

# Measurement of Right Atrial Volume and Diameters in Healthy Nepalese with Normal Echocardiogram.

Karki DB,<sup>1</sup> Pant S,<sup>1</sup> Yadava SK,<sup>1</sup> Vaidya A,<sup>2</sup> Neupane DK,<sup>1</sup> Joshi S<sup>1</sup>

<sup>1</sup>Department of Internal Medicine

<sup>2</sup>Department of Community Medicine

Kathmandu Medical College Teaching Hospital  
Kathmandu, Nepal

## Corresponding author

D.B. Karki

Department of Internal Medicine

Kathmandu Medical College Teaching Hospital

Kathmandu, Nepal

Email: profdbkarki@gmail.com

## Citation

Karki DB, Pant S, Yadava SK, Vaidya A, Neupane DK, Joshi S. Measurement of Right Atrial Volume and Diameters in Healthy Nepalese with Normal Echocardiogram. *Kathmandu Univ Med J* 2014;46(2):110-2.

## ABSTRACT

### Background

The size of right atrium is expected to be different in diverse healthy ethnic groups. It is important to know the normal size of right atrium in our healthy population.

### Objective

The study aimed to find out the normal values of right atrial volume, right atrial short axis diameter and right atrial long axis diameter in healthy Nepalese population with normal echocardiographic findings. It also looked at correlations between right atrial dimensions and the right atrial volume.

### Method

Verbal consent was taken from all the participants. One hundred participants between the age of 18 and 60 years with normal echocardiographic findings and without any chronic disease were included in this study. Right atrial volume was measured by using area length method. Right atrial short axis diameter and Right atrial long axis diameter were measured in the four chamber view.

### Result

The mean right atrial volume was 23.64±5.36 ml (range 11.30 - 40.00 ml). The range of right atrial short axis diameter and right atrial long axis diameter were 1.34-3.80 cm and 2.4-4.7 cm respectively.

### Conclusion

The size of right atrium in the Nepalese population is smaller compared to western population. Male right atrial volume size is greater than female in Nepalese population similar to western population. The findings of normal value of right atrial volume and right atrial diameter in Nepalese population will help the physician to assess patients with various conditions affecting the right atrium.

## KEY WORDS

*Nepalese population, right atrial short axis diameter, right atrial long axis diameter, right atrial volume.*

## INTRODUCTION

Numerous medical conditions can produce enlargement of right atrium (RA). Literature on the measurement of right atrial size is sparse. To our knowledge, there are no studies about the normal values of measurement of right atrium in the Nepalese population. The present study has been carried out to find out the normal dimensions and volume of right atrium in the Nepalese population.

Right atrium, which receives venous blood from the

superior and inferior vena cava, is also a site for sinoatrial node. The Eustachian valve is located at the junction of the inferior vena cava and the right atrium. Rarely, it extends to insert on the inter-atrial septum and must be distinguished from cor triatum dexter.<sup>1</sup> Patients with chronic cor pulmonale are found to have enlarged right atrium.<sup>2</sup> Rheumatic or congenital tricuspid stenosis, atrial septal defect, Ebstein's anomaly and endomyocardial

fibrosis are some of the clinical conditions associated with enlarged right atrium.<sup>3-6</sup> The presence of a small ventricle with obliteration of the apex and large atrium shown on two dimensional echocardiography is highly suggestive of endomyocardial fibrosis.<sup>7,8</sup>

The assessment of right atrial size is important in clinical practice to assess RA size in diseases associated with RA enlargement. Normally the size of right atrium is similar to left atrium. The atrial size is believed to be smaller than their respective ventricle. Presently the size of the right atrium is assessed just by visual impression.

This study is expected to help physicians in diagnosing enlargement of right atrium in Nepal.

## METHODS

This is a hospital-based cross sectional study carried out at Department of Internal Medicine, Kathmandu Medical College Teaching Hospital, Kathmandu, Nepal in which a total of 100 participants attending Kathmandu Medical college teaching hospital between June and December 2013 for various medical problems and having normal echocardiogram were enrolled in this cross sectional study. Participants having a history of chronic medical illness and any abnormal echocardiographic finding were excluded. Weight in kilogram, height in centimeter, Body Mass Index in kg/m<sup>2</sup>, and Body Surface Area in square meter were recorded. Right atrial volume (RAV) in milliliter, right atrial short axis diameter (RASAD) and right atrial long axis diameter (RALAD) in centimeters were measured by echocardiographic machine, Medison SA 9900. The volume of the right atrium was obtained in end systole from the area length method from the apical four chamber view. The short and long axis diameters of the right atrium were measured during the end of diastolic phase.

SPSS version 20 was used for data entry. Range, mean and standard deviation were computed to describe the characteristics of data. Pearson correlation was used to measure relationship between right atrial diameter and right atrial volume. Verbal consent from the study group was taken. The maximal long axis distance of the right atrium was taken from the centre of tricuspid annulus to the centre of the superior RA wall. The RA minor axis distance was measured from the mid level of the RA free wall to the interatrial septum.

## RESULTS

Thirty nine percent of the subjects were male and sixty one percent were female. The minimum and maximum age of the study group was 18 and 60 years respectively. The mean age was 39.38 ± 11.70 years (males: 39.9 ± 11.55, females: 39.1 ± 12.35). The mean, SD and range for RAV, RASAD, RALAD and RAV to BSA are summarized in Table 1. RA volume of male is greater than female (p-value 0.04). Similarly RASAD of male is more than female (p-value 0.03).

**Table 1. Right atrial volume, Right atrial short axis diameter, Right atrial long axis diameter in the study population.**

		Both Sex	Male	Female	P – value
Right atrial Volume (ml)	Mean ± SD	23.64± 6.36	27.26± 6.40	24.56± 5.97	0.04
	(range)	(11.30-40.00)	(14.70-40)	(11.30-37.70)	
RA short axis diameter (cm)	Mean ± SD	2.82± 0.47	2.94± 0.45	2.73± 0.45	0.03
	(range)	(1.34-3.80)	(1.66-3.80)	(1.34-3.80)	
RA long axis diameter (cm)	Mean ± SD	3.59± 0.49	3.60± 0.46	3.58± 0.51	0.81
	(range)	(2.4-4.7)	(2.60-4.70)	(2.40-4.70)	
RAV/body surface area	Mean	16.26± 3.9	16.58± 3.25	16.04± 3.77	0.51
	(range)	(26.30-7.41)	(25.03-8.16)	(26.30-7.41)	

## DISCUSSION

The study measured right atrial dimensions in otherwise echocardiographically healthy sample of Nepalese population. Right atrium is expected to be slightly larger than the left atrium because it receives blood from the whole body whereas left atrium receives blood only from the lungs.

Various studies have reported different right atrial dimensions in different populations. In comparison, the right atrial dimension reported in our study is smaller. The smaller size of right atrium in the Nepalese population compared to western population may be due to ethnical difference. According to a study by Y. Wang et al, the right atrial volume from the apical four chamber view has been found to be 39±12 ml in men and 27±7 ml in women in American population.<sup>9</sup> Correlation between atrial volume and age was not found in Y. Wang et al study. According to the Mayo clinic manual of Echocardiography, the normal right atrial short axis diameter in both genders is 2.9 - 4.5 cm and left atrial volume 22±6 ml/m<sup>2</sup>. According to the guidelines for echocardiographic assessment of the right heart in adults by American Society of Echocardiography, the upper reference limits are set for RA minor and major axis dimensions at 4.4 and 5.3 cm respectively at end diastole.<sup>10</sup> In our study, the minor and major axis dimensions of the right atrium were found to be 2.82±0.47 cm and 3.59±0.49 cm respectively. The range of right atrial short axis and long axis diameters were 1.34-3.80 cm and 2.4 -4.7 cm respectively.

The minor axis dimension in male and female has been divided as, mildly abnormal (4.6-4.9 cm), moderately abnormal (5-5.4 cm) and severely abnormal (≥5.5 cm).<sup>11</sup> Mean values for right atrial short axis and long axis

measurements were found to be greater in right ventricular volume overload patients than in normal:  $6.5 \pm 0.3$  vs  $3.6 \pm 0.1$  cm and  $6.0 \pm 0.3$  vs.  $4.2 \pm 0.1$  cm respectively.<sup>12</sup> Measurements of right atrial and right ventricular size by 2-D echocardiography readily distinguish normal patients from those with right ventricular volume overload.<sup>12</sup> Study on atrial volume in a normal adult population has revealed Right Atrial volume  $39 \pm 12$  ml in non-athletic men and  $27 \pm 7$  ml in women.<sup>9</sup> The measurements of Right atrial volume and dimensions were smaller in the our study compared to the measurements by other workers quoted above and the difference was statistically significant.

In the present study, the upper limit of right atrial volume in both genders was 40 ml ( $23.64 \pm 5.36$  ml). The upper limit of Right Atrial volume in male and female were 40 ml ( $26.75 \pm 6.65$ ) and 37.70 ml ( $23.82 \pm 5.6$ ) respectively. The upper limit of RASAD in male and female were 3.80 cm ( $2.94 \pm 0.45$ ) and 3.80 cm ( $2.73 \pm 0.45$ ) respectively. The upper limit of RALAD in male and female were 4.70 cm ( $3.60 \pm 0.46$ ) and 4.70 cm ( $3.58 \pm 0.511$ ) respectively. The indexed Right Atrial volume in male and female were ( $16.56 \pm 3.95$ ) ml/M<sup>2</sup> and ( $16.04 \pm 3.77$ ) ml/M<sup>2</sup> respectively. Limited data on a small number of healthy individuals has revealed that indexed right atrial volumes are similar to left atrial normal values in men (21 ml/m<sup>2</sup>) but appear to be slightly smaller in women.<sup>9</sup>

## REFERENCES

1. Yavuz T, Nazli C, Kinay O, Kutsal A. Giant Eustachian valve with Echocardiographic appearance of divided right atrium. *Tex Heart Inst* 2002;29(4):336.
2. Thakker RM, Mundhra S, Upadhyay G, Shah RB, Shah AM. Chronic cor-pulmonale: the experience of a tertiary care teaching hospital in Gujarat. *International Journal of Medical Science and Public Health*, [cited September 11, 2014]; Online First: 27 Aug, 2014. doi:10.5455/ijmsph.2014.270820141.
3. Medd WE and Kinmonth JB. Congenital Tricuspid Stenosis. *Br Med J* 1962;1(5278):598-600.
4. Geva T, Martins JD, Wald RM. Atrial septal defects. *Lancet* 2014 May 31;383(9932):1921-32.
5. Attenhofer Jost CH, Connolly HM, Edwards WD, Hayes D, Warnes CA, Danielson GK. Ebstein's anomaly - review of a multifaceted congenital cardiac condition. *Swiss Med Wkly* 2005;135(19-20):269-81.
6. Santra G, Sinha PK, Phaujdar S, De D. Right ventricular endomyocardial fibrosis. *J Assoc Physicians India* 201;60:63-5.
7. Berenshtein CS, Pifiero D, Marcotegui M, Brumoldi R, Blanco MV, Lerman J. Usefulness of echocardiography and Doppler echocardiography in endomyocardial fibrosis. *J Am Soc Echocardiogr* 2000;13(5):385
8. Hassan WM, Fawzy ME, Alltelaly S, Hegazy H, Malik S. Pitfalls in diagnosis and clinical, Echocardiographic haemodynamic findings in endomyocardial fibrosis: a 25 year experience. *Chest* 2005;128(6):3985.
9. Wang Y, Gautman JM, Heilbron D, Wahr D, Schiller NB. Atrial volume in normal adult population by two dimensional echocardiography. *Chest* 1984;86(4):595-601.
10. Lawrence G et al. Guidelines for the Echocardiographic Assessment of the Right Heart in Adults. A report from the American Society of Echocardiography. *J Am Soc Echocardiogr* 2010;23:685-713.
11. OH JK, Seward JB, Tajik AJ. The Echo Manual. 3<sup>rd</sup> edition. Philadelphia: Lippincott Williams and Wilkins; 2006.
12. Bommer W, Weinert L, Neumann A, Neef J, Mason DT, De Maria A. Determination of right atrial and right ventricular size by two dimensional echocardiography. *Circulation* 1979;66:91-100.
13. Whitlock M, Garg A, Gelow J, Jackson T, Broberg C. Comparison of left and right atrial volume by Echocardiography versus Cardiac Magnetic Resonance Imagery using the Area-length method.
14. Do DH, Therrien J, Marrelli A, Martucci J, Sebaq IA. Right Atrial size relates to right ventricular end diastolic pressure in an adult population with congenital heart disease. *Echocardiography* 2011; 28(1):109-16.

Echocardiography consistently underestimated the atrial volumes compared to Cardiac Magnetic Resonance Imaging using the area length method.<sup>13</sup> Right atrial size measured by echocardiography is strongly correlated to invasive parameters of right ventricular diastolic filling and predicts high right ventricular end diastolic pressure.<sup>14</sup>

## Limitation

Subjects having various complaints but with normal echocardiographic finding were included in the study. Normal healthy population would have been ideal but was not feasible in the Nepalese context as asymptomatic population do not usually undergo health screening. Sampling may also be considered limited in terms of size and inclusion of different sub-groups of Nepalese population according to ethnic groups and geographical regions.

## CONCLUSION

The study provides normal range of right atrial dimension for Nepalese population. The study also shows that measurement of right atrial volume and dimensions is possible during routine echocardiographic examination. The upper limits of the normal values of right atrial study could be very helpful in clinical practice.