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## Introduction

- Transpulmonary thermodilution (TPTD) and the *Pulse Contour Cardiac Output* (PiCCO™) technique is a hemodynamic monitoring system gaining recognition and wide usage in the intensive care setting [1].
- TPTD operates via a single thermal indicator technique to determine cardiac index (CI), and derivatives volumetric variables [2].
- TPTD signal artifacts other than shunt have been evoked [3,4], but their real impact on CI values was never established [5].
- The present case describes the impact of a cross-talk phenomenon on the TPTD curve and CI measurement when the technique was assessed using a femoral central venous access in a critically ill patient.



**Figure 1:** The transpulmonary thermodilution (TPTD) curve prior to draw back the right femoral PiCCO™ catheter. Please note that the TPTD curve is characterized by a premature as well as a late peak with a dilution appearing large and biphasic (CI value = 1.15 L.min<sup>-1</sup>.m<sup>-2</sup>).

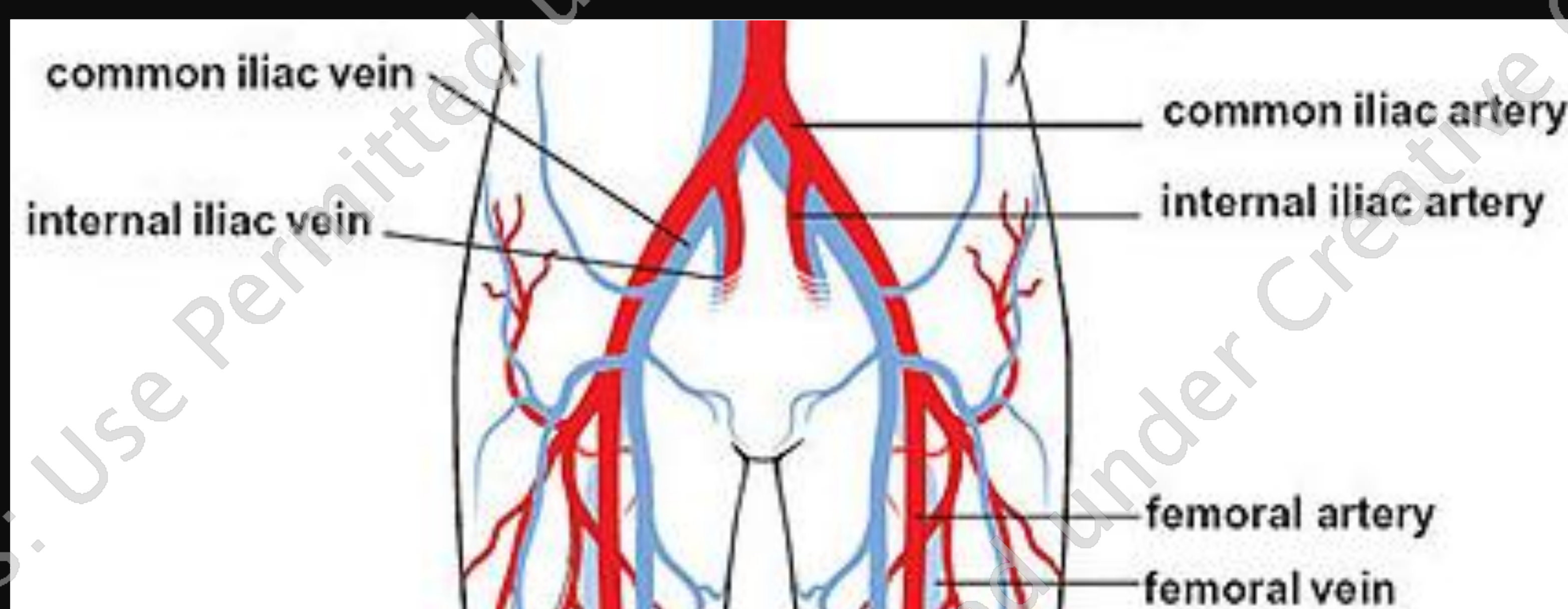


**Figure 2:** The transpulmonary thermodilution (TPTD) curve after the right femoral PiCCO™ catheter has been repositioned. Please note that the premature peak disappeared with a dilution appearing normal and less large (CI value = 3.44 L.min<sup>-1</sup>.m<sup>-2</sup>).

## Case report

A 19-year-old man was diagnosed with acute cerebellar ischemic stroke and cerebral edema following a low-energy skiing accident, and suspected to have traumatic dissection of the right vertebral artery. Vasopressor therapy was intermittently necessary to maintain adequate cerebral perfusion pressure. We established an advanced hemodynamic monitoring using a TPTD technique. A left femoral central venous catheter (V) of 20 cm length was already in place. We inserted a 20-cm-long PiCCO™ catheter in the right femoral artery (A) in order to complete the device setup (Fig 1).

The thermodilution curves initially observed appeared early and biphasic (“camel-curve” type, Fig 1), with an incomprehensibly low CI, when compared to the normal CI value obtained by echocardiography Doppler. We assumed that the close and matched positioning of venous and arterial femoral catheters of equal length (20cm) was responsible for a signal interference (described as the cross-talk phenomenon). To resolve the present artifact, we drew back the right femoral catheter by 8 cm (Fig 2). We then observed a common TPTD curve with normal uniphasic shape, signal delay, and CI value (Fig 2).



**Figure 3:** Schematic anatomy of the large femoral and iliac blood vessels demonstrating contiguity of artery and vein in the retroperitoneal compartment

## Discussion

Venous-arterial thermodilution artifacts may be responsible for an early detection of the thermal indicator in TPTD. This is the first observation of an early and biphasic “camel-curve” type TPTD signal, impacting CI values, related to the anatomical contiguity of large vessels (Fig 3).

In the present case, CI values were abnormally low before the right femoral PiCCO™ catheter was withdrawn by 8 cm. This finding is explained by part of the cold saline solution injected through the femoral venous catheter inducing significant temperature changes in the close artery (vessel contiguity). The resulting TPTD curve appeared large and biphasic, shaped by a premature as well as a late peak. As the thermal bolus is detected twice (early artifact and expected detection), the area under the curve was larger, and consequently the CI lower.

Once the arterial catheter had been isolated from the injection site by repositioning, the signal artifact was eliminated, and a common TPTD curve with CI values closely reflecting the patient cardiac function was detected.

## Conclusion

- Transpulmonary thermodilution (TPTD) and the *Pulse Contour Cardiac Output* (PiCCO™) technique is a simple, effective and safe hemodynamic monitoring system.
- The use of a femoral central venous catheter is a secure approach in neurosurgical critically ill patients as the present line position does not affect jugular venous return and potentially intracranial pressure.
- However, the use of a femoral venous catheter longer than the femoral artery catheter is recommended to avoid a cross-talk phenomenon and its impact on TPTD curve and CI measurement.

## References

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