مورد بعض واصل لها blood Supply لويس.
- شرايين بهتان لونها (أبيض) ممن واصل لها blood Supply لويس.

the responsible of body temperature is arteriol - الحابس الكبير -

Cyanosis :-
Capillary خلص لأصبح بيضة مزرق بالشتاء وهي ال فيها دم جس بيضة مزرق.

- arteriolar vasoconstriction ← إيدين متلجة
- arteriolar Vasodilatation ← حرارة.

Vasomdion :-

Subject :

(a) blood doesn't flow in capillary all time the capillary contain blood at this moment. what happen? intermittent flow.

We have 2 groups :-

① active group → hypoxia, hypercapnia, acidosis → frequency of open capillary more than 12 / times in min. → كل شوية بحابس تفتح توصل دم وترجع تسكر

② Semiactive :- (نادرة) precapillary sphincters open the blood reach tissue, then precapillary sphincters close again.

شبه نشطة أوصل لها دم احتياطي عشان ما تتعفن

Frequency : 6-12 times / min.

(b) How much velocity of blood flow in capillary?
1000 times lower than in aorta.

- heart pump blood in aorta in 7m/s.

* Capillary has so great surface area so that the velocity is measured on total cross sectional area.

* blood flow is great in aorta.
* blood flow is slow in capillary.

Subject : / /

It slow blood flow - is very usefule in order to forme tissue fluid

* pxchange material through capillary wall : passive and simple diffusion.
  - Substances في أشياء بتعتمد على
  - membrane وفي أشياء بتعتمد على

@ Substance factors:-

↓ molecular weight → ↑ diffusion (يتمرر بسهولة)

↑ molecular weight → ↓ diffusion (يتمرر بصعوبة)

II = with concentration gradiunt ↑ → ↑ diffusion

لو الدم قليلة في لوعاء الدموي وكتير في النسجة تنقل الدم من النسجة للوعاء الدموي العكس صحيح.

III :- Solubility :-

↑ lipid Soluble → ↑ diffusion (fast).

Water soluble substances pass through spaces between endothelial cells.

(b) Capillary membranes factors :-

1- high permeable → ↑ diffusion (أسرع).

2- basment membrane discontinouse → easy movement of fluid

Subject : / /

Well formed basment membrane → small amounte of fluid can pass thraugh it.

2- Surface area.

enforcedly :- there are 100 precapillary sphicters
- only 80 sphincters are open → more capillary open so that more exchange of material.

- Only 20 sphicters are open → less capillary open so that less exchang of material.

Factors affecting of permeubility :-
basment membrane and layer of endothelial cells
capillary جدران الـ
Fenestarted ← (endothelial) وفيما بين الـ

1- ph :-
In Chemistry :-
Ca^{+2} + alkali = calcium hydroxide that forme precipitate and small amount of salt.

- asidosis doesn't dissolve calcium so that the fenestarted is open

Subject :

Alkalosis is against ascidosis so that the Calciume is procipitate on fenestra.

-acidosis increase permeability.
-alkalosis decreate permeability.

histamine : It is produced by "WBC" aned released in allergy.

histamine causis arteriolar vasodilatation so thet the capillary pores open.

excessive heat or cold :-
excessive heat :- in this case, he capillary pores and sphincters open so that the permenbilty increase → ↑ filterat.

11- excessive coling :- against excessive heating in turn, we know disease called frozen bites that the limp beeome black, → gungrene.

* bulk flow :-
Capillary hydrostatic pressure :- pressure in Cappillary, fluid is fiterated from capillary to tissue.

Subject : / /

Arteriolar end = 35
venoular end = 15
net = 20 with filteration.

tissue hydrostatic pressure : the pressure of fluid on capillary wall from outside capillary.

لو إنسجة واوعية فيها edema ورم فيها سوائل كتير بتضغط على جدار الـ capillary كتير إنت الـ capillary بتضغط فالسوائل تنتقل من الـ tissue لـ Capillary

* Colliodal osmotic pressure of plasme protein :-
plasma proteins :- albumins, group of globulin, little amount of prothrombin and many protiens that produced by liver then releuse to blood plusma and heave osmotic pressure.

plasma proteins like sponge, absorbe water, it has osmotic pressure about 25 mm.Hg

fluid movement from tissue → Capillary

* tissue colloidal osmotic pressure :-

Do tissues contain proteins ? Yes, and they have osmotic pressure.

Subject : ..... / /

"لو حصل إلتهاب شديد في الأنسجة تقوم الأنسجة بإخراج البروتينات"

البروتينات داخل الأنسجة تسحب الدم من الشعيرات الدموية للأنسجة بدليل أنه لما نحط بنقرمك إيدك بتورم

لما إيدك بتسحب بتهاجر شوية بروتينات من الدم إلى الأنسجة و كرد فعل للأنسجة بتخرج شوية بروتينات

لما الـ tissue osmotic يزيد تقوم بسحب الماء لناحيتها و النسيج يورم.

"طبة الحب و طراحة"