ABC

THE **ABCs** OF LOP

ZIMMER BIOMET

Have any of your patients complained of post-operative tourniquet pain or transient nerve pain? Did you know, nerve-related injuries have been attributed to higher levels of tourniquet inflation pressure and higher pressure gradients?[1]

Make no mistake; Limb Occlusion Pressure (LOP) is not just any pressure that stops blood flow to the limb. We know that patients all have different systolic blood pressure, limb shape and circumference – and having the ability to choose the lowest possible pressure for each patient makes sense.

The Zimmer Biomet A.T.S.® 5000 measures the minimum cuff pressure necessary to stop arterial blood flow and reports this information back to you. Concurrently, it also displays the Recommended Tourniquet Pressure (RTP) for that specific patient's limb, which accounts for any fluctuations in blood pressure throughout the case.

Let's discuss the ABCs of LOP

A IS FOR ABSOLUTE MINIMUM

B IS FOR BLOODLESS FIELD

C IS FOR CONFIDENCE

Absolute Minimum

The true definition of LOP, as defined by McEwen *et al.*, is the minimum cuff pressure that stops arterial blood flow distal to the cuff.[2] This definition is supported by Tuncali *et al.* as being called Arterial Occlusion Pressure (AOP).[3] The terms AOP and LOP are synonyms. Using the minimum effective pressure (i.e. LOP) added to a pressure margin has been shown to allow the use of lower tourniquet cuff pressures when compared to recommended standards without affecting limb hemostasis.[4*]

Bloodless Field

It has been well reported and studied that high tourniquet pressure can cause nerve damage, weakening, partial or complete muscle paralysis and injury to the tissue under and near the tourniquet.[4*, 5, 6*]

Tourniquet cuff pressures that are too low could result in bleeding distal to the cuff that can result in undesirable blood in the surgical field and blood loss. Insufficient tourniquet cuff pressures have been reported to impair venous return, while allowing arterial blood flow to continue.[7] Therefore, setting tourniquet pressures too low can cause pooling of blood in the field.

*A.T.S. 5000 not used in study

Confidence

LOP should be used to determine the minimum effective tourniquet pressure. The A.T.S. 5000 includes two methods for measuring LOP, including the Distal Method and the EZ Method, which allows you to determine LOP without a non-sterile sensor. A recent study concluded that both methods provide agreeable results of accurate, effective LOP measurement.[8*]

Another study found that when using a standard width tourniquet cuff with an automatic-equipped tourniquet system to sense LOP and adding a pressure margin, the patient experiences tourniquet cuff pressure of 12 to 25% less when compared to current practice. Additionally, tourniquet hemostasis was successfully obtained in 93% of the cases.[2*]

The A.T.S. 5000 completes this entire process in approximately 30 seconds. Reid *et al.* showed that the LOP plus a pressure margin gave good hemostasis in 93.2% of upper extremity procedures and 97.5% in lower extremity procedures.[4*]

Compared to previous Zimmer Biomet tourniquet models, LOP processes have been improved in the A.T.S. 5000. With improved signal quality, the distal sensor can be detected in 1-2 seconds.[9] Additionally, EZ Method does not require an additional sensor - simplifying workflow - and LOP measurements can be performed closer to cuff inflation time.[10]

The A.T.S. 5000 reports the LOP and RTP, providing you an option to personalize the tourniquet cuff pressures, while keeping the final setting of pressure in your hands.

*A.T.S. 5000 not used in study

References

1. McEwen J, Casey V. Measurement of hazardous pressure levels and gradients produced on human limbs by non-pneumatic tourniquets. In: Proceedings of the 32nd Conference of the Canadian Medical and Biological Engineering Society 2009. Calgary, Canada; 2009 May 20-22. p 1-4.
2. McEwen J.A., Inkpen K.B., Younger A., "Thigh tourniquet safety: Limb occlusionpressure measurement and a wide contoured cuff allow lower cuff pressure" Surg Tech34:8-18, 2002.
3. Tuncali B, Karci A, Tuncali BE, Mavioglu O, Ozkan M, Bacakoglu AK, Baydur H, Ekin A, Elar Z. "A new method for estimating arterial occlusion pressure in optimizing pneumatic tourniquet inflation pressure.", Anesth Analg. 2006 Jun; 102(6):1752-7.
4. Reid H.S., Camp R.A., and Jacob W.H., "Tourniquet hemostasis: a clinical study", Clin Orthop 177:230-234, 1983.
5. Tredwell S.J., Wilmink M., Inkpen K., McEwen J.A., "Pediatric tourniquets: Analysis of cuff and limb interface, current practice, and guidelines for use.", J Pediatr Orthop 21:671-676, 2001.
6. McEwen J.A., Kelly D.L., Jardanowski T., Inkpen K., "Tourniquet safety in lower leg applications", Orthop Nurs 21:55-62, 2002.
7. Massey K.A., Blakeslee C., Martin W, Pitkow H.S., "Pneumatic ankle tourniquets: physiological factors related to minimal arterial occlusion pressure", J Foot Ankle Surg 38:256-263, 306-307, 1999.
8. Hughes L., McEwen J., "Investigation of clinically acceptable agreement between two methods of automatic measurement of limb occlusion pressure: a randomised trial." BMC Biomedical Engineering, 2021.
9. Internal TR-1773, ATS 5000 Distal LOP Verification r1.0, 2021.
10. Internal TR-1774, ATS 5000 EZ LOP Verification r1.0, 2021.

Laboratory testing is not necessarily indicative of clinical performance.

ZIMMER BIOMET
Moving You Forward.™

1389.2-US-en-Issue Date 2022-04