

RESQGARD BIBLIOGRAPHY
STUDIES THAT INCLUDED USE OF AN IMPEDANCE THRESHOLD DEVICE
IN SPONTANEOUSLY-BREATHING APPLICATIONS

Clinical (Human) Studies

1. Huang M, Brothers RM, Ganio MS, Lucas RA, Cramer MN, Moralez G, Convertino VA, Crandall CG. Tolerance to a haemorrhagic challenge during heat stress is improved with inspiratory resistance breathing. *Exp Physiol* 2018;103(9):1243-1250.
2. Kay VL, Sprick JD, Rickards CA. Cerebral oxygenation and regional cerebral perfusion responses with resistance breathing during central hypovolemia. *Am J Physiol Regul Integr Comp Physiol* 2017;313:R132-R139.
3. Convertino VA, Parquette BA, Wampler DA, Manifold CA, Lindstrom DA, Boland LL, Burkhardt NT, Lurie KG, Lick CJ. Use of intrathoracic pressure regulation therapy in breathing patients for the treatment of hypotension secondary to trauma. *Scand J Trauma Resuscitation Emerg Med* 2017;25(1):105.
4. Colquhoun DA, Naden K, Thiele RH. Frequency domain analysis of cerebral near infrared spectroscopy signals during application of an impedance threshold device in spontaneously breathing volunteers. *J Clin Monit Comput* 2016;30:389-398.
5. Gamboa A, Paranjape SY, Black BK, Arnold AC, Figueira R, Okamoto LE, Nwazue VC, Diedrich A, Plummer WD, Dupont WD, Robertson D, Ray SR. Inspiratory resistance improves postural tachycardia: a randomized study. *Circ Arrhythm Electrophysiol* 2015;8:651-658.
6. Satterlee PA, Kamrud JW, Boland LL, Lick CJ. Use of an impedance threshold device to treat prehospital hypotension. *Prehosp Emerg Care* 2015;19(1):158.
7. Wampler D, Convertino V, Weeks S, Hernandez M, Larrumbide J, Manifold C. Use of an impedance threshold device in spontaneously breathing patients with hypotension secondary to trauma: an observational cohort feasibility study. *J Trauma Acute Care Surg* 2014;77(3):S140-S145.
8. Gaszynska E, Roguszka K, Stankiewicz-Rudnicki M, Wieczorek A, Gaszynski T. Comparison of haemodynamic effects of noninvasive ventilation delivered via ResQGARD and CPAP Boussignac masks. *Pol Przegl Chir* 2013;85(3):129-132.
9. Segal N, Page DI, Lick CJ, Doering DD, Yannopoulos D. Use of an impedance threshold device to treat severe hypotension in a pregnant woman: case report and review of the literature. *J Emerg Med* 2013;45(4):e113-115.
10. Convertino VA, Parquette B, Zeihr J, Traynor K, Baia D, Bamblatt M, Vartanian L, Suresh M, Metzger A, Gerhardt RT, Lurie KG, Lindstrom D. Use of respiratory impedance in prehospital care of hypotensive patients associated with hemorrhage and trauma: a case series. *J Trauma Acute Care Surg* 2012;73:S54-S59.
11. Suresh M, Parquette B, Lindstrom D, Traynor K, Baia D, Baumblatt M, Vartanian L, Convertino V. Treatment of hypotensive patients by EMS personnel by modulating intrathoracic pressures. *Prehosp Emerg Care* 2012;16(1):173.
12. Convertino VA, Ryan KL, Rickards CA, Glorsky SL, Idris AH, Yannopoulos D, Metzger A, Lurie KG. Optimizing the respiratory pump: harnessing inspiratory resistance to treat systemic hypotension. *Respir Care* 2011;56(6):846-857.
13. Smith SW, Parquette B, Lindstrom D, Metzger AK, Kopitzke J, Clinton J. An ITD increases blood pressure in hypotensive patients. *J Emerg Med* 2011;41(5):549-558.
14. Lindstrom DA, Parquette BA. Use of an impedance threshold device increases blood pressure in spontaneously breathing hypotensive patients. *Prehosp Emerg Care* 2009;13(1):99-100.
15. Luber S, Roppolo L, Idris A. Blood pressure response to the impedance threshold device in hypotensive emergency department patients. *Acad Emerg Med* 2008;15(5):S225.
16. Ryan KL, Cooke WH, Rickards CA, Lurie KG, Convertino VA. Breathing through an inspiratory threshold device improves stroke volume during central hypovolemia in humans. *J Appl Physiol* 2008;104:1402-1409.
17. Rickards CA, Cohen KD, Bergeron LL, Burton L, Khatri PJ, Lee CT, Ryan KL, Cooke WH, Doerr DF, Lurie KG, Convertino VA. Inspiratory resistance, cerebral blood flow velocity and symptoms of acute hypotension. *Av Sp Env Med* 2008;79(6):557-564.
18. Rickards CA, Ryan KL, Cooke WH, Lurie KG, Convertino VA. Inspiratory resistance delays the reporting of symptoms with central hypovolemia: association with cerebral blood flow. *Am J Physiol Regul Integr Comp Physiol* 2007;293(1):R243-250.

19. Melby DP, Lu F, Sakaguchi S, Zook M, Benditt DG. Increased impedance to inspiration ameliorates hemodynamic changes associated with movement to upright posture in orthostatic hypotension: a randomized blinded pilot study. *Heart Rhythm* 2007;4(2):128-135.
20. Idris AH, Convertino VA, Ratliff DA, Doerr DF, Lurie KG, Gabrielli A, Banner MJ. Imposed power of breathing associated with use of an ITD. *Respir Care* 2007;52(2):177-183.
21. Convertino VA, Ryan KL, Rickards CA, Cooke WH, Idris AH, Metzger A, Holcomb JB, Adams BD, Lurie KG. Inspiratory resistance maintains arterial pressure during central hypovolemia: implications for treatment of patients with severe hemorrhage. *Crit Care Med* 2007;35(4):1145-1152.
22. Smith SW, Metzger AK, Kopitzke J, Clinton J, Lurie KG. Use of an ITD in hypotensive patients in the emergency department. *Circulation* 2006;114(Suppl II):18.
23. Cooke WH, Lurie KG, Rohrer MJ, Convertino VA. Human autonomic and cerebrovascular responses to inspiratory impedance. *J Trauma* 2006;60(6):1275-1283.
24. Convertino VA, Ratliff DA, Eisenhower KC, Warren C, Doerr DF, Idris AH, Lurie KG. Inspiratory impedance effects on hemodynamic responses to orthostasis in normal subjects. *Aviat Space Environ Med* 2006;77(5):486-493.
25. Convertino VA, Ratliff DA, Crissey J, Doerr DF, Idris AH, Lurie KG. Effects of inspiratory impedance on hemodynamic responses to a squat-stand test in human volunteers: implications for treatment of orthostatic hypotension. *Eur J Appl Physiol* 2005;94(4):392-399.
26. Convertino VA, Cooke WH, Lurie KG. Restoration of central blood volume: application of a simple concept and simple device to counteract cardiovascular instability in syncope and hemorrhage. *J Gravit Physiol* 2005;12(1):P55-60.
27. Melby DP, Sakaguchi S, Scutter R, Zook M, Benditt DG. A novel inspiratory impedance threshold device may diminish orthostatic intolerance. *Heart Rhythm* 2004;1(18):S227.
28. Melby DP, Convertino VA, Ratliff DA, Doerr DF, Idris A, Lurie KG, Benditt DG. An inspiratory impedance device improves hemodynamics during a squat-stand test: implications for treating orthostatic intolerance. *Heart Rhythm* 2004;1(18):S257.
29. Doerr DF, Ratliff DA, Convertino VA, Lurie KG. Comparison of two methods of non-invasive determination of cardiac output during an orthostatic challenge. *Aviat Space Environ Med* 2004;75:B117.
30. Convertino VA, Ratliff DA, Ryan KL, Doerr DF, Ludwig DA, Muniz GW, Britton DL, Clah SD, Fernald KB, Ruiz AF, Lurie KG, Idris AH. Hemodynamics associated with breathing through an inspiratory impedance threshold device in human volunteers. *Crit Care Med* 2004;32(9):S381-366.
31. Convertino VA, Ratliff DA, Ryan KL, Cooke WH, Doerr DF, Ludwig DA, Muniz GW, Britton DL, Clah SD, Fernald KB, Ruiz AF, Idris A, Lurie KG. Effects of inspiratory impedance on the carotid-cardiac baroreflex response in humans. *Clin Auton Res* 2004;14:240-8.

Pre-Clinical (Animal) Studies

1. Metzger AK, Berger PS, Lick MC, Segal N, Convertino VA, Lurie KG. Augmentation of negative intrathoracic pressure improves cerebral perfusion: a paired study using an impedance threshold device to treat intracranial hypertension in a spontaneously breathing porcine model. *Neurocritical Care Society* 2017; poster.
2. Metzger A, Rees J, Segal N, McKnite S, Matsuura T, Convertino V, Gerhardt RT, Lurie KG. "Fluidless" resuscitation with permission hypotension via impedance threshold device therapy compared with normal saline resuscitation in a porcine model of severe hemorrhage. *J Trauma Acute Care Surg* 2013;75:S203-S209.
3. Vigani A, Shih AC, Buckley GJ, Londoño L, Bandt C. Cardiopulmonary effects of a new inspiratory impedance threshold device in acute hemorrhagic shock in dogs. *J Vet Emerg Crit Care* 2011;21(6):618-624.
4. Shih AC, Vigani A, Loring N, Pereira FG, Szarowicz M, Bandt C. Cardiopulmonary effects of a new inspiratory impedance threshold device in anesthetized hypotensive dogs. *Vet Anaesth Analg* 2010;37:215-221.
5. Srinivasan V, Nadkarni V, Metzger A, Matsuura T, McKnite S, Lurie K. The hemodynamic benefits and work of breathing with the impedance threshold device during pediatric hemorrhagic shock. *Crit Care Med* 2008;36(12):A6.

6. Voelckel WG, Yannopoulos D, Zielinski T, McKnite S, Lurie KG. Inspiratory ITD effects on hypotension in heat-stroked swine. *Av Sp Env Med* 2008;79(8):743-748.
7. Metzger A, Marino B, Matsuura T, Alexander C, Herman M, McKnite S, Srinivasan V, Nadkarni V, Lurie K. An ITD improves 24-hour survival in a spontaneously breathing pediatric porcine model of hemorrhagic shock. *Circulation* 2007;116(16):II-632.
8. Yannopoulos D, McKnite SH, Metzger A, Lurie KG. Intrathoracic pressure regulation for intracranial pressure management in normovolemic and hypovolemic pigs. *Crit Care Med* 2006;34(12):S495-500.
9. Sigurdsson G, Yannopoulos D, McKnite SH, Sondeen JL, Benditt DG, Lurie KG. Effects of an inspiratory ITD on blood pressure and short term survival in spontaneously breathing hypovolemic pigs. *Resuscitation* 2006;68(3):399-404.
10. Marino BS, Yannopoulos D, Sigurdsson G, Lai L, Cho C, Redington A, Nicolson S, Nadkarni V, Lurie KG. Spontaneous breathing through an inspiratory ITD augments cardiac index and stroke volume index in a pediatric porcine model of hemorrhagic hypovolemia. *Crit Care Med* 2004;32(9 Suppl):S398-405.
11. Lurie KG, Zielinski TM, McKnite SH, Idris AH, Yannopoulos D, Raedler CM, Sigurdsson G, Benditt DG, Voelckel WG. Treatment of hypotension in pigs with an inspiratory ITD: a feasibility study. *Crit Care Med* 2004;32(7):1555-1562.
12. Samniah N, Voelckel WG, Zielinski TM, McKnite S, Patterson R, Benditt DG, Lurie KG. Feasibility and effects of transcutaneous phrenic nerve stimulation combined with an inspiratory impedance threshold in a pig model of hemorrhagic shock. *Crit Care Med* 2003;31(4):1197-1202.
13. Lurie KG, McKnite S, Nadkarni V, Yannopoulos D, Sigurdsson G, Srinivasan V, Marino B, Frascone RJ, Dries D, Idris A. Cardio-cranial interactions: reduction of elevated intracranial pressure with an inspiratory ITD in spontaneously breathing pigs after resuscitation from cardiac arrest. *Crit Care Med* 2003;31(12)Suppl:A10.
14. Lurie KG, Zielinski T, McKnite S. Use of an inspiratory impedance threshold valve for the rapid treatment of hemorrhagic shock in spontaneously breathing pigs. *Crit Care Med* 2001;29(12)Suppl:A13.

Review Articles

1. Convertino VA. Mechanism of inspiration that modulate cardiovascular control; the other side of breathing. *J Appl Physiol* 2019;127:1187-1196.
2. Winklewski PJ, Wolf J, Gruszecki M, Wszedybyl-Winklewska M, Narkiewicz K. Current understanding of the effects of inspiratory resistance on the interactions between systemic blood pressure, cerebral perfusion, intracranial pressure, and cerebrospinal fluid dynamics. *J Appl Physiol* 2019;127:1206-1214.
3. Rickards CA. Vive la resistance! The role of inspiratory resistance breathing on cerebral blood flow. *Respir Physiol Neurobiol* 2019;265:76-82.
4. Scheeren TWL, Saugel B. Journal of clinical monitoring and computing 2016 end of year summary: monitoring cerebral oxygenation and autoregulation. *J Clin Monit Comput* 2017;31:241-246.
5. Hosznyak R. Does impedance threshold device therapy have a place in the treatment of increased intracranial pressure in pre-hospital patients? A literature review. *British Paramedic J* 2016;1(2):18-23.
6. James RH, Henning DCW, Smith JE. The use of impedance threshold devices in spontaneously breathing, hypotensive trauma patients. *Trauma* 2015;17(2):102-108.
7. Segal N, Yannopoulos D, Truchot J, Laribi S, Plaisance P, Convertino VA. Improving vital organs perfusion by the respiratory pump: physiology and clinical use. *Ann Fr Anesth Reanim* 2013;32(9):572-579.
8. Convertino VA, Ryan KL, Rickards CA, Glorsky SL, Idris AH, Yannopoulos D, Metzger A, Lurie KG. Optimizing the respiratory pump: harnessing inspiratory resistance to treat systemic hypotension. *Respir Care* 2011;56(6):846-857.
9. Metzger A, Lurie K. Harnessing cardiopulmonary interactions to improve circulation and outcomes after cardiac arrest and other states of low blood pressure. *Handbook of Cardiac Anatomy, Physiology and Devices* 2009;Humana Press.
10. Parsons D, Convertino V, Idris A, Smith S, Lindstrom D, Parquette B, Aufderheide T. The impedance threshold device (ITD-7): a new device for combat casualty care to augment circulation and blood pressure in hypotensive spontaneously breathing warfighters. *J Spec Ops Med* 2009;9(2):49-52.
11. Aufderheide TP, Lurie KG. Vital organ blood flow with the impedance threshold device. *Crit Care Med* 2006;34(12):S466-S473.

12. Convertino VA, Cooke WH, Lurie KG. Inspiratory resistance as a potential treatment for orthostatic intolerance and hemorrhagic shock. *Aviat Space Environ* 2005;76(4):319-325.
13. Chapleau MW. Modulation of baroreflex function by altering inspiratory impedance: potential mechanisms and clinical implications. *Clin Auton Res* 2004;14:217-219.
14. Sigurdsson G, Yannopoulos D, McKnite S, Lurie KG. Cardiorespiratory interactions and blood flow generation during cardiac arrest and other states of low blood flow. *Curr Opin Crit Care* 2003;9:183-188.
15. Lurie KG, Zielinski T, Voelckel W, McKnite S, Plaisance P. Augmentation of ventricular preload during treatment of cardiovascular collapse and cardiac arrest. *Crit Care Med* 2002;30[Suppl]:S162-S165.

The generally cleared indication for the ResQGARD ITD available for sale in the United States (US) is for a temporary increase in blood circulation during emergency care, hospital, clinic, and home use. The studies referenced here are not intended to imply specific outcomes-based claims not yet cleared by the US FDA. Preclinical data may not be reflective of clinical results.