



## A Cross Sectional Study to assess the role of C reactive protein as predictive marker for hypertension in a tertiary care hospital

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### Abstract:

**Introduction:** Hypertension is prevalent globally and is on the rise posing as a major public health concern. In individuals with hypertension, it has been found that C reactive protein (CRP) levels are related to vascular stiffness, atherosclerosis and the development of end organ damage and CVD. The present study aims to assess the role of C reactive protein as a predictive marker for hypertension in a tertiary care hospital.

**Methods:** A Cross-sectional study was carried out among 200 patients with newly diagnosed hypertension, in the Department of Medicine, MGM Medical College & M. Y. Hospital, Indore (M.P) during the period of March 2019 to February 2020. History was taken from the patient and clinical examination was done after obtaining informed consent.

**Results:** The mean age of our study population was  $49.75 \pm 7.93$ . The higher percentage of patients i.e. 60% were males while 40% were females. The mean SBP was  $152.14 \pm 12.45$  mm of Hg. Significant relationship was found between CRP levels and SBP (Brachial) ( $P < 0.05$ ). However, relation between DBP (Brachial) and CRP was found to be statistically non-significant ( $P > 0.05$ ). 98.6% of Patients having CRP  $< 1.0$  mg/l had a Normal TC level while 22.90% of patients having CRP  $> 3.0$  mg/l had a high TC level. Dyslipidemia was seen in 83 (41.5%) of the patients in our study. The association between CRP and dyslipidemia was found to be significant.

**Conclusion:** Serum CRP levels have been found to correlate with atherosclerotic risk factors. Thus, the current study presents data concerning the association between inflammation and hypertension by studying levels of CRP in the latter, and provides a stimulus to understand whether a causal relationship between CRP and hypertension could be present.

**Keywords:** CRP, Diastolic Blood Pressure, Dyslipidemia, Hypertension, Systolic Blood Pressure

### Introduction:

Hypertension is present globally with a prevalence of approximately 1 billion and is on the rise around the world with a projection of 1.5 billion by 2025. [1] It is marked by endothelial dysfunction, increased peripheral vascular resistance, large artery stiffness and vascular remodelling along with an associated

pro inflammatory state. [2] In individuals with hypertension, it has been found that C reactive protein (CRP) levels are related to vascular stiffness, atherosclerosis and the development of end organ damage and CVD. CRP is associated with the recruitment of macrophages and monocytes into the sub endothelial tissue, and can induce monocytes to

express tissue factor, leading to vessel wall thickening and subsequent atherosclerotic plaque formation.<sup>[3]</sup> The present study aims to assess the role of C reactive protein as a predictive marker for hypertension in a tertiary care hospital.

**Materials And Methods:**

A Cross-sectional study was carried out among 200 patients with newly diagnosed hypertension, in the Department of Medicine, MGM Medical College & M. Y. Hospital, Indore (M.P) during the period of March 2019 to February 2020. History was taken from the patient and clinical examination was done after obtaining informed consent. Patient

confidentiality was maintained. Patients were subjected for further investigations when required. Only routine investigations were conducted on the patients. Study was done according to the regulations of the Institutional Ethics Committee.

**Results:**

As shown in table 1, the distribution of patients based on their age. The highest percentage of patients i.e. 49.5% belonged to 50-60Years followed by 28.5% who were in40-50Yearsage group, 11.5% were 60-70 Years old while, the least i.e. only 10.5% were in the 30-40 Years Age group.

**Table-1 shows age distribution of hypertensive patients.**

| Age Group    | Frequency  | Percentage   |
|--------------|------------|--------------|
| 30-40 years  | 21         | 10.5         |
| 41-50 years  | 57         | 28.5         |
| 51-60 years  | 99         | 49.5         |
| 61-70 years  | 23         | 11.5         |
| <b>Total</b> | <b>200</b> | <b>100.0</b> |

As shown in table 2, The above table shows the association between CRP and SBP BRACHIAL of patients which was found to be statistically significant (P<0.05). It implies that CRP level of

patients differs significantly with their BRACHIAL SBP. Patients having CRP Level3.0 mg/l74.3% had a BRACHIALSBP of >=161 mmHg.

**Table-2 shows the association between CRP Levels and Brachial SBP.**

| BRACHIAL SBP<br>(mm of Hg) |       | CRP LEVEL (mg/l) |        |        | TOTAL  |
|----------------------------|-------|------------------|--------|--------|--------|
|                            |       | <1.0             | 1-3    | >3.0   |        |
| <b>&gt;=161</b>            | Count | 2                | 9      | 26     | 37     |
|                            | %     | 2.8%             | 9.6%   | 74.3%  | 18.5%  |
| <b>131-140</b>             | Count | 35               | 1      | 0      | 36     |
|                            | %     | 49.3%            | 1.1%   | 0.0%   | 18.0%  |
| <b>141-150</b>             | Count | 33               | 30     | 3      | 66     |
|                            | %     | 46.5%            | 31.9%  | 8.6%   | 33.0%  |
| <b>151-160</b>             | Count | 1                | 54     | 6      | 61     |
|                            | %     | 1.4%             | 57.4%  | 17.1%  | 30.5%  |
| <b>TOTAL</b>               | Count | 71               | 94     | 35     | 200    |
|                            | %     | 100.0%           | 100.0% | 100.0% | 100.0% |

|                           |         |    |         |             |
|---------------------------|---------|----|---------|-------------|
| <b>PEARSON CHI SQUARE</b> | Value   | Df | P-value | Result      |
|                           | 186.675 | 6  | 0.000   | SIGNIFICANT |

As shown in table 3, the association between CRP Level and DBP BRACHIAL of patients which was found to be statistically nonsignificant ( $P > 0.05$ ). It implies that CRP Level of patients does not differ significantly with their DBP BRACHIAL. In patients

having  $CRP > 3.0 \text{ mg/l}$ , 37.1% had a BRACHIAL DBP of 101-110 mm Hg, 37.1% had BRACHIAL DBP of  $\leq 90 \text{ mmHg}$  and 25.7% had BRACHIAL DBP of 91-100mmHg.

**Table-3 shows the association between CRP Levels and Brachial DBP**

| <b>BRACHIAL DBP (mm of Hg)</b> |       | <b>CRP LEVEL (mg/l)</b> |            |                 | <b>TOTAL</b> |
|--------------------------------|-------|-------------------------|------------|-----------------|--------------|
|                                |       | <b>&lt;1.0</b>          | <b>1-3</b> | <b>&gt;3.0</b>  | <b>93</b>    |
| <b>&lt;=90</b>                 | Count | 34                      | 13         | 46              | 93           |
|                                | %     | 47.9%                   | 37.1%      | 48.9%           | 46.5%        |
| <b>101-110</b>                 | Count | 23                      | 13         | 21              | 57           |
|                                | %     | 32.4%                   | 37.1%      | 48.9%           | 46.5%        |
| <b>91-100</b>                  | Count | 14                      | 9          | 27              | 50           |
|                                | %     | 19.7%                   | 25.7%      | 28.7%           | 25.0%        |
| <b>TOTAL</b>                   | Count | 71                      | 35         | 94              | 200          |
|                                | %     | 100.0%                  | 100.0%     | 100.0%          | 100.0%       |
| <b>PEARSON CHI SQUARE</b>      | Value | Df                      | p-value    | Result          |              |
|                                | 4.676 | 4                       | 0.322      | NOT SIGNIFICANT |              |

As shown in table 4, the association between CRP and ANKLE SBP of patients which was found to be statistically significant ( $P < 0.05$ ). In patients having

$CRP \text{ Level} > 3.0 \text{ mg/l}$ , 42.9% had an ANKLE SBP of  $\geq 181 \text{ mmHg}$

**Table-4 shows the association between CRP Levels and Ankle SBP**

| ANKLE SBP<br>(MM OF hg) |       | CRP LEVEL (mg/l) |         |             | TOTAL   |
|-------------------------|-------|------------------|---------|-------------|---------|
|                         |       | <1.0             | 3-Jan   | >3.0        | 12      |
| <=140                   | Count | 2                | 4       | 6           | 12      |
|                         | %     | 2.80%            | 4.30%   | 17.10%      | 6.00%   |
| 141-150                 | Count | 11               | 6       | 2           | 19      |
|                         | %     | 15.50%           | 6.40%   | 5.70%       | 9.50%   |
| 151-160                 | Count | 10               | 5       | 1           | 16      |
|                         | %     | 14.10%           | 5.30%   | 2.90%       | 8.00%   |
| 161-170                 | Count | 22               | 13      | 5           | 40      |
|                         | %     | 31.00%           | 13.80%  | 14.30%      | 20.00%  |
| 171-180                 | Count | 14               | 19      | 6           | 39      |
|                         | %     | 19.70%           | 20.20%  | 17.10%      | 19.50%  |
| >=181                   | Count | 12               | 47      | 15          | 74      |
|                         | %     | 16.90%           | 50.00%  | 42.90%      | 37.00%  |
| TOTAL                   | Count | 71               | 94      | 35          | 200     |
|                         | %     | 100.00%          | 100.00% | 100.00%     | 100.00% |
| PEARSON CHI<br>SQUARE   | Value | Df               | p-value | Result      |         |
|                         | 37.52 | 10               | 0       | SIGNIFICANT |         |

As shown in table 5, the association between CRP and TC Levels of patients which was found to be

statistically significant (P<0.05). 98.6% of Patients having CRP3.0mg/l had a high TC level.

**Table-5 shows the association between CRP Levels and Total Cholestrol (TC) levels**

| TOTAL CHOLESTROL<br>LEVELS (mg/dl) |       | CRP LEVEL (mg/l) |        |        | TOTAL  |
|------------------------------------|-------|------------------|--------|--------|--------|
|                                    |       | <1.0             | 1-3    | >3.0   | 12     |
| <=200<br>Normal                    | Count | 70               | 81     | 27     | 178    |
|                                    | %     | 98.6%            | 86.2%  | 77.1%  | 89.0%  |
| >200<br>Abnormal                   | Count | 1                | 13     | 8      | 22     |
|                                    | %     | 1.4%             | 13.8%  | 22.9%  | 11.0%  |
| TOTAL                              | Count | 71               | 94     | 35     | 200    |
|                                    | %     | 100.0%           | 100.0% | 100.0% | 100.0% |

|                    |        |    |         |             |
|--------------------|--------|----|---------|-------------|
| PEARSON CHI SQUARE | Value  | Df | p-value | Result      |
|                    | 12.467 | 2  | 0.002   | SIGNIFICANT |

As shown in table 6, the association between CRP and dyslipidemia status of patients which was found to be statistically significant (P<0.05). It implies that

CRP Level of patients differs significantly with their dyslipidemic Status. In patients having CRP3.0mg/l show 91.4% had dyslipidemia while 8.6% did not.

**Table -6 shows the association between CRP Levels and Dyslipidemia**

| DYSLIPIDEMIA       |        | CRP LEVEL (mg/l) |         |             | TOTAL  |
|--------------------|--------|------------------|---------|-------------|--------|
|                    |        | <1.0             | 1-3     | >3.0        | 12     |
| NO                 | Count  | 67               | 47      | 3           | 117    |
|                    | %      | 94.4%            | 50.0%   | 8.6%        | 58.5%  |
| YES                | Count  | 4                | 47      | 32          | 83     |
|                    | %      | 5.6%             | 50.0%   | 91.4%       | 41.5%  |
| TOTAL              | Count  | 71               | 94      | 35          | 200    |
|                    | %      | 100.0%           | 100.0%  | 100.0%      | 100.0% |
| PEARSON CHI SQUARE | Value  | Df               | p-value | Result      |        |
|                    | 76.357 | 2                | 0.000   | SIGNIFICANT |        |

**Discussion:**

Our Study included newly diagnosed hypertensive patients who were in the age group between 30 to 65 years. The mean age of our study population was 49.75 ± 7.93.

In the study by **Schillaci G. et al (2003)**<sup>[4]</sup> the mean age for hypertensive patients (n=135) was 47 ± 11 which is comparable with our study population. **Xu T et al. (2008)**<sup>[5]</sup> in their study found the mean age to be 50.40±10.76 which is comparable with our study.

Amongst the study population, 80 participants (40%) were females while 120 participants (60%) were males.

**Xu T et al. (2008)**<sup>[5]</sup> in their study concluded that of the total 1,529 subjects who participated in the study; there were 352 males and 415 females in the case group. This is different from our study which could be due to a smaller sample size of our study.

The mean SBP was 152.14 ± 12.45 mm of Hg. Significant relationship was found between CRP levels and SBP (Brachial) (P<0.05). It implies that CRP level of patients differs significantly with their BRACHIAL SBP. Patients having CRP level <1.0mg/l, 49.30% had a SBP BRACHIAL in between 131-140 mmHg while for patients having CRP>3.0mg/l 74.30% had a BRACHIAL SBP of >=161 mmHg.

**Schillaci G. et al (2003)**<sup>[4]</sup> in their study found the mean BP to be  $153 \pm 18$  mm of Hg along with a Significant relationship CRP levels and SBP(Brachial) ( $P < 0.01$ ) which is comparable with our study.

The mean DBP was  $93.67 \pm 8.69$  mm of Hg. The relation between DBP (Brachial) and CRP was found to be statistically non-significant ( $P > 0.05$ ). In patients having  $CRP > 3.0$ mg/l, 37.10% had a BRACHIAL DBP of 101-110 mmHg, 37.10% had a BRACHIAL DBP of  $\leq 90$  mmHg and 25.70% had a BRACHIAL DBP of 91-100 mmHg.

**Schillaci G. et al (2003)**<sup>[4]</sup> in their study found the mean BP to be  $95 \pm 10$  mm of Hg and no Significant relationship was found between CRP levels and DBP(Brachial) ( $P > 0.2$ ) which is comparable with our study.

The mean TC was observed to be  $177.53 \pm 26.25$  mg/dl in the study group. 98.6% of Patients having  $CRP < 1.0$  mg/l had a Normal TC level while 22.90% of patients having  $CRP > 3.0$ mg/l had a high TC level. Significant relationship was found between CRP levels and Total Cholesterol levels ( $P = 0.002$ ).

**Xu T et al. (2008)**<sup>[5]</sup> in their study found the TC levels to be higher in hypertensive individuals compared to those without HTN with statistical significance.

Dyslipidemia was seen in 83 (41.5%) of the patients in our study.

Significant relationship was found between CRP levels and Dyslipidemia ( $P < 0.001$ ) in our study.

#### References:

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patients having  $CRP < 1.0$ mg/l, 94.40% did not have dyslipidemia while only 5.60% did. In patients with  $CRP 1-3$ mg/l, 50% did not have dyslipidemia and 50% did. On the other hand, in patients having  $CRP > 3.0$ mg/l show 91.40% had dyslipidemia while 8.60% did not. The association between CRP and dyslipidemia was found to be statistically significant ( $p < 0.05$ ).

**Xu T et al. (2008)**<sup>[5]</sup> in their study found that hyperlipidemia (compared with dyslipidemia in our study) was comparatively more and statistically significant in cases with HTN.

There are however, limitations to this study. As this is a cross-sectional study, we cannot establish the temporal relationship between CRP and onset of hypertension. Secondly, confounders such as unmeasured variables related to CRP and/either BP may confound an association between inflammation and hypertension.

#### Conclusion:

Arterial hypertension has been related with many inflammatory markers found in circulation, including CRP, independently of other risk factors, promoting the idea of hypertension as a potentially pro-inflammatory condition. Serum CRP levels have been found to correlate with atherosclerotic risk factors. Thus, the current study presents data concerning the association between inflammation and hypertension by studying levels of CRP in the latter, and provides a stimulus to understand whether a causal relationship between CRP and hypertension could be present.

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