Medtronic

Clinical evidence bibliography

Studies showing how capnography monitoring can help patients

Microstream™ capnography monitoring reviewed by independent healthcare researchers

Over 250 published sources verify the effectiveness of capnography monitoring to help clinicians identify and mitigate respiratory compromise. Microstream™ capnography technology is engineered to provide you comprehensive continuous monitoring that:

- Is engineered for accuracy
- May help clinicians improve patient safety
- Is intended to help clinicians enhance efficiency

We are dedicated to ensuring that our monitoring solutions have been tested and reviewed not only internally, but also by independent, objective healthcare researchers.

The studies in this bibliography highlight the potential benefits of capnography monitoring in a wide variety of patients.

We strive to deliver innovative healthcare solutions – developed in ethical collaboration with medical professionals – that improve outcomes and enhance quality of life for patients. We hope this clinical bibliography will help you do just that.

2023

AUTHORS	TITLE	CITATION	
Champreeda V, et al.	Nocturnal respiratory abnormalities among ward-level postoperative patients as detected by the Capnostream 20p monitor: A blinded observational study.	*PLoS One*. 2023; 18 (1): e0280436.	https://pubmed.ncbi.nlm.nih.gov/36662703
Jurado MJ, et al.	End-tidal and transcutaneous CO(2) monitoring during sleep in children aged under three with suspected sleep apnea	*Pediatr Pulmonol*. 2023; 58 (3): 963-966.	https://pubmed.ncbi.nlm.nih.gov/36453512
Wang Y, et al.	The effect of capnography on the incidence of hypoxia during sedation for EGD and colonoscopy in mildly obese patients: a randomized, controlled study	*BMC Anesthesiol*. 2023; 23 (1): 188.	https://pubmed.ncbi.nlm.nih.gov/37259022

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AUTHORS	TITLE	CITATION	
Ambert M, et al.	Continuous Respiratory Surveillance with Capnography and Oximetry After Bariatric Surgery	*Surgical Endoscopy*. 2022; 36 S119.	
Castellví-Font A, et al.	Association between Integrated Pulmonary Index™ and ICU outcomes in patients under mechanical ventilation	*Intensive Care Medicine Experimental* 2022; 10 (Supplement 29): 114	
Corbett G, et al.	Service Evaluation of the Impact of Capnography on the Safety of Procedural Sedation	*Front Med (Lausanne)*. 2022; 9 867536.	https://pubmed.ncbi.nlm.nih.gov/35602494
Gurlu R, et al.	Can Non-Invasive Capnography and Integrated Pulmonary Index Contribute to Patient Monitoring in the Pediatric Emergency Department?	*Klin Padiatr*. 2022; 234 (1): 26-32.	https://pubmed.ncbi.nlm.nih.gov/34359093
Gutiérrez JJ, et al.	Contribution of chest compressions to end-tidal carbon dioxide levels generated during out-of-hospital cardiopulmonary resuscitation	*Resuscitation*. 2022; 179 225-232.	https://pubmed.ncbi.nlm.nih.gov/35835250
Ogura T, et al.	Propensity score matching analysis for adverse events of EUS-guided biliary drainage in advanced elderly patients (PEACE study)	*Therap Adv Gastroenterol*. 2022; 1517562848 221092 612.	https://pubmed.ncbi.nlm.nih.gov/35601802

The Microstream™ Capnography Monitoring System should not be used as the sole basis for diagnosis or therapy and is intended only as an adjunct in patient assessment.

Potvin J, et al.	Effects of capnometry monitoring during recovery in the post-anaesthesia care unit: a randomized controlled trial in adults (CAPNOSSPI)	*J Clin Monit Comput.* 2022; 36 (2): 379-385.	https://pubmed.ncbi.nlm.nih.gov/33550546
Werther T, et al.	Monitoring of carbon dioxide in ventilated neonates: a prospective observational study	*Arch Dis Child Fetal Neonatal Ed.* 2022; 107 (3): 293-298.	https://pubmed.ncbi.nlm.nih.gov/34344835
Williams E, et al.	Factors affecting the arterial to end-tidal carbon dioxide gradient in ventilated neonates	*Physiol Meas.* 2022; 43 (2)	https://pubmed.ncbi.nlm.nih.gov/35196261
Yılmaz Ferhatoğlu S, et al.	Deep Sedation and Patient Safety in Pediatric Patients Undergoing Radiofrequency Catheter Ablation: A Prospective Study	*GKD Anest Yoğ Bak Dern Derg.* 2022; 28 (1): 97-103.	

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AUTHORS	TITLE	CITATION	
Akbas I, Kocak, AO, Celik, BK, Menekse, TS, Demir, M, Gur, STA, Kerget, B and Cakir, Z	Performance of integrated pulmonary index for pulmonary embolism in dyspneic patients	*Bratisl Lek Listy.* 2021; 122 (1): 65-70.	https://pubmed.ncbi.nlm.nih.gov/33393323
Batcik S, et al.	The Effect of Prone Position on the Integrated Pulmonary Index (IPI) Score in Lumbar Disc Surgeries Performed With Spinal Anesthesia	*Medical Bulletin of Haseki.* 2021; 59 (4):	
Bisschops R, et al.	Implementing capnography to help improve patient safety during procedural sedation: quality improvement in a high-volume gastroenterology department	*Eur J Gastroenterol Hepatol.* 2021; 33 (1S Suppl 1): e522-e528.	https://pubmed.ncbi.nlm.nih.gov/33905213
Blonder Y, Mazor, E and Jew, K	Advanced Capnography Sampling Lines May Improve Patient Comfort and Compliance	*Med Devices (Auckl).* 2021; 14 37-42.	https://pubmed.ncbi.nlm.nih.gov/33633472
Deng J, et al.	A capnography and transcutaneous CO(2) profile of bariatric patients during early postoperative period after opioid-sparing anesthesia	*Surg Obes Relat Dis.* 2021; 17 (5): 963-967.	https://pubmed.ncbi.nlm.nih.gov/33622605
Fishman H, et al.	Associations between polysomnography measurements and postoperative adverse respiratory events in children with neuromuscular disease	*J Clin Sleep Med.* 2021; 17 (4): 757-765.	https://pubmed.ncbi.nlm.nih.gov/33231163
Kaur R, Vines, DL, Patel, AD, Lugo-Robles, R and Balk, RA	Early Identification of Extubation Failure Using Integrated Pulmonary Index and High-Risk Factors	*Respir Care.* 2021;	https://pubmed.ncbi.nlm.nih.gov/33947791
Khanna AK, Jungquist, CR, Buhre, W, Soto, R, Di Piazza, F and Saager, L	Modeling the Cost Savings of Continuous Pulse Oximetry and Capnography Monitoring of United States General Care Floor Patients Receiving Opioids Based on the PRODIGY Trial	*Adv Ther.* 2021; 1-15.	https://pubmed.ncbi.nlm.nih.gov/34031858
Khanna AK, Jungquist, CR, Buhre, W, Soto, R, Di Piazza, F and Saager, L	Modeling the cost savings of continuous pulse oximetry and capnography monitoring of united states hospital ward patients receiving opioids	*Anesthesia and Analgesia.* 2021; 132 (3 SUPPL): 39-40.	
Kuroe Y, Mihara, Y, Okahara, S, Ishii, K, Kanazawa, T and Morimatsu, H	Integrated pulmonary index can predict respiratory compromise in high-risk patients in the post-anesthesia care unit: a prospective, observational study	*BMC Anesthesiol.* 2021; 21 (1): 123.	https://pubmed.ncbi.nlm.nih.gov/33882856
Ozlem Sezen, et al.	The value of integrated pulmonary index monitoring in pediatric endoscopic interventions under sedation	*Kuwait Med J.* 2021; 53 (3): 282-90.	
Tekin E, Ozlu, I, Bayraktar, M, Can, NO and Yilmaz, S	Comparison of the integrated pulmonary index with cardiac risk scores in acute coronary syndromes	*Annals of Clinical and Analytical Medicine.* 2021; 12 (3): 242-247.	
Urman RD, Khanna, AK, Bergese, SD, Buhre, W, Wittmann, M, Le Guen, M, Overdyk, FJ, Di Piazza, F and Saager, L	Postoperative opioid administration characteristics associated with opioid-induced respiratory depression: Results from the PRODIGY trial	*J Clin Anesth.* 2021; 70 110167.	https://pubmed.ncbi.nlm.nih.gov/33493688

2020

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Broens SJL, Prins, SA, de Kleer, D, Niesters, M, Dahan, A and van Velzen, M	Postoperative respiratory state assessment using the Integrated Pulmonary Index (IPI) and resultant nurse interventions in the post-anesthesia care unit: a randomized controlled trial	*J Clin Monit Comput.* 2020;	https://pubmed.ncbi.nlm.nih.gov/32729065
Chung F, Wong, J, Mestek, ML, Niebel, KH and Lichtenthal, P	Characterization of respiratory compromise and the potential clinical utility of capnography in the post-anesthesia care unit: a blinded observational trial	*J Clin Monit Comput.* 2020; 34 (3): 541-551.	https://pubmed.ncbi.nlm.nih.gov/31175500
Duyu M, Bektas, AD, Karakaya, Z, Bahar, M, Gunalp, A, Caglar, YM, Yersel, MN and Bozkurt, O	Comparing the novel microstream and the traditional mainstream method of end-tidal CO(2) monitoring with respect to PaCO(2) as gold standard in intubated critically ill children	*Sci Rep.* 2020; 10 (1): 22042.	https://pubmed.ncbi.nlm.nih.gov/33328527
Khanna AK, Bergese, SD, Jungquist, CR, Morimatsu, H, Uezono, S, Lee, S, Ti, LK, Urman, RD, McIntyre, R, Jr., Tornero, C, Dahan, A, Saager, L, Weingarten, TN, Wittmann, M, Auckley, D, Brazzi, L, Le Guen, M, Soto, R, Schramm, F, Ayad, S, Kaw, R, Di Stefano, P, Sessler, DI, Uribe, A, Moll, V, Dempsey, SJ, Buhre, W and Overdyk, FJ	Prediction of Opioid-Induced Respiratory Depression on Inpatient Wards Using Continuous Capnography and Oximetry: An International Prospective, Observational Trial	*Anesth Analg.* 2020; 131 (4): 1012-1024.	https://pubmed.ncbi.nlm.nih.gov/32925318
Kocak AO, Cakir, Z, Akbas, I, Gur, STA, Kose, MZ, Can, NO, Sengun, E and Gemis, OF	Comparison of two scores of short term serious outcome in COPD patients	*Am J Emerg Med.* 2020; 38 (6): 1086-1091.	https://pubmed.ncbi.nlm.nih.gov/31378412
Michael FA, Peveling-Oberhag, J, Herrmann, E, Zeuzem, S, Bojunga, J and Friedrich-Rust, M	Evaluation of the Integrated Pulmonary Index® during non-anesthesiologist sedation for percutaneous endoscopic gastrostomy	*J Clin Monit Comput.* 2020;	https://pubmed.ncbi.nlm.nih.gov/32734356
Özdemir L, Azizoğlu, M and Yapıcı, D	Respirators used by healthcare workers due to the COVID-19 outbreak increase end-tidal carbon dioxide and fractional inspired carbon dioxide pressure	*J Clin Anesth.* 2020; 66 109901.	https://pubmed.ncbi.nlm.nih.gov/32473501
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Ruiz de Gauna S, Gutiérrez, JJ, Ruiz, J, Leturiondo, M, Azcarate, I, González-Otero, DM, Corcuera, C, Russell, JK and Daya, MR	The impact of ventilation rate on end-tidal carbon dioxide level during manual cardiopulmonary resuscitation	*Resuscitation*. 2020; 156 215-222.	https://pubmed.ncbi.nlm.nih.gov/32622015
Sezen O and Cevik, B	Monitoring beyond standard practice during awake craniotomy: Integrated pulmonary index (IPI)	*Kuwait Medical Journal.* 2020; 52 (4): 446-449.	
Weingarten TN, Morimatsu, H, Fiorda-Diaz, J, Bergese, SD, Ariyoshi, M, Sprung, J, Dahan, A and Overdyk, FJ	New-Onset Atrial Fibrillation Detected by Continuous Capnography Monitoring: A Case Report	*Am J Case Rep.* 2020; 21 e925510.	https://pubmed.ncbi.nlm.nih.gov/32948738
Williams E, Dassios, T and Greenough, A	Assessment of sidestream end-tidal capnography in ventilated infants on the neonatal unit	*Pediatr Pulmonol.* 2020; 55 (6): 1468-1473.	https://pubmed.ncbi.nlm.nih.gov/32187888

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Hasegawa H, Kamata, K, Hayashi, M, Komayama, N, Kawamata, T and Ozaki, M	Can pediatric Gamma Knife radiosurgery be managed under monitored anesthesia care? A case presentation and proposal from anesthesiologists	*J Radiosurg SBRT*. 2019; 6 (3): 235-239.	https://pubmed.ncbi.nlm.nih.gov/31998544
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Khanna A, Buhre, W, Saager, L, Di Stefano, P, Weingarten, T, Dahan, A, Brazzi, L and Overdyk, F	Derivation and validation of a novel opioid-induced respiratory depression risk prediction tool	*Critical Care Medicine*. 2019; 47 (1 Supplement 1):	
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Oba S, Turk, HA, Isil, CT, Sayin, P and Kilinc, L	Safety of microstream capnography monitoring in patients under sedation for colonoscopy	*Haseki Tip Bulteni*. 2019; 57 (3): 232-239.	
Öztürk MC, Demiroluk, Ö, Abitagaoglu, S and Ari, DE	The Effect of sevoflurane, desflurane and propofol on respiratory mechanics and integrated pulmonary index scores in laparoscopic sleeve gastrectomy. A randomized trial	*Saudi Med J*. 2019; 40 (12): 1235-1241.	https://pubmed.ncbi.nlm.nih.gov/31828275
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Stine CN, Koch, J, Brown, LS, Chalak, L, Kapadia, V and Wyckoff, MH	Quantitative end-tidal CO(2) can predict increase in heart rate during infant cardiopulmonary resuscitation	*Heliyon*. 2019; 5 (6): e01871.	https://pubmed.ncbi.nlm.nih.gov/31245640
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Fot EV, Izotova, NN, Yudina, AS, Smetkin, AA, Kuzkov, VV and Kirov, MY	The Predictive Value of Integrated Pulmonary Index after Off-Pump Coronary Artery Bypass Grafting: A Prospective Observational Study	*Front Med (Lausanne)*. 2017; 4 132.	https://pubmed.ncbi.nlm.nih.gov/28848733
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Ishiwata T, Tsushima, K, Fujie, M, Suzuki, K, Hirota, K, Abe, M, Kawata, N, Terada, J and Tatsumi, K	End-tidal capnographic monitoring to detect apnea episodes during flexible bronchoscopy under sedation	*BMC Pulm Med*. 2017; 17 (1): 7.	https://pubmed.ncbi.nlm.nih.gov/28061836

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