Sciatic block in AOCP patients: is an increase in regional saturation possible?

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Background and aims: Peripheral artery disease is an abnormal narrowing of the arteries due to endothelial dysfunctions which result in vessel obstruction. PAD most commonly affects the legs. When recommended endovascular surgery represents goal standard and can be performed with regional anesthesia. Is it is well documented how local anesthetics used in RA techniques are responsible for the sensitive, motor and sympathetic blockade of the nerves which causes vasoplegia. This study aimed to evaluate variations of regional saturation,indicating peripheral vasodilatation,in PAD affected patients subjected to a sciatic block prior to endovascular procedures.

Methods: We conducted Single-center prospective observational study to evaluate of the improvement of peripheral vascular perfusion, monitored with near-infrared spectroscopy, in patients undergoing endovascular surgery after performing sciatic nervous block.

Thirty-one patients were enrolled from January 2017 to January 2019 from the Professor Righi's Angiography Division and Doctor Merlo's Department of Vascular Surgery. On all patients treated sciatic block was performed with 20 ml of Mepivacaine 1% and peripheral saturation monitored with NIRS periprocedurally.

Results: Mean baseline rSO2 was 58,12. After performing the sciatic popliteal block a mean of 62,12 rSO2 was obtained. After fifteen minutes the average increase in rSO2 was 64,25 increasing to 66,47 at 30 minutes. At the end of the surgical procedure mean rSO2 values were 67,63.

Conclusions:In this study we were able to observe an increase in NIRS values periprocedurally. This study gives an important input concerning the relevance of peripheral nerve block in complementing revascularization procedures and implementing peripheral reperfusion given local anesthetics vasoplegic and consequent vasodilatation properties.

Endovascular treatment of critical limb ischemia involves long and painful procedures which often require anesthesia. Particularly patients presenting with ischemic resting pain require higher levels of analgesia in order to endure such long interventions. On the other hand, critical limb ischemia patients tend to have significant comorbidities which make them poor candidates for deep sedoanalgesia or general anesthesia. Regional anesthesia with sciatic nerve block is a less invasive and more cost-effective pain management alternative to general anesthesia during ambulatory orthopedic and vascular surgical procedures and has lower post-procedure morbidity, such as nausea and pain, or post-anesthesia care needs.

In the last decade regional anesthesia has acquired more and more attention thanks to the development of new techniques especially those involving ultrasound guidance.

Local anesthetic properties are by now well known and present numerous advantages. Their mechanism of action is to interrupt neural conduction by inhibiting the influx of sodium ions through channels or ionophores within neuronal membranes, this results in an interruption of the nerve's transmission.

The sympathetic nervous system represents a fundamental homeostatic system that exerts considerable control over blood pressure and the distribution of blood flow. This process has been referred to as neurovascular control.

Local anesthetics with their channel blocking properties are responsible not only of inhibiting the nerve motor and sensitive capacity but also of blocking it's sympathetic components. This will result in a vasoplegia phenomena that causes vasodilatation. Moreover the blockade of the sympathetic nervous system is well know to lower stress response to the surgical stimulus which reduces the impact of inflammation in the involved region.

Recently NIRS has been used to monitor limb oxygenation in patients affected by AOCP. In a experimental study NIRS values were compared in 20 healthy volunteers after an occlusion test proximally at the leg and distally at the foot demonstrating changes in NIRS oxygenation values at the inferior extremities vary not only because of arterial occlusion but also depending on the the site of the occlusion.

The first study regarding the use of NIRS in limb perfusion was conducted by Cheatle et al. who used it to detect oxygenation at the leg in 17 AOCP affected patients and in 21 control healthy individuals evaluating oxygen use before and after tourniquet induced ischemia.

McCully et al. Instead compared the tax of de-saturation and re-saturation at the leg before and after physical exercise in patients with AOCP and in healthy ones.

It is well documented how regional anesthesia guarantees an adequate analgesia during and after endovascular procedures seen how critical limb ischemia patients are, frequently presenting with resting pain they can be very stressed before undergoing endovascular interventions.

On the other hand it is not clear weather regional anesthesia actually gives a positive contribute in increasing perfusion at the ischemic limb in association with endovascular procedures.The objective of our study was specifically that of evaluating whether there can be an increase in regional limb perfusion in patients affected by AOCP who undergo endovascular surgery.

Based on our results we were able to observe that the average rSO2 at time 0 was seen rapidly increasing after performing the sciatic popliteal block testifying for the fact that nerve block associated with sympathetic block which causes vasoplegia and consequent vasodilatation.

In literature no other studies were found investigating these particular properties of local anesthetics being used during nerve blocks. To our knowledge, this is the first report to consider the impact of regional anesthesia on limb perfusion.

Our results show that there could be an improvement of the ischemic region secondary to vasoplegia and vasodilatation. As we have argued elsewhere regional anesthesia may be considered a promising aspect of endovascular surgery.

Mean baseline rSO2 was 58,12. After performing the sciatic popliteal block a mean of 62,12 rSO2 was obtained. After fifteen minutes the average increase in rSO2 was 64,25 increasing to 66,47 at 30 minutes. At the end of the surgical procedure mean rSO2 values were 67,63. We demonstrated a statistically significant result of NIRS mean measurements taken during the procedure that could not be attributed to chance, with an ANOVA one way test.

We also cared to verify a statistically significant difference in the rSO2 trend at both limbs and exclude any possible physiological bias related to changes in blood pressure, S02, drug administration.

To do this we collected data on the contralateral limb and analyzed it once again with an ANOVA one way test to assess if NIRS values measured at the healthy limb demonstrated statistically significantly different from each other. The test concluded this time for no statistical difference between these measurements and corroborating a null hypothesis.

We then confronted NIRS measurement trends from the ischemic limb and the healthy one using a t-student test considering only the 24 patients for which we had bilateral measurements.

The test demonstrated a statistically significant difference for all post procedural measurements. Stating there is no correlation in between measurement trends of the two limbs.

In conclusion our study was inspired by the increased use of NIRS during surgical procedures especially those concerning patients with PAD treated with endovascular surgery. Despite being a monocentric study it was able to state the benefit of sciatic popliteal block in limb reperfusion considering the increasing trend in NIRS values we registered compared to the control limb being the contralateral healthy one.

The impact of this study is limited by the small number of patients, nonetheless it may be worthy of future research.

Future investigations should consider the potential effects of local anesthetics and nerve block more carefully and address this matter in future studies, especially considering the possibility of a continuous peripheral nerve block. This technique could guarantee not only pain relief in a deteriorated and ischemic limb but also, as we aimed to demonstrate, help through vasodilatation limb perfusion in the most critical patients.Numerous evidence in literature also indicate the possibility of a domestic therapy with perineural catheters through portable infusion pumps. Case reports of ambulatory perineural infusion were described via peripheral nerve catheters in various locations including paravertebral, interscalene, intersternocleidomastoid, infraclavicular, axillary , psoas compartment, femoral, fascia iliaca, sciatic/Labat , sciatic/popliteal, and tibial nerve placement. This data stimulates further interest in peripheral nerve blockade in patients affected by PAD that are candidates for endovascular surgery. It certainly is an issue for future research to explore.