

https://dspace.org/

The accuracy of blood pressure devices in paediatric renal outpatients

Mwandla, Nokukhanya Swazi

2016

http://hdl.handle.net/10539/23191

Downloaded from a DSpace repository. https://dspace.org/

THE ACCURACY OF BLOOD PRESSURE DEVICES IN PAEDIATRIC RENAL OUTPATIENTS

Nokukhanya Swazi Mwandla

Student number: 699539

Supervisor: Prof U Kala

A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Medicine in the branch of Paediatrics

Johannesburg, 2016

DECLARATION

I, *Nokukhanya Swazi Mwandla*, declare that this research report is my own work. It is being submitted for the degree of Master of Medicine in the branch of Paediatrics in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

……N.S Mwandla……

……1st …… day of ……September……, 2016

Dedicated to my sister

Nosiphiwe Thabisile Mwandla

1990- 2013

ABSTRACT

Purpose

The purpose of this study is to determine accuracy of aneroid and automated machines versus the mercury gold-standard in blood pressure (BP) determination. Childhood hypertension is an important condition that is most often secondary hypertension. The accurate measurement of BP is imperative.

Methods

94 paediatric renal outpatients had BP taken in a random order with Welch Allyn aneroid, Dinamap Pro 100 and Omron HEM 907 manometers. The BP was compared to a mercury manometer. 2 observers obtained the manual device readings simultaneously but blindly to each other. Inter-device differences were used to validate the devices by two international standards.

Results

The aneroid manometer overestimates SBP and DBP. The Dinamap Pro 100 overestimates SBP and underestimates DBP. The Omron HEM 907 was accurate for SBP, but overestimates DBP.

Conclusion

Abnormal oscillatory BP readings need confirmation using manual methods. Further studies are needed to determine accuracy of the aneroid manometer.

ACKNOWLEDGEMENTS

I would like to thank Prof Kala for his supervisory role.

I would also like to thank the management of Chris Hani Baragwanath Academic Hospital for granting permission to perform the study at paediatrics outpatient renal clinic and to use hospital equipment for the study.

TABLE OF CONTENTS

		Page
DECLARATION		ii
DEDICATION		iii
ABSTRACT		iv
ACKNOWLEDGEMENTS		v
TABLE OF CONTENTS		vi
LIST OF FIGURES		viii
LIST OF TABLES		ix
NOMENCLATURE		x
PREFACE		xi
1.0	**INTRODUCTION**	**1**
	1.1 Definitions	**2**
	1.2 Blood pressure measurements	**2**
	1.2.1 Importance	2
	1.2.2 Indications	3
	1.2.3 Blood pressure devices	4
	1.2.3.1 Mercury sphygmomanometer	4
	1.2.3.2 Automated devices	5
	1.2.4 Validation protocols	5
	1.2.4.1 BHS and AAMI protocols	5
	1.3 Current evidence	**8**
	1.4 Study aims and objectives	**10**
2.0	**METHODS**	**11**
	2.1 Study design	**11**
	2.2 Sample population	**11**
	2.3 Data collection	**12**
	2.3.1 Randomisation	16
	2.4 Data analysis	**16**
	2.4.1 Inter-observer reliability	17
	2.4.2 Device agreement	17
	2.4.2.1 Bland-Altman plots	18
	2.4.3 BP analysis in ranges	18
3.0	**RESULTS**	**20**
	3.1 Population characteristics	**20**
	3.2 Inter-observer agreement	**20**
	3.3 Inter-device evaluation	**22**
	3.3.1 Correlation and regression	23
	3.3.2 BP analysis in ranges	26
4.0	**DISCUSSION**	**30**

5.0 CONCLUSIONS **34**

REFERENCES 36

APPENDIX A: TURNIT IN REPORT 39

APPENDIX B: DATA COLLECTION SHEET 40

APPENDIX C: ETHICS CLEARANCE CERTIFICATE 41

APPENDIX D: PLAGIARISM DECLARATION 42

LIST OF FIGURES

Figure		Page
2.1	Photograph of Dinamap Pro 100	14
2.2	Photograph of Omron HEM-907	15
2.3	Photograph of Welch Allyn aneroid manometer	15
3.1	Disease profile of study participants	21
3.2	Bland-Altman plot of differences in SBP and DBP measurements between aneroid and mercury sphygmomanometer	28
3.3	Bland-Altman plot of differences in SBP and DBP measurements between Dinamap Pro 100 and mercury sphygmomanometer	28
3.4	Bland-Altman plot of differences in a) SBP and b) DBP measurements between Omron Pro100 and the standard mercury sphygmomanometer	29

LIST OF TABLES

Table		Page
1.1	Causes of childhood hypertension	3
1.2	Revised British Hypertension Society grading criteria	8
3.1	Study population characteristics	21
1.4	Inter-observer comparison	20
3.3	Inter-device comparison of BP measurements	25
3.4	Observer 2 Systolic blood pressure and Diastolic blood pressure values	26
3.5	Analysis by range of BP	27

NOMENCLATURE

AAMI	Association for the Advancement of Medical Instrumentation
AKI	Acute kidney injury
BHS	British Hypertension Society
BP	Blood pressure
DBP	Diastolic blood pressure
ESH	European Society of Hypertension
FSGS	Focal segmental glomerulosclerosis
HIV	Human immunodeficiency virus
PUJ	Pelvi-ureteric junction
PUV	Posterior urethral valves
RTA	Renal tubular acidosis
SLE	Systemic lupus erythematosus
UTI	Urinary tract infection
VUR	Vesico-ureteric reflux
SBP	Systolic blood pressure
SD	Standard deviation

DEFINITIONS

Manual device	Aneroid and/ or mercury sphygmomanometer
Oscillometric device	Dinamap and/ or Omron BP machine

PREFACE

Which blood pressure monitor is the perfect replacement for the gold-standard mercury device? Mercury sphygmomanometers are heavy to carry and pose a potential hazard in paediatric wards and outpatient clinics. The hospital is teeming with automated machines, such that these are used without positive scientific validation.

The purpose of this study is to be part of the solution. I chose to perform this prospective study due to paucity of device validation in Africa.

This report is targeted toward the South African doctor and medical student. There are many unanswered and unasked questions. One needs to question efficacy and validity. Make a difference.

I would like to thank the young study participants, for their willingness. Those that agreed to participate handled the process with such grace. I thank the second observer, Ms Kolatsoeu, for giving of her time and expertise and, most importantly, my supervisor for expert guidance.