Indian Journal of Basic and Applied Medical Research; March 2020: Vol.-9, Issue- 2. P. 369-378
DOI: 10.36848/IJBAMR/2020/12215.51435

Original Article

Do we use appropriate size blood pressure air cuff? Descriptive study

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Abstract:

Introduction: Prevalence of obesity and Hypertension are rapidly increasing. Use of too small cuffs that don't encircle the arm properly leads to recording of high blood pressure [(1)]. British Hypertension Society (BHS) in 2004[(2)] & American Heart Association (AHA) in 2005[(3)] have come out with new recommendations for BP Air Cuffs to be used in different range of Mid Upper Arm Circumference. So this study aimed to find out awareness & Use of appropriate BP Air cuff among doctors, availability and sizes of different cuffs and their appropriateness to majority of our population.

Materials & Methods: Standardized Questionnaire, Stadiometer, Electronic weighing scale & Inch tape to measure Mid Upper Arm Circumference.

Results: Only 13% of doctors were aware of the BP cuff bladder size they use; 21% of doctors knew that the bladder has to encircle 80% of MUAC. The BP cuff supplied with BP instruments at present is of appropriate size only for 27% of our population and one need to buy an Adult BP cuff size as per AHA recommendation which is not readily available, to cater to the rest. If one has to cover the majority with single cuff the standard adult cuff as specified by British Hypertension Society will be the answer, being of appropriate size for 84% of our population but not at all available in our country. The manufacturer's recommendation for BP Cuffs use in MUAC range is not in concordance with either AHA or BHS recommendation.

Conclusion: Doctors have to update and Authors of Practical Physiology & Manual of Clinical Medicine books have to update and provide complete information on simple but essential and most important skills like recording of BP to provide better health care & to avoid iatrogenic illnesses.

Key words: Appropriate BP cuff, American Heart Association, British Hypertension Society.

Introduction:

India with 1.2 billion people is the second most populous country in the world and is currently experiencing rapid epidemiological transition from under nutrition due to poverty which dominated in the past for centuries being replaced by obesity associated with physical inactivity, life style changes and over eating / eating calorie rich food due to industrialization & urbanization within the past few decades and the prevalence of obesity is 24.6% in Tamil Nadu. [(4)]. No doubt obesity is a modifiable risk factor for Hypertension. But studies have proved that when a regular cuff is used rather than appropriate large cuff in moderately obese subjects (AC 33- 41 cm) 37% of those found to be hypertensive were actually normotensive[(5)]. Blood pressure being one out of four vital signs is recorded almost on all patients yet it is most inaccurately performed procedure in clinical medicine[(3)]. The most important and easily avoidable source of error in sphygmomanometry is design of the cuff and

variations obtained with arm circumference & cuff width [6]. Appropriate cuff selection is important whether measurements are made with Gold standard manual Mercury or Mercury free sphygmomanometer or Automated Oscillometric Digital BP Instruments. Recognizing this fact the British Hypertension Society in 2004[2] & American Heart Association in 2005[3] have come out with new recommendations that an appropriate BP cuff's bladder should encircle 80% of Mid Upper Arm Circumference of the individual. Though more than a decade since new recommendation have been made first year practical Physiology books and Manuals of Clinical Medicine except Macleod's Clinical Examination [7] don't state this fact and no book gives the recommended Cuff size for different MUAC range except Manual of Practical Medicine by R Alagappan[8] that gives a table but not updated from 2002; Macleod's Clinical Examination clearly states that " The bladder should encircle 80% to 100% of the arm. In obese patients with large arms a normal sized cuff of 12.5x 23 cm will over estimate BP and using too large a cuff produces only a small under – estimation of BP (2-3mm in systolic BP)'. Renowned BP instrument manufacturer since 1965 – Diamond company manufactures apart from regular cuff, a cuff with longer wrapping cloth allowing comfortable use in obese individual so that it doesn't gets loosened on inflation but not with different & large bladder size. All is not dark, for companies like Happy hearts & Omron have come up with increased bladder sized cuffs for Manual & Digital BP instruments respectively though the specification for which MUAC range meant by manufacture is not as per AHA or BHS recommendations.

Aim & objectives:

- Assess awareness & Practice among Doctors on use of appropriate BP cuff size.
- To find out percentage of our sample population in Theni for whom the regular BP cuff size supplied with BP instrument is appropriate
- To find out a cuff size and / or a complementary cuff size which if available in addition to regular cuff, will be appropriate for majority of our population.

Materials & Methods:

After obtaining institutional ethical committee clearance this descriptive study was conducted among 100 doctors in TamilNadu after getting signed consent, using a structured questionnaire over two month and by visiting web sites & stores selling Surgical and Medical Equipments to know regular cuff supplied with BP instruments & different cuff sizes available as accessories.

Mid Upper Arm Circumference was measured along with height & weight measurements for 52 males & 52 females aged more than 18 year using high quality flexible tape calibrated in Centimetre in who are not suffering from any illnesses that may affect MUAC by oedema and loss of weight after obtaining consent.

Inclusion Criteria: Aged 18 and above not suffering from any illnesses listed in exclusion criteria

Exclusion Criteria: Subjects who do regular fitness Exercises involving upper arm, manual workers who lift heavy weights regularly like load man, Construction labourers, those on medication like NSAIDS, HIV drugs, Diuretics, Suffering from Vomiting, Diarrhoea, Fever, Diabetics, Hypo or Hyperthyroidism, Cushing's disease, Addison's Disease, severe Anaemia, Renal Failure, Cardiac Failure, Liver Failure, Psychiatric Illnesses, Preeclampsia & Pregnant women in third trimester were excluded.

Statistical Analysis:

Data was tabulated, analyzed and results in percentage are being discussed.

Results & Observations:

Though about 86% of doctors were aware that in different sizes of Air cuffs dimensions of both bladder and wrapping cloth varies only 70% knew that use of inappropriate BP cuff will lead to high and low pressure with smaller and larger cuff respectively. Only 13% of doctors had noted the bladder size in the cuff they are using regularly. Only 28% of doctors had updated their knowledge on appropriate cuff size

The small adult size cuff supplied with BP instrument is apt for only 27% of our population; for 71% it will lead to recording of higher BP.

The regular small adult cuff (as per AHA recommendation) supplied with standard BP instruments is apt for 27% of our population only & we need to buy one Adult cuff as accessory which is not readily available

Standard Adult Cuff size as per BHS guidelines is apt for 84% of our adult population

Table 1: Age Groups of Patients Cared

Group	Age Group	Doctors catering their service	
		No	%
1	<1	26	26
2	1<18	46	46
3	18<60	74	74
4	>60	31	31
So far never practiced			2
Only infants			1
Up to 18			21
>1 to 18			15
Adults			74
Only more than 60			1
18 – 85			45
All age groups			11

Table 2: Duration of Practice

Group	Years of Practice	
	Years	Frequency & %
1	0<4	26
2	4<7	35
3	7<10	12
4	>10	25
5	Never practiced	2

Table 3: **Number of Years in Govt Service**

Groups	No of Years in Govt Service	No & % 0f Participants
1	<4	31
2	4<7	16
3	7<10	10
4	>10	35
5	Not in service	8

Table 4: **Knowledge, Attitude & Practice**

S. No	Knowledge on	No & % of participants who knew
1	Bladder size in the Air cuff supplied with Mercury BP Apparatus is 12x22cm	13
2	In Different Sizes of Riva Rocci Cuff both Air bladder & Wrapping cloth size should vary	86
3	Use of small bladder sized BP cuff than recommended size will record higher pressure	69
4	Use of large bladder sized BP cuff than recommended size will record lower pressure	67

Table 4: Continued

S. No	Knowledge & Attitude on	Response	%
1	% of MUAC that appropriate Air Bladder should cover is	60%	28
		70%	28
		80%	21
2	Large Adult cuff	I have	10
		I don't get adult patients	14
		I didn't think it affects recorded value in obese individuals	32
		Tried to purchase but not available in the market	32

Table 5: **MUAC Study population statistics**

	Height in meters	Weight in KG
No Valid	104	104
No missing	0	0
Mean	1.6376	63.69
Median	1.63	64
Mode	1.56	64
Std Deviation	0.093	12.072
Minimum	1.44	40
Maximum	1.85	87

Table 6: **Percent of Sample Population in MUAC Groups as Per AHA Recommendation:**

MUAC Group	MUAC in CM	Name & Cuff Size	Within Female		Within male		Total	
			Frequency	Percent	Frequency	Percent	Frequency	Percent
1	22-26 cm	Small Adult 12x22	16	30.8	12	23	28	**26.9**
2	27-34 cm	Adult 16x30	34	65.4	40	76.9	74	71.2
3	35 – 44 cm	Large Adult	2 16x36	3.8	0	0	2	1.9
		Total	52	100	52	100	104	100

*The small adult size cuff supplied with BP instrument is apt for only 27% of our population; for 71% it will lead to recording of higher BP.

Table 7: Percent of Sample Population in MUAC Group As Per British Hypertension Society Recommendation

MUAC group	Cm	Name & cuff size	Within female		Within male		Total	
			Frequency	Percent	Frequency	Percent	Frequency	Percent
1	<23	Small Adult / Child 12x18	6	11.54	5	9.62	11	10.58
2	23-33	Standard Adult 12x26	41	78.85	46	88.46	87	**83.65**
3	>33 – <50	Large Adult 12x40	5	9.62	1	1.9	6	5.77
		Total	52	100	52	100	104	100

* Standard Adult Cuff size as per BHS guidelines is apt for 84% of our adult population; but that sized cuff is not at all available in India

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Table 8: Available Air Bladder Sizes with Bp Instruments for Clinic Use Vs % MUAC Group as Per American Heart Association Recommendation

Type of BP Instrument	Name as per AHA	Air Bladder Size in cm	MUAC GROUP as per AHA guidelines in cm	Name as per Manufacturer & guideline For use in MUAC in cm	Frequency & % of sample population it is apt for			
					F	M	T	%
1. Manual – Mercury & Mercury Free Sphygmomanometer &	Small Adult	12x22	22-26	Not mentioned	16	12	28	**26.9**
2. Digital _- Oscillometric	Small Adult	10x22CM	No such size as per BHS too	22-32				
Happy Hearts – Double tube Large Adult BP Air cuff – Accessory part	Adult Cuff	15x32	27-34	Large Adult BP Cuff 32-42	34	40	74	71
Omron –L - Digital - Oscillometric	Adult Cuff	15x30	27-34	Large Adult BP Cuff 32-42				

- For two females MUAC measurement was 35Cm; but yet 30 cm is 80% of 36 cm.

*With the regular small adult cuff (as per AHA recommendation) supplied with standard BP instruments is apt for 27% of our population only & we need to buy one Adult cuff as accessory which is not readily available

Discussion:

Out of hundred participants 77% had answered any one out of the three options - 60% or 70% 0r 80%. Only those 21 who had answered as 80% have probably updated their knowledge or remembered what has been given in Macleods Clinical Examination book. But those who answered as 60 & 70% also have remembered what Practical Physiology books / Physiologists taught them or guessed approximately as they are frequently using BP instruments

10% of our doctors have answered that they own large cuff. But on further enquiry all 10 have only a cuff different from regular by length of wrapping cloth not by bladder size.

There seems to be a mismatch of data as 32 doctors have responded that they tried to purchase but large cuff is not available in the market and 10 were thinking that they have appropriate cuff to cater for their obese patients totalling 42 but around 70% only know that regular cuff will record higher BP. The mismatch is due to those

who found difficulty during sphygmomanometry due to wrapped Air Cuff layers getting separated from velcro attachment on inflating the cuff or not able to secure it snugly after inflation of Cuff has been started. On analysing the answers, it was found that Anaesthetists, Physicians, Paediatricians & Cardiologists & Postgraduates were better aware of the fact that 80% of MUAC has to be covered by the bladder but many of them too were not aware of the bladder size of regular cuff supplied with BP instruments indicating the urgent need for continuing medical education for practicing doctors in service too on basic medical techniques also.

What if subjects with normal BP are treated with antihypertensive agents? Does it demand so much of outcry?

Yes. Apart from unnecessary economical burden imposed, the adverse effects of first line antihypertensive agent Thiazide diuretics leads to impaired carbohydrate tolerance, hyperlipedemia, hyponatremia, weakness & fatigability; Beta blockers block physiological response of body to raise blood sugar levels and fatigue which can lead to eating instead of using stored energy and so weight gain[9]. It can also lead to mild persistent hypotension resulting in fatigue, weakness, lethargy& depression(10). Hypotension may stimulate feed - back regulation of BP by Renin – Angiotensin – Aldosterone Mechanism physiologically and there is a possibility of the subject being stamped as non responder / resistant hypertension patient and tried with more potent nti hypertensive drugs and antidepressants too perpetuating and aggravating obesity too by physical inactivity and over eating.

Limitations: Sample size of both doctors and general population is small

Scope: The author is planning to propagate the results of this study through various Forums

- To organize a multi centre study on larger samples and submit the results to ICMR for recommendation to Government to formulate regulation to bring appropriate changes in the Air Cuff size supplied with BP Instruments
- To organize Continuing Medical Education for doctors on ‘Sphygmo manometry’

Conclusions:

Doctors didn’t update their knowledge on use of Appropriate Air cuff size and Basic books don’t give adequate information on different sized adult BP cuffs and MUAC for which they should be used; moreover only recently large adult cuffs are marketed at internet web site. Hence they didn’t bother to know size of Air cuff supplied with BP instrument that they so frequently use though they knew (70%) that use of small than appropriate cuff will lead to recording of higher BP & they didn’t attempt to buy large adult cuff.

Though 70% doctors knew that in different sized BP Cuffs both the Air Cuff and wrapping cloth size should vary, they didn’t try to purchase large Air Cuffs & those 10 doctors who thought they had large cuff didn’t note that in their large Air cuff only the wrapping cloth was longer.

The manufacturer’s recommendation for use in MUAC range is not in concordance with either AHA or BHS recommendation .Air cuff sizes as recommended by BHS is not available in India though the Adult cuff as per specification of BHS is appropriate for >84% of our population.

Technical support: Professor & HOD Dr N Ethiya , Dr K Ganesh, Dr U Kalpana Rani, Dr M Vijayalakshmi, Dr M Usha Rani & Ms S Dhana Lakshmi of Department of Physiology, & Professor & HOD Dr M Saleem, Dr M Thiruvenkadam, Dr S V Saranya, Dr A M Veerakumar & Dr V Ram Prabhakar of Department of Social and Preventive Medicine, Govt Theni Medical College, Theni.

Acknowledgement:

I, Dr S Nalini solemnly assure that the information given above is true to my knowledge, the study is original work of the author and the same was not published in any other journal or presented at any meeting.

Questionnaire:

Your patients are in the age group of (more than one option shall be ticked)

a. ≤ 1 yr b. 2-18 yr c. >18-60 d. >60

Tick number of year you are practicing –

a. 1-4 b. 5-7 c. 8-10 d. >10

Tick number of year you are in Service –

a. 1-4 b. 5-7 c. 8-10 d. >10

1. The size of the Adult Air Cuff supplied with Mercury Sphygmomanometer is

a. 12x22 cm b. 16x30 cm c. 16x36 cm d. 16x42 cm

2. In different cuff sizes changes will be in length and breadth of

a. Air Bladder b. wrapping cloth c. Both d. None

3. The cuff width should be not less than ----------% of Mid Upper Arm Circumference

a. 50% b. 60% c. 70% d. 80%

4. Use of small cuff than recommended size will lead to recording of ----------BP (Low, same or High BP as recorded with appropriate BP cuff)

5. Use of large cuff than recommended size will lead to recording of ----------BP

(Low, same or High BP as recorded with appropriate BP cuff)

6. Do you have large adult cuff / if no what is / are the reason/s

a. I don't get adult patients at all

b. I treat adult patients but I did not think it is essential as I am /was of opinion that obese individual do not need special / large cuff

c. Tried to purchase but not available in the market

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Date of Submission: 29 January 2020
Date of Peer Review: 27 February 2020
Date of Acceptance: 21 March 2020
Date of Publishing: 30 March 2020
Author Declaration: Source of support: Nil, Conflict of interest: Nil
Ethics Committee Approval obtained for this study? YES
Was informed consent obtained from the subjects involved in the study? YES
For any images presented appropriate consent has been obtained from the subjects: NA
Plagiarism Checked: Urkund Software

DOI: 10.36848/IJBAMR/2020/12215.51435