Aortic Regurgitation in Iraqi Hypertensive Patients
Frequency and Risk Factors

Ali S. Baay
College of Medicine, University of Babylon, Hilla, Babylon, Iraq.

Abstract
Aortic regurgitation is back flow of the blood from the aorta to the left ventricle, many causes of this relatively common valvular lesion but one of the most important is hypertension a so common medical problem.

Aim of the study: to assess the frequency of, severity and risk factors of aortic regurgitation in hypertensive patients

The results and discussion: show significant No. of hypertensive patients have aortic regurgitation most of them have non significant lesion with the dilatation of aortic root and increasing age are significant risk factors ,this finding consistent with most of the studies

Recommendations: it is wise to assess all hypertensive patients with noninvasive simple test, echocardiography, for evidence of aortic regurgitation.

Introduction
Aortic valve insufficiency results from leakage and backflow of blood that is ejected from the left ventricle (LV) into the ascending aorta back into the left ventricle.

Many mechanisms contribute to aortic valve insufficiency. These include abnormalities of the aortic valve leaflets and pathologies of the proximal aortic root. [1]

Mechanisms of aortic regurgitation
Rheumatic heart disease still remains the most common cause of severe aortic regurgitation over the past several decades. [2,18], however, diseases involving the aortic root are becoming more frequent, In fact, more than half of patients who present with pure aortic regurgitation (AR) without any associated cardiac anomalies have aortic valve insufficiency caused by aortic root disease. [3]

Causes of aortic regurgitation include the following: [3]

1. Aortic cusp abnormalities
2. Perforation (e.g., infective endocarditis)
3. Cusp shrinkage
4. Rheumatic disease
5. Rheumatoid disease
6. Ankylosing spondylitis
7. Bicuspid aortic valve
8. Loss of commissural support
9. Ventricular septal defect
10. Dissection (tears) of the aorta
11. Aortic root abnormalities: The usual underlying histopathologic changes in aortic tissue associated with aortic dilatation are summarized as "cystic medial necrosis" and, although qualitatively similar, are variable in severity and include:
   1. Dilatation
   2. Familial conditions
   3. Marfan syndrome
   4. Hypertension
   5. Ehlers-Danlos syndrome
   6. Pseudoxanthoma elasticum
   7. Idiopathic
   8. Distortion (aortitis)
   9. Syphilis
   10. Rheumatoid disease
   11. Ankylosing spondylitis
   12. Nonspecific aortitis

Aortic regurgitation can be seen in patients with hypertension frequently and hypertension is one of the most important causes of chronic AR[4]. Although aortic regurgitation of minimal or mild degree is well recognized to occur in patients with systemic hypertension, severe degrees of aortic regurgitation are rare in such patients; aortic valve replacement in such patients has rarely previously been reported. [3]

Early case reports and pathological series suggest that hypertension might directly predispose to aortic regurgitation because of enlargement of the aortic root, but recent pathological and M-mode echocardiographic studies have not found an association between blood pressure and aortic root size when the confounding influence of aging is considered.[3,4,5]

Thus, aortic root diameter is strongly related to age, and senescence may result in cystic medial necrosis.

In contrast, other M-mode echocardiographic studies have noted significant relations of aortic root diameter to systolic and diastolic pressures. [4,6,7,8]

Furthermore, severe aortic regurgitation due to idiopathic aortic root dilatation is associated with antecedent hypertension.[9,16,19]

There is what called normal regurgitation seen in 3% of the healthy population by color Doppler but most of the study show higher prevalence among hypertensive patients. [10,11,17]

So hypertension is a key point in the etiology of aortic regurgitation.

The aim of the study:

To study the frequency of AR in hypertensive Iraqi patients with assessing the aortic root size at sinus of valsalva, age and gender as risk factors.

Patients and Methods

350 hypertensive patients 170 male and 180 female age ranging between 20-65(mean age52.6) were studied with transthoracic echocardiography by 2D ,M mode and Doppler study were done for all by HDI 1500 machine in Babylon/Iraq from September 2007 to Feb 2009.

Inclusion criteria:
1. Age 20-65 years
2. With blood pressure >140/90 in 2 reading 24 hours apart or had being diagnosed as hypertension on treatment since > 6 months [2]

Patients were divided according to the age into 3 groups
20-35 years old
36-50 years old
51-65 years old
Any patient with AR seen by colure Doppler where labeled as +ve.

Those +ve patients are classify into significant and non significant regurgitation by [12]

**Significant AR:** any of the following:
1- LVEDD> 75mm
2- Regurgitant jet width/LVOT diameter ratio>60%
3- Vena contracta (the smallest neck of the flow at the level of aortic valve) width >6mm
4- AR pressure half time(PHT) <250 millisecond
5- Dense continuous wave signal
6- Diastolic flow reversal in descending aorta: early diastolic reversal

**Non significant AR:** any of the following:
1- LVEDD<55 mm
2- Regurgitant jet width/LVOT diameter ratio<30%
3- Vena contracta <3mm
4- AR PHT>400 millisecond
5- Faint continuous wave signal
6- Diastolic flow reversal in descending aorta: holodiastolic reversal

The aortic root dimension at the level of sinus of valsalva is measured if >40mm it is enlarged.

332 healthy normotensive persons (175 male and 157 female) are studied similarly as a control group

**Statistical analysis**
The tests used for the analysis include test for proportion between patients and control and chi square test for the other parameters

**Results**
The patients group distributed as:

<table>
<thead>
<tr>
<th>Patients age</th>
<th>male</th>
<th>female</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-35</td>
<td>40</td>
<td>55</td>
<td>95</td>
</tr>
<tr>
<td>36-50</td>
<td>80</td>
<td>60</td>
<td>140</td>
</tr>
<tr>
<td>51-65</td>
<td>50</td>
<td>65</td>
<td>115</td>
</tr>
<tr>
<td>total</td>
<td>170</td>
<td>180</td>
<td>350</td>
</tr>
</tbody>
</table>

The control group distribution:

<table>
<thead>
<tr>
<th>Patients age</th>
<th>male</th>
<th>female</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-35</td>
<td>43</td>
<td>48</td>
<td>91</td>
</tr>
<tr>
<td>36-50</td>
<td>79</td>
<td>52</td>
<td>131</td>
</tr>
<tr>
<td>51-65</td>
<td>53</td>
<td>57</td>
<td>110</td>
</tr>
<tr>
<td>total</td>
<td>175</td>
<td>157</td>
<td>332</td>
</tr>
</tbody>
</table>

There are no statistical significances regarding gender and age between patients and control with P value >0.005.

I- Out of 350 patients are involved in the study 86 (24.6%) patient have AR by echocardiography while out of 332 control person only 11(3.3%) have AR with 95% confident interval between the two proportion.
II- Out of 86 patients have AR, 72 (83.7%) have non significant regurgitation while the minority 14 (16.3%) patients have significant lesion.

III- Regarding control group; only 11 patients (3.3%) have AR all of them are non significant.

Regarding the risk factors study:

I- Age:

<table>
<thead>
<tr>
<th>age</th>
<th>AR</th>
<th>No AR</th>
<th>total</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-35</td>
<td>24</td>
<td>71</td>
<td>95</td>
<td>0.49</td>
</tr>
<tr>
<td>36-50</td>
<td>20</td>
<td>120</td>
<td>140</td>
<td>0.7</td>
</tr>
<tr>
<td>51-65</td>
<td>42</td>
<td>73</td>
<td>115</td>
<td>0.35</td>
</tr>
<tr>
<td>total</td>
<td>86</td>
<td>264</td>
<td>350</td>
<td></td>
</tr>
</tbody>
</table>

There is a significant difference between the frequency of AR between young and old age with P value <0.05 (0.026)
For control

<table>
<thead>
<tr>
<th>Age</th>
<th>AR</th>
<th>No AR</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-35</td>
<td>2</td>
<td>89</td>
<td>91</td>
</tr>
<tr>
<td>36-50</td>
<td>2</td>
<td>129</td>
<td>131</td>
</tr>
<tr>
<td>51-65</td>
<td>7</td>
<td>103</td>
<td>110</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>321</td>
<td>332</td>
</tr>
</tbody>
</table>

II- Gender:

<table>
<thead>
<tr>
<th>Gender</th>
<th>AR</th>
<th>No AR</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>42</td>
<td>128</td>
<td>170</td>
</tr>
<tr>
<td>female</td>
<td>44</td>
<td>136</td>
<td>180</td>
</tr>
<tr>
<td>total</td>
<td>86</td>
<td>264</td>
<td>350</td>
</tr>
</tbody>
</table>

There is no statistically significant difference in the frequency of AR between male and female with P value 0.83 (>0.05)

III- Aortic root size:

<table>
<thead>
<tr>
<th>size</th>
<th>AR</th>
<th>No AR</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>enlarge</td>
<td>66</td>
<td>4</td>
<td>70</td>
</tr>
<tr>
<td>normal</td>
<td>20</td>
<td>260</td>
<td>280</td>
</tr>
<tr>
<td>total</td>
<td>86</td>
<td>264</td>
<td>350</td>
</tr>
</tbody>
</table>

For the control

<table>
<thead>
<tr>
<th>size</th>
<th>AR</th>
<th>No AR</th>
<th>total</th>
</tr>
</thead>
<tbody>
<tr>
<td>enlarge</td>
<td>7</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>normal</td>
<td>4</td>
<td>219</td>
<td>323</td>
</tr>
<tr>
<td>total</td>
<td>11</td>
<td>321</td>
<td>332</td>
</tr>
</tbody>
</table>

There is a statistically significant difference in the frequency of AR between those with dilated aortic root comparing with the normal root.

**Discussion**

The hypertension is a common cause of AR due to dilatation or distortion of the aortic root causing changes in the valve function leading to regurgitation but in most cases is non significant. The findings in this study show that AR seen more commonly in hypertensives than in normotensive persons.

Most of patients with AR show non significant regurgitation. The risks factors with significant difference are old age (>50 years) and dilated aortic root at the level of sinus of valsalva while the gender show no significant difference.

The finding of hypertension as a cause of non significant aortic regurgitation are consistent with other studies as Vittorio Palmieri et al study which show same finding even in the use of larger sample size but differ from Waller BF study which show severe AR in hypertensive patients that need valve replacement. [12,13,14,15.] J Kontos et al study and Lonati L et Lonati LLonati Lal study show the same findings of age and aortic root size as a risk factors although the former study show relation of aortic
Conclusions
1- Hypertension can cause AR but in most cases are non significant
2- Echocardiography is a reliable method for assessing the heart in hypertension and predict complications
3- The risk increase more in age older than 50 years and in presence of dilated aortic root
4- The gender show no difference

Recommendation
It is wise to screen hypertensive patients for cardiac complications with safe non invasive way by echo. To detect AR.

References
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17- Pulse Pressure Is Inversely Related to Aortic Root Diameter Implications for the Pathogenesis of Systolic Hypertension Hypertension, February 1, 2008; 51(2): 196 – 202

18- Aortic Root Diameter and Longitudinal Blood Pressure Tracking Hypertension, September 1, 2008; 52(3): 473 - 477.