Dear colleagues,

Claude and Cestmir agreed to address to the Vasculab forum to further discussion the issue concerning existence/non existence of closed shunts. They have discussed it between themselves, but they continue the have divergent attitudes.

Pro/contra standpoint is attached

Claude/Cestmir

**Cestmir Receck:**

Maneuvers provoking reflux in incompetent GSV are based on two different mechanisms:

1.     The compression/release maneuver evokes reflux by reducing the pressure in the lower leg veins, creating thereby a pressure difference between the veins in the thigh and the lower leg. It simulates ambulatory pressure gradient occurring during calf pump activity; principally, it does not influence the diameter of the refluxing channels.

*C.Franceschi: .*

*Even if the proximal pressure is not increased when walking, the reflux is overloaded by the flow/pressure of the calf pump that combined with wall reaction to such a stress leads to dilatation.*

**Cestmir Receck:**

2.     The Valsalva maneuver increases the intra-abdominal pressure and evokes reflux by elevating the pressure in the iliac and common femoral vein above the pressure in the deep lower leg veins; the increase in pressure is accompanied by dilatation of the common femoral vein and the incompetent GSV. This mechanism takes place during coughing, up heaving heavy objects, heavy labor.

*C.Franceschi:*

*OK*

**Cestmir Receck:**

What about to perform both tests simultaneously?

Claude touched on an interesting topic: how to interpret the flow in the tributaries of the GSV arch: is it a normal flow draining venous blood into the femoral vein or is this a refluxing flow escaping from a pelvic vein?

*C.Franceschi:*

*Valsalva maneuver makes the difference.*

**Cestmir Receck:**

In case of a normal flow: the tributary should not be enlarged; no reflux should be detected in the GSV segments both proximal and distal to the issue of the tributary.

*C.Franceschi:*

*in case of GSV incompetence just below the descending tributary while the GSV end is competent, a reflux occurs during the compression-release and Paranà diastole ( more physiological than compression-release , just try it and then let me know.) BUT not during the Valsalva maneuver.*

**Cestmir Receck:**

In case of a flow refluxing selectivelywithin the tributary from a pelvic vein: the tributary should be enlarged

*C.Franceschi: Most of the time, yes , but they are not necessarly very large : thanks to following them up to the “source” of the Valsalva reflux, I “discovered “ the location of some anatomic points so far not described as pelvic escape point ( Perineal (P Point) , Iinguinal (I Point), Clitoridian (C Point) .*

*Cher Cestmir,*

*You ask my “opinion” that I hope to be a “rational answer”.*

**Cestmir Receck:**

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**Cestmir Receck:**

; no reflux should be demonstrable in the GSV proximal to the tributary (between the issue and the SFJ); reflux should be detectable in the GSV distal to the tributary.

I would like to ask Claude and other colleagues who have large experience with these provoking maneuvers to specify their opinions on this issue

**Cestmir Receck:**

I did not understand the following sentence… *the reflux is overloaded by the flow/pressure of the calf pump that combined with wall reaction to such a stress leads to dilatation.* Could you please specify in more detail?

**C.Franceschi:**

 **The refluxing flow is activated by the calf diastole. Despite the blood is not a perfect liquid, we can apply roughly the Bernouill’s equation, where the pressure gradient is proportional to the hydrostatic gravitational pressure(HGP = mgh) + the static pressure (SP) + dynamic pressure (DP= ½ mv²). So , independently of HGP, SP + DP increases with the velocity and volume of diastolic expansion of the pump. This energy is partly absorbed by mechanical interaction with the venous wall (shear stress and strain due turbulences). This mechanical energy/pressure against the wall leads to a dilatation proportionally to the compliance. This compliance changes with the passive and active structures of the wall. The change of these structures depends more or less on the biologic response to this stress. The overloading flow/pressure is made of the volume/velocity of the blood available in the deep network that refluxes through the SFJ ( or any other incompetent superficial-deep connection). For that reason, the distal disconnection of a closed shunt at the re-entry, ablates the overloading reflux and so reduces the vein caliber. But GHP is not fractionned and continues to exert its pressure against the wall. If the shunt disconnection is proximal, at the escape point, not only the overloading reflux is ablated , but , in addition, the GHP is fragmented, which results in caliber reduction more important than the one that is achieved by the distal disconnection.**

**Cestmir Receck:**

You wrote: *In case of GSV incompetence just below the descending tributary while the GSV end is competent, a reflux occurs during the compression-release and Paranà diastole ( more physiological than compression-release,… BUT not during the Valsalva maneuver.* Can you explain why the reflux is evoked by compression/release maneuver but not by Valsalva maneuver?

**C.Franceschi:**

**In absence of pelvic leak and GSV incompetence, the flow of the descending tributaries cannot reflux neither by the Valsalva manoeuver nor by the compression/release. In case of GSV incompetence distally to a competent terminal valve, the flow of the normal tributaries (included descending tributaries) is evoked because of the inefficient closure of the incompetent valves that allows its aspiration by the pump diastole ( release phase of compression or Paranà).On the contrary, in this case, the Valsalva cannot evoke any descending flow neither in the GSV thanks to the closure of the terminal valve, nor in the descending tributaries because their connections to the deep veins are competent. So only the Valsalva maneuver, when positive, can distinguish a descending reflux fed by a pelvic escape point from a normal descending flow, because the compression-relaxation/Paranà evokes a descending flow in both conditions i.e pelvic escape point/no pelvic escape point. Taking not in account this fact, may responsible of wrong diagnosis and “mysterious” failures.**

**Cestmir Receck:**

I have further questions concerning reflux intensity fed by an arch tributary: Which is the hemodynamic significance of such reflux? How much does it disturb the venous hemodynamics? Which is the clinical relevance of such reflux? Plethysmographic evaluation would clear the situation.

**C.Franceschi: Many varicose veins in female, during and post pregnancy are due to pelvic escape points ( Perineal,Obturator, Inguinal and Clitoridian). The caliber of the refluxing arch tributary is very variable and sometimes decreases to normal and no longer refluxing during the post pregnancy period of time ( reason why I suggest to wait 9 months after pregnancy before treating these varices). When their size is small, the Color Doppler can help fantastically. The clinical relevance is very variable, particularly in terms of trophic disorders, BUT important in terms of cosmetics concern.**

**Cestmir Receck:**

We can suppose that the reflux intensity might be distinctly smaller than in cases with incompetent SFJ; the findings by Cappelli corroborate this assumption: he found out that the diameter of the GSV <5 mm measured 15 cm below the SFJ (which hints at small reflux intensity) was indicative of reflux fed by an arch tributary, whereas diameter larger than 6 mm was mostly found in SFJ incompetence.

**C.Franceschi:**

**Indeed**

**Cestmir Receck:**

As concerns the pressure/flow relations, my approach to discover the motive force triggering reflux was much simpler: I have performed venous pressure measurements and found the peak ambulatory pressure gradient of 37.4 +- 6.4 mm Hg between thigh veins and lower leg veins; Arnoldi found out similar values: 33 +- 11.8 mm Hg. The time behavior of the pressure gradient can be illustrated by overlapping of pressure curves in the popliteal vein and posterior tibial vein (see attached schematic illustration gained from the article by Arnoldi).

**C.Franceschi**

**This is the gradient , i.e DP ( Bernouilly) that confirms my comment. In addition, DUS shows its effect on the flow velocity, direction and regimen**

***In case of GSV incompetence distally to a competent terminal valve, the flow of the normal tributaries (included descending tributaries) is evoked because of the inefficient closure of the incompetent valves that allows its aspiration by the pump diastole ( release phase of compression or Paranà).On the contrary, in this case, the Valsalva cannot evoke any descending flow neither in the GSV thanks to the closure of the terminal valve, nor in the descending tributaries because their connections to the deep veins are competent. So only the Valsalva maneuver, when positive, can distinguish a descending reflux fed by a pelvic escape point from a normal descending flow, because the compression-relaxation/Paranà evokes a descending flow in both conditions i.e pelvic escape point/no pelvic escape point. Taking not in account this fact, may responsible of wrong diagnosis and “mysterious” failures.***

**Cestmir Receck:**

Excuse me, there was a misunderstanding: under the term reflux.

**C.Franceschi**

**That’s why we should agree for the definition of every term in a glossary that takes in account the progress in knowledge. I proposed reflux = flow direction opposite to the valves ….Not every necessary new term should be called jargon.**

 **Cestmir Receck:**

, I understand a pathological centrifugal flow leaking out via an escape point from a deep vein (popliteal, femoral, iliac), where the pressure remains unaffected during calf pump activity and where there is enough blood at disposal to counteract the decreased pressure in the lower leg veins. If there is, in case of the arch tributary, no escape point in the iliac vein (Valsalva negative, no connection), we cannot speak about a factual reflux causing hemodynamic disturbance. If a centrifugal flow

 **C.Franceschi**

 **This is called reflux by the majority of the phlebologists. I proposed retrograde but without success**)

**Cestmir Receck:**

is demonstrable by the compression/release maneuver, the hemodynamic significance of such a flow is negligible.

**C.Franceschi:**

 **BUT sufficient to cause varicose dilatations and cosmetic complains.**

**Cestmir Receck:**

I am afraid I must state that the term ***closed shunt*** is a false imagination that does not exist in the reality. The refluxing blood is not a part of a ***closed circulation***as illustrated on your scheme. During muscle relaxation, it is impossible that the blood in the superficial femoral vein moves toward the heart in such an amount to feed the reflux. The blood refluxing in incompetent GSV comes from ***incompetent***iliac and common femoral vein where there is enough blood at disposal to counteract the decreased pressure in the deep lower leg veins. You can try to prove it using color coded DUS. There must be enough blood at disposal to evoke hemodynamically efficient reflux; this venous blood stock can be supplied only from incompetent deep veins; any competent valve situated above the escape point in the deep vein reduces essentially the supply and makes the resulting reflux hemodynamically hardly efficient.

**C.Franceschi**

*During the pump diastole, the pressure gradient between Sperficial-femoral vein and calf re-entry is favorable for a superficial femoral vein emptying trhough  the incompetent GSV ( closed shunt). The GSV reflux is also fed by the iliac vein ...but only when the iliac and common femoral valves are incompetent (first case).When they are competent (second case) , the reflux is also important even if less important than in the first case. I saw it with Color DUS.*

**C.Franceschi:**

Open shunts and open deviated shunts presented on the schemes do not evoke a pathological reflux that would be able to cause hemodynamic disturbance: they are hemodynamically ineffective because the amount of the supplied blood is not large enough to cause hemodynamic disturbance: it comes from the capillaries.

  **C.Franceschi** *Open Vicarious shunts are not involved in diastole but only permanently ( reisdual pressure from the capillaries)  with peaks evoked by the muscular systole. The Open deviated shunts are superficial incompetent tributaries that are overloaded during the diastole by the GSV flow ( made of the flow coming from its competent tributaries). Indeed, this shunt is not overloaded as much as when coming from the deep veins, but it exists though its hemodynamic relevance is not sufficient to create important pressure disturbance but it is suficient to dilate the superficial vein ( varicose) .*

**Cestmir Receck:**

Thus, you have a turn to prove (using plethysmography or venous pressure measurements) that open shunts and deviated open shunts are hemodynamically effective; until then they must be considered hemodynamically inefficient.

**C.Franceschi:**

*I didn't perform such measurements BUT the vein can be considerd as a gauge because its caliber change ( clinically and DUS) with the pressure.*

**Cestmir Receck:**

Air plethysmography measures functional venous volume: this is the volume change that occurs from the supine to the standing position. It is fed physiologically by venous flow coming through capillaries;

**C.Franceschi:**

*Yes, the residual pressure ( term usually used in physiology)*

**Cestmir Receck:**

in pathological situations also by reflux

**C.Franceschi:**

*Yes*.

**Cestmir Receck:**

Open shunts  and deviated open shunts represent the filling that takes place physiologically through capillaries

**C.Franceschi:**

*Yes BUT the physiological capillary flow is drained by the wrong vein where into which it is diverted, permanently with  systolic peaks through the open vicarious shunts and during the diastole through the open deviated shunts.*

*Thank you again for your interest in my studies, because your expertise helps me to improve my explanations.*

*Attached a model and its physical rational validated by the Physics Lab of the French Ecole Polytechnique and a physicist of the Polytechnique de Lausanne..*

**Cestmir Receck:**

There is indeed a pressure gradient between the superficial femoral vein and the deep lower leg veins during calf pump activity but there is no incompetent communication between these pressure poles (if we exclude e.g. mid thigh perforator) to trigger reflux. The GSV issues into the ***common femoral vein***. Reflux (diastolic centrifugal flow) within the incompetent GSV is **exclusively**fedfrom from the incompetent iliac and common femoral vein.

 **C.Franceschi:**

**BUT there is a path through the incompetent SFJ that make it possible (ask any physicist) I saw ( Color DUS) this also in a deep closed shunt made of a double Superficial femora vein. You are right , in case of iliac-common femoral vein incompetence ( Trendenburg described it ) the reflux is eased by the gravitational pressure and is predominant to the superficial femoral vein supply. Another evidence is that in case of iliac thrombosis ( while the popliteal vein is competent) associated to GSV incompetence , an important reflux ( I have seen it several times) . On an other hand, a closed circuit ( closed shunt, private circulation) can be also defined as a circuit that allows part of deep blood propelled up by the systole through a vein (e.g up to the iliac) , to be aspirated back during the diastole through another one ( e.g GSV) , and so on repeatedly at each step when walking.**

**Cestmir Receck:**

Thus closed shunt/closed circuit to all intents and purposes does not exist.

**C.Franceschi:**

**Thus closed shunt/closed circuit to all intents and purposes does exist.**

**Cestmir Receck:**

If there is a competent valve in the CFV or iliac vein (a very rare situation), only the venous volume contained between the competent valve and the SFJ is available to counterpoise the decreased pressure in the deep lower leg veins; this volume is to small to cause a significant hemodynamic disturbance.

**C.Franceschi:**

**Unless it is bigger because fed by the superficial femoral vein ( closed shunt)***The Open deviated shunts are superficial incompetent tributaries that are overloaded during the diastole by the GSV flow ( made of the flow coming from its competent tributaries).*

**Cestmir Receck:**

Where is the source of reflux in open deviated shunts?

**C.Franceschi:**

**At the junction between the GS trunk and the incompetent tributary**.

**Cestmir Receck:**

 You often speak about ***overloading;*** how do you measure overloading? In which units?

**C.Franceschi:**

**Velocity and time of the reflux at the escape point as displayed by Doppler .**

**Cestmir Receck:**

Which is the value discriminating overloading from not overloading?

**C.Franceschi:**

 **Presence or absence of escape point e.g a refluxing tributary disconnected from the escape oint is still refluxing but its flow is reduced to the draining flow fed by its skin territory.**