



Inter-arm systolic blood pressure difference is associated with a higher incidence of ischemic strokes

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General Note



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ABSTRACT

Inter-arm systolic blood pressure difference (IAD) of more than 15 mm Hg (SIAD) is associated with increased cardiovascular morbidity and mortality. IAD is attributed to atherosclerosis of the upper arm arteries. Although suggested in the literature, it has never been objectively documented that this group of patients are at a higher risk of strokes. This study was done to see if an association exists between SIAD and strokes.

Keywords: lacunar infarct, inter-arm blood pressure difference, hypertension, stroke

Abbreviations: ASH: American Society of Hypertension; CT: Computerized tomography; HTN: Hypertension; IAD: Inter-arm systolic blood pressure difference; JNC-7: The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; MRI: Magnetic resonance imaging; SIAD: Significant (>15 mmHg) systolic inter-arm blood pressure difference.

1. INTRODUCTION

Blood pressure is generally measured on in one arm – usually the non-dominant arm. However, increasing data has suggested that routine readings should be done with both arms due to a not uncommon variation in arm-to-arm blood pressure differences. In a cohort of elderly patients, 10% of the patients had an inter-arm difference of 10 mm/Hg or greater (Fotherby et al, 1993). Lane found that 20% of his patients registered this difference (Lane et al, 2002). Another study of ambulatory patients demonstrated a 40% incidence of a 10-mm/Hg gradient in blood pressure between the right and left arms. (Cassidy et al, 2001). Although a 10 mm Hg difference in inter-arm blood pressure is suggestive of peripheral vascular disease, a 15 mm or higher difference appears to be more ominous (Christopher E Clark et al, 2007).

Inter-arm blood pressure difference may be as a result of several conditions causing vascular obstruction, including atherosclerosis, vasculitis, fibromuscular hyperplasia, connective tissue disorders, radiation arteritis, thoracic outlet compression, dissecting aortic aneurysm, and congenital abnormalities (Osler 1915; Geisbock 1905; Norris 1917). Clinically common inter-arm blood pressure difference is probably due to stenosis involving the subclavian arteries (Shadman et al, 2004) and is related to atherosclerosis (Kay et al, 1930). In a recent meta-analysis of 20 studies, a systolic blood pressure difference of more than 15 mm Hg between the right and left arm was associated with a 2.5 greater risk of peripheral vascular disease, a 1.7 fold increase in cardiovascular mortality, and a 1.6 higher risk of all-cause death (Clark et al, 2012). Systolic inter-arm blood pressure difference of more than 15 mmHg is associated with peripheral vascular disease, pre-existing cerebro-vascular disease, increased cardiovascular mortality and all-cause mortality. It has been suggested that inter-arm blood pressure difference may also be associated with an increased propensity for strokes. This retrospective study confirms this association.

2. METHODS

We retrospectively reviewed charts of 170 consecutive patients seen in our office over a period of two months. All patients were hypertensive. Standard blood pressure measurement techniques were used with an appropriate-sized cuff at the level of the right atrium, with the patient rested for 5 minutes, and with the back supported. As part of the study, blood pressure was measured in both arms using the same sphygmomanometer during the same sitting. Systolic blood pressure was categorized as follows: Normal: less than 120/80 mmHg; Pre-HTN: 120 to 139/80 to 89 mmHg; HTN: 140/90 mmHg or greater: Stage 1: 140 to 159/90 to 99 mmHg, Stage 2: 160/100 mmHg or greater. All patients had been diagnosed with hypertension with at least 2 consecutive elevated BP measurements (≥ 140 mm Hg systolic and/or 90 mm Hg diastolic or $\geq 130/80$ mm Hg in the presence of diabetes mellitus or chronic kidney disease). All patients were on lifestyle changes recommendations and conventional anti-hypertensive patients, consistent with JNC 7 (Chobanian et al, 2003) and ASH guidelines (Gradman et al, 2010). Of these patients, 52 had brain MRI's reports in their charts. Magnetic resonance imaging (MRI) is more sensitive than computed tomography (CT) scanning for the identification of acute and old lacunes (Nitkunan et al, 2008). The reports were generated by radiologists and their interpretation was used for this study.

3. RESULTS

Of the 170 patients, there were 112 (66%) males and 58 (34%) females< their ages ranged from 23 to 92. Of these 170 patients, 52 patients (35 males; 17 females) had MRI of the brain done. Of these 52, 16 (31%) had SIAD while 36 (69%) had no IAD. Of the 16 with SIAD, 11 (69%) had MRI evidence of old infarcts [8 (50%) lacunar], while 5 (31%) did not. Of the 36 with no IAD, 13 (36%) had MRI evidence of old infarcts [7 (19%) lacunar] while 23 (64%) did not.

4. DISCUSSION

Strokes are either hemorrhagic or ischemic. Ischemic strokes are usually of three types: large artery infarcts due to thrombotic occlusions with underlying atherosclerosis in the larger arteries such as the carotid, vertebrobasilar or cerebral arteries. Cardiac infarcts are embolic in nature and a common cause of recurrent strokes. The third kind is lacunar infarcts. These small vessel infarcts called

lacunes account for 15%-25% of all ischemic strokes (Sacco et al, 2006). Lacunes occur in the area of the deep penetrating arteries (usually smaller than 500 μm in diameter) and arise directly from larger arteries in the brain including the middle cerebral artery, anterior cerebral artery, posterior cerebral artery, posterior communicating artery, cerebellar arteries and the basilar artery (Fisher, 1982). Occlusion of these penetrating arteries due to micro-atheroma results in small subcortical infarcts (< 15 mm in diameter) and is the most common etiology (Fisher 1968). Occasionally the cause of lacunar infarcts may be cardiac thromboembolism (Rojas et al, 2008) or lipohyalinosis (Bejot et al, 2008). Both microatheroma and lipohyalinosis usually occur in patients with hypertension and involve atherosclerosis. They occur most frequently in the basal ganglia and in the internal capsule, thalamus, corona radiata, or pons and are usually asymptomatic. The association of inter-arm blood pressure difference and ischemic and especially lacunar infarcts appears logical. Inter-arm blood pressure difference indicates atherosclerotic narrowing of the subclavian arteries. These patients have a higher incidence of cardiovascular and cerebrovascular morbidity and mortality. This suggests that the atherosclerosis in these patients is not only more generalized but also severe. Atheromatous changes in the cerebral and lacunar arteries with resultant occlusion, is therefore not an unexpected finding in these patients.

5. CONCLUSION

Patients with inter-arm systolic blood pressure difference of more than 15 mm are twice as likely to have MRI evidence of old infarcts (especially lacunar) in the brain, when compared to those without. This study objectively confirms the suspected higher incidence of strokes in these patients. Inter-arm blood pressure difference is therefore a marker of a much more severe and a much more generalized atherosclerosis, necessitating a more aggressive approach. These data also make a compelling case for bilateral brachial blood pressure measurements to be taken in all patients. If a difference exists, the higher of the two readings should be used in the clinical management of hypertension (Singer et al, 1996). Consideration should be given to the earlier use of statins and anti-inflammatory agents in these patients.

RESEARCH HIGHLIGHTS

- An inter-arm difference in systolic blood pressure is not benign and has clinical implications.
- An inter-arm difference in systolic blood pressure is associated with an increased risk of cardiovascular and all cause mortality over 10 years
- Patients with inter-arm systolic blood pressure difference of more than 15 mm are twice as likely to have MRI evidence of old ischemic infarcts (especially lacunar) in the brain
- Blood pressure measurement in both arms should become a routine part of cardiovascular assessment in medical care.

DISCLOSURE STATEMENT

The author has no conflicts of interest to disclose.

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