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CCCN Congratulates Board of Directors Member Dorothy Morris

Dorothy Morris, RN, MA, CCN(C), National Director for Health Promotion and Advocacy for the Canadian Council of Cardiovascular Nurses (CCCN), and Nurse Educator in Coronary Care and Cardiovascular Intensive Care in Victoria, BC, was recently elected to the Board of Directors for Hypertension Canada at its October 18, 2014, Annual General Meeting in Gatineau, Quebec. Dorothy is enthusiastic about the opportunity to serve on the Board of Directors for both organizations, and further the important efforts to reduce hypertension—the number one risk factor for death and disability in the world, affecting more than seven million Canadians. She is also grateful to have the opportunity to be involved, on behalf of CCCN, with the Hypertension Advisory Committee.

The Hypertension Advisory Committee represents 18 national health care, public health and not-for-profit organizations, formed to guide the development and implementation of policies and advocacy efforts to reduce the burden of hypertension in Canada. The group includes members representing the Canadian Nurses Association, Canadian Medical Association, College of Family Physicians and Heart and Stroke Foundation of Canada. The group is led by the Canadian Institute of Health Research (CIHR) and Heart and Stroke Foundation Chair for Hypertension, Dr. Norm Campbell from the University of Calgary, and Policy Director, Tara Duhaney. The first policy on Restricting Marketing of Unhealthy Foods and Beverages to Children and Youth in Canada was published one year ago and is available on the CCCN website. Two new policies are highlighted in articles published in the October 2014 issue of the Canadian Journal of Cardiology: "Death by Diet: The Role of Food Pricing Interventions as a Public Policy Response and Advocacy Opportunity" and "Health Food Procurement Policy: An Important Intervention to Aid the Reduction in Chronic Noncommunicable Diseases".

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Impedance Cardiography-Guided Treatment of Hypertension: A Review of the Literature

Fadi Khraim, PhD, RN, and Rodolfo Pike, RN, MN, NP

Abstract

Background: *Hypertension occurs when regulatory mechanisms fail, resulting in increased cardiac output (CO) and/or increased systemic vascular resistance (SVR). Impedance cardiography (ICG) is a non-invasive technology that measures CO and SVR.*

Objective: *To assess the literature related to the use of ICG in guiding the selection of anti-hypertensive medications in individuals with hypertension.*

Design: *PubMed and Cumulative Index to Nursing and Allied Health Literature databases were searched for pertinent literature. Only English language, primary research reports published between 1990 and 2014 were included.*

Findings: *The literature demonstrated significant reduction of blood pressure among participants who were treated with ICG-guided selection of anti-hypertensive medications when compared to standard treatment.*

Conclusion: *Although the research reviewed is not without limitations (e.g., small sample sizes and small effect sizes), individualized pharmacologic treatment of uncontrolled hypertension based on ICG-obtained hemodynamics seems successful in reducing blood pressure. Further research within the Canadian context that addresses the limitations is warranted.*

Key words: impedance cardiography, hypertension, treatment, hemodynamic measurement

Khraim, F., & Pike, R. (2014). Impedance Cardiography-Guided Treatment of Hypertension: A Review of the Literature. *Canadian Journal of Cardiovascular Nursing, 24*(4), 7–12.

Normal blood pressure (BP) is essential for maintaining adequate and effective perfusion to body tissues. In order to maintain normal BP, the body regulates both cardiac output (CO) and systemic vascular resistance (SVR) (Beevers, Lip, & O'Brien, 2001; Conway, 1984). The regulatory mechanisms that adjust CO use one or more of the following means in order to control the BP: altering body fluid content, altering the heart rate, and/or altering the force of contraction. On the other hand, SVR is controlled by balancing the mechanisms of vasoconstriction and vasodilatation of blood vessels. When the balance between CO and SVR is disrupted, BP deviates from normal leading to immediate subnormal tissue perfusion and gradual tissue damage. Hypertension (HTN) results from elevations of CO, SVR or both. SVR is particularly important to the evaluation of individuals with HTN because an increase in SVR during everyday stress may be implicated as a pathophysiologic mechanism (Sherwood & Turner, 1995). Therefore, knowledge of these hemodynamic elements, CO and SVR, is essential for understanding HTN with relation to its diagnosis and treatment.

Background

Impedance Cardiography

Hypertension is a leading risk factor for mortality and morbidity caused by various cardiac and vascular diseases. Worldwide, it is estimated that 54% of cerebrovascular accidents, 47% of myocardial ischemia, 75% of hypertensive disease, 25% of other cardiovascular disease, 13.5% of all deaths, and 6% of lost healthy life years are linked to HTN (Lawes, Vander Hoorn, & Rodgers, 2008). In a retrospective population-based survey of Canadians in 2007–2008, Robitaille et al. (2012) reported that 23% of adult Canadians were diagnosed with HTN with about 418,000 newly diagnosed cases yearly. Based on trends from previous years, the authors projected that 26.5% of all Canadian adults would be diagnosed with HTN in 2012–2013.

Impedance cardiography (ICG) is a non-invasive and safe, valid, and reliable technology that facilitates the measurement of various indices of cardiac function, including heart rate (HR) and stroke volume (SV) (Bayram & Yancy, 2009; Ventura, Taler, & Strobeck, 2005). Therefore, CO may also be derived from the HR and SV measures. Furthermore, simultaneous BP measurement permits the derivation of SVR, which allows defining the hemodynamic mechanisms underlying HTN.

ICG involves recording changes in thoracic impedance using transmitting and sensing electrodes that are applied to the bases of the neck and thorax bilaterally (Ventura et al., 2005) (Figure 1). The ICG device introduces a

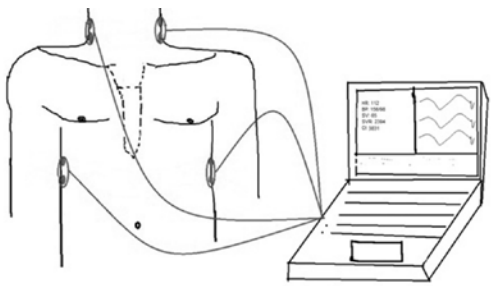

Figure 1: Illustration of obtaining the hemodynamic measurements using ICG

high-frequency, low-amplitude alternating current through the transmitting electrodes. The ICG uses Ohm's Law to determine the changes in thoracic fluid content based on the impedance (resistance) to the current that travels through the chest. Because of the different tissues that occupy the chest cavity (i.e., lungs, bone, heart, blood vessels, etc.), the impedance to the current travelling in the chest varies. Normally, the current seeks the path with least impedance, which is the fluid-filled structure; the aorta (Bayram & Yancy, 2009). Consequently, the sensing electrodes measure impedance associated with the pulsatile blood flow in the aorta that occurs during the cardiac cycle. As the thoracic blood volume changes due to systole and diastole, a fluctuation of the measured impedance occurs. This fluctuation allows for measurement and calculation of the hemodynamic variables of interest such as the SV, CO, myocardial contractility, and total fluid content (Mathews, 2007). These hemodynamic measures would normally require expensive and invasive techniques that can be done only in the intensive care setting. The ability of the ICG to provide such valuable hemodynamic measures in the office setting is key in developing medication treatment protocols tailored according to the hemodynamic mechanisms of HTN (Bayram & Yancy, 2009; Ventura et al., 2005). Therefore, the aim of this report is to review the available literature related to the use of ICG-guided selection of anti-hypertensive medications in individuals with hypertension.

Methods

PubMed and Cumulative Index to Nursing and Allied Health Literature (CINAHL) databases were searched for available literature related to the use of ICG-guided selection of anti-hypertensive medications in individuals with hypertension. To capture all possible literature in this area, a combination of the following key words was used in the search: impedance cardiography, hypertension, and treatment. The search was limited to English language, and original research published between January 1990 and April 2014. Following examination of the titles and abstracts of the identified literature, only reports of clinical studies that examined the outcomes of using ICG-guided treatment of hypertension were included. Duplicate reports, clinical case reports, editorials, and clinical reviews were excluded.

Results

The literature search resulted in 96 articles of which 10 reports met the inclusion criteria for the review. The reports included in this review were of studies that compared the effectiveness and advantages of using ICG-guided selection of anti-hypertensive medications in patients with uncontrolled hypertension with treatment that used standard guidelines for selection of anti-hypertension medication. The studies originated from Poland, Romania, Japan, and the United States. Of the 10 reports, nine compared the clinical outcomes (e.g., changes on BP) (Table 1) and one explored

Table 1: Summary of Studies and its Results for Using ICG-guided Treatment vs. Standard Treatment

Author	Design	Sample Characteristics	Intervention	Key Results
Sramek et al. (1996)	• One group pre-test & post-test • 3 weeks treatment program	• N=322 • Uncontrolled HTN (MAP ≥ 105, treated with ≥ 2 anti-HTN medication)	• Selection of Anti-HTN medication based on ICG- obtained hemodynamics as suggested by the ICG device (algorithm not explained)	• 63% achieved normotensive status (defined as MAP<105)

Taler et al. (2002)	• Randomized clinical trial
	• 3 months treatment program
		• ICG group (n=50) & specialist-care group (n=54)
		• Uncontrolled HTN (BP> 140 when taking ≥2 medication)
			ICG group:
			• For low CO and/or high SVR:
			  • Add/increase VD
			  • Discontinue or reduce agents that lower CO
			• For high CO and/or low SVR:
			  • Add/increase BB or CSA
			  • Reduce or discontinue VD
			• High TFC (every visit):
			  • Add or increase diuretic
				• The use of ICG significantly (p<0.01) reduced BP in the ICG-care group when compared with the specialist-care group (169±3/87±2 to 139±2/72±1 mm Hg and 173±3/91±2 to 147±2/79±1 mm Hg, respectively)

Sharman et al. (2004)	• Retrospective chart review • Treatment of HTN using ICG during a minimum of 3 months and 3 visits.	• N=21 • Uncontrolled HTN (BP≥ 140/90, and taking 2 or more anti-HTN medications)	• Used the algorithm described in Taler et al. (2002)	• Compared to entry BP measures, the use of ICG reduced SBP (142 vs.157, p<0.05) • Reduction in DBP was not statistically significant

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Smith et al. (2006)	• Multi-centre randomized clinical trial • 3 months with 5 visits treatment program	• ICG group (n=69) & control group (n=95) • Uncontrolled HTN (BP= 140-179/ 90-109, and taking 1-3 anti-HTN medications)	ICG-care group: • Low/normal CO and high SVR: • add or increase ACEI, ARB, CCB, or VD • Reduce BB • high CO and normal SVR: • add or increase BB or CSA • reduce VD • High fluid content (every visit): • Add or increase diuretic	• Compared to their baseline measures, the use of ICG significantly ($p<0.05$) reduced BP in the ICG-care group when compared with the standard treatment group: • SBP 19±17 vs 11±18 mmHg, and DBP (12±11 vs 5±12 mmHg)
Sramek et al. (2008)	• One group pre-test & post-test • 3 months treatment program	• N=56 • Uncontrolled HTN	• Selection of Anti-HTN medication according to ICG- obtained hemodynamics: • Diuretics for hypervolemia • Negative inotropes for hyperinotropy • VD, ACEI, or ARB for vasoconstriction	• 84% achieved normotensive status (not defined)
Aoka (2009)	• One group pre-test & post-test • 4.7± 4.3 months treatment program (average)	• N=113 • Uncontrolled HTN	• Selection of Anti-HTN medication according to ICG- obtained hemodynamics (not defined) • 72% achieved target BP reduction (<140/90)	
Krzesinski et al. (2012)	• Two groups pre-test & post-test • Both office-based and ambulatory BP measurements were performed • 3 months treatment program	• Untreated primary HTN or treated but Uncontrolled HTN • Random assignment: ICG-guided treatment group (n=41) & standard treatment group (n=34)	ICG-care group: • If CO is high, BB was given. • If TFC is high, a thiazide diuretic is given. • If SVR is high, ACEI or ARB is given (in combination with CCB if SVR was significantly high) • In case of complex hemodynamic disturbances, drug combinations were given • If 24-hour BP > 140/90, then ACEI/ARB (in a & b) or a diuretic (in c) is added	• The use of ICG significantly ($p<0.05$) reduced BP in the ICG-guided treatment group when compared with the standard treatment group for the following: • Office SBP 18.1±12.8 vs 10.7±11.7 mmHg, and DBP (12.2±7.2 vs 8.9±8.8 mmHg) • Ambulatory 24-hour SBP (16.7±9.3 vs 10.5±11.9 mm Hg) • Ambulatory 24-hour SBP (16.7±9.3 vs 10.5±11.9 mm Hg) • Ambulatory day-time SBP (10.5±11.7 vs 17.2±10.1 mm Hg)
Aoka et al. (2013)	• One group pre-test & post-test • Eight weeks treatment plan	• Untreated primary HTN (BP≥140/90): • High CO group (n=17) • High SVR group (n=24)	• High CO group were BB (atenolol) • High SVR were given long-acting CCB (controlled release nifedipine)	• Treatment with BB for high CO group and with CCB for high SVR reduced blood pressure equally (average reduction in BP was 12.5±7.8 mmHg and 15.6±13.3 mmHg, respectively
Krzesinski et al. (2013)	• Two groups pre-test & post-test. • 3 months treatment program	• Untreated primary HTN or treated but uncontrolled HTN (BP> 140 when taking 1 or 2 medications) • Random assignment: ICG-guided group (n=44) & standard treatment group (n=47)	• Used the algorithm described in Krzesinski et al. (2012)	• The use of ICG significantly ($p<0.05$) reduced BP in the ICG-guided group when compared with the standard treatment group 12 weeks after treatment • Office SBP reduction was (131.6±11.4 vs. 136.12±12.0 mmHg) and DBP (83.7±6.7 vs. 87.0±7.1 mmHg) • Ambulatory night time SBP reduction (117.2±9.8 vs 121.3±9.5 mmHg), and SBP (68.4±6.4 vs. 71.9±7.2 mmHg)
HTN= hypertension, SBP= systolic blood pressure, DBP=diastolic blood pressure, ICG= impedance cardiography, CO= cardiac output, SVR= systemic vascular resistance, TFC= total fluid content, MAP= mean arterial pressure, CCB= calcium channel blocker, BB=β-blocker, VD=vasodilator, ACEI=angiotensin converting enzyme inhibitor, ARB=angiotensin receptor blocker, CSA= central sympathetic agonist				

the short- and long-term cost-effectiveness of using ICG-guided treatment of uncontrolled HTN compared to using standard treatment (Ferrario & Smith, 2006). Furthermore, three of the reports were conference abstracts. The conference abstracts by Sramek, Tichy, Hojerova, and Cervenka (1996) and Sramek, Badila, Bartos, Tirziu, and Ghiorge (2008) did not publish subsequent full research reports that could have provided additional data related to the studies.

Methodological Approaches

The methodological approaches of the studies were varied. All studies were prospective except for the study by Sharman, Gomes, and Rutherford (2004) who used a retrospective chart review design. Five studies used quasi-experimental designs (one-group pre-test post-test design) (Aoka, 2009, Aoka, Hagiwara, & Kasanuki, 2013; Sharman et al., 2004; Sramek et al., 2008; Sramek et al., 1996). The other four studies were randomized clinical trials with two-group (an ICG-guided treatment group and a control group) pre-test post-test designs (Krzesinski, Gielerak, & Kowal, 2013; Krzesinski, Gielerak, Kowal, & Piotrowicz, 2012; Smith, Levy, & Ferrario, 2006; Taler, Textor, & Augustine, 2002) with only Smith et al. (2006) being a multicentre study. The sample sizes of the individual studies were varied (Table 1). The smallest sample size used was reported by Sharman et al. (2004) (N=21) and the largest was by Sramek et al. (1996) (N=322), where the authors reported using random sampling.

Office-based BP measurement was used to assess participants' BP changes in all studies. In addition, Krzesinski et al. (2012) and Krzesinski et al. (2013) reported using ambulatory BP measurement, in which participants wore ambulatory devices that measured their BP within specified intervals daily throughout the study period. Moreover, the studies demonstrated a wide variation of follow-up periods for their participants ranging from three weeks to 18 months. The follow-up periods often included several visits to the clinic where BP, ICG, and other biophysiologic measures were taken. The methodological variations and similarities are described in Table 1.

Treatment protocols. The various ICG-guided treatment protocols that were reported in the studies are described in Table 1. Whenever a standard treatment protocol was prescribed to participants, it was based on local, national, or regional clinical practice guidelines for the treatment of HTN in the country where the study was conducted.

Outcomes of the Studies

Blood pressure reduction. Overall, all of the studies reported significant reduction in BP among participants treated with ICG-guided selection of anti-hypertensive medications compared to those treated using standard HTN treatment protocols. All reports further demonstrated that a higher percentage of participants treated with ICG-guided anti-hypertension treatment protocols achieved the target BP reduction compared to those treated with standard treatment guidelines. The randomized clinical trials reported insignificant baseline differences in attributes such as BP. Nonetheless, at the conclusion of the follow-up periods, significant reductions of BP were noted in the ICG-guided groups compared to the control groups. For example, Taler et al. (2002) reported that at the conclusion of the study all participants had lower BPs than their baseline. Taler et al. (2002) further maintained that those in the ICG-guided group (n=50) had significantly greater BP reduction than those assigned to the control group (n=54) (BP: 139/72 mmHg vs 147/79 mmHg, respectively; $p<0.05$). The other randomized clinical trials obtained similar results. In those studies, the authors reported achieving the desired BP reduction among 57%-84% of study participants following the initiation of the ICG-guided protocol of selecting anti-hypertensive medication. Table 1 provides a summary of the main findings pertaining to BP reduction in all studies.

Cost-effectiveness. Ferrario & Smith (2006) used data collected from another related study (Smith et al., 2006) to estimate the short- and long-term cost-effectiveness of ICG-guided treatment among participants with uncontrolled HTN. Cost-effectiveness was defined as the incremental cost (i.e., office visits, medications, ICG testing, etc.) per incremental reduction of SBP or DBP measured by mm Hg during the trial. The investigators reported that, when compared to standard treatment that used predefined HTN treatment protocols based on national guidelines (n=95), ICG-guided treatment of HTN (n=69) significantly reduced costs ($p<0.05$). The short-term cost-effectiveness of using ICG-guided treatment among patients with uncontrolled HTN was $20 per incremental reduction of SBP measured by mm Hg (vs $36 for standard care) and $23 per incremental reduction DBP measured by mm Hg (vs $79 for standard care). The estimated long-term cost-effectiveness for using ICG-guided treatment was $476 in savings and 0.109 quality-adjusted life-years gained per patient (amounts are in U.S. dollars). The authors further reported that treating 9.2 patients with ICG would result in one year of life saved.

Discussion

ICG is a non-invasive technology that is becoming increasingly useful in hemodynamic patient monitoring. It offers the health care provider measurements of important cardiac hemodynamics and, therefore, can facilitate the process of medication selection for individuals with HTN (Ventura et al., 2005). This report provides a review of studies that assessed the use of ICG-guided selection of anti-hypertensive medications among patients with uncontrolled HTN. The designs of the studies were varied; hence, influencing their inability to assess causal relationships. Of the reports reviewed, only four were of randomized clinical trials. Randomized clinical trials are the research 'gold standard' when the aim is to infer causality. This is because of random assignment of participants to either the intervention or control group which makes any differences that appear in the post-test a result of the intervention rather than a possible difference between the two groups (Campbell & Stanley, 1966). Consequently, randomized

clinical trials are superior in their ability to produce generalizable results compared to studies that used quasi-experimental designs. Therefore, the lack of significant differences of participants' baseline characteristics in the ICG-group and the control group in the randomized clinical studies contributed to the convincing nature of the evidence.

Literature related to HTN control demonstrated that even a modest sustained reduction in BP (5-6 mmHg) was associated with 20–40% reduction in stroke, coronary heart disease, and major cardiovascular events (Collins et al., 1990). A later meta-analysis of 147 trials on the benefits of using various drug therapies to reduce BP among patients with HTN reported comparable results (Law, Morris, & Wald, 2009). In this meta-analysis, the authors reported that lowering systolic BP by 10 mmHg or diastolic BP by 5 mmHg using any of the main classes of BP-lowering medications was associated with 20% reduction in coronary heart disease events, 32% reduction in stroke, and 25% reduction in heart failure. This further highlights the potential advantage of ICG-guided treatment of uncontrolled HTN as an effective approach to reduce mortality and morbidity among patients with HTN.

Nurses play a pivotal role in blood pressure management of patients diagnosed with HTN. Their role is particularly emphasized with patient education related to attaining a healthy lifestyle including weight management, dietary sodium restriction, exercise, smoking cessation, alcohol reduction, stress management, and monitoring for medication compliance in order to achieve BP control. ICG, a non-invasive tool, can be easily used by nurses to obtain data about the hemodynamics of patients with HTN. Nurses can identify altered hemodynamics and alert members of the health care team about the findings, allowing health care providers to use ICG-guided medication selection in order to optimize BP control. For advanced practice nurses, such as nurse practitioners, they can use ICG to assist with their own clinical decision-making to guide antihypertensive therapy.

The reviewed reports demonstrated that ICG-guided medication selection for uncontrolled HTN appears beneficial in lowering BP more effectively than standard treatment protocols. Standard treatment protocols that are based on local, national, or regional clinical practice guidelines are criticized because they often lack specific guidelines for the treatment of uncontrolled HTN (Al-Ansary et al., 2013). These guidelines are also criticized for being dissimilar and inconsistent with regard to the selection of first line anti-HTN medication classes of pharmacological therapy, the adjustment of therapy itself, and inconsistency related to using a combination of anti-HTN medications (Al-Ansary et al., 2013). On the other hand, the success in lowering BP among participants treated with ICG-guided medication selection may theoretically be explained by the individualization of the treatment protocol based on the hemodynamic mechanism causing HTN. The individualized treatment protocol allows the health care provider to tailor and then to adjust the pharmacological therapy to target the hemodynamic mechanisms (CO and SVR) underlying high BP (Aoka et al., 2013; Ventura et al., 2005).

While using a randomized clinical design is a major strength of some of the studies, the relatively small sample sizes and small effect sizes of these studies are limitations. Cohen's (1992) formula to calculate the effect size for BP reduction in those studies was used (i.e., the difference between two means divided by a standard deviation for the data). The effect sizes for three of the randomized clinical trials ranged from 0.39 to 0.61 (Krzesinski et al., 2012; Krzesinski et al., 2013; Smith et al., 2006). According to Cohen (1992), an effect size that is less than 0.8 is considered either small or medium. Therefore, it is plausible that the statistically significant reductions of BP in those studies were not a reflection of true effect of using ICG as a part of the HTN treatment protocol (Button et al., 2013). When this occurs, it weakens the reliability of those studies and reduces the generalizability of their results. On the other hand, the calculated effect sizes of the BP reductions in the study conducted by Taler et al. (2002) were extraordinarily large (effect sizes ranged between 4.0–7.0, N=104). Such very large effect sizes were mainly due to lack of BP variability (i.e., small standard deviations) in this study. The surprisingly low variability in BP was neither explained in the report by Taler et al. (2002), nor could it be explained in light of the other studies reviewed in this report or according to other literature relating to BP variability among patients with HTN (Hansen et al., 2010; Pierdomenico et al., 2006). It is notable to mention that the definition of "uncontrolled hypertension" (primarily, a BP ≥ 140/90 mm Hg and taking one or more medication) that was used in five of the studies was similar to the definition endorsed in the literature (Calhoun et al. 2008).

The only study that compared the cost-effectiveness of using ICG-guided to standard-care treatment of uncontrolled HTN reported significant advantages for using ICG. However, it is important to note that this study explored the projected long-term cost-effectiveness of using ICG-guided treatment and not the actual costs associated. So, more research that focuses on the actual cost-effectiveness of using ICG-guided treatment is warranted.

Conclusion

ICG technology potentially offers health care providers, such as advance practice nurses and physicians, the needed tools to make individualized decisions related to the selection of effective anti-hypertensive medication based on the hemodynamic mechanism underlying HTN. The literature reviewed demonstrated that the use of ICG-obtained hemodynamics in guiding the selection of medication to treat patients with uncontrolled HTN has potential effectiveness and advantage over conventional clinical practice guidelines. In Canada, HTN is a leading risk factor for mortality and morbidity. Despite the existence of evidence from other nations (i.e., U.S., Japan, Poland, and Romania), literature in the area using ICG to guide treatment of HTN originating from Canada is lacking.

ICG-guided treatment for Canadians with uncontrolled HTN appears promising. However, the authors believe that the effectiveness and advantages of using ICG-obtained hemodynamics in tailoring medication therapy to reduce BP need to be examined first given the identified limitations of the evidence presented and based on the process by which Canadian HTN treatment guidelines are revised. The authors believe that ICG is going to have a great impact on the health outcomes among Canadians treated for HTN. ♥

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REFERENCES

Al-Ansary, L.A., Tricco, A.C., Adi, Y., Bawazeer, G., Perrier, L., Al-Ghonaim, M., ... Straus, S.E. (2013). A systematic review of recent clinical practice guidelines on the diagnosis, assessment and management of hypertension. *PLOS ONE, 8*(1), e53744.

Aoka, Y. (2009). Limitation of monotherapy and benefit of impedance cardiography as a guide for a combination therapy in achieving blood pressure control in essential hypertension [Abstract]. *Journal of Clinical Hypertension, 11*(4) A21.

Aoka, Y., Hagiwara, N., & Kasanuki, H. (2013). Heterogeneity of hemodynamic parameters in untreated primary hypertension, and individualization of antihypertensive therapy based on noninvasive hemodynamic measurements. *Clinical and Experimental Hypertension, 35*(1), 61–66.

Bayram, M., & Yancy, C.W. (2009). Transthoracic impedance cardiography: A noninvasive method of hemodynamic assessment. *Heart Failure Clinics, 5*(2), 161–168. http://dx.doi.org/ 10.1016/j.hfc.2008.12.001

Beevers, G., Lip, G.Y., & O'Brien, E. (2001). The pathophysiology of hypertension. *British Medical Journal, 322*, 912–916.

Button, K.S., Ioannidis, J.P., Mokrysz, C., Nosek, B.A., Flint, J., Robinson, E.S., & Munafò, M.R. (2013). Power failure: Why small sample size undermines the reliability of neuroscience. *Nature Reviews Neuroscience, 14*, 365–376.

Calhoun, D.A., Jones, D., Textor, S., Goff, D.C., Murphy, T.P., Toto, R.D., ... Carey, R.M. (2008). Resistant hypertension: Diagnosis, evaluation, and treatment. A scientific statement from the American Heart Association Professional Education Committee of the Council for High Blood Pressure Research. *Hypertension, 51*, 1403–1419.

Campbell, D., & Stanley, J. (1966). *Experimental and quasi-experimental designs for research*. Chicago, IL: Rand-McNally.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*(1), 155–159.

Collins, R., Peto, R., MacMahon, S., Godwin, J., Qizilbash, N., Collins, R., … Hennekens, C.H. (1990). Blood pressure, stroke, and coronary heart disease: Part 2, short-term reductions in blood pressure: Overview of randomised drug trials in their epidemiological context. *The Lancet, 335*, 827–838. http://dx.doi.org/10.1016/0140-6736(90)90944-Z

Conway, J. (1984). Hemodynamic aspects of essential hypertension in humans. *Physiological Reviews, 64*, 617–660.

Ferrario, C.M., & Smith, R.D. (2006). Cost-effectiveness of impedance cardiography testing in uncontrolled hypertension. *The American Heart Hospital Journal, 4*, 279–289.

Hansen, T.W., Thijs, L., Li, Y., Boggia, J., Kikuya, M., Björklund-Bodegård, K., ... Staessen, J.A. (2010). Prognostic value of reading-to-reading blood pressure variability over 24 hours in 8,938 subjects from 11 populations. *Hypertension, 55*, 1049–1057.

Krzesinski, P., Gielerak, G.G., & Kowal, J.J. (2013). A "patient-tailored" treatment of hypertension with use of impedance cardiography: A randomized, prospective and controlled trial. *Medical Science Monitor: International Medical Journal of Experimental and Clinical Research, 19*, 242–250. http://dx.doi.org/10.12659/MSM.883870; 10.12659/MSM.883870

Krzesinski, P., Gielerak, G., Kowal, J., & Piotrowicz, K. (2012). Usefulness of impedance cardiography in optimisation of antihypertensive treatment in patients with metabolic syndrome: A randomised prospective clinical trial. *Kardiologia Polska, 70*, 599–607.

Law, M.R., Morris, J.K., & Wald, N.J. (2009). Use of blood pressure lowering drugs in the prevention of cardiovascular disease: Meta-analysis of 147 randomised trials in the context of expectations from prospective epidemiological studies. *British Medical Journal, 338*, b1665. http://dx.doi.org/10.1136/bmj.b1665

Lawes, C.M., Vander Hoorn, S., & Rodgers, A. (2008). Global burden of blood-pressure-related disease, 2001. *The Lancet, 371*, 1513–1518. http://dx.doi.org/10.1016/S0140-6736(08)60655-8

Mathews, L. (2007). Paradigm shift in hemodynamic monitoring. *Internet Journal of Anesthesiology, 11*(2), 21–27. Retrieved from http://ispub.com/IJA/11/2/13289

Pierdomenico, S.D., Lapenna, D., Di Tommaso, R., Di Carlo, S., Esposito, A.L., Di Mascio, R., ... Mezzetti, A. (2006). Blood pressure variability and cardiovascular risk in treated hypertensive patients. *American Journal of Hypertension, 19*, 991–997.

Robitaille, C., Dai, S., Waters, C., Loukine, L., Bancej, C., Quach, S., … Quan, H. (2012). Diagnosed hypertension in Canada: Incidence, prevalence and associated mortality. *Canadian Medical Association Journal, 184*(1), E49–E56. http://dx.doi.org/ 10.1503/cmaj.101863

Sharman, D.L., Gomes, C.P., & Rutherford, J.P. (2004). Improvement in blood pressure control with impedance cardiography-guided pharmacologic decision making. *Congestive Heart Failure, 10*(1), 54–58.

Sherwood, A., & Turner, J. (1995). Hemodynamic responses during psychological stress: Implications for studying disease processes. *International Journal of Behavioral Medicine, 2*(3), 193–218. http://dx.doi.org/10.1207/s15327558ijbm0203_1

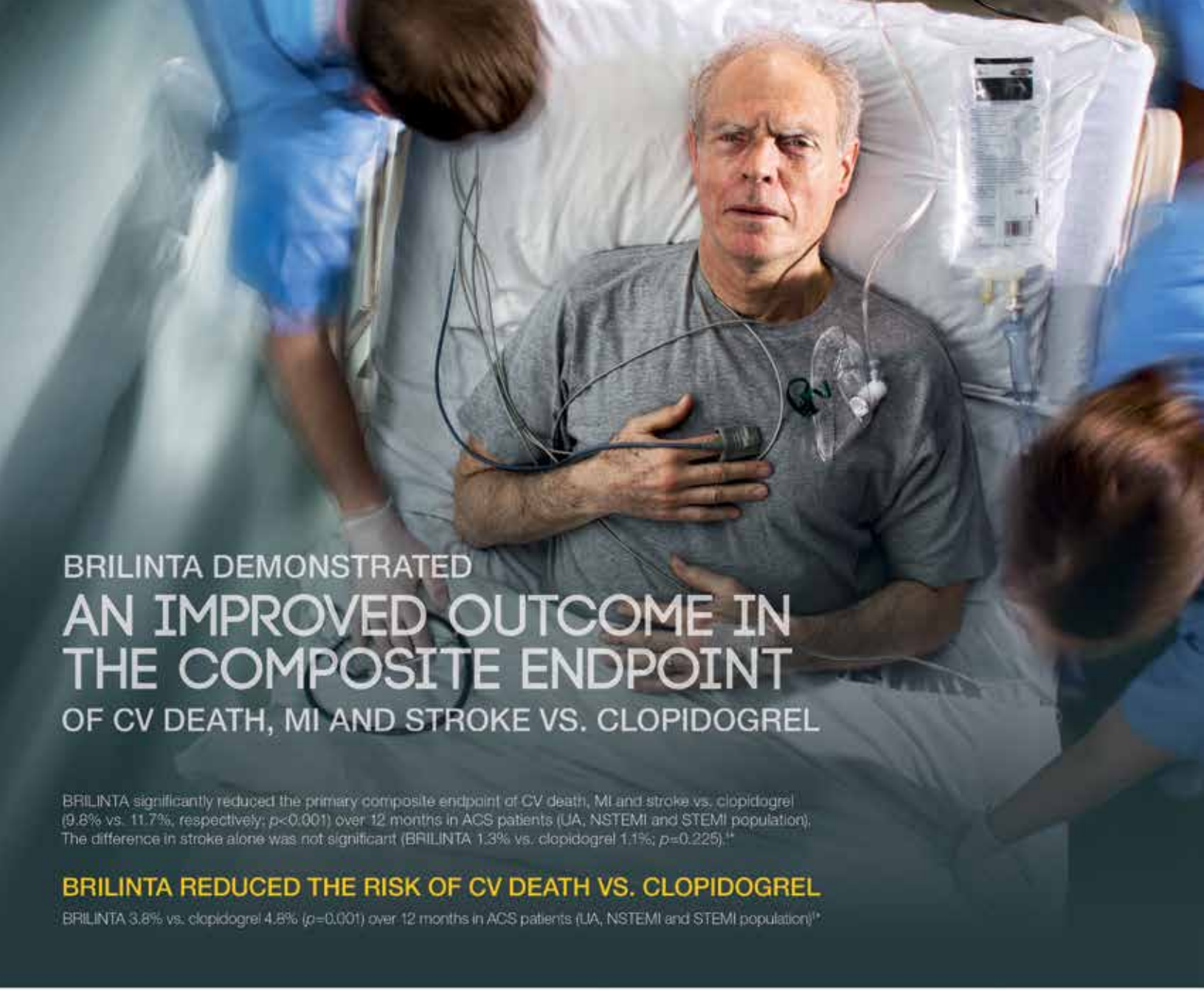
Smith, R.D., Levy, P., & Ferrario, C.M. (2006). Value of noninvasive hemodynamics to achieve blood pressure control in hypertensive subjects. *Hypertension, 47*, 771–777. http://dx.doi.org/10.1161/01.HYP.0000209642.11448.e0

Sramek, B.B., Badila, E., Bartos, D., Tirziu, C., & Ghiorge, S. (2008). Treating hypertension as a hemodynamic disorder results in three-fold improvement in outcomes [Abstract]. *Journal of Clinical Hypertension, 10*(Suppl. A) A81.

Sramek, B.B., Tichy, J.A., Hojerova, A., & Cervenka, V. (1996). Normohemodynamic goal-oriented antihypertensive therapy improves the outcome [Abstract]. *American Journal Hypertension, 9*(4) 141A.

Taler, S.J., Textor, S.C., & Augustine, J.E. (2002). Resistant hypertension: Comparing hemodynamic management to specialist care. *Hypertension, 39*, 982–988.

Ventura, H.O., Taler, S.J., & Strobeck, J.E. (2005). Hypertension as a hemodynamic disease: The role of impedance cardiography in diagnostic, prognostic, and therapeutic decision making. *American Journal of Hypertension, 18*(2 Pt 2), 26S–43S. http://dx.doi.org/10.1016/j.amjhyper.2004.11.002



BRILINTA DEMONSTRATED

AN IMPROVED OUTCOME IN THE COMPOSITE ENDPOINT

OF CV DEATH, MI AND STROKE VS. CLOPIDOGREL

BRILINTA significantly reduced the primary composite endpoint of CV death, MI and stroke vs. clopidogrel (9.8% vs. 11.7%, respectively; $p<0.001$) over 12 months in ACS patients (UA, NSTEMI and STEMI population). The difference in stroke alone was not significant (BRILINTA 1.3% vs. clopidogrel 1.1%; $p=0.225$).[1*]

BRILINTA REDUCED THE RISK OF CV DEATH VS. CLOPIDOGREL

BRILINTA 3.8% vs. clopidogrel 4.8% ($p=0.001$) over 12 months in ACS patients (UA, NSTEMI and STEMI population)[1*]

Indication and clinical use:
BRILINTA (ticagrelor), co-administered with acetylsalicylic acid (ASA), is indicated for the secondary prevention of atherothrombotic events in patients with Acute Coronary Syndromes (ACS) (unstable angina [UA], non–ST elevation myocardial infarction [NSTEMI] or ST elevation myocardial infarction [STEMI]) who are to be managed medically, and those who are to be managed with percutaneous coronary intervention (PCI) (with or without stent) and/or coronary artery bypass graft (CABG). Based on a relationship observed in PLATO between maintenance ASA dose and relative efficacy of BRILINTA compared to clopidogrel, BRILINTA is recommended to be co-administered efficacy of BRILINTA in pediatric patients below the age of 18 have not been established. Therefore, BRILINTA is not recommended in this population.

Contraindications:
- Patients with active pathological bleeding (e.g., peptic ulcer or intracranial hemorrhage)
- Patients with a history of intracranial hemorrhage
- Patients with moderate to severe hepatic impairment
- Patients who are also taking strong CYP3A4 inhibitors

Most serious warnings and precautions:
Bleeding risk: BRILINTA should be used with caution in patients with a propensity to bleed (e.g., due to recent trauma, recent surgery, active or recent gastrointestinal bleeding, or moderate hepatic impairment) and in patients requiring oral anticoagulants (e.g., warfarin) and/or fibrinolytics agents (within 24 hours of BRILINTA dosing). Caution should also be used in patients with concomitant administration of medicinal products that may increase the risk of bleeding (e.g., non-steroidal anti-inflammatory drugs [NSAIDs]).

Maintenance dose ASA: Co-administration of BRILINTA and high maintenance dose ASA (>150 mg daily) is not recommended.

Other relevant warnings and precautions:
- Cardiac events in discontinued patients
- Bradycardic events
- Hypersensitivity, including angioedema
- Dizziness and confusion
- Discontinuation prior to surgery
- Dyspnea
- Pregnant or nursing women
- Possible increase in creatinine levels
- Uric acid increase

For more information:
Consult the Product Monograph at azinfo.ca/brilinta/pm274 for important information regarding adverse reactions, drug interactions and dosing information not discussed in this piece. The Product Monograph is also available by calling AstraZeneca Canada at 1-800-668-6000.

*Randomized, double-blind, multicentre study. Patients were eligible for enrollment if they were hospitalized for an acute coronary syndrome (UA, NSTEMI or STEMI) with an onset of symptoms during the previous 24 hours. Patients were randomized to ticagrelor (180 mg loading dose, 90 mg BID thereafter; n=9333) or clopidogrel (300-600 mg loading dose, 75 mg QD thereafter; n=9291) in combination with acetylsalicylic acid and other standard therapies. The currently approved loading dose for clopidogrel is 300 mg.[2]

References: 1. BRILINTA® Product Monograph, AstraZeneca Canada Inc. September 9, 2013. **2.** Wallentin L, Becker RC, Budaj A *et al.* Ticagrelor versus clopidogrel in patients with acute coronary syndromes. *N Engl J Med* 2009;361(11):1045-57.

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