Effect of anti hypertensive drugs on hand grip strength

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Abstract:
Introduction. Hand grip strength is good indicator of overall strength, and when reduced is associated with adverse health consequences. Few studies have described the association between commonly prescribed anti hypertensive drugs and muscle strength and hence this study was done. Aim To assess handgrip strength in young hypertensive individuals.

Materials and methods. Grip strength was assessed on 100 hypertensive men and women on antihypertensive drugs, aged between 30 and 50 years of age attending hypertension clinic at RGGGH, Chennai. People with other illnesses were excluded. Handgrip strength of patients was measured using handgrip dynamometer during the two week period in June 2013. Grip strength was measured for 100 age-matched doctors who were taken as controls. The handgrip strength was compared between the two groups.

Statistical methods Two sample t-test with Multiple linear regression was used. The drugs used by patients were Amlodipine, Enalapril and Atenolol. Results. The average handgrip strength for the control group was 60.03 kg and that for patients was 20.8 kg and this reduction was statistically significant (p value 0.001). As in control group, mean grip strength of female patients was lesser than that of males (p 0.001). There was significant reduction in handgrip strength in patients taking Atenolol (-blocker) and Enalapril (ACE inhibitor) in addition to those on calcium channel blocker. Grip strength decreased progressively with increasing number of medications.

Discussion and conclusion. The average reduction of grip strength associated with anti hypertensive drug used in this study were relevant clinically. These findings may reflect a direct adverse effect of specific drugs or the underlying process of hypertension on muscle function. Findings that men had better handgrip strength than women replicated previous studies. Grip strength is reduced in people taking anti hypertensive drugs. The effects were more marked in patients on Amlodipine alone.
It is important to identify such changes early, so that alternative antihypertensive drug can be given to patients with poor hand grip.

**Keyword**: antihypertensive drugs, hand grip strength

**Introduction:**

Grip strength refers to the muscular power and force that can be generated with hands. Hand grip strength correlates with strength of other muscle groups and therefore it is a good indicator of overall strength. Muscle strength as marker of muscle quality is more important than quantity in estimating mortality risk. Having good hand grip strength is important, as stronger muscles and connective tissues are more injury resistant and recover faster when injured. When grip strength is reduced, it is associated with adverse health consequences. The study of Taekema et al. aimed to assess if handgrip strength predicts changes in functional, psychological and social health among oldest old. Muscle wasting is a dominant feature of old age and is commonly referred to as sarcopenia and grip strength is a marker of sarcopenia. Studies have shown associations between muscle strength and physical fitness, disability or cognition. Lower handgrip strength predicted an accelerated decline in ADL disability and cognition in both old and young. Increased morbidity and mortality due to poor hand grip is also demonstrated in a study on after controlling risk factors. Hypertension is the most prevalent modifiable risk factor with a high prevalence among older adults. The protective effects of cardiorespiratory fitness on hypertension are well known. Middle and high levels of muscular strength were associated with a reduced risk of hypertension. The long-term biological mechanisms behind muscular strength and blood pressure are still not clearly defined. However, one possible mechanism that links strength training to hypertension status is through acute elevations in arterial blood pressure during weight training that leads to long term protective changes in the smooth muscle content of the arterial wall. Some doubts are raised whether the reduced muscle strength in people with hypertension could be cause or effect. However the association is significant after adjustment for other cardiovascular risk factor such as smoking alcohol intake, family history of hypertension. According to Maslow et al study, only baseline prehypertensive men (not normotensive men); muscular strength was inversely associated with incidence of hypertension. On average, men with at least middle strength level had a lower risk of developing hypertension compared with men with low strength. Impaired grip strength is known to be associated with metabolic syndrome. Among leaner individuals, greater handgrip strength was associated with lower risk of type 2 Diabetes. Handgrip strength was negatively associated with fasting insulin in cross sectional data. Skeletal muscle weakness may precede and predict the development of insulin resistance, and raise the intriguing possibility of common cause in skeletal pathophysiology. Cardiovascular drugs have been shown to have adverse effect on muscle strength in elderly people affecting their activities of daily living. Men and women of poor grip strength were significantly more likely to report a poor opinion of general health and therefore report poor quality of health. Poor muscular strength has been shown to be associated with increased morbidity and mortality in diverse samples of middle-aged and elderly people.
**Handgrip strength**

The participants are asked to stand up and hold the dynamometer in dominant hand with arm parallel to body without squeezing the arm against the body. The participant was allowed one test trial. After this 3 trails were allowed in each hand and the best score was used for analysis. It is known that the dominant hand had greater grip strength than non-dominant hand in both sexes. Handgrip strength was measured in Kilograms (Kg). Few studies have described the association between the use of a range of commonly prescribed antihypertensive drugs and muscle strength. It was therefore decided to test grip strength in younger individuals on antihypertensive drugs.

**Aim:**
To assess handgrip strength in young hypertensive individuals

**Materials and methods:**
Grip strength was assessed on 100 hypertensive men and women on antihypertensive drugs, between 30 and 50 years of age, attending hypertension clinic at the Rajiv Gandhi Govt. Generalhospital, Chennai. People with other illnesses were excluded. All patients underwent clinical examination including neurological examination and those who didn’t have clinical weakness were included.

Based on the age, the effect size was calculated and is 0.4687 and with = 0.05, power (1-)= 0.95, the sample size was calculated using G-Power analysis software and is 100 for each of the two groups. Handgrip strength of patients was measured using handgrip dynamometer The study was done in the two week period between 1st June and 15th June 2013. Both the hands were handed. The participants were seated, their elbow by their side and flexed to right angles, and a neutral wrist position, the dynamometer and provision of support underneath the dynamometer. Calculation of the mean of three trials of grip strength for each hand was done; A person’s grip strength usually results in having the strongest grip strength when their arm is extended at 90° before tested. Best of 6 attempts (3 in each hand) was taken. All patients studied and the controls were right their body, hence this position was used. During the same period, grip strength was measured for age-matched doctors who were taken as controls. The handgrip strength was compared between the two groups.

**Statistical methods:** Two sample t-test was used. Chi square test was used, using the SPSS software version 17.

**Results:**
Overall 100 people between the ages of 30 and 50 who were on antihypertensive drugs were studied. Of these, 47 were men and 53 were women. Of the control group 49 were men and 51 were women doctors.
Average age of patients was 44.4 and that of controls were 42. The drugs used by the 100 hypertensive patients in this study were Amlodipine, Enalapril and Atenolol, either alone or in combination. The handgrip strength of the 100 patients and that of controls were averaged and displayed in the chart.

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<th>Std. Deviation</th>
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Among the antihypertensive drugs used patients taking Amlodipine had lesser grip and best strength was recorded in patients taking only Atenolol. Grip strength decreased progressively with increasing number of medications used (Figure 3). When additional medication was used there was average reduction in handgrip strength of 3.87 kg. and least in those taking all three drugs. Neither the duration of therapy nor the age group difference affected hand grip strength. As in control group, mean grip strength of female patients was lesser than that of males.

**Discussion:**
According to the study on grip strength and cardiovascular drug use in older people, by Ashfield TA et al, 1 use of some cardiovascular drugs including antihypertensive drugs was associated with reduced grip strength in older people. This is also seen in other studies. 3, 7 The average reduction of grip strength in this study was significant. In our study too, there was considerable difference in grip strength between the patients on antihypertensive drugs and the control group. There was reduction in strength with calcium channel blockers, but there was no significant association between handgrip strength and -blocker and ACE inhibitor seen in the previous study. 1 In contrast, in this study there was significant reduction in handgrip strength in patients taking Atenolol (-blocker) and Enalapril (ACE inhibitor) in addition to those on calcium channel blocker. These findings may reflect a direct adverse effect of specific drugs or the underlying process of hypertension. The average reduction of grip strength associated with antihypertensive drug used in this study was sizeable and relevant clinically. It is known that sex accounts for the largest differences in grip strength measurement. 5 In general, females have lower grip strength than male. Findings in this study that men had better handgrip strength than women replicated previous studies. 5, 7

**Strengths of our study**
Availability of an objective assessment of muscular strength with the use of handgrip dynamometer

**Limitations of our study**
We do not know if the participants are less or more fit of the same group in general population as fitness has an effect on hand grip strength. Because controls are homogenous group of doctors, external validity is limited to healthy upper middle and high socioeconomic status and higher educational status. Lack of sufficient data on diet intake prohibits us from adjusting for potential nutritional confounders that may contribute to poor handgrip in patients.

**Conclusion:**
Grip strength is reduced in people taking antihypertensive drugs. This may be due to adverse effect of specific drugs or the underlying effect of hypertension on muscle function in people less than 50 years of age. The effects were more marked in patients taking Amlodipine alone. This is a significant finding. Further research is needed to replicate our findings and establish causal relationships. If the results are replicated, it is
recommended that patients taking anti-hypertensivedrugs especially Amlodipine should have periodic monitoring of hand-grip strength. It is important to identify such changes early, so that alternative anti-hypertensive drug can be given to patients with poor hand grip.

Reference:


APPENDIX

ANOVA

Input: Tail(s) = One
Effect size $d = 0.4687690$
error prob =0.05
Power (1- error prob) =0.95
Allocation ratio N2-N1 = 1
Output: Noncentrality parameter =3.314697
Critical $t = 1.652586$
Sample size group 1 = 100
Sample size group 2 = 100
Df =198
Total sample size =200
Actual power = 0.951390