Informational Bulletin

IMPORTANT INFORMATION – PLEASE READ AND KEEP

Publication references:

MAC-Pilot - Accuracy of the target value control

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Introduction

Der MIRUS™ shines with its target value controlled sedation and applied with high accuracy by the integrated MAC pilot. As this outstanding feature of the MIRUS system is often questioned by external parties, this bulletin is intended to provide scientific proof and thus objectively counter these unfounded claims.

We are pleased to provide you with the following powerful list of publications, which scientifically investigate and sustainably prove the target value controlled sedation of the MIRUS™.

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The target value controlled and accurate sedation with MIRUS™

A scientific proof of the accuracy of target value controlled sedation

- Bomberg H., Meiser A. et al. (2014). A Novel Device for Target Controlled Administration and Reflection of Desflurane--The Mirus™. Epub 69(11):1241-50. Doi: 10.1111/anae.12798.

“The Mirus control unit displays respiratory pressure and flow continuously. The end-tidal desflurane concentration is controlled automatically to a set target value.”

“The Mirus system has its own control unit for determination of the endtidal concentration and for target-controlled administration of the anaesthetic agent. Therefore, other devices such as an external gas monitor or a syringe pump are not needed. In addition, it can be used to administer desflurane, which is not possible using the Anaconda because the low boiling point of desflurane prohibits delivery via a syringe pump.”

“To our knowledge, the Mirus is the only commercially available monitor assigning concentrations to the phases of the respiratory cycle according to flow.”

- Perbet, S. (2015). Evaluation of richmond agitation sedation scale according to alveolar concentration of sevoflurane during a sedation with sevoflurane in ICU patients. Intensive Care Medicine Experimental 2015 3(Suppl 1): A27. Doi:10.1186/2197-425X-3-S1-A27

“This study found a correlation between the RASS and also the FeSevo or MAC of sevoflurane. The decrease in the RASS was well correlated with the increase in the concentration of sevoflurane and decreased BIS. Sedation with inhalated sevoflurane administered by the Mirus™ system allows stable concentrations of sevoflurane and was well correlated to the targeted level of sedation...”

- Meiser A., Bomberg H., Volk T., Groesdonk HV. (2017). Neue technische Entwicklung der inhalativen Sedierung. Anaesthesist 66, 274–282 (2017). Doi: 10.1007/s00101-017-0269-5. German.

“For MIRUS, the end-tidal concentration can be set as the target value. In the technical evaluation cyclical fluctuations of 20% with a periodicity of 2.6 min around the target value were detected, whereby the target value was adhered to very precisely on average. When used on patients no fluctuations in sedation depth could be detected, neither clinically nor by monitoring the EEG using the bispectral index.”

- Romagnoli S. et al. (2017). The New MIRUS System for Short-Term Sedation in Postsurgical ICU Patients. Crit Care Med. 2017;45(9): e925-e931. Doi:10.1097/CCM.000000000000246

“The MIRUS system seems to represent a step forward due to some interesting technical properties: first, it can deliver desflurane (potential advantage of desflurane include the fastest onset/offset among the VAs), which cannot be used with a syringe pump because of the low boiling point (sevoflurane and isoflurane can also be used); second, the MIRUS comprises a monitor for gas concentration, pressure, and flow measurements (AnaConDa, an external gas monitor, must be used) with high accuracy and precision of the end-tidal concentrations; third, the MIRUS has its own control unit for determination of the end-tidal VA concentration target controlled administration (an external gas monitor or a syringe pump is not needed). The MIRUS system consists of a main unit, with a VA reservoir connected to an interface by a multilumen cable for gas injection and for measuring gas pressure, flow, and concentration. The system is connected to the respiration circuit between the Y-piece and the tracheal tube, with a Reflector and a heat and moisture exchanger and microbiological filter. Airway pressure and gas flow are continuously measured and displayed on the screen of the control unit. The end-tidal concentration is automatically regulated to a target value by the main control system according to the MAC set in the machine.”

- Böttiger BW, Kuckelt W (2018). Jahrbuch Intensivmedizin 2018. Pabst Science Publishers Verlag: Lengerich. Page: 55 – 62.

“The second innovation is the MIRUS™ anesthesia gas reflection system, which has been on sale since 2013. The dead space volume here is also 100 ml. However, the HME filter portion is interchangeable and desflurane can be applied in addition to isoflurane and sevoflurane (specific adapters required). First studies show a slightly lower reflectivity compared to the classic AnaConDa™, so that a faster passive drop in the anaesthetic gas concentration must be expected. Numerous safety aspects and a target value control selectable according to the MAC concept are available in the system and make the application very easy, especially for unstable intensive care patients. A change of the respiratory minute volume has no influence on the measured anaesthetic gas concentration.”

- Bellgardt M, Drees D, Vinnikov V, et al. (2018). Use of the MIRUS™ system for general anaesthesia during surgery: a comparison of isoflurane, sevoflurane and desflurane. Journal of Clinical Monitoring and Computing. 2018 Aug;32(4):623-627. DOI: 10.1007/s10877-018-0138-z.

“The MIRUS™ system enables automated end-expired control of volatile anaesthetics. The device is positioned between the Y-piece of the breathing system and the patient’s airway. The system has been tested in vitro and to provide sedation in the ICU with end-expired concentrations up to 0.5 MAC. We describe its performance in a clinical setting with concentrations up to 1.0 MAC. In 63 ASA II–III patients undergoing elective hip or knee replacement surgery, the MIRUS™ was set to keep the end-expired desflurane, sevoflurane, or isoflurane concentration at 1 MAC while ventilating the patient with the PB-840 ICU ventilator. In 60 out of 63 patients 1.0 MAC could be reached and remained constant during surgery. The MIRUS™ system reliable delivers 1.0 MAC of the modern inhaled agents, both during mechanical ventilation and spontaneous (assisted) breathing.”

- Bellgardt, M., Georgevici, A.I., Klutzny, M. et al. (2019). Use of MIRUS™ for MAC-driven application of isoflurane, sevoflurane, and desflurane in postoperative ICU patients: a randomized controlled trial. Ann. Intensive Care 9, 118 (2019). Doi: 10.1186/s13613-019-0594-8

“The use of volatile anaesthetics as sedatives in the ICU is relevant for the patient’s outcome. The MIRUS™ System (MS) is the first anaesthetic gas reflector system which can administer Desflurane (DES) besides Isoflurane (ISO) and Sevoflurane (SEVO). The MS can independently measure and control anaesthetic gas concentrations. We aimed to compare the MS gas consumption with the minimal, low and high flow consumption of a conventional semi-closed anaesthesia machine - the Aisys CS (GE Healthcare, Madison, WI, USA) which has a similar end tidal concentration control.”

“In the clinically relevant domains for ICU sedation (0.5 MAC) we could derive the following consumptions: MS ISO at 0.5 Vol% consumes an average of 2 mL/h which is identical to the Aisys at FGF 1 L/min; MS SEVO at 1 Vol% consumes an average of 10 mL/h which is comparable to the Aisys at FGF 2.5 L/min (8.2 mL/h); MS DES at 3 Vol% uses up an average of 12 mL/h corresponding to the Aisys at FGF 1 L/min (9.7 mL/h). The MS interpolation curve for all three gases shows a divergent tendency at 3 Vol% which most likely corresponds to the spillover effect described for Desflurane.”

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