REPUBLIC OF CAMEROON
PEACE-WORK-FATHERLAND

MINISTRY OF HIGHER EDUCATIO

THE UNIVERSITY OF YAOUNDE

FACULTY OF MEDICINE AND BIOMEDICAL SCIENCES

REPUBLIQUE DU CAMEROUN
PAIX-TRAVAIL-PATRIE

MINISTERE DE L'ENSEIGNEMENT SUPERIEUR

UNIVERSITE DE YAOUNDE I

FACULTE DE MEDECINE ET DES SCIENCES BIOMEDICALES

DEPARTMENT OF OBSTETRICS AND GYNECOLOGY

THE IMPORTANCE OF REMOTE AUTO BLOOD PRESSURE MEASUREMENT IN THE SURVEILLANCE OF CASES OF PREECLAMPSIA/ECLAMPSIA DURING THE POSTPARTUM

Thesis written and defended publicly in partial fulfillment of the requirements for the award of Medical Doctor (MD) degree by;

NDANGOH PETER NANJOH JUNIOR

17M060

SUPERVISOR

Prof. MBU Robinson Enow

Professor of Obstetrics and Gynecology

Co-SUPERVISOR

Dr. EBONG Clifford

Senior lecturer of Obstetrics and Gynecology

Academic year 2023-2024

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DEDICATION

In the lovely memory of Chief KAKA ESOWE Daniel

And

To my beloved NANJOH'S Family

ACKNOWLEDGEMENTS

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- All those who accepted to participate on this study, for trusting us about your health.

ADMINISTRATIVE AND TEACHING STAFF OF THE FACULTY OF MEDICINE AND BIOMEDICAL SCIENCES

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Dean: Pr. NGO OUM Esther epse MEKA

Vice-Dean in charge of programming and monitoring academic activities: Pr. NTSAMA ESSOMBA Claudine Mireille

Vice-Dean in charge of Students' records, follow-up, and statistics: Pr. NGANOU Chris Nadège épouse GNINDJIO

Vice-Dean in charge of Co-operation and Research: Pr. ZEH Odile Fernande

Director of Academics, Student records and Research: Dr VOUNDI VOUNDI Esther

Director of Administrative and Financial Affairs: Mme ESSONO EFFA Muriel Glawdis

General Coordinator of the Specialization Cycle: Pr NJAMNSHI Alfred KONGNYU Pierre

Chief of service, Finance: Mr Mme NGAMLI NGOU Mireille Albertine épouse WAH Valentin

Deputy Chief of service, Finance: Mme MANDA BANA Marie Madeleine épouse ENGUENE

Chief of service, Administration and Personnel: Pr. SAMBA Odette NGANO ép. TCHOUAWOU

Chief of service, Certifications: Mrs ASSAKO Anne DOOBA

Deputy chief of service, Certifications: Dr NGONO AKAM MARGA Vanina

Chief of service, Student records and statistics: Mme BIENZA Aline

Deputy Chief of service, Student records and statistics: Mrs FAGNI MBOUOMBO AMINA ép. ONANA

Chief of service, Equipment and Maintenance: Mrs HAWA OUMAROU

Deputy Chief of service, Equipment and Maintenance: Dr NDONGO née MPONO EMENGUELE

Interim Chief Librarian: Mrs FROUISSOU née MAME Marie-Claire

Stores Accountant: Mr MOUMEMIE NJOUNDIYIMOUN MAZOU

2. PROGRAM AND SPECIALTY TRAINING COORDINATORS

Coordinator, Oral Medicine: Pr. BENGONDO MESSANGA Charles

Coordinator, Pharmacy: Pr. NTSAMA ESSOMBA Claudine

Coordinator, Intern Specialization Cycle: Pr. ONGOLO ZOGO Pierre

Coordinator, Specialization in Morbid Anatomy/Pathology: Pr. SANDO Zacharie

Coordinator, Specialization in Anesthesia and Critical Care: Pr. ZE MINKANDE Jacqueline

Coordinator, Specialization in General Surgery: Pr. NGO NONGA Bernadette

Coordinator, Specialization in Gynecology and Obstetrics: Pr DOHBIT Julius SAMA

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Coordinator, Specialization in Pediatrics: Pr. MAH Evelyn MUNGYEH

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Coordinator, Post-Graduate Education Program: Pr. KASIA Jean Marie

CESSI Pedagogic Manager: Pr. ANKOUANE ANDOULO Firmin

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Pr. MONEKOSSO Gottlieb* (1969-1978)

Pr. EBEN MOUSSI Emmanuel (1978-1983)

Pr. NGU LIFANJI Jacob* (1983-1985)

Pr. CARTERET Pierre (1985-1993)

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Pr. SOSSO Maurice Aurélien (1993-1999)

Pr. NDUMBE Peter* (1999-2006)

Pr. TETANYE EKOE Bonaventure (2006-2012)

Pr. EBANA MVOGO Côme (2012-2015)

Table I: Teaching staff of FMBS

3. TEACHING STAFF

No	NAMES	RANK	DISCIPLINE
DEPARTMENT OF SURGERY AND SUBSPECIALTIES			
1	**SOSSO Maurice Aurélien (HD)**	P	General Surgery
2	DJIENTCHEU Vincent de Paul	P	Neurosurgery
3	ESSOMBA Arthur (Interim HD)	P	General Surgery
4	HANDY EONE Daniel	P	Trauma/Orthopaedic Surgery
5	MOUAFO TAMBO Faustin	P	Paediatric Surgery
6	NGO NONGA Bernadette	P	General Surgery
7	NGOWE NGOWE Marcellin	P	General Surgery
8	ZE MINKANDE Jacqueline	P	Anaesthesia-Critical care
9	BAHEBECK Jean	AP	Orthopaedic Surgery
10	BANG GUY Aristide	AP	General Surgery
11	BENGONO BENGONO Roddy Stéphane	AP	Anaesthesia-Critical care
12	FARIKOU Ibrahima	AP	Orthopaedic Surgery
13	JEMEA Bonaventure	AP	Anaesthesia-Critical care
14	OWONO ETOUNDI Paul	AP	Anaesthesia-Critical care
15	BEYIHA Gérard	AP	Anaesthesia-Critical care
16	ESIENE Agnès	AP	Anaesthesia-Critical care
17	EYENGA Victor Claude	AP	Surgery/Neurosurgery
18	GUIFO Marc Leroy	AP	General Surgery
19	NGO YAMBEN Marie Ange	SL	Trauma/Orthopaedic Surgery
20	AHANDA ASSIGA	SL	General Surgery
21	AMENGLE Albert Ludovic	SL	Anaesthesia-Critical care
22	BIWOLE BIWOLE Daniel Claude	SL	General Surgery

	Patrick		
23	BWELE Georges	SL	General Surgery
24	FONKOUE Loïc	SL	Trauma/Orthopaedic Surgery
25	MBOUCHE Landry Oriole	SL	Urology
26	MEKEME MEKEME Junior Barthelemy	SL	Urology
27	TSIAGADIGI Jean Gustave	SL	Trauma/Orthopaedic Surgery
28	SAVOM Eric Patrick	SL	General Surgery
29	BELLO FIGUIM	SL	Neurosurgery
30	BIKONO ATANGANA Ernestine Renée	SL	Neurosurgery
31	IROUME Cristella Raïssa BIFOUNA épouse NTYO'O NKOUMOU	SL	Anaesthesia-Critical care
32	KONA NGONDO François Stéphane	SL	Anaesthesia-Critical care
33	MULUEM Olivier Kennedy	SL	Orthopaedic Surgery
34	NDIKONTAR KWINJI Raymond	SL	Anaesthesia-Critical care
35	NWAHA MAKON Axel Stéphane	SL	Urology
36	EPOUPA NGALLE Frantz Guy	L	Urology
37	FOLA KOPONG Olivier	L	General Surgery
38	FOUDA Jean Cédrick	L	Urology
39	MOHAMADOU GUEMSE Emmanuel	L	Orthopaedic Surgery
40	NGOUATNA DJEUMAKOU Serge Rawlings	L	Anaesthesia-Critical care
41	NYANIT BOB Dorcas	L	Paediatric Surgery
42	OUMAROU HAMAN NASSOUROU	L	Neurosurgery
43	FOSSI KAMGA GACELLE	L	Paediatric Surgery
44	MBELE Richard II	L	Thoracic Surgery
45	MFOUAPON EWANE Hervé Blaise	L	Neurosurgery
46	NYANKOUE MEBOUINZ Ferdinand	L	Trauma/Orthopaedic Surgery
DEPARTMENT OF INTERNAL MEDICINE			
47	**SINGWE Madeleine ép NGANDEU (HD)**	P	Internal Medicine/Rheumatology
48	AFANE ZE Emmanuel	P	Internal Medicine/Pulmonology

49	ANKOUANE ANDOULO	P	Internal Medicine/ Gastroenterology and Hepatology
50	ASHUNTANTANG Gloria Enow	P	Internal Medicine/Nephrology
51	BISSEK Anne Cécile	P	Internal Medicine/Dermatology
52	KAZE FOLEFACK François	P	Internal Medicine/Nephrology
53	KINGUE Samuel	P	Internal Medicine/Cardiology
54	KUATE TEGUEU Calixte	P	Internal Medicine/Neurology
55	MBANYA Jean Claude	P	Internal Medicine/Endocrinology
56	NDJITOYAP NDAM Elie Claude	P	Internal Medicine/Gastro-enterology and Hepatology
57	NDOM Paul	P	Internal Medicine/Oncology
58	NJAMNSHI Alfred K.	P	Internal Medicine/Neurology
59	NJOYA OUDOU	P	Internal Medicine/Gastroenterology and Hepatology
60	SOBNGWI Eugène	P	Internal Medicine/Endocrinology
61	PEFURA YONE Eric Walter	P	Internal Medicine/Pulmonology
62	KOUOTOU Emmanuel Armand	P	Internal Medicine/Dermatology
63	HAMADOU BA	AP	Internal Medicine/Cardiology
64	BOOMBHI Jérôme	AP	Internal Medicine/Cardiology
65	MENANGA Alain Patrick	AP	Internal Medicine/Cardiology
66	FOUDA MENYE Hermine Danielle	AP	Internal Medicine/Nephrology
67	KOWO Mathurin Pierre	AP	Internal Medicine/Gastroenterology and Hepatology
68	NGANOU Chris Nadège	AP	Internal Medicine/Cardiology
69	NTONE ENYIME Félicien	AP	Internal Medicine/Psychiatry
70	NDONGO AMOUGOU Sylvie	SL	Internal Medicine/Cardiology
71	OWONO NGABEDE Amalia Ariane	SL	Internal Medicine/Interventional Cardiology
72	KUATE née MFEUKEU KWA Liliane Claudine	SL	Internal Medicine/Cardiology
73	ATENGUENA OBALEMBA Etienne	SL	Internal Medicine/Oncology

74	ETOA NDZIE ép. ETOGA Martine Claude	SL	Internal Medicine/Endocrinology
75	KAMGA OLEN Jean Pierre Olivier	SL	Internal Medicine/Psychiatry
76	MBONDA CHIMI Paul-Cédric	SL	Internal Medicine/Neurology
77	NDJITOYAP NDAM Antonin Wilson	SL	Internal Medicine/Gastroenterology
78	DEHAYEM YEFOU Mesmin	SL	Internal Medicine/Endocrinology
79	ESSON MAPOKO Berthe Sabine ép. PAAMBOG	SL	Internal Medicine/Oncology
80	MAÏMOUNA MAHAMAT	SL	Nephrology
81	MASSONGO MASSONGO	SL	Internal Medicine/Pulmonology
82	MENDANE MEKOBE Francine épouse EKOBENA	SL	Internal Medicine/Endocrinology
83	MINTOM MEDJO Pierre Didier	SL	Internal Medicine/Cardiology
84	NDOBO épouse KOE Juliette Valérie Danielle	SL	Internal Medicine/Cardiology
85	NGAH KOMO Elisabeth	SL	Internal Medicine/Pulmonology
86	NGARKA Léonard	SL	Internal Medicine/Neurology
87	NKORO OMBEDE Grâce Anita	SL	Internal Medicine/Dermatologist
88	NTSAMA ESSOMBA Marie Josiane ép. EBODE	SL	Internal Medicine/Geriatrics
89	ANABA MELINGUI Victor Yves	L	Internal Medicine/Rheumatology
90	FOJO TALONGONG Baudelaire	L	Internal Medicine/Rheumatology
91	NZANA Victorine Bandolo ép. FORKWA	L	Internal Medicine/Nephrology
92	EBENE MANON Guillaume	L	Internal Medicine/Cardiology
93	ELIMBY NGANDE Lionel Patrick Joël	L	Internal Medicine/Nephrology
94	KUABAN Alain	L	Internal Medicine/Pulmonology
DEPARTMENT OF MEDICAL IMAGING AND RADIOLOGY			
95	**ZEH Odile Fernande (HD)**	P	Radiology/Medical Imaging
96	MOUELLE SONE	P	Radiotherapy
97	NKO'O AMVENE Samuel	P	Radiology/Medical Imagery
98	GUEGANG GOUJOU. E.	P	Medical Imagery /Neuroradiology
99	MOIFO Boniface	P	Radiology/Medical Imagery

100	ONGOLO ZOGO Pierre	AP	Radiology/Medical Imagery
101	SAMBA Odette NGANO	AP	Biophysics/Medical Physics
102	MBEDE Maggy ép. ENDEGUE MANGA	SL	Radiology/Medical Imagery
103	MEKA'H MAPENYA Ruth-Rosine	SL	Radiotherapy
104	NWATSOCK Joseph Francis	L	Radiology/Nuclear Medicine
105	SEME ENGOUMOU Ambroise Merci	L	Radiology/Medical Imagery
	DEPARTMENT OF GYNECOLOGY AND OBSTETRICS		
106	**NGO UM Esther Juliette ép. MEKA (HD)**	AP	Gynaecology Obstetrics
107	BELLEY PRISO Eugène	P	Gynaecology Obstetrics
108	FOUMANE Pascal	P	Gynaecology Obstetrics
109	MBOUDOU Émile	P	Gynaecology Obstetrics
110	MBU ENOW Robinson	P	Gynaecology Obstetrics
111	NKWABONG Elie	P	Gynaecology Obstetrics
112	TEBEU Pierre Marie	P	Gynaecology Obstetrics
113	KEMFANG NGOWA Jean Dupont	P	Gynaecology Obstetrics
114	DOHBIT Julius SAMA	AP	Gynaecology Obstetrics
115	FOUEDJIO Jeanne H.	AP	Gynaecology Obstetrics
116	MVE KOH Valère Salomon	AP	Gynaecology Obstetrics
117	NOA NDOUA Claude Cyrille	AP	Gynaecology Obstetrics
118	BELINGA Etienne	AP	Gynaecology Obstetrics
119	ESSIBEN Félix	AP	Gynaecology Obstetrics
120	METOGO NTSAMA Junie Annick	SL	Gynaecology Obstetrics
121	EBONG Cliford EBONTANE	SL	Gynaecology Obstetrics
122	MBOUA BATOUM Véronique Sophie	SL	Gynaecology Obstetrics
123	NSAHLAI Christiane JIVIR FOMU	SL	Gynaecology Obstetrics
124	NYADA Serge Robert	SL	Gynaecology Obstetrics
125	MENDOUA Michèle Florence épouse NKODO	L	Gynaecology Obstetrics
126	TOMPEEN Isidore	L	Gynaecology Obstetrics
	DEPARTMENT OF OPHTALMOLOGY, ENT AND STOMATOLOGY		
127	**DJOMOU François (HD)**	P	ENT

128	BELLA Assumpta Lucienne	P	Ophthalmology
129	EBANA MVOGO Côme	P	Ophthalmology
130	NDJOLO Alexis	P	ENT
131	NJOCK Richard	P	ENT
132	OMGBWA EBALE André	P	Ophthalmology
133	ÉPÉE Émilienne épouse ONGUENE	P	Ophthalmology
134	KAGMENI Gilles	P	Ophthalmology
135	BILLONG Yannick	AP	Ophthalmology
136	DOHVOMA Andin Viola	AP	Ophthalmology
137	EBANA MVOGO Stève Robert	AP	Ophthalmology
138	KOKI Godefroy	AP	Ophthalmology
139	MINDJA EKO David	AP	ENT/Maxillo-Facial Surgery
140	NGABA Olive	AP	ENT
141	ANDJOCK NKOUO Yves Christian	SL	ENT
142	ASMAOU BOUBA Dalil	SL	ENT
143	BOLA SIAFA Antoine	SL	ENT
144	MVILONGO TSIMI épouse BENGONO Caroline	SL	Ophthalmology
145	AKONO ZOUA épouse ETEME Marie Evodie	SL	Ophthalmology
146	ATANGA Léonel Christophe	SL	ENT-MFS
147	MEVA'A BIOUELE Roger Christian	SL	ENT-MFS
148	MOSSUS Yannick	SL	ENT-MFS
149	NANFACK NGOUNE Chantal	SL	Ophthalmology
150	NGO NYEKI Adèle-Rose épouse MOUAHA-BELL	SL	ENT-MFS
151	NOMO Arlette Francine	SL	Ophthalmology
DEPARTMENT OF PEDIATRICS			
152	**ONGOTSOYI Angèle ép. PONDY (HD)**	P	Paediatrics
153	KOKI NDOMBO Paul	P	Paediatrics
154	ABENA OBAMA Marie Thérèse	P	Paediatrics

155	CHIABI Andreas	P	Paediatrics
156	CHELO David	P	Paediatrics
157	NGUEFACK Séraphin	P	Paediatrics
158	NGUEFACK ép. DONGMO Félicitée	P	Paediatrics
159	MAH Evelyn	P	Paediatrics
160	MBASSI AWA	AP	Paediatrics
161	NGO UM KINJEL Suzanne épse SAP	AP	Paediatrics
162	KALLA Ginette épse MBOPI KEOU	AP	Paediatrics
163	NOUBI N. ép. KAMGAING M.	SL	Paediatrics
164	MEKONE NKWELE Isabelle	SL	Paediatrics
165	EPEE ép. NGOUE Jeannette	SL	Paediatrics
166	MEGUIEZE Claude-Audrey	SL	Paediatrics
167	TONY NENGOM Jocelyn	SL	Paediatrics
168	KAGO TAGUE Daniel Armand	L	Paediatrics
DEPARTMENT OF MICROBIOLOGY, PARASITOLOGY, HEMATOLOGY AND INFECTIOUS DISEASES			
169	**MBOPI KEOU François-Xavier (HD)**	P	Bacteriology/Virology
170	ADIOGO Dieudonné	P	Microbiology/Virology
171	GONSU née KAMGA Hortense	P	Bacteriology
172	LUMA Henry	P	Bacteriology/Virology
173	MBANYA Dora	P	Haematology
174	OKOMO ASSOUMOU Marie Claire	P	Bacteriology/Virology
175	TAYOU TAGNY Claude	P	Microbiology/Haematology
176	TOUKAM Michel	AP	Microbiology
177	LYONGA Emilia ENJEMA	AP	Microbiology
178	CHETCHA CHEMEGNI Bernard	SL	Microbiology/Haematology
179	KINGE Thomson NJIE	SL	Infectious Diseases
180	NDOUMBA NKENGUE Annick ép. MINTYA	SL	Haematology
181	NGANDO Laure ép. MOUDOUTE	SL	Parasitology
182	VOUNDI VOUNDI Esther	SL	Virology
183	NGOGANG Marie Paule	SL	Clinical Laboratory Sciences
184	BOUM II YAP	SL	Microbiology

185	ESSOMBA Réné Ghislain	L	Immunology and Infectious Diseases
186	MEDI SIKE Christiane Ingrid	L	Clinical Laboratory Sciences
187	BEYELA Frédérique	L	Infectious Diseases
188	ANGANDJI TIPANE Prisca ép. ELLA	L	Clinical Laboratory Sciences /Haematology
DEPARTMENT OF PUBLIC HEALTH			
189	**KAMGNO JOSEPH (HD)**	P	Public Health/Epidemiology
190	ESSI Marie Josée	P	Public Health/Medical Anthropology
191	BEDIANG Georges Wylfred	P	Medical Informatics/Public Health
192	NGUEFACK TSAGUE	AP	Public Health/Biostatistics
193	TAKOUGANG Innocent	AP	Public Health
194	TANYA née NGUTI K. A.	AP	Public Health
195	BILLONG Serges Clotaire	AP	Nutrition
196	KEMBE ASSAH Félix	SL	Public Health
197	KWEDI JIPPE Anne Sylvie	SL	Epidemiology
198	MOSSUS Tatiana née ETOUNOU AKONO	SL	Epidemiology
199	NJOUMEMI ZAKARIAOU	SL	Public Health/Health Economics
200	ABBA-KABIR HAAMIT-M	SL	Public Health/Health Economics
201	MBA MAADJHOU Berjauline Camille	SL	Public Health/Epidemiology
202	AMANI ADIDJA	L	Public Health
203	EYEBE EYEBE Serge Bertrand	L	Public Health
DEPARTMENT OF MORPHOLOGICAL SCIENCES AND MORBID ANATOMY			
204	**MENDIMI NKODO Joseph (HD)**	P	Morbid Anatomy/ Pathology
205	ESSAME OYONO	P	Morbid Anatomy/ Pathology
206	FEWOU Amadou	P	Morbid Anatomy/ Pathology
207	SANDO Zacharie	P	Morbid Anatomy/ Pathology
208	BISSOU MAHOP	AP	Sports Medicine
209	KABEYENE OKONO Angèle	AP	Histology/Embryology
210	AKABA Désiré	AP	Human Anatomy
211	NSEME Eric	AP	Legal Medicine

212	NGONGANG Gilbert Frank Olivier	SL	Legal Medicine
213	MENDOUGA MENYE Coralie Reine Bertine ép. KOUOTOU	L	Morbid Anatomy
DEPARTMENT OF BIOCHEMISTRY			
214	**NDONGO EMBOLA ép. TORIMIRO Judith (HD)**	P	Molecular Biology
215	PIEME Constant Anatole	P	Biochemistry
216	AMA MOOR Vicky Joceline	P	Clinical Biology/Biochemistry
217	EUSTACE BONGHAN BERINYUY	SL	Biochemistry
218	GUEWO FOKENG Magellan	SL	Biochemistry
219	MBONO SAMBA ELOUMBA Esther Astrid	L	Biochemistry
DEPARTMENT OF PHYSIOLOGY			
220	**ETOUNDI NGOA Laurent Serges (HD)**	P	Physiology
221	ASSOMO NDEMBA Peguy Brice	AP	Physiology
222	AZABJI KENFACK Marcel	SL	Physiology
223	DZUDIE TAMDJA Anastase	SL	Physiology
224	EBELL'A DALLE Ernest Remy Hervé	L	Human Physiology
DEPARTMENT OF PHARMACOLOGY AND TRADITIONAL MEDICINE			
225	**NGONO MBALLA Rose ABONDO (HD)**	AP	African Pharmaco-therapeutics
226	NDIKUM Valentine	SL	Pharmacology
227	ONDOUA NGUELE Marc Olivier	L	Pharmacology
DEPARTMENT OF ORAL SURGERY, MAXILLO-FACIAL SURGERY AND PERIODONTOLOGY			
228	**BENGONDO MESSANGA Charles (HD)**	P	Stomatology
229	NOKAM TAGUEMNE M.E.	SL	Dental Medicine
230	EDOUMA BOHIMBO Jacques Gérard	SL	Stomatology and Surgery
231	LOWE NANTCHOUANG Jacqueline Michèle épouse ABISSEGUE	SL	Paediatrics Dentistry
232	Jules Julien NDJOH	SL	Dental Surgery
233	MBEDE NGA MVONDO Rose	SL	Dental Medicine

234	MENGONG ép. MONEBOULOU Hortense	SL	Paediatric Dentistry
235	BITHA BEYIDI Thècle Rose Claire	L	Maxillo-Facial Surgery
236	GAMGNE GUIADEM Catherine M	L	Dental Surgery
237	NIBEYE Yannick Carine Brice	L	Bacteriology
238	KWEDI Karl Guy Grégoire	L	Dental Surgery
239	NKOLO TOLO Francis Daniel	L	Dental Surgery
DEPARTMENT OF PHARMACOGNOSY AND PHARMACEUTICAL CHEMISTRY			
240	**NTSAMA ESSOMBA Claudine (HD)**	P	Pharmacognosy/pharmaceutical chemistry
241	NGAMENI Bathélémy	P	Phytochemistry/ Organic chemistry
242	NGOUPAYO Joseph	P	Phytochemistry/Pharmacognosy
243	GUEDJE Nicole Marie	AP	Ethnopharmacology/Plant Biology
244	BAYAGA Hervé Narcisse	L	Pharmacy
DEPARTMENT OF PHARMACOTOXICOLOGY AND PHARMACOKINETICS			
245	**ZINGUE Stéphane (HD)**	AP	Pharmacy
246	FOKUNANG Charles	P	Molecular Biology
247	MPONDO MPONDO Emmanuel	P	Pharmacy
248	TEMBE Estella ép. FOKUNANG	AP	Clinical Pharmacology
249	TABI OMGBA	SL	Pharmacy
250	NENE AHIDJO ép. NJITUNG TEM	L	Neuropharmacology
DEPARTMENT OF GALENICAL PHARMACY AND PHARMACEUTICAL LEGISLATION			
251	**NNANGA NGA Emmanuel (HD**)	P	Galenical Pharmacy
252	MBOLE Jeanne Mauricette épse MVONDO	SL	Quality control and management of health products and food
253	SOPPO LOBE Charlotte Vanessa	SL	Quality control of Drugs
254	MINYEM NGOMBI Périne ép. AFUH	L	Pharmaceutical Regulation
255	NYANGONO NDONGO Martin	L	Pharmacy
256	ABA'A Marthe Dereine	L	Drug Analysis

Key: HOD= Head of department

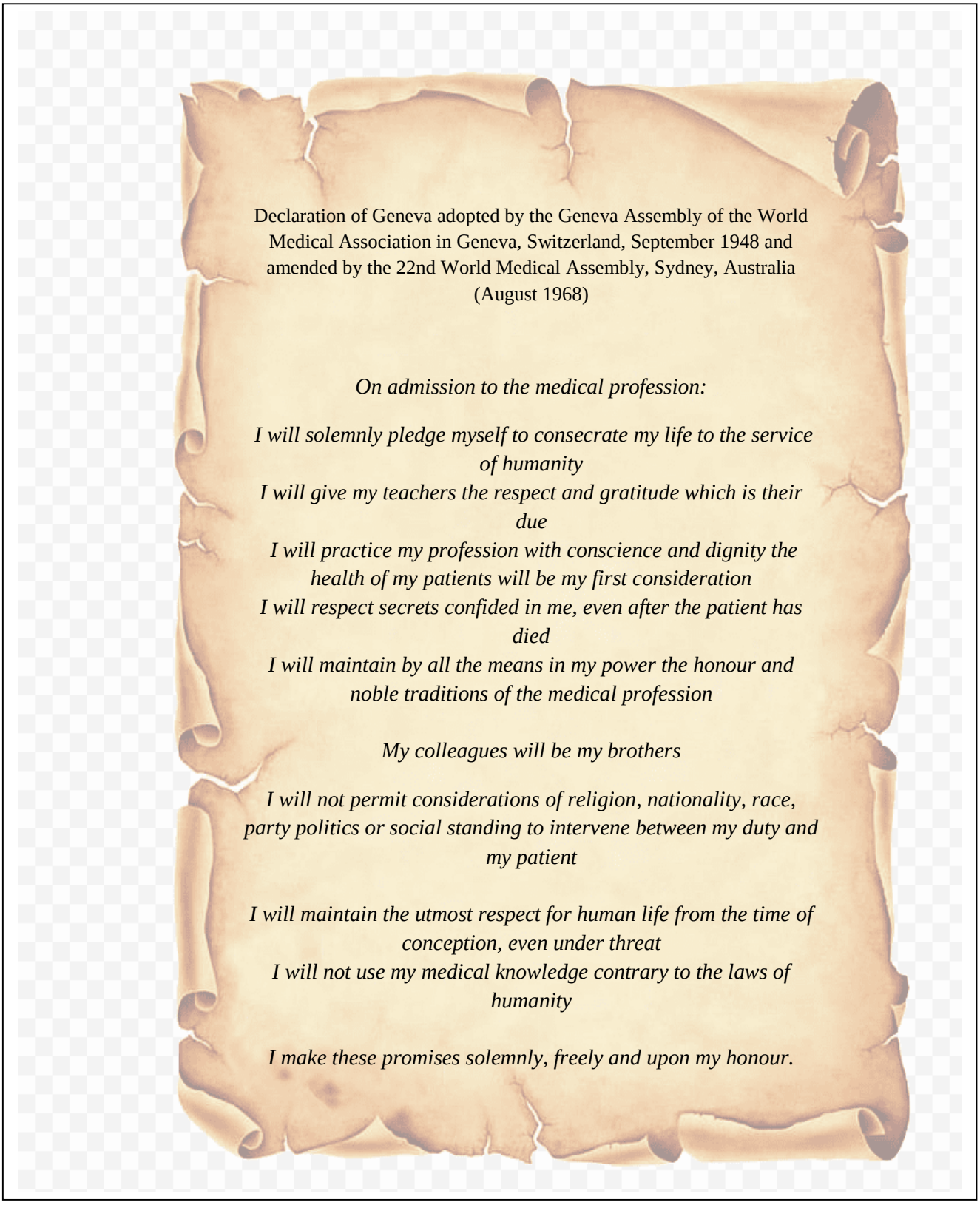
P: Professor

AP: Assistant professor

SL: senior lecturer

L: Lecturer

THE PHYSICIAN'S OATH



Declaration of Geneva adopted by the Geneva Assembly of the World Medical Association in Geneva, Switzerland, September 1948 and amended by the 22nd World Medical Assembly, Sydney, Australia (August 1968)

On admission to the medical profession:

I will solemnly pledge myself to consecrate my life to the service of humanity
I will give my teachers the respect and gratitude which is their due
I will practice my profession with conscience and dignity the health of my patients will be my first consideration
I will respect secrets confided in me, even after the patient has died
I will maintain by all the means in my power the honour and noble traditions of the medical profession

My colleagues will be my brothers

I will not permit considerations of religion, nationality, race, party politics or social standing to intervene between my duty and my patient

I will maintain the utmost respect for human life from the time of conception, even under threat
I will not use my medical knowledge contrary to the laws of humanity

I make these promises solemnly, freely and upon my honour.

Figure 1: physician's oath

SUMMARY

BACKGROUND: Hypertension in pregnancy, particularly preeclampsia/eclampsia is a major public health problem. Preeclampsia/eclampsia are among the three leading causes of maternal morbidity and mortality worldwide. While Blood pressure and albuminuria often normalize after delivery, there is evidence of increased cardiovascular and renal disease risk during the postpartum.

OBJECTIVE: The main objective was to evaluate the importance of auto remote blood pressure measurement in the surveillance of cases of pre-eclampsia/eclampsia during the post-partum

METHODS: This was a prospective cohort study which was carried out from November 2023 to May 2024(7 months), at the Yaoundé Central Hospital and Yaoundé Gynaeco-Obstetric and Pediatric Hospital. We retained 126 cases (42 who were exposed and 84 who were non-exposed) made of women in the postpartum who were diagnosed and treated for pre-eclampsia/eclampsia. We later separated them into two groups namely exposed (group of parturient who monitored their blood pressure remotely on daily basis throughout the postpartum period) and non-exposed (group of women who did not monitor their blood pressure throughout the postpartum period). We compared the mean remote blood pressure and proteinuria amongst these women.

RESULTS: The average age of women in the study population was 30.4 ± 8.1years with the most affected age group being 35-39 years and majority were primiparas. About 59.9% of women in the study population had more than four antenatal contacts, 42.2% were diagnosed between 34-37 weeks of gestation and most women delivered through cesarean section. The non-exposed group had a higher risk of having high blood pressure than the exposed group at the end of the postpartum period, with mean systolic blood pressure of 140.13±13.07 vs 132.71 ± 15.89. The exposed group was protective (RR: 0.66, 95% CI [0.31-1.44], p=0.006). There were 3 cases of seizures in the non-exposed group compare to none in the exposed group. There was persistent blurred vision and headache in the non-exposed on day 42 postpartum.

CONCLUSION: Auto remote blood pressure measurement in postpartum women with preeclampsia/eclampsia reduces high blood pressure risk and related complications, improving maternal health outcomes.

Keywords: preeclampsia, eclampsia, seizures

RESUME

INTRODUCTION : L'hypertension pendant la grossesse est un important problème de santé publique. La pré-éclampsie et l'éclampsie figurent parmi les trois principales causes de morbidité et de mortalité maternelle dans le monde. La pression artérielle et l'albuminurie des patientes souffrant de pré-éclampsie/éclampsie reviennent généralement à des valeurs normales dans les mois qui suivent l'accouchement (42 jours), mais il est désormais prouvé que les femmes souffrant de pré-éclampsie/éclampsie sont plus susceptibles de développer des maladies cardiovasculaires et rénales après l'accouchement. En outre, ces patientes présentent des complications en dehors des établissements de soins hospitaliers.

OBJECTIF : L'objectif principal était d'évaluer l'importance de l'auto mesure à distance de la pression artérielle dans la surveillance des cas de pré-éclampsie/éclampsie pendant le post-partum.

METHODOLOGIE : Il s'agit d'une étude de cohorte prospective que nous avons menée de novembre 2023 à mai 2024 (7 mois), à l'hôpital central de Yaoundé et à l'hôpital gynéco-obstétrique et pédiatrique de Yaoundé. Nous avons retenu 126 cas (42 exposées et 84 non exposées) constitués de parturientes diagnostiquées et traitées pour pré-éclampsie/éclampsie. Nous les avons ensuite séparés en deux groupes, à savoir les exposées (groupe de parturientes qui ont surveillé leur tension artérielle quotidiennement pendant la période post-partum) et les non-exposées (groupe de parturientes qui n'ont pas surveillé leur tension artérielle pendant la période post-partum). Nous avons déterminé la tension artérielle moyenne et la protéinurie moyenne chez les 02 groupes de femmes et nous les avons ensuite comparées.

RESULTATS : L'âge moyen de la population étudiée était de 30,4 ± 8,1 ans, la tranche d'âge la plus représentée étant celle des 35-39 ans, et la majorité des femmes étaient des primipares. Environ 59,9 % des femmes de la population étudiée ont eu plus de quatre contacts prénataux, 42,2 % ont été diagnostiquées entre 34 et 37 semaines de grossesse et la majorité des femmes ont accouché par césarienne. Le risque d'hypertension artérielle était plus élevé dans le groupe non exposé que dans le groupe exposé à la fin du post partum avec une pression artérielle systolique moyenne de 140.13±13.07mmHg comparer à 132.71±15.89mmHg. Le groupe exposé était protecteur avec un RR : 0,66 ; IC à 95 % [0,31-1,44], pour une valeur p=0,006. Il y a eu 03 cas de convulsions dans le groupe non exposé et aucun dans le groupe exposé. Il y'avait une vision floue persistante et des céphalées dans le groupe non exposé au 42^{e} jour postpartum.

CONCLUSION : L'auto mesure à distance de la pression artérielle chez les femmes en post-partum souffrant de pré-éclampsie/éclampsie réduit le risque d'hypertension artérielle et les complications qui y sont liées, améliorant ainsi l'état de santé de la mère.

Mots-clés : pré-éclampsie, éclampsie, crises de convulsion

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LIST OF ABBREVIATIONS

ACE inhibitors: Anti Converting Enzyme Inhibitors

ACOG: American College of Obstetrics and Gynecology

ALAT: Alanine Aminotransferase

ANC: Antenatal Consultations

ASAT: Aspartate Aminotransferase

BMI: Body Mass Index

BP: Blood Pressure

CVDs: cardiovascular disease

DBP: Diastolic Blood Pressure

DIC: Disseminated Intravascular Coagulation

E: Eclampsia

ECG: ElectroCardiogram

FMBS: Faculty of Medecin and Biomedical Sciences

GH: Gestational Hypertension

Hb: Hemoglobin

HBP: High blood pressure

HBPM: Home Blood Pressure Measurement

HDP: Hypertensive Disorders in PreEgnancy

HELLP: Hemolysis elevated liver enzymes and low platelet

i.e.: That Is

IM: IntraMuscular

IV: IntraVenous

MDBP: Mean Diastolic Blood Pressure

MgSO4: Magnesium Sulphate

mmHg: Millimeters of Mercury

MP: Mean proteinuria

MSBP: Mean Systolic Blood Pressure

PE: Preeclampsia

PP: PostPartum

RUQ: Right Upper Quadrant

SBP: Systolic Blood Pressure

WHO: World Health Organization

YCH: Yaounde Central Hospital

YGOPH: Yaounde Gynaeco-Obstetric and Pediatric hospital

CHAPTER 1: INTRODUCTION

1.1 Background

Preeclampsia/eclampsia refer to a syndrome characterized by the new onset of hypertension and proteinuria after 20 weeks of gestation and/or 6 weeks postpartum in a previously normotensive woman [1]. According to the American College of Obstetricians and Gynecologists (ACOG), hypertension in pregnancy is defined as systolic blood pressure ≥140mmHg and/or diastolic blood pressure ≥90mmHg in two occasions at least 4-6 hours apart after 20 weeks of gestation for pregnancy induced hypertension or before 20 weeks of gestation for chronic hypertension [2]. Preeclampsia/eclampsia are among the three leading causes of maternal morbidity and mortality worldwide: responsible for 50.000 maternal deaths each year[3]. It is a deadly disease, especially in Africa, where it is the most frequent cause of maternal death. Preeclampsia and eclampsia rates are higher in developing countries because of a lack of prenatal care and insufficient access to hospital care [4].

Hypertension in pregnancy is an important public health problem thus a major cause of fetal, neonatal and maternal morbidity and mortality affecting 10-15% of pregnant women [5]

In Africa, high blood pressure affects 5-10% of pregnant women, and causes 30% of maternal deaths and 20% of fetal and neonatal death, compared to 16% in developed countries [6]. It is often defined as systolic blood pressure greater than 30mmHg and/or diastolic blood pressure greater than or equal to 15mmHg from baseline values.

In Cameroun, according to a study carried out in 2009, the prevalence of preeclampsia was 8.2% [6]. Several women with a history of preeclampsia/eclampsia are not diagnosed with hypertension because women-specific risk factors are not consistently screened for in the daily clinic. As a result, high blood pressure can go undetected and unmanaged for many years, especially in sub-Saharan Africa, where access to care remains a public health issue [7,8].

Although blood pressure and albuminuria in patients with preeclampsia generally return to normal values in the months following delivery, there is now evidence that women with preeclampsia are more likely to develop cardiovascular diseases (CVDs) after delivery.

Furthermore, the American Heart Association has already recognized preeclampsia as an independent risk factor for cardiovascular diseases. Some studies have shown that women after preeclampsia are highly exposed to developing hypertension before the age of 55 years [9].

In our context, there is currently little information on the associated clinical factors of persistent hypertension after preeclampsia.

1.2 Justification

Hypertensive disorders in pregnancy can significantly have negative effect on maternal, neonatal and fetal health.

According to previous studies, preeclampsia is the most frequently encountered form of hypertensive disorder among pregnant women in our context [10].

Generally, monitoring pregnant women by measuring their blood pressure and checking for proteinuria during antenatal contacts has shown to reduce the incidence of severe preeclampsia and eclampsia [11]. At the same time this showed the importance of post-partum preeclampsia and eclampsia, which occurs when the patient has been discharge from the hospital and the six weeks post-partum visit. This is the period when the patient's blood pressure is not controlled.

After delivery, which is considered the best treatment for preeclampsia, it is important to continue following up these women due to the risk of persistent cardiovascular and renal dysfunctions.

In order to prevent these complications, there is the need to monitor blood pressure through home auto blood pressure measurement.

We therefore decided to study the importance of remote auto blood pressure measurement on the surveillance of hypertensive disorders during post-partum period.

1.3 Research Question

Does Auto remote blood pressure monitoring lead to early detection and better management of cases of preeclampsia/eclampsia during the post-partum period?

1.4 Research Hypothesis

Remote surveillance of blood pressure monitoring during the post-partum period may lead to early detection and better management of post-partum complication of preeclampsia/eclampsia, leading to improved maternal health outcomes.

1.5 Objectives

1.5.1 General Objectives

Evaluate the importance of remote auto blood pressure measurement in the surveillance of cases of preeclampsia/eclampsia during the post-partum period.

1.5.2 Specific objectives

Our specific objectives as follow;

1. Describe the socio-obstetrical profiles of pregnant women treated for preeclampsia/eclampsia and are in the post-partum period.
2. Determine the mean remote and facility arterial blood pressures among women treated for preeclampsia/eclampsia and are in the postpartum period.
3. Determine the mean remote and facility proteinuria among these women.
4. Compare the remote and facility mean arterial blood pressure and proteinuria among the women.

1.6 Definition of operational terms

- **Hypertension** is defined as systolic blood pressure ≥ 140mmHg and or diastolic blood pressure ≥ 90mmHg measured between 4-6hours.
- **Gestational Hypertension:** Pregnancy-induced hypertension defined as systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90mmHg on two separate measurements at least 4 hours apart without proteinuria or end-organ dysfunction after 20 weeks of gestation.
- **Chronic Hypertension :** Hypertension diagnosed before pregnancy or in the first 20 weeks of pregnancy
- **Preeclampsia:** It's defined as blood pressure ≥ 140/90mmHg with proteinuria ≥ 300mg/24h after 20 weeks of gestation
- **HELLP Syndrome:** A life-threatening form of complication of severe preeclampsia characterized by Hemolysis, Elevated Liver enzymes and Low Platelets
- **Eclampsia:** Generalized seizures in patients with preeclampsia
- **Postpartum Hypertension:** Hypertension that persists after delivery.
- **Antenatal care (ANC):** It can be defined as the care provided by trained health-care professionals to pregnant women in order to ensure the best health conditions for both mother and baby during pregnancy.

CHAPTER 2 : LITERATURE REVIEW

2.1 Introduction

2.1.1 Definition and overview

Hypertensive pregnancy disorders are among the most common complications during pregnancy and the early postpartum period. There are four major types of hypertensive pregnancy disorders; Chronic hypertension. Gestational hypertension, preeclampsia and eclampsia. The most common type is gestational hypertension, also referred to as pregnancy-induced hypertension, which is hypertension that occurs after 20 weeks of gestation. Chronic hypertension describes that is diagnosed prior to pregnancy or in early pregnancy. Preeclampsia is a condition in which pre-existing or new-onset hypertension is complicated by proteinuria and/or other features of end-organ dysfunction after 20 weeks' gestation. Preeclampsia may also progress to the life-threatening HELLP syndrome which is characterized by hemolysis, elevated liver enzymes and low platelet count. Eclampsia is a severe convulsive manifestation of hypertensive pregnancy disorders that is charatirezed by new-onset eclamptic seizures (tonic-clonic, focal or multifocal). These disorders are usually diagnosed during regular prenantal care,which includes routine surveillance of blood pressure ,weight and urine test. Management depends on severity of the condition. Nonurgent hypertensive pregnancy disorders (chronic hypertension, gestational hypertion or preeclampsia without severe features) are generally managed with careful monitoring, possibly antihypertensive medications in chronic hypertension, and delivery at 37 weeks if there is no progression to severe preeclampsia. Patient with urgent hypertensive pregnancy disorders (preeclampsia with severe features, eclampsia or HELLP), which are associated with increased maternal and fetal morbidity and mortality, require urgent maternal stabilization, magnesium sulphate for seizure prophylaxis and expedited delivery of the fetus. Delivery is the only curative option for urgent hypertensive pregnancy disorders.

2.1.2 Epidemiology

2.1.2.1 Descriptive Epidemiology

- Hypertensive disorders in pregnancy, and preeclampsia in particular, represent one of the leading causes of maternal mortality in developed countries [12].
- In Sub-Saharan Africa, it is the third leading cause of maternal mortality and the leading cause of perinatal mortality.
- In Cameroon, it is the 3rd leading cause of maternal mortality at YGOPH.

2.1.2.2 Analytic Epidemiology

Population at risk: While 10-15% of nulliparous women and 3-5% of multiparous women will develop gestational hypertension, 3-7% of nulliparous women and 1-3% of multiparous women will have their pregnancy complicated by preeclampsia.

In Cameroon;

- 7.7% according to *Leke et al.*1987
- 5% according to *Mboudou et al.* 2009

2.1.3 Etiology

A number of risk factors are classically recognized in the table below.

- **Genetic predisposition**: family history of preeclampsia (in mother or sister);
- **immunological**: primiparity, brief period of exposure to sperm, insemination with donor sperm;
- **Physiologica**l: high maternal age(≥35years)
- **Linked to maternal pathologies**: personal history of preeclampsia, obesity, gestational diabetes or diabetes mellitus, thrombophilia, autoimmune disorders, arterial hypertension and chronic nephropathy;
- **Pregnancy-related**: nulliparity,long interval between two pregnancies, multiple gestation, hydatidiform mole, congenital or chromosomal anomaly of the fetus.

Table II: Population at fetal risk by maternal vasculorenal pathology [13].

Age	Less than 20 or greater than or equal to 35 years
Family Past history	History of preeclampsia/eclampsia in the family, diabetes , obesity
Personnal Past History	HBP, thrombophilia, autoimmune disorders Nephropathy, obesity 18 > age > 40
Obstetrical History	Eclampsia, pre-eclampsia, intra uterine growth retardation, intra uterine death
Actual Pregnancy	Twin pregnancies, first pregnancy, nulliparity, Congenital or chromosomal anomalies of the fetus

2.2 Recall

2.2.1 Blood pressure measurement. [12]

Measuring blood pressure is a simple procedure, but one that needs to be well codified, especially during pregnancy. The device must be of good quality: mercury manometer that cannot be adjusted in the office or capsule manometer frequently calibrated on a mercury device, or automatic device. The cuff should cover two-thirds of the arm circumference; otherwise blood pressure will be overestimated. In obese patients, it's better to measure on the forearm and auscultates the radial.

The measurement must be taken:

- Bare arm ;
- Arm at heart level: if the patient is in the left decubitus position and the measurement is taken on the right arm, the BP is underestimated by around 12 mmHg. The best approach is therefore to measure BP on a seated woman, with her arm resting on a table at heart height;
- Accurate to within 2 mmHg, without rounding, taking into account the abrupt change in the timbre and intensity of arterial noise in the diastolic, as the disappearance of arterial noise in pregnant women is rarely perceived due to the vibrations heard at very low values;

- Taking into account the woman's anxiety, it is preferable to measure blood pressure in pregnant women at a distance from the obstetrical examination, in a seated position, after a few minutes of calm and conversation.

Practically, a BP equal to or greater than 140/90mmHg is considered abnormal in a patient who comes for a consultation, with the measurement taken in a seated position after a few minutes' rest. A rise of 15 mmHg in diastolic or 30 mmHg in systolic is considered abnormal. To be taken into consideration, these figures must be obtained at two close consultations. The table below shows WHO classification of blood pressure levels;[14]

Table III : Blood pressure classification according to WHO [14].

CATEGORY	**SBP(mmHg)**		**DBP(mmHg)**
Optimum	<120 mmHg	And	<80 mmHg
Normal	120- 129 mmHg	And/or	80- 84 mmHg
Normal High	130- 139 mmHg	And/or	85- 89 mmHg
Stage 1 Hypertension	140-159 mmHg	And/or	90- 99 mmHg
Stage 2 Hypertension	160- 179 mmHg	And/or	100- 109 mmHg
Stage 3 Hypertension	≥ 180 mmHg	And/or	≥ 110
Isolated systolic hypertension	≥ 140 mmHg	And	< 90 mmHg

2.2.2 Anatomy[12]

❖ The Pregnant Uterus

The woman’s body undergoes a lot of changes during pregnancy. The most important change concerns the uterus. This change is due to the influence of growth hormones, steroid hormones and estrogen. The gravid uterus is so called when it contains the product of conception. The uterus (womb) is a thick-walled, pear-shaped, hollow muscular organ made

up of three layers namely; perimetrium, myometrium and endometrium. The uterus has two horn-like organs at the top (the fallopian tubes). It is connected at the bottom by the cervix, which is the part that dilates during vaginal delivery. The uterus has several sections which are; Fundus, the uppermost and widest part of the uterus, Corpus which is the main body of the uterus where fertilized egg implants during pregnancy, Isthmus which is between corpus and cervix which is the lowest part of the uterus. Moreover, in the case of the gravid uterus, it is composed of the body, the lower segment and the cervix. At term, the gravid uterus alone weighs an average of 1000 grams and has a capacity of 4 to 5 liters for a single-fetal pregnancy.

❖ **Uterine Vascularization**

- **Arteries**

- **Uterine artery;** It stretches, unwinding its coils and increasing its length, which triples or even quadruples, while its calibre increases very little. At the end of pregnancy, its total diameter is 2.20 mm (±0.10) and its calibre 1.45 mm (±0.20). After delivery (complete expulsion of the placenta), uterine artery retraction leads to an increase in diameter, and uterine expansion tends to adhere to the uterine artery and its branches. As the lower segment stretches, the artery tends to move away from the ureter and vaginal fornix. When the lower segment is well formed, the uterine artery junction is 2.5 cm from the vaginal fornix. The external branches retain their helical arrangement even in the uterus at term. They form numerous anastomoses, especially opposite the placental zone.
- **Ovarian artery**: its calibre increases from its origin to its termination, reaching a calibre equal to that of the uterine artery in the subannexal region, with which it completely anastomoses. Its diameter doubles or even triples during pregnancy.

- **Veins**

They undergo a greater increase in number and volume than the arteries. In the gravid uterine body, there is no zone of venous vascularization. In the wall of the lower segment and in the cervix, there are numerous veins whose caliber is smaller than that of the body.

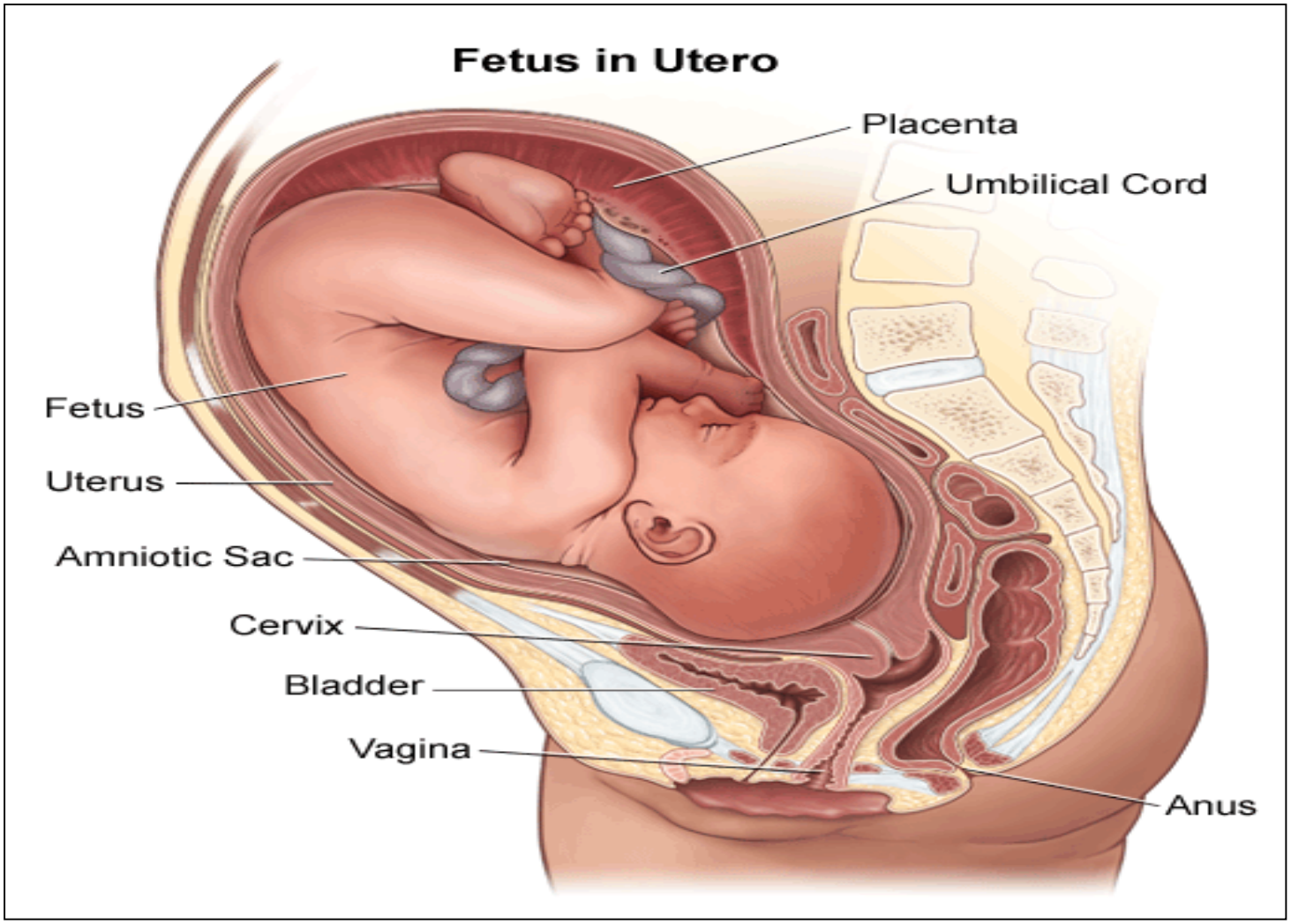


Figure 2: Pregnant Uterus [15]

❖ **Placenta**

The placenta at term is a disc 18 to 20 cm in diameter, 4 to 5 cm thick in the center and 4 to 6 mm thick at the edges. It weighs around 500 g at term. It has a fetal side and a maternal side. Its structure is made up of the decidua and the placenta itself, with the basal plate, the chorionic plate and between the two, the intervillous chamber and the chorionic villi.

- **The decidua**: the uterine mucosa is modified at the implantation site by the decidual reaction and is called decidua.
- **The basal plate** is attached to the uterine wall. It is essentially formed, from the intervillous chamber to the basal decidual plate, by residual elements of the syncytio-trophoblast and cytotrophoblast, often covered by a fibrinoid layer.

- **The intervillous chamber and chorionic villi**, which arise from the chorionic plate. Certain villi pass from one plate to the other, these are the clamping villi, and others remain free in the intervillous chamber. Each villi pedicle and its arborisation form a functional vascular unit; the fetal cotyledon

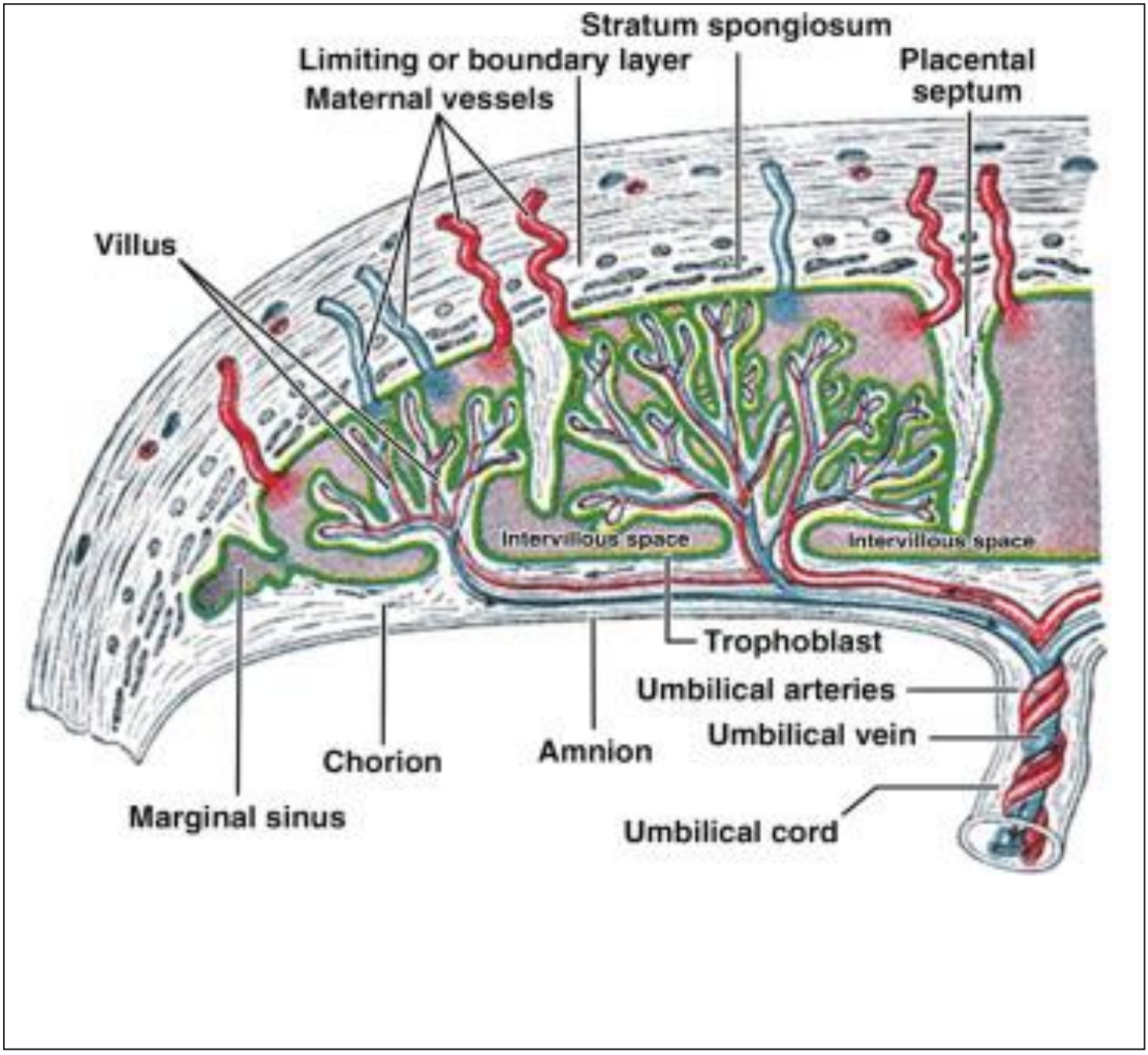


Figure 3 : Internal morphology of placenta (Université médicale francophone) [12]

2.2.3 Physiology

❖ Normal Pregnancy

During normal pregnancy, there are two trophoblastic invasions of the spiral arteries

- The first occurs between the 8th and 12th week of gestation and leads to the creation of a trophoblastic shell and an intravascular plug which completely obstructs the decidual capillaries of the spiral arteries, thus protecting the egg from maternal blood.
- The second invasion occurs between the 13th and 18th week and results in the progressive disappearance of the endothelial cells, the smooth muscle cells of the media and the internal muscle cells of the elastic layer. This is replaced by fibrin, which causes these vessels to lose their contractile properties. After 16 weeks, the trophoblastic cells invade and destroy the elastic and smooth muscle layer of the spiral artery wall. This process is complete by 4 months of age, resulting in an arteriolar system with low resistance and high flow in the intervillous chamber.

  All these phenomena transform the spiral vessels into low-pressure, high-flow vessels ensuring placental and foetal vascularisation. On a general view, several physiological changes have been observed.

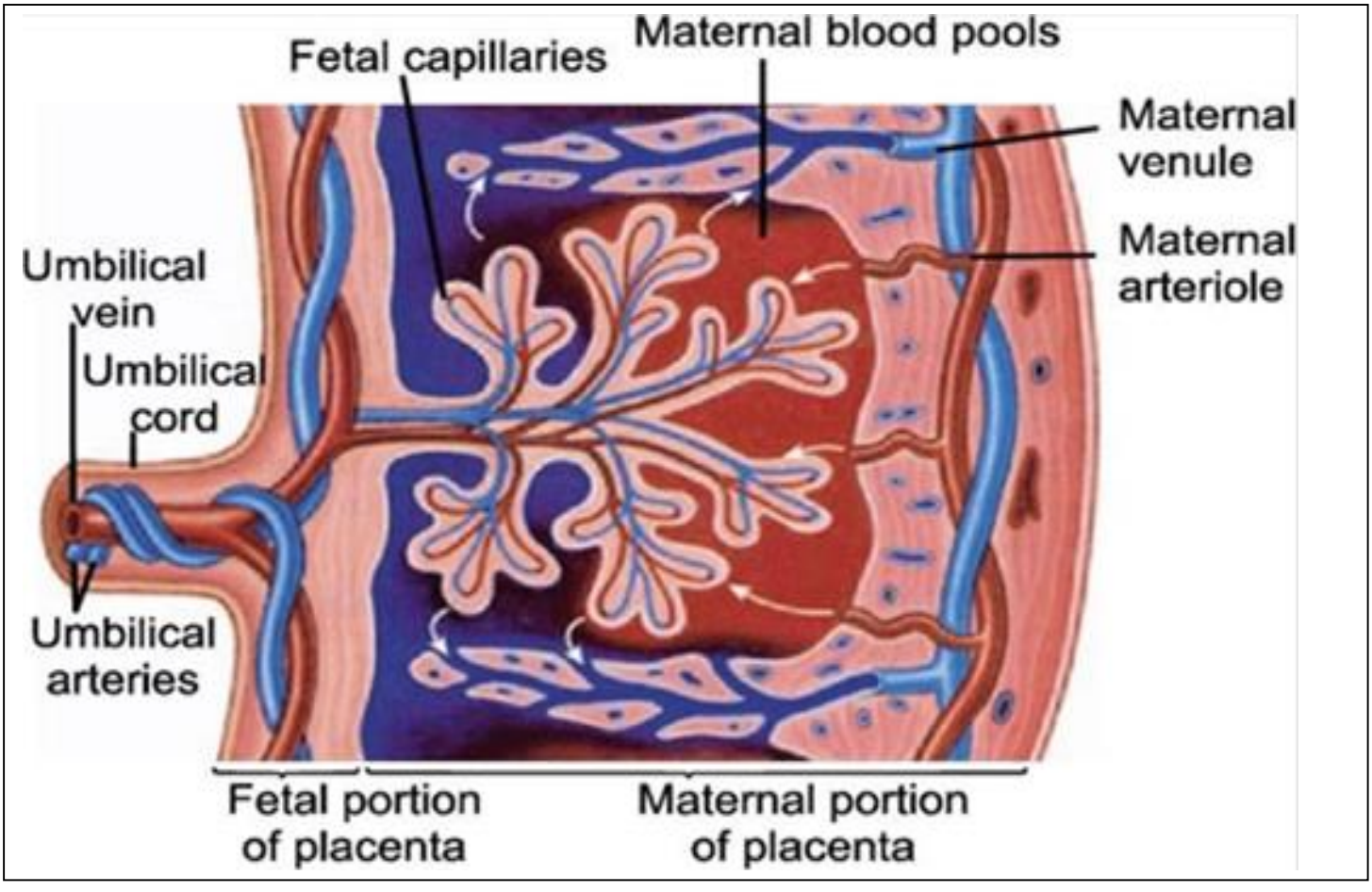


Figure 4: Feto-placental circulation-of-biology-at-cornell-university-fall-2007 [16]

❖ **Changes During Pregnancy** [13]

❖ **Cardiovascular and hematological modifications**

- Increases in cardiac output of 30 to 50% (by increasing ventricular ejection volume from 70 to 90ml), plasma volume of more than 45% (plasma volume increases from 2600 to 3800 mL at 34 weeks) and blood volume (20%) between 6 and 32 weeks' gestation, which will lead to gravid anaemia by haemodilution;
- Compression of the large vessels by the gravid uterus during strict supine position, preventing venous return/hypoperfusion, is the cause of oedema (five to eight out of ten pregnant women; these oedemas are physiological if they are not accompanied by arterial hypertension) and fetal suffering;
- Blood pressure is slightly affected, slightly decreasing in the 2nd trimester by 15 to 20 mmHg. The decrease in diastolic blood pressure is explained by a reduction of around 33% in peripheral arterial vascular resistance.
- The lower limit of haemoglobin during pregnancy is 10.5 g/100 ml.
- Coagulation factors increases (fibrinogen, factors VII/VIII), which explains the frequency of thrombosis.

❖ **Respiratory Modifications**

- Pregnant women hyperventilate (an increase of 50-60%), resulting in physiological hypocapnia. This is linked to progesterone, which reduces the sensitivity of the respiratory centres in normal pregnancy. However, some women may experience breathing difficulties in the last trimester of pregnancy when the uterine fundus presses on the diaphragm, as there is then a reduction in total capacity.
- Airway oedema due to fluid retention caused by hypoprotidemia, leading to intubation difficulties

❖ **Kidney Changes**

As the kidney becomes a beneficiary, it adapts to the cardiac output. As a result, the renal output increases from 500 ml/min to 700-800 ml/min during pregnancy, leading to an increase in glomerular filtration. This allows uric acid, creatinine and urea to be eliminated. The result is a reduction in blood levels of these substances. The increase in maternal extracellular fluids is around 30% in favor of the plasma sector. This increase is responsible for a drop in hematocrit, which is not anemia but haemodilution. The rest of the extracellular fluid is distributed in the interstitial spaces, leading to clinical infiltration of the tissues, which may generate frank edema, which remains physiological.

2.3 Pathophysiology

✓ **Overview:** Multiple martenal, fetal and placental factors are involved in placental hypoperfusion, which leads to maternal hypertension and other consequences.

- **U**terine spiral arteries normally develop into high-capacity blood vessels.This process is defective in patients with preeclampsia,which leads to acute atherosis of the decidual vessels(presence of arterial wall fibrinoid necrosis and lymphotic infiltration) and abnormal blood flow(high pressure,pulsatile flow) of the placenta and fetus [17]
- Arterial hypertension with systemic vasoconstriction causes placental hypoperfusion which leads to release of vasoactive substance thus increasing martenal blood pressure to ensure sufficient blood supply to the fetus.
- Sytemic endothelial dysfunction causes placental hypoperfusion which increases placental release of factors causing endothelial lesion that leads to microthrombosis.
- Abnormal placental (or throphoblast) implantation or development in the uterus.

✓ **Consequences of vasoconstriction and microthrombosis**

- Organ ischemia and damage
- Preeclampsia: multiorgan involvement(primarily renal)
- Eclampsia: predominantly cerebral
- HELLP syndrome: severe systemic inflammation with multiorgan hemorrhage and necrosis (thrombotic microangiopathy of the liver)
- Chronic hyperperfusion of the placenta leads to insufficiency of the uteroplacental unit and fetal growth restriction.

Table IV: Systemic effects of hypertensive pregnancy disorders [18] [19] .

Systemic effects of hypertensive pregnancy disorders			
Organ	Pathomechanism	Disorder	Occurrence
Kidney	▪ Glomerular endothelial dysfunction and hypertension induced vasoconstriction	▪ Protenuria ▪ Impaired renal function ▪ Edema	▪ Preeclampsia ▪ Eclampsia ▪ HELLP syndrome
Lung	▪ Increased systemic vascular resistance and volume overloaded leading to left ventricular dysfunction thus increasing pulmonary capillary hydrostatic pressure, capillary permeability and decreases albumin	▪ Pulmonary edema ▪ Respiratory distress	▪ Severe preeclampsia ▪ HELLP syndrome
Liver	▪ Vasoconstriction and microthrombotic obstruction of liver sinusoids leads to liver cell damage	▪ Liver impairement and liver swelling	▪ HELLP syndrome ▪ Severe preeclampsia ▪ Eclampsia

Central Nervous System(CNS)	▪ Hypertension induced vasoconstriction and endothelial damage leading to disruption of cerebral microcirculation with microthrombi thus vasospasms in the CNS	▪ Seizures	▪ Eclampsia
Blood	▪ Systemic microthrombi and vasoconstriction leads to overactivation of the coagulation system and platelet consumption ▪ Microangiopathic hemolysis	▪ Disseminated intravascular coagulopathy ▪ Thrombocytopenia ▪ Anemia	▪ HELLP syndrome ▪ Severe preeclampsia

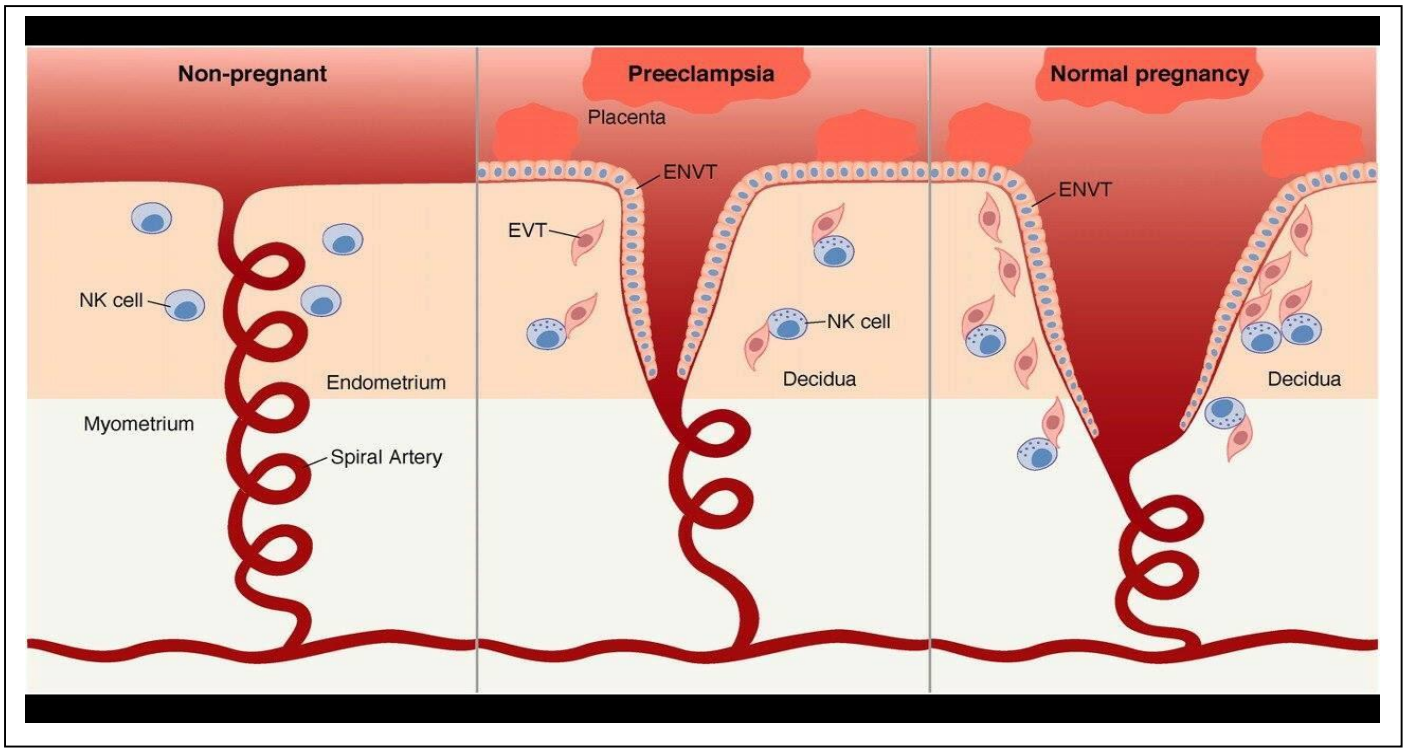


Figure 5: Diagram of placentation [20].

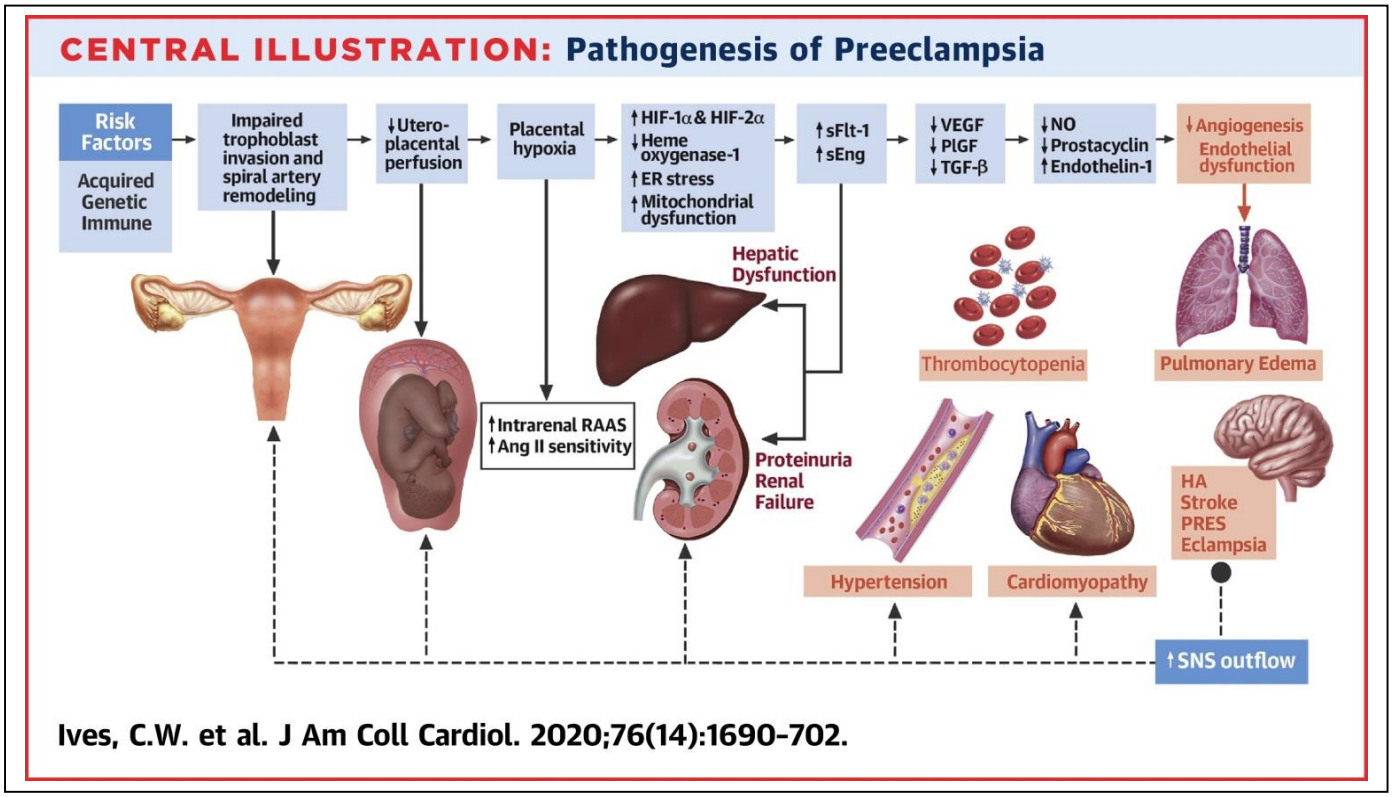


Figure 6: Pathophysiology of preeclampsia [20].

2.4 Clinical manifestations and diagnosis

2.4.1 Clinical features

❖ **Gestational Hypertension**

- Asymptomatic hypertension
- Nonspecific symptoms (eg. morning headache, fatigue , dizziness) can occur

❖ **Preeclampsia**[21]

- Onset;
  - ~90% occur after 34 weeks' of gestation.
  - In approximately 5% of individual with preeclampsia , the condition is not diagnosed during pregnancy and symptoms only develop postpartum(postpartum preeclampsia)[22]

❖ **Preeclampsia without severe features (Mild preeclampsia)**

- Usually asymptomatic
- Nonspecific symptoms may include:
  - Headaches
  - Visual disturbances
  - RUQ or epigastric pain
  - Rapid development of edema
- Hypertension
- Protenuria

❖ **Preeclampsia with severe features**[23]

- Severe hypertension (SBP ≥160mmHg or DBP ≥110mmHg)
- Protenuria, oliguria
- Headache
- Visual disturbance(blurred vision, scotoma)
- RUQ or epigastric pain
- Pulmonary edema
- Cerebral symptoms(altered mental status, nausea, vomiting, hyperreflexia, clonus)

❖ **HELLP Syndrome**[24]

- Onset: most commonly >27 weeks' gestation(~30% occur postpartum)
- Preeclampsia usually present. (~85%)
- Nonspecific symptoms: nausea,vomiting,diarrhea

- RUQ pain(liver capsule pain; liver hematoma)
- **Rapid clinical deterioration**(DIC,pulmonary edema, acute renal failure, stroke, abruption placentae)

NB: Hypertension and proteinuria may be mild or even absent in patients with HELLP syndrome. Patients may present primarily with nonspecific symptoms [25].

❖ **Eclampsia**

- Onset: The majority of cases occur intrpartum and postpartum
- Most often associated with severe preeclampsia but can be also be associated with mild preeclampsia
- Eclampsia seizures: generalized tonic-clonic seizures [26].

2.4.2 DIAGNOSIS

❖ **Approach** [27] [28] [29] [30]

✓ At each prenatal care appointment, screen all patients for features of hypertensive pregnancy disorders e.g.

- Blood pressure≥140/90mmHg
- Rapid weight gain and/or new severe edema
- Urine dipstick:>2+ protein
- Asses for end –organ damage (eg complete blood count, basic metabolic panel, liver chemistries).
- Confirm diagnosis based on diagnostic criteria for hypertensive pregnancy disorders.
- Asses fetal health via antepartum fetal surveillance

NB: - In patients with chronic hypertension, conduct baseline 24-hour urine protein, serum liver, and renal function tests at the initial prenatal care visit; an upward trend may indicate superimposed preeclampsia [27].

❖ **Diagnostic workup** [27] [31] [30]

The initial workup for all suspected hypertensive pregnancy disorders is the same.

✓ **Serial blood pressure measurement**[27]

- **Hypertension**: SBP≥140mmHg and/or DBP ≥90mmHg(on 2 separate measurements at least 4hours apart)
- **Severe hypertension**: SBP≥160mmHg and/or DBP≥110mmHg[27]

✓ **Urine Studies**[27] [29]

Any of the following may be used to asses for proteinuria

- **24-hour urine collection(gold standard)**

Proteinuria (urinary protein excretion ≥300mg/day)

- **Urine protein:creatinine ratio**: ≥0.3 (the ratio is typically calculated before starting 24-hour urine collection to prevent diagnostic delay)
- **Urine dipstick**:>2+ protein(low accuracy; consider only if other tests are not feasible.[30]

✓ **Blood Tests**[27] [28]

Perform the following in all patients to assess for end-organ dysfunction.

- **Complete blood count**: ↓Hb; ↓platelets may be seen in severe preeclampsia or HELLP
- **Liver chemistries**:↑Transaminases are suggestive of severe preeclampsia or HELLP.(AST is typically elevated to a greater extent than ALT, unlike in many other forms of parenchymal liver disease. Elevated transaminases may also be seen in pregnancy-associated liver disease, especially acute fatty liver of pregnancy)
- **Renal function tests**: Declining eGFR is indicative of severe preeclampsia(patients with chronic hypertension may have preexisting renal impairment, including proteinuria, emphasizing the importance of establishing baseline values at the first prenatal care visit)
- **Lactate dehydrogenase**: Levels may be elevated in HELLP. (secondary to hemolysis or hepatic ischemia and/or necrosis)

✓ **Additional Studies(selected patients)**

- **Chronic hypertension** [28]
  - Serum electrolytes
  - ECG in patients with long-standing hypertension
  - Consider serum uric acid levels: Abnormal elevated suggests preeclampsia(levels of uric acid naturally increase in the late pregnancy, however, the level in preeclampsia are much higher)

✓ **Suspected HELLP(** thrombocytopenia and/or liver function impairement)

- Peripheral smear: schistocytes indicate hemolysis

- Coagulation studies:↑D-dimer,↑prothrombine time/partial thromboplastin time, ↓fibrinogen, and ↓antithrombin III suggest disseminated intravascular coagulation.

✓ **Infractable headache or neurological symptoms**: CT head to rule out intracranial hemorrhage or alternative pathology

❖ **Diagnostic criteria** [27] [28] [30] [32]

Table V: Diagnostic criteria for Hypertensive disorders of pregnancy [26] [27] [28] [32].

Diagnostic criteria for hypertensive pregnancy disorders		
Disorders		**Diagnostic criteria**
Chronic hypertension		▪ Hypertension diagnosed before pregnancy 20 weeks of pregnancy with or without end-organ dysfunction
Gestational hypertension		▪ Hypertension (≥140/90mmHg) diagnosed at≥20 weeks' gestation. ▪ No history of preexisting hypertension ▪ Patients are otherwise asymptomatic with normal laboratory studies(ie no proteinuria, no end-organ dysfunction)
	Preeclampsia without severe features	• HBP(≥140/90mmHg) and proteinuria, as evidence by any of the following: • 24-hour urine collection: ≥300mg/24hours • Urine proteins: creatinine ration: ≥0.3 • Urine dipstick: >2+ protein
	Preeclampsia with severe features	• GH plus≥1 of the following: • Severe hypertension(≥160mmHg systolic or ≥110mmHg diastolic) • Thrombocytopenia(eg platelets < 100,000 cell/mm^3 • Impared renal function; - Serum creatinine>1.1mg/dl or doubling of serum creatinine

Preeclampsia		▪ Impaired liver function not explained by alternative diagnoses - ≥2 times upper limit of normal of transaminases - Severe,refractory RUQ or epigastric pain ▪ Pulmonary edema ▪ New onset of either: - Headache that is unresponsive to medication - Visual disturbance(blurred vision,scotoma)
	HELLP syndrome	• Preeclampsia plus all of the following - H=Hemolysis(eg ↓hemoglobin,↓haptoglobin,↑LDH, and ↑indirect bilirubin) - EL= Elavated Liver enzymes(↑AST,↑ALT) - LP=Low Platelets(<100,000cell/mm^3)
	Chronic hypertension with superimposed preeclampsia	• History of HBP with either: - New onset of ≥1 of the following - Proteinuria - Thrombocytopenia - Impaired renal or liver function - Symptoms of preeclampsia - Or sudden worsening of existing proteinuria of hypertension
Eclampsia		• New-onset of seizures(generalized tonic-clonic, focal or multifocal) in a patient with preeclampsia

❖ **FETAL ASSESSMENT**[33] [27]

Fetal evaluation should be conducted in parallel with maternal workup.

- Cardiotocography: to monitor fetal heart rate and uterine contractions
- Ultrasound to asses:

✓ Blood flow to the placenta and fetus; findings on the Doppler ultrasound include:

- Increased resistance and abnormal flow pattern in atypical uterine arteries[34]
- Bilateral notches (ie early diastolic indentation) in the uterine artery flow profile.[35]

✓ Signes of fetal distress: eg reduced movement, abnormal or absent breathing, reduced or absent tone

✓ Evidence of complications[27] [34]

- Fetal growth restrictions
- Placental abruption
- Oligohydramnios

2.4.3 Differential Diagnosis

❖ **Differential diagnosis of altered liver chemistries** [36] [37]

- Hyperemesis gravidarum[38]
- Intrahepatic cholestasis of pregnancy
- Acute fatty liver of pregnancy
- HELLP syndrome

❖ **Differential diagnosis of eclampsia**

Seizures disorders during pregnancy can be caused by any of the following:

- Epilepsy
- Encephalitis
- Metabolic disorders (hypoglycemia, hyponatremia)
- Hemorrhagic stroke
- Ischemic stroke
- Withdrawal syndrome

❖ **Differential diagnosis of HELLP syndrome**

- Other causes of thrombocytopenia : thrombotic microangiopathy(hemolytic uremic syndrome)
- Other pregnancy-associated liver diseasis:

- Acute fatty liver of pregnancy
- Intrahepatic cholestatsis of pregnancy

- Other causes of acute liver failure not specific to pregnancy(eg fulminant viral hepatitis)

2.4.4 Management

❖ **Overview of pharmacotherapy**

✓ **Antihypertensive for urgent blood pressure control in pregnancy**[27]

Antihypertensives should be given within 30-60 minutes of diagnosis in urgent hypertensive pregnancy disorders.

- Parenteral labetalol(avoiod in patients with contraindications to beta blockers)
- Nifedipine (immediate release)
- Parenteral hydralazine

✓ **Common oral antihypertensive in pregnancy**[28] [27]

- Labetalol
- Nifedipine
- Metgyldopa

NB: Avoid ACE inhibitors and angiotensin receptors blockers during pregnancy (especially during the 1st trimester) because of their teratogenic effect.

✓ **Magnesium sulfate for seizure prophylaxis** [27] [39] [40]

- Indications
  - Eclampsia
  - HELLP syndrome
  - Preeclampsia with severe features
- Administration: magnesium sulfate(IV or IM)
  - Contraindicated in patients with myasthenia gravis
  - Should be administered with care in patients with renal insufficiency (MgSO4 is excreted by the kidney. Therefore, patients with renal insufficiency are at increased risk of hypermagnesemia)
- Monitoring
  - Monitor all patients for hypermagnesemia(e.g. decreased deep tendon reflexes, respiratory depression)

- If signs of hypermagnesemia (lethargy, Somnolence, blurred vision, muscle paralysis, nausea, vomiting, hypotension, bradycardia, cardiac arrest) administer calcium gluconate.

✓ **Preeclampsia prophylaxis**

Assess all patients with chronic and gestational hypertension for risk factors for preeclampsia

Table VI: Risk Factors for preeclampsia[27] [28] [41].

Risk factors for preeclampsia	
High-risk factors	**Moderate-risk factors**
• Previous eclampsia or preeclampsia • Chronic hypertension • Type 1 or 2 diabetes mellitus • Autoimmune disease(eg antiphospholipid syndrome, systemic lupus erythematous) • Chronic kidney disease • Multiple gestation(eg twins)	• First pregnancy • Family history of preeclampsia • Maternal age≥35 years • BMI>30kg/m2 • Gestational diabetes • Pregnancy risk factors(small for gestational age, history of poor pregnancy outcome, in vitro fertilization, interval between pregnancy≥10 years) • Poor socioeconomic background

➢ **Aspirin for preeclampsia prophylaxis** [41]

- **Indications:** ≥ high risk features or ≥2 moderate-risk factors for preeclampsia
- **Regimen:** low-dose aspirin between 12-20 weeks' gestation(optimally before 16weeks)

➢ **Corticosteroids for fetal lung maturity**[42]

- **Indications:** anticipated delivery between 24 and 34 weeks' gestation[42]
- **Agents:** bethamethasone or dexamethasone

❖ Management of urgent hypertensive pregnancy disorders

Patients with preeclampsia with severe features, HELLP or eclampsia require immediate control of hypertension and management of complications (ideally in a tertiary care center) to minimize maternal and fetal mortality and morbidity.

✓ Approach [27] [43]

- Initiate antihypertensive for urgent blood pressure control in pregnancy
- Administer MgSO4 for seizure prophylaxis
- Asses for indication of immediate delivery regardless of gestational age.

▪ If present: urgent delivery after maternal hemodynamic stabilization.

▪ If absent:

- ≥34 weeks' gestation: Deliver
- 24-34 weeks' gestation: Administer corcticosteroids for fetal lung maturity followed by expedited delivery
- Before fetal viability: Continuation of pregnancy is not recommended because of the significant risk of maternal life threatening complication.

➢ **Indications for expedited delivery in hypertensive pregnancy disorders**

✓ **Immediate Delivery** [43] [44]

The presence of any of the following is an indication for immediate delivery after maternal stabilization.

- Eclampsia
- Pulmonary edema
- Disseminated intravascular coagulation
- Placenta abruption
- Severe hypertension refractory to antihypertensives
- Signs of fetal distress
- Fetal demise or fetus unlikely to survive

✓ **Urgent delivery**[43]

Delivery should be expected after administration of corticosteroids for fetal lung maturity if any of the following are present.

- Labor or premature rupture of membranes
- Severe oligohydramnios
- Reversed end-diastolic flow on umbilical artery Doppler
- New-onset or worsening renal impairement
- Moderate or severe thrombocytopenia
- Abnormal liver chemistries

➢ **Preeclampsia with severe features** [27,43]

a) Medical Management

- Start antihypertensive for urgent blood pressure control in pregnancy
- Administer magnesium sulphate for seizures prophylaxis
- Monitor blood pressure, oxygen saturation and urine output
- Manage complications (e.g. pulmonary edema, headache, renal **insufficiency).**

b) Obstetric Management

- Indications for immediate delivery regardless of gestational age present: Deliver (Vaginal delivery is preferred but often cesarean delivery is needed in the case of younger gestational age, immature cervix or fetal conditions)
- Indications for immediate delivery absent
  - ≥34 weeks' gestation : Deliver
  - Between fetal viability and 34 weeks' gestation: assess maternal and fetal status

- Unstable: Stabilize the mother and proceed to delivery
- Stable;
- Administer corticosteroids for fetal lung maturity
- Strictly monitor maternal and fetal status.

➢ **Eclampsia** [27,43]

a) Medical Management

- Treat eclamptic seizures
  - Place the patient in the lateral decubitus psotition to:
    - Prevent placental hypoperfusion due to inferior vena cava compression
    - Reduce the risk of inhalation of foreign material
  - Start anticonvulsive therapy
    - First line: Magnesium sulphate
- Start antihypertensive s for urgent blood pressure control in pregnancy

b) Obstetric Management

- Eclampsia is an indication for immediate delivery regardless of gestational age.
- Delivery should occur only after the mother is stable and seizures have stopped.

➢ **HELLP Syndrome** [27,43]

a) Medical Management

- Administer blood products (e.g. platelets,packed red blood cells, fresh frozen plasma) as needed to manage hemorrhage and coagulopathy.
- Initiate antihypertensive for urgent blood pressure control in pregnancy.
- Administer magnesium sulphate for seizure prophylaxis

b) Obstetric Management

- Expedited delivery is indicated for all patients regardless of gestational age
  - ≥34 weeks' gestation: Deliver immediately
  - 24-34 weeks' gestation: Administer corticosteroids for fetal lung maturity, if feasible.
  - Delivery may be until 24-48hours after corticosteroids administration if maternal and fetal status remains stable.

❖ **Management of non-urgent hypertensive pregnancy disorders**

This section provides an overview of the management of chronic hypertension, gestational hypertension or preeclampsia without severe features.[28]

- Perform a full maternal and fetal assessment to determine severity
- Assess gestational age using a reliable method
  - Gestational age ≥37weeks: Deliver

- Gestational age < 37 weeks

- Expectant management until ≥37 weeks(unless expedited delivery in hypertensive pregnancy disorders is indicated)
- Monitor 1-2 times weekly(including blood pressure, laboratory studies and fetal assessment)
- Initiate hypertensive if clinically indicated
- Chronic hypertension and gestational hypertension: Initiate aspirin for preeclampsia prophylaxis if clinically indicated.
- Anticipated delivery between 24 and 34 weeks' gestation: Administer corticosteroids for fetal lung maturation.
- Educate patients to recognize features of severe preeclampsia and signs of fetal distress to seek prompt medical attention if they develop.

➢ **Chronic hypertension in pregnancy**

a) Medical Management

- All patients: encourage lifestyle modifications for hypertension (e.g. smoking cessation, exercise, avoid caffeine and excess sodium)
- Threshold to initiate antihypertensives (in treatment-native patients):blood pressure≥140/90mmHg [45,46]

Table VII: Management of chronic hypertension [28].

Management of chronic hypertension in pregnancy	
Blood pressure	**Management**
≥140/90mmHg (mild hypertension)	• Start antihypertensive drugs • Patients already on antihypertensives - Continue treatment - Review safety profiles of antihypertensives for use in pregnancy

Systolic pressure≥160mmHg and/or diastolic pressure ≥110mmHg lasting ≥15minutes (severe hypertension)	• Administer antihypertensive therapy as soon as possible according to agents used in pregnancy. (ideally within 60 minutes)

✓ **Prophylaxis against superimposed preeclampsia** [41]

Patients with chronic hypertension are at high risk of developing preeclampsia

- Educate patients on the symptoms of preeclampsia
- Start aspirin in prophylaxis against preeclampsia

b) Obstetric management

- Chronic hypertension without superimposed preeclampsia: Deliver between 27 and 29 weeks' gestation
- Superimposed preeclampsia without severe features; consider expectant management till 37 weeks; gestation with close maternal and fetal surveillance

➢ **Gestational hypertension and preeclampsia without severe features**

✓ **Approach** [27]

- ≥37 0/7 weeks' gestation: Hospitalize and deliver.
- 36 6/7 weeks' gestation
  - Perform a full obstetric ultrasound (estimating fetal weight and amniotic fluid volume)
  - Screen for indications for expedited delivery in hypertensive pregnancy disorders.
  - If present: Deliver; administer corticosteroids for fetal lung maturity if indicated and feasible.
  - If absent;
    - Manage expectantly; deliver at 37 weeks
    - Follow-up 1-2 times weekly for maternal and fetal monitoring
    - Initiate antihypertensive if clinically indicated
  - Patients with SBP ≥160mmHg and/or DBP≥110mmHg should be diagnosed with preeclampsia with severe features and managed accordingly.

✓ **Hospitalization and Delivery** [44]

- Delivery is recommended at ≥37 weeks' gestation.

- Expedited delivery is recommended, regardless of gestational age, if there is evidence of maternal or fetal deterioration.
- If feasible, administer corticosteroids for fetal lung maturation if delivery of a viable fetus between 24 and 34 weeks' gestation indicated.

✓ **Outpatient Management** [47]

Maternal and fetal monitoring

- Serial blood pressure monitoring
- Assessment for the development or worsening of preeclampsia
- Serial laboratory studies
  - Weekly assessment of platelet count, serum creatinine and liver chemistries
  - In addition weekly assessment for proteinuria is recommended for patients with gestational hypertension

Fetal monitoring

- Weekly assessment of amniotic fluid index
- Fetal non stress test once or twice weekly; if nonreactive, perform a biophysical profile
- Ultrasound assessment of fetal growth every 3-4 weeks

- Preeclampsia without severe features can progress to preeclampsia with severe features within days and, therefore should be closely monitored.

2.4.5 Complications

a) Maternal complications

- Placenta Abruptio
- Disseminated intravascular coagulation
  - Injury to placenta →tissue factor release→ unregulated activation of the coagulation cascade
  - ~20% of patients with HELLP syndrome develop disseminated intravascular coagulation
- Cerebral hemorrhage, ischemic stroke
- Acute respiratory distress syndrome
- Acute renal failure
- Hepatic subcapsular hematoma
  - Complication of severe preeclampsia and HELLP syndrome
  - Svere hypotension may occur due to rupture of hematoma

- Aspiration pneumonia
- Retinal detachment
- Long-term: increased risk for cardiovascular disease, diabetes mellitus and chronic kidney disease

  Maternal death

b) Fetal complication

It occurs due to insufficient plancental perfusion

- Fetal growth restriction
- Preterm birth
- Seizure-induced fetal hypoxia
- Fetal death

2.4.6 Prognosis

The prognosis of hypertensive pregnancy disorders depend on the severity of the condition and the complications that occur. In the majority of cases, the conditions resolve within hours or days after delivery.

✓ Recurrent rate in following pregnancies

- Preeclampsia: 10-20% [48]
- Eclampsia:1-2%
- HELLP syndrome: 3-5% [49]

✓ Maternal mortality

- Eclampsia:5-10%
- HELLP syndrome:1-3.5%

✓ Fetal mortality

- Eclampsia:5-11% [50]
- HELLP syndrome: up to 24%

2.5 Review of studies

2.5.1 In the world

Table VIII: Review of studies

Title and place of study	Authors and year of study	Setting	Results
Remote blood pressure monitoring in high risk pregnancy — study protocol for a randomised controlled trial (REMOTE CONTROL trial)	Theepika Rajkumar, Jill Freyne, Marlien Varnfield, Kenny Lawson, Kaley Butten, Renuka Shanmugalingam, Annemarie Hennessy and Angela Makris 2023	The REMOTE Control trial will recruit patients across 3 metropolitan Australian teaching hospitals; Liverpool, Campbelltown and Bankstown Hospitals. Within these hospitals, women at high risk of developing a hypertensive disorder of pregnancy are referred to specialist obstetric medicine clinics, where their blood pressure is monitored regularly throughout their pregnancy, leading to an additional 6–8 clinic reviews. The non-inferiority trial will compare remote blood pressure monitoring with conventional clinic monitoring in a 1:1	Results will be reported according to Consolidated Standards of Reporting Trials (CONSORT) guidelines, using the extension for non-inferiority trial. They will be presented as adjusted risk ratios with 95% confidence intervalsls

		allocation ratio.	
Home blood pressure monitoring in the antenatal and postpartum period: A systematic review meta-analysis	Erkan Kalafat , Can Benlioglu , Basky Thilaganathan , Asma Khalil 2019	Recent evidence suggests that home blood pressure monitoring (HBPM) is an effective way of managing women with hypertensive disorders of pregnancy (HDP) without increasing adverse outcomes. The aim of this systematic review and meta-analysis was to investigate the safety and efficacy of HBPM during pregnancy	. The literature search yielded 1082 citations and 12 additional citations were identified through other sources. Abstracts of 798 records were reviewed for eligibility and 65 studies were selected for full-text review. Eleven studies were eligible for inclusion in the systematic review. The PRISMA flow diagram demonstrates the study selection and the excluded articles with reasons (Fig. 1). Among the included studies for systematic
Patient perceptions, opinions and satisfaction of telehealth with remote blood pressure monitoring postpartum	Nicole A. Thomas, Anna Drewry, Susan Racine Passmore, Nadia Assad and Kara K. Hoppe 2021	Our aim was to conduct a post participation survey of respondent experiences with in-home remote patient monitoring via telehealth for blood	Sixty six percent of respondents completed the survey. The majority of women found the technology fit easily into their lifestyle. Privacy concerns

		pressure monitoring of women with postpartum hypertension. We hypothesized that the in-home remote patient monitoring application will be implemented with strong fidelity and have positive patient acceptability.	were minimal and factors that influenced this included age, BMI, marital status, and readmissions. 95% of women preferred remote care for postpartum follow-up, in which hypertensive type, medication use and ethnicity were found to be significant factors in influencing location of follow-up. Most women were satisfied with the devices, but rates varied by hypertensive type, infant discharge rates and BMI.
Eclampsia in African Milieu, Yaounde-Cameroon: epidemiology, seasonal variations and treatment regimen	Essiben Félix,1 Wandji Yemga Dorielle Vanessa,2 Ngo Um Meka Esther,3 Mve Koh Valère,1 Dohbit Sama Juilius Sama,1	We carried out a retrospective cross-sectional descriptive study from December 2017 to April 2018 at YGOPH. All women managed for eclampsia over the	The frequency of eclampsia was 0.96% (151/25680). The mean age of patients was 23.95±6,02 years. Singles (73.5%), housewives (40.4%) and nulliparous patients (54.9%) were the

	Ojong Samuel Atomveng,4 Foumane Pascal 2017	preceding 10 years, from May 1st 2008 to April 30th 2018, were included in the study. We evaluated the seasons of disease occurrence, socio-demographic and clinical characteristics on admission and treatment regimen. We analysed our data using Epi info 7.0.	most represented. The disease occurred more frequently during the major rainy season (43.7%). Patients were most often referred cases (70.2%). Eclampsia occurred mostly antepartally (70.3%). Hypertension was most often severe (83.45%). Nicardipine was the most used antihypertensive medication (76.8%) and magnesium sulphate was the anti-convulsant of choice (98.0%). The majority of women delivered by caesarean section (77.8%). HELLP syndrome was the most common maternal complication (9.9%), while prematurity was the

			most frequent fetal complication (58.9%). The maternal and neonatal mortality rates were 8.6% and 24.4%, respectively
Telehealth with remote blood pressure monitoring for postpartum hypertension	Kara K. Hoppe , Makeba Williams , Nicole Thomas , Julia B. Zella , Anna Drewry , KyungMann Kim , Thomas Havighurst , Heather M. Johnson 2019	Investigate feasibility of telehealth with remote blood pressure monitoring for management of hypertension in postpartum women at risk of severe hypertension after hospital discharge. A prospective single-cohort feasibility study	Among 1413 deliveries 263 (19%) women had hypertension in pregnancy and 55/124 (47%) of women approached were consented. The retention rate was 95%. Among study participants, the incidence of severe hypertension after discharge was 9 (16%). 29 (53%) of participants required treatment due to exacerbations in blood pressure after discharge, in which 9(16%) were severe. There were no hospital readmissions. Overall 39 (86%)

			participants were satisfied with the remote monitoring.
Self-monitoring of blood pressure in pregnancy: A mixed methods evaluation of a national roll-out in the context of a pandemic	Hannah Wilson , Katherine L. Tucker , Alison Chisholm , James Hodgkinson , Layla Lavallee b, Lucy Mackillop , Alexandra E. Cairns , Lisa Hinton , Charlie Podschies , Lucy C. Chappell , Richard J. McManus 2022	To evaluate how English maternity units implemented self-monitoring of blood pressure (SMBP) in pregnancy in response to the COVID-19 pandemic. Mixed methods including surveys, anonymised patient data and in-depth interviews with women in maternity units across England.	SMBP was predominantly used to provide additional BP monitoring for hypertensive or high-risk pregnant women. Overall maternity units and women were positive about its use in terms of reducing the need for additional face-to-face contacts and giving women more control and insight into their own BP. However, there were challenges in setting up SMBP services rapidly and embedding them within existing care pathways, particularly around interpreting readings and managing the provision of monitors.
Comparing standard office-based follow-	Adi Hirshberg, Katheryne Downes,	This study was design to compare	206 women were randomised (103 in

up with text-based remote monitoring in the management of postpartum hypertension: a randomised clinical trial	Sindhu Srinivas	the effectiveness of text-based blood pressure monitoring to in-person visits for women with hypertensive disorders of pregnancy in the immediate postpartum period.	each arm). Baseline characteristics were similar. There was a statistically significant increase in a single blood pressure obtained in the texting group in the first 10 days post partum as compared with the office group (92.2% vs 43.7%; adjusted OR 58.2 (16.2–208.1), p<0.001). Eighty-four per cent of patients undergoing text-based surveillance met ACOG criteria for blood pressures at both recommended points.
Remote monitoring of blood pressure to reduce the risk of preeclampsia related complications with an innovative use of mobile technology	R. Ganapathy , A. Grewal , J.S. Castleman 2016	Assess ease of use and safety of the newly developed kit which included a Bluetooth enabled blood pressure machine and an android based mobile phone. The phone was modified to have	The technology provides accurate data and visual cues including safe remote transfer instantaneously. 90% of the women agreed that the Kit was simple to use

		only one application in it which showed the blood pressure readings with a traffic light system. The study was a proof of concept for wider use of the kit. We provided 50 women who were admitted with the kit. We assessed ease of use of the blood pressure machine and accuracy of readings including remote transfer to a computer.	and 78% would prefer this model of testing at home.

CHAPTER 3 : METHODOLOGY

3.1 Type of study

We conducted a prospective cohort study

3.2 Site of study

Our study was carried out in two hospitals in Yaoundé. These hospitals were the Yaoundé Central Hospital (YCH) and Yaounde Gynaecology-Obstetrics and pediatrics hospital (YGOPH)

Yaoundé Gynaecology, Obstetrics and Pediatrics Hospital

It is a reference health facility created in 2002 and specializes in mother and child health care. Its gynecology/obstetrics department has a capacity of 34 inpatient beds, 3 delivery tables,4 operating theatres with two laparoscopy columns. The service carries out an average of 3015 deliveries per year with a staff of 14 specialists in Obstetrics and Gynecology. The cesarian section rate is 34.5%

. **Yaoundé Central Hospital**

This reference hospital located in the heart of Yaoundé has one of the biggest and most specialized maternity unit with over 72 in-patient beds, 6 delivery tables, 2 service operating theatres, 11 gynecologists and a large highly trained staff. It records about 219 deliveries per month and 2628 deliveries per year. The rate of cesarian section is 34.5%.

These are reference hospitals. Hence, have been chosen for this study because of their great patient turn out, good follow up, and clear records

3.3 Duration of study

The study was carried out over a duration of nine months, beginning from October 2023 to June 2024.During this period the following tasks were accomplished: writing of protocol, obtaining of ethical clearance and other authorization documents, data collection and analysis, thesis writing, proofreading and publishing of the results. Recruitment of participants began in January 2024 up to April 2024.

3.4 Study population

Our study population consisted of all postpartum women in the selected hospitals within the period of the study. The women were screened based on the following criteria;

3.4.1 Inclusion Criteria

Exposed Group

- Women diagnosed with preeclampsia/eclampsia before delivery who monitored their blood pressure remotely on daily basis for 6weeks after delivery.
- Have access to a smart phone (personal or close family member living with participant)
- Acceptable level of education in order to fill in their information correctly into MedArc application.(primary education)
- Acceptance to participate freely in the study and sign consent form.

Non-exposed Group:

- Acceptance to participate freely in the study
- Women diagnosed with preeclampsia/eclampsia before delivery who monitored their blood pressure after delivery only in the hospital facility and on the 42nd day postpartum visit.
- Any level of education.

3.4.2 Exclusion Criteria

- Preeclampsia/eclampsia with comorbidities.

3.4.3 Non-Inclusion Criteria

- All pregnant women with end organ dysfunction.

3.5 Sampling

3.5.1 Sampling Method

Recruitment of participants was non-probabilistic, consecutive and non-exhaustive.

3.5.2 Sample size estimation

Based on our study design, the sample size was calculated using the Sechelsmann formula, as shown below;

$$n = \left[\frac{2 * \left(Z_{\alpha} + Z_{\beta}\right)^{2} * p * (1-p)}{(p_0 - p_1)^2}\right]$$

Where;

P_1 = proportion of women with preeclampsia/eclampsia who monitored their blood pressure only in the hospital before being discharged and on 6th week visit after delivery.

P_2 = proportion of women with preeclampsia/eclampsia who monitored their blood pressure daily at home for 6 weeks after delivery

$P = (P_0 + P_1) / 2$

$\alpha = 0.05$

$Z_\alpha = 1.96$

$\beta = 0.1$

$Z_\beta = 0.84$

Therefore **n = 42 participants**

There were 42 participants in the exposed group and 84 in the non-exposed given a ratio of 1:2.

3.6 Procedures

3.6.1 Administrative procedures

We developed and presented the research proposal to the supervisors for validation, after which we obtained authorization from the management of the hospitals and ethical clearance from the Institutional Review Board of the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I.

3.6.2 Recruitment and data collection

Both participants of the exposed and unexposed group were recruited in the postpartum wards of the two selected hospitals. Exposed group consisted of women treated for preeclampsia/eclampsia who monitored their blood pressure remotely on daily at home for six weeks after delivery. The non-exposed group was made up of women treated for preeclampsia/eclampsia who monitored their blood pressure only in the health facility and on the 42nd day postpartum, matched by age (±2years) and parity.

Women in the exposed group had minimum basic education and possessed an electronic sphygmomanometer, they were trained on how to use the instruments and how to chart the results.

For specific objective 1: Baseline data were collected on enrolment, including age, marital status, profession, religion, level of education, residence, gravida formula, past medical history and gestational age.

For specific objective which was to determine the mean remote and facility blood pressure among these women;

Women in the exposed group were trained on self-monitoring of blood pressure. This training included instructions on how to measure blood pressure at home and recorded into MedArc application. Participants or their trained partners, took daily measurements at home using the sphygmomanometers. These measurements were taken twice a day, in the morning (8am) and the evening (8pm), after five minutes of rest. These readings included systolic, diastolic and pulse readings which were recorded into the MedArc application installed in their smartphones.

The application automatically recorded these measurements and allowed us to monitor their readings. If blood pressure values are too high or too low. The investigator receives a signal via MedArc application and calls the patient to come for evaluation. In the case of any hospital admission, participants continued their daily blood pressure monitoring

Figure 7; Electronic syphengomanometer

Recording of facility blood pressure

About MedArc Application

MedArc is a free app, available to be used by everyone from patients to family members to health providers. Its main objectives are:

- **Tracking Health parameters:**

Helps users track various healthcare parameters, including blood pressure, blood sugar level

- **Storing Health Data:**
  Stores health data securely in electronic medical record (EMR) that are accessible at anytime and anywhere.
- **Receiving Medical Results:**

  Enables users to receive their medical results and reports directly in their electronic medical record.

- **Requesting Healthcare Services:**
  Allow users to request health care services directly and connect them with health specialist.

Through these features, MedArc facilitates comprehensive health monitoring and communication between patient healthcare providers.

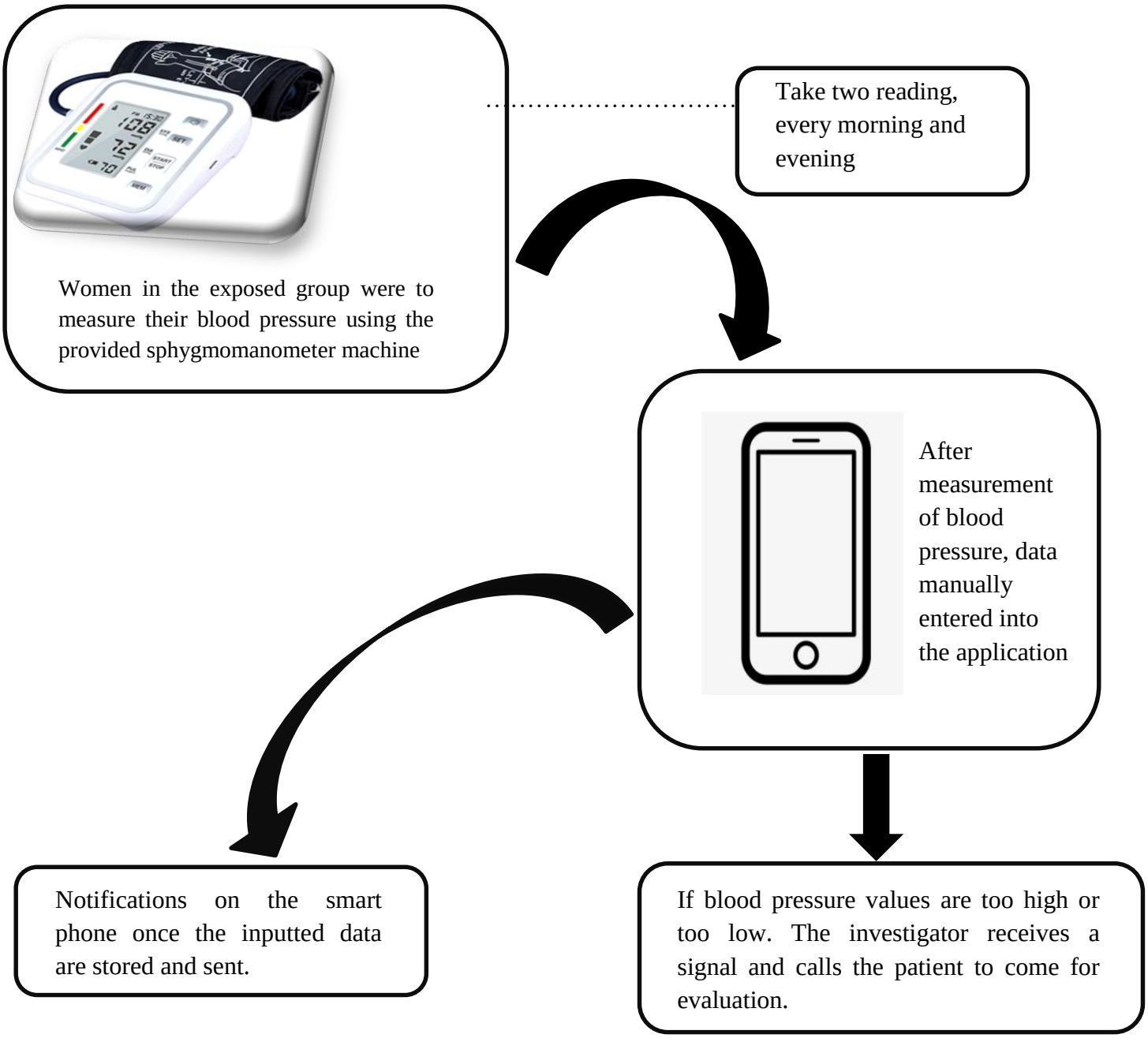
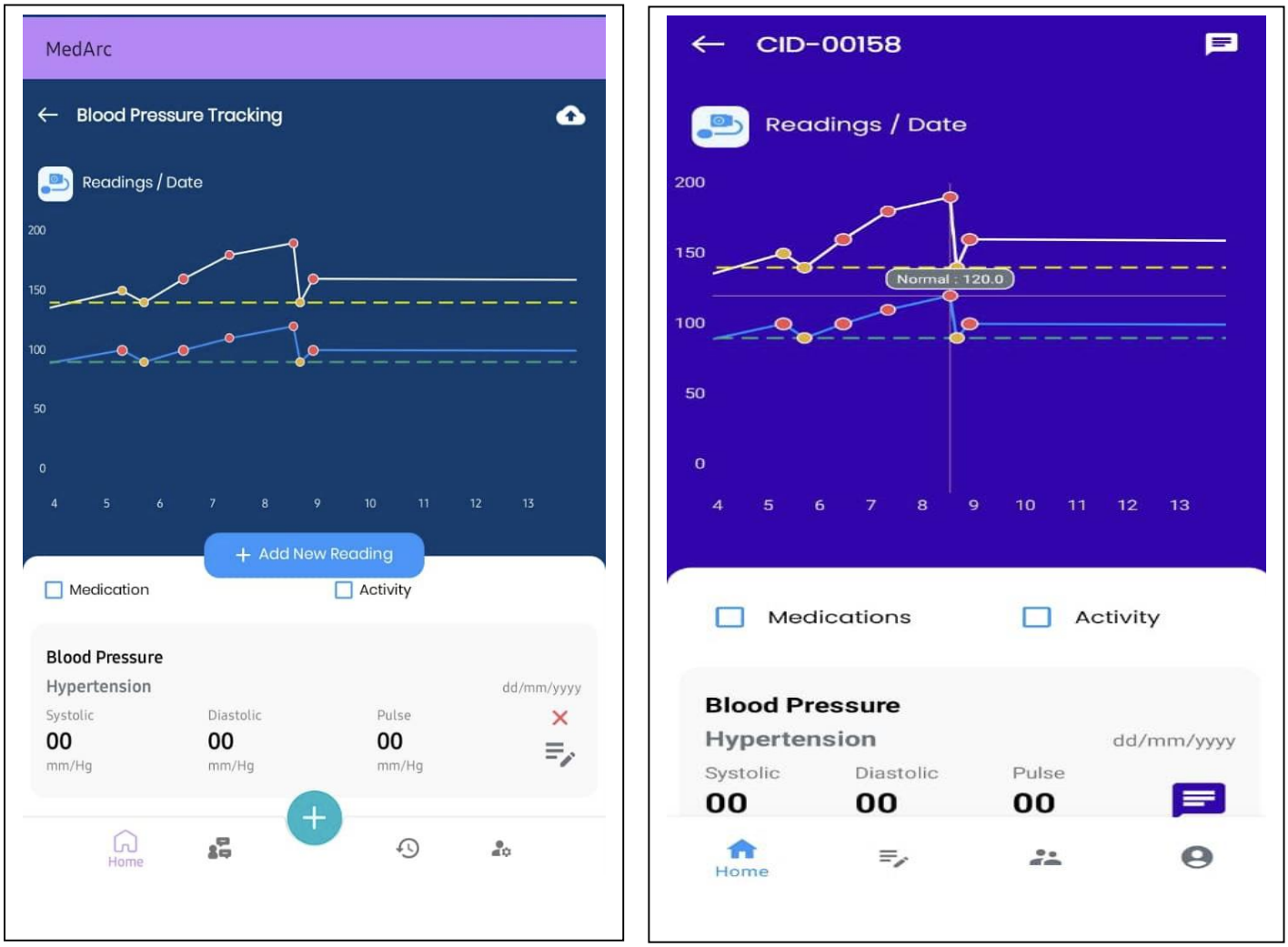


Figure 8: Illustration of self-management of blood pressure for the exposed women



i) Patient's view of the application ii) Doctor's view of the application

Figure 9: Patient/Doctor view of the app with detail statistics of the same patient.

For specific objective 3: Patients urine dipstick test was done on recruitment in hospital facility for both groups and repeated on postpartum day 10 only for the exposed group out of hospital facility. This test was done freely by the main investigator.

For specific objective 4: For every participant in the study, information of interest was collected with the help of a questionnaire and data sheet for study variables. This questionnaire was designed, internally validated by supervisors, tested and then adapted for the study. The data collected were analysed and compared.

3.6.3 Variables

For every participant in the study, information of interest was collected with the help of a questionnaire. This questionnaire was designed, internally validated by supervisors, tested and then adapted for the study. The following were searched for;

1. Sociodemographic data: this included age, gestational age, parity, marital status, religion, profession, level of education.
2. Past medical and Obstetric history: we shall check for past history of pre-eclampsia,, notion of a new sexual partners and family history of hypertension as well as any other known risk factors.
3. History of pregnancy: we obtained information on the number of antenatal contacts (ANCs), gestational age at first ANC, gestational age at diagnosis, blood pressure and proteinuria at diagnosis, gestational age at delivery and mode of delivery.
4. Outcome Variables; Blood pressure ranges, facility mean arterial blood pressure, remote mean arterial blood pressure, maternal complications at recruitment, out of hospital facility and at day 42 visit, remote and facility mean proteinuria and the differences in means.

3.7 Data collection and analysis

3.7.1 Materials for data collection

- Pre-established consent forms
- Pre-established questionnaires
- Rim of A4 papers
- Patients' medical records
- Electronic syphengomanometers
- Pen, pencil…

3.7.2 Statistical analysis

Data collected were entered into the computer and analysed using Epi info version 7.2.5.0 statistical software package. Person's chi-square was used for comparison between categorical data and Student's T test for numerical data. Exposed and non-exposed group characteristics were compared by calculating their frequencies and their percentages. The mean blood pressures and proteinuria in both groups were compared using relative risk. All p values less than 0.005 were considered statically significant. Results were represented in tables. Qualitative variable were presented as absolute numbers, frequencies and percentages while quantitative variables were presented as mean and standard deviation.

3.7.3 Material for data management

- Computer
- Scientific calculator
- Microsoft software package
- USB flash drive
- Smart phone
- Questionnaire
- MedArc application

3.8 Human resources

- Main Investigator
- Director
- Co-Supervisor
- Application Manager
- Statistician
- Participants

3.9 Ethical considerations

Before data collection, ethical clearance was requested and obtained from the ethical committee of the Faculty of Medicine and Biomedical Sciences. We equally requested administrative authorisations from the management of respective Hospitals to carry out the study.

A written informed consent form was collected from each participant.

Confidentiality was ensured by assigning randomly generated codes to every participant and these codes were used at every stage of documentation.

All data collected will be used only for the research.

CHAPTER 4: RESULTS

1.1 Recruitment of the study population

For this study, we actively recruited participants delivered in the Obstetrics and Gyaecology services of YGOPH and the YCH from January 10th to April 15th 2024.

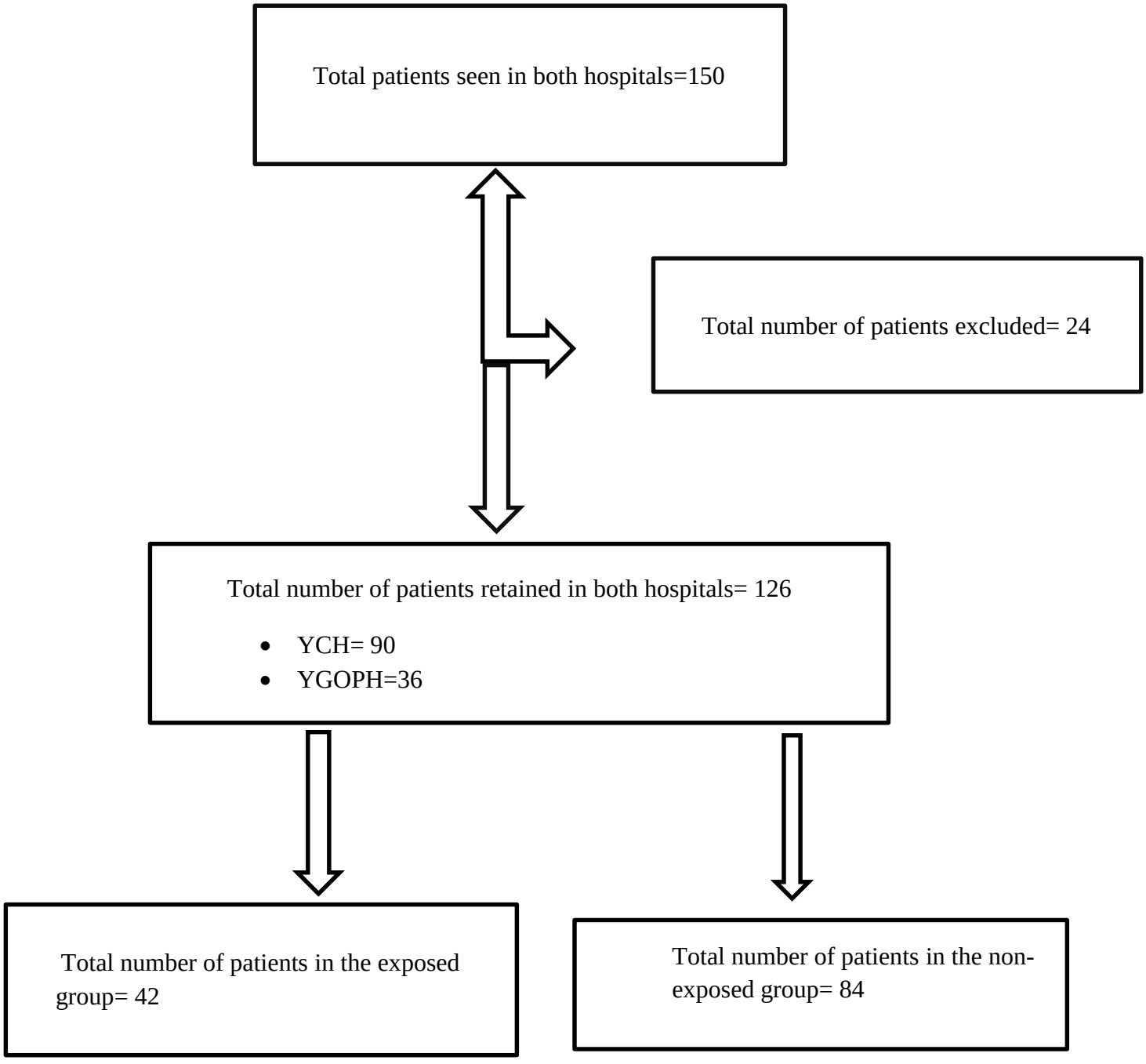


Figure 10: Recruitment flow chart

OBJECTIVE 1: Socio-obstetrical profiles of pregnant women treated for preeclampsia/eclampsia and are in the post-partum period.

Table IX: Distribution of participants according to socio-obstetrical profiles.

Variable	**Frequency** (n=126)		
	Exposed n=42(%)	**Non-exposed n=84(%)**	**Total n=126(%)**
AGE (Years)			
15-19	7(16.6)	17(20.2)	24(19.0)
20-24	3 (7.1)	8 (9.5)	11(8.7)
25-29	6 (14.2)	14 (16.6)	20(15.8)
30-34	9 (21.4)	18 (21.4)	27(21.4)
35-39	11 (26.1)	19 (22.6)	30(23.8)
40 +	6 (14.2)	8 (9.5)	14(11.1)
Marital Status			
Single	9 (21.4)	33(39.2)	42(33.3)
Married	9(21.4)	25(29.7)	34(26.9)
Divorced	3 (7.1)	1 (1.1)	4(3.1)
co-habitation	21(50.0)	25(29.7)	46(36.5)
Religion			
Christain	34(80.9)	79(94.0)	113(89.6)
Muslim	6(14.2)	4(4.7)	10(7.9)
Others	2(4.7)	1(1.1)	3(2.3)

The age group most represented was 35-39 years with 21.4% from each group, cohabiting and majority were Christians.

Table X: Distribution according level of education and occupation

Variable	**Frequency** (n=126)		**Total n=126(%)**
	Exposed n=42(%)	**Non-exposed n=84(%)**	
Level of education			
None	0(0.0)	11(13.1)	11(8.7)
Primary	0(0.0)	42(50.0)	42(33.3)
Secondary	41(97.6)	29(34.5)	70(55.5)
University	1(2.3)	2(2.3)	3(2.3)
Occupation			
Civil servant	4(9.5)	4(4.7)	8(6.3)
Private	8(19.0)	7(8.3)	15(11.9)
Informal	7(16.6)	11(13.1)	18(14.2)
Student	14(33.3)	25(29.7)	39(30.9)
Housewife	7(16.6)	18(21.4)	21(19.8)
Unemployed	2(4.7)	19(22.6)	21(16.6)

The majority had secondary level of education (97.1% Vs. 34.5%) followed by primary level and were mostly students.

Table XI: Distribution of participants according to obstetrics characteristics

Variable	**Frequency** (n=126)		**Total n=126(%)**
	Exposed n=42(%)	**Non-exposed n=84(%)**	
Gravidity			
Primigravidum	10(23.8)	20(23.8)	30(23.8)
Paucigravidum	8(19.0)	29(34.5)	37(29.3)
Multigravidum	4(9.5)	9(10.7)	13(10.3)
Grand multigravidum	20(47.6)	26(30.9)	46(36.5)
Parity			
Nulliparous	0(0.0)	1(1.2)	1(0.8)
Primiparous	16(38.1)	32(38.5)	48(38.4)
Pauciparous	7(16.6)	22(26.5)	29(23.2)
Multiparous	6(14.2)	15(18.0)	21(16.8)
Grand multiparous	13(30.9)	13(15.6)	26(20.8)

The population was mainly grand multigravidas (47.6% Vs. 30.9%) and primiparas (38.1%) as shown in table 3

Table XII: Distribution of the study population according to pregnancy characteristics

Variable	Frequency (n=126)		Total n=126(%)
	Exposed n=42(%)	Non-exposed n=84(%)	
Number of ANC done			
≥4	23(54.7)	52(61.9)	75(59.5)
<4	19(45.2)	32(38.1)	51(40.4)
History of pre-eclampsia/eclampsia	14(33.3)	18(21.4)	32(25.4)
New Sexual partner	8(19.0)	32(38.1)	40(31.7)
History hypertension	3(7.1)	11(13.1)	14(11.1)
Gestational Age at diagnosis			
22-25	0(0.0)	6(7.1)	6(4.7)
26-29	7(16.6)	10(11.9)	17(13.4)
30-33	10(23.8)	22(26.1)	32(25.4)
34-37	21(50.0)	32(38.1)	53(42.0)
38-40	4(9.5)	13(15.4)	17(13.4)
40	0(0.0)	1(1.1)	1(0.7)
Systolic blood pressure at diagnosis			
<140mmHg	0(0.0)	0(0.0)	0(0.0)
140-160mmHg	11(26.1)	27(32.1)	38(30.1)
>160mmHg	31(73.8)	57(67.8)	88(69.8)
Diastolic blood pressure at diagnosis			
<90mmHg	2(4.7)	7(8.3)	9(7.1)
90-110mmHg	21(50.0)	51(60.7)	72(57.1)
>110mmHg	19(45.2)	26(30.9)	45(35.7)
Gestation age at delivery			
28-31	0(0.0)	2(2.4)	2(1.6)
32-35	10(26.3)	22(26.8)	32(26.6)
36-39	25(65.7)	44(53.6)	69(57.5)
≥40	3(7.8)	14(17.0)	17(14.1)
Delivery Mode			
Vaginal Delivery	19(41.3)	27(32.1)	46(36.5)
Cesarean section	23(54.7)	57(67.8)	80(63.5)

About 59.9% of women in the study population had more than four antenatal contacts, 42.2% were diagnosed between 34-37 weeks of gestation. About 69.8% had initial Systolic blood pressure greater than 160mmHg and 57.1 % had diastolic blood pressure between 90 and 110mmHg. Most of the women delivery through cesarean section (63.5%).

OBJECTIVE 2 and 3: The mean remote and facility arterial blood pressure and proteinuria among women treated for preeclampsia and are in the post-partum period

Table XIII: Distribution of participants according to mean blood pressure and proteinuria on recruitment

Variable	Mean Value		RR [CI at 95%]	p-value
	Exposed n=42	Non-Exposed n=84		
MSBP 21.84 ± 18.15	165.09 ± 21.84	159 ± 18.15	1.33(0.54-3.27)	0.1605
MDBP 22.12 ± 16.36	104.88 ± 22.10	100.50 ± 16.36	1.14(0.54-2.40)	0.2116
MP 0.82 ± 0.75	1.85 ± 0.823	1.64 ± 0.75	0.67(0.09-4.68)	0.1574

Legend: MSBP= mean systolic blood pressure

MDBP= mean diastolic blood pressure

MP= mean proteinuria

There was no statistical significant difference in mean arterial blood pressure and proteinuria in the two groups.

Table XIV: Distribution of participants according to mean post-partum blood pressure and proteinuria at end of post-partum period (day 42)

Variable	**Mean Value ± SD**		**RR [CI at 95%]**	**p-value**
	Exposed n=42	**Non-Exposed n=84**		
MSBP 15.89 ± 13.07	132.71 ± 15.89	140.14 ±13.07	0.66 (0.31-1.44)	**0.006**
MDBP 12.31 ± 10.05	84.04 ± 12.31	88.23 ± 10.05	0.66(0.30-1.44)	**0.0432**
MP 0.59 ± 0.65	1.46 ± 0.59	1.53 ± 0.65	0.722(0.32-1.65)	0.54

Legend: MSBP= mean systolic blood pressure

MDBP= mean diastolic blood pressure

MP= mean proteinuria

The risk of having high blood pressure (systolic blood pressure and diastolic blood pressure) was significantly lower in the exposed group compared to the non-exposed group.

OBJECTIVE 4: Compare the remote and facility mean arterial blood pressure and proteinuria among the women.

Table XV: The difference in Mean blood pressure and proteinuria at recruitment and at end of postpartum period.

Variable	Mean Value		RR [CI at 95%]	p-value
	Exposed n=42	Non-Exposed n=84		
MDSBP 20.63 ± 14.12	27.14 ± 20.63	19.29 ± 14.12	0.66	**0.01**
MDDBP 21.25 ± 12.14	16.97 ± 21.25	12.32 ± 12.14	0.49	0.12
MDP 0.51 ± 0.65	0.29 ± 0.51	0.22 ± 0.65	1.28	0.58

Legend: MDSBP= mean difference systolic blood pressure

MDDBP= mean difference diastolic blood pressure

MDP= mean difference proteinuria

The mean difference systolic blood pressure in the exposed group compared to the non-exposed group, was statistically significant (p=0.01) with an approximate difference of 7.86mmHg.

Table XVI: Distribution of participants according to complications at recruitment.

Variable	**Cases**		**RR [CI at 95%]**	**p-value**
	Exposed n=42	**Non-Exposed n=84**		
Blurred Vision	26(61.9)	47(55.9)	1.17(0.70-1.96)	0.525
Headache	21(50)	28(33.3)	1.63(0.84-3.17)	0.123
Seizures	3(7.1)	8(9.5)	0.80(0.29-2.18)	0.656
Lower limb oedema	14(33.3)	28(33.3)	1.00(0,59-1,68)	1.000
Dyspnea	5(11.9)	1(1.1)	2.70(1.72-4.23)	**0.008**
Epigastric pain	9(21.4)	12(14.2)	1.36(0.77-2.40)	0.312

Blurred vision was the most frequent complication in the exposed group compared to the non-exposed group (61.9% Vs 55.9%) while dyspnea was more in the exposed group and the difference was statistically significant (p= 0.008.)

Table XVII: Complication from hospital discharge to day 42 of post-partum

Variable	**Cases**		**RR [CI at 95%]**	**p-value**
	Exposed n=42(%)	**Non-Exposed n=84(%)**		
Blurred Vision	14(33.3)	22(26.1)	1.25(0.74-2.08)	0.400
Headache	21(50.0)	28(33.3)	1.57(0.96-2.55)	0.07
Seizures	0(0.0)	3(3.5)	/	/
Lower limb oedema	3(7.1)	3(3.5)	1.53(0.66-3.56)	0.37
Dyspnea	1(2.3)	2(2.3)	1.00(0.19-5.05)	1.00
Epigastric pain	6(14.2)	11(13.1)	1.06(0.5-2.14)	0.85

They were 3 cases of seizures in the non-exposed group as against exposed group.

Table XVIII: Complications on day 42 postpartum checkup

Variable	**Cases**		**RR [CI at 95%]**	**p-value**
	Exposed n=42(%)	**Non-Exposed n=84(%)**		
Blurred Vision	4(9.2)	13(15.4)	0.67(0.27-1.65)	0.35
Headache	17(22.6)	26(30.9)	0.46(0.27-0.76)	**0.002**
Seizures	0(0.0)	0(0.0)	/	/
Lower limb oedema	0(0.0)	2(2.3)	3.04(2.37-3.91)	0.15
Dyspnea	1(2.3)	1(1.1)	1.52(0.36-6.18)	0.61

There was persistent blurred vision and headache in the non-exposed group.

CHAPTER 5: DISCUSSION

5.1 Preeclampsia/eclampsia during the postpartum

According to previous studies, preeclampsia is the most frequently encountered form of hypertensive disorder among pregnant women in our context and can have detrimental effects on maternal, neonatal and fetal health [10]. Delivery, which is considered the ultimate treatment for preeclampsia/eclampsia and there is evidence that women with preeclampsia/eclampsia are likely to develop cardiovascular and renal disease after delivery [9] . Usual methods of blood pressure monitoring in the postpartum rely on periodic clinic visits, which may not capture sudden changes or fluctuations in blood pressure. This was an experimental study with the aim of evaluating the importance of remote auto blood pressure measurement in the surveillance of postpartum preeclampsia/eclampsia cases, highlighting its benefits in early detection, intervention and improved patient outcome.

To achieve this, a total of 126 postpartum patients diagnosed and treated for preeclampsia/eclampsia were recruited, comprising of 42 patients in the exposed group (using remote auto blood pressure monitoring) and 84 patients in the non-exposed group(traditional monitoring) . We then compared maternal outcomes at the end of the postpartum period.

5.2. Sociodemographic profile of women

The average age of our study population was 30.4 ± 8.1 years which is similar to a study conducted in Cameroon in 2015 that reported a mean age of 31.4 ± 4.2 years[51]. The most represented population age range was 35-39 years (23.8%).This is slightly higher than a study conducted in 2024 in Cameroon where the most represented age group was 30-34 years [51]. Students were predominant in the study population, which is consistent with the findings from a 2024 study in Cameroon [51]. In contrast, other studies have found that women working in the informal sector were predominant [52]. This difference may be due to variations in sample size and inclusion criteria; specifically, our study required women in the exposed group to have completed primary education.

There were 46 cohabitating women, accounting for 36.5% of the sample. 55.5% of participants had secondary level of education. The majority of participants were Christians, comprising of 89.9% of the study population. These results are consistent with recent studies conducted in 2015 and 2024 in Cameroon [51,52].

5.2.1. Obstetrical profiles of women

Primiparity, an established risk factor of preeclampsia, was found in 38.4% of our study population. This observation is similar to a 2024 study in Cameroon, which reported a primiparity rate of 33.1% and aligns with several other studies[51]. Good-quality antenatal care is crucial for screening and early management of condition that may affects materno-fetal prognosis. The WHO currently recommends eight antenatal care contacts during pregnancy. In our study, fewer than four prenatal follow-up were noted in 51.7% of cases. This result is comparable to studies conducted in 2022 in N'djamena and in 2016 in Mali, which showed rates of 47.9% and 49.8% respectively[53,54]. This could be attributed to the precarious economic situation that hinders access to quality care in our health institutions.

Certain factors in the past medical histories were found to be contributory. This included new sexual partner (37.), previous history of preeclampsia (34.4%) and history of hypertension (11.1%). These results are similar to those reported in other studies [2,9,55,56].

Preeclampsia is a pregnancy complication characterized by high blood pressure and signs of damage to organs and systems, often the kidneys. It typically begins after 20 weeks of pregnancy in women whose blood pressure was previously normal.

In our setting preeclampsia generally develops in the third trimester, with the majority of cases diagnosed between 30-37weeks of gestation as in this study. Most deliveries in both groups occurred between 36-39 weeks. The pattern suggests that once preeclampsia is diagnosed in the third trimester, efforts should be made not to prolong the pregnancy. Before this age of pregnancy, the gold standard is to allow pregnancy to continue to provide for further fetal lung maturity and this requires close monitoring of the mother and foetus couple.

With respect to delivery method, cesarean delivery was the most common of deliveries, accounting for 63.4% of cases. This finding is similar to results from several recent studies [2,51–53]. This high number of cesarean deliveries in this study may be attributed to several factors:

- Delayed diagnosis in peripheral facilities
- Late referrals of patients to practitioners for cesarean deliveries as a maternal-fetal rescue measure.
- Availability of emergency caesarean delivery kits in each hospital where the study was conducted.

5.3.Mean Postpartum Blood Pressure and proteinuria

5.3.1. Mean Blood pressure proteinuria at recruitment

The average systolic blood pressure was higher in the exposed group compared to the non-exposed group (165.0mmHg vs 159mmHg), and the average diastolic blood pressure was also slightly higher in the exposed group compared to the non-exposed group (104.8mmHg vs 100.5mmHg). These values are slightly lower than those reported in a 2024 study carried out in Cameroon and a 2012 study carried out in Benin, where the average systolic blood pressure was 175.75mmHg and 182.2mmHg, and average diastolic blood pressure was 113.8mmHg and 110.8mmHg respectively [51,57]. This difference in blood pressure value between our study and those conducted in Cameroon and Benin could be attributed to various factors such as difference in population characteristics, healthcare infrastructures, genetic predispositions and life style factors. Additionally variations in measurement techniques and sample sizes may also contribute to discrepancies in findings. Further research is needed to fully understand the underlying reasons for these differences. Mean proteinuria was similar in the two groups ($p > 0.05$)

5.3.2. Mean Blood pressure and proteinuria at the end of postpartum period (Day 42)

The average blood pressure at the end of the postpartum period was significantly lower in the exposed group compared to the non-exposed group, with an average systolic blood pressure of 132.7mmHg vs. 140.14mmHg and average diastolic blood pressure of 84.0mmHg vs. 88.2mmHg. Despite the exposed group having a higher average blood pressure at recruitment compared to the non-exposed group. This results suggests overall better blood pressure control, highlighting the benefits of a remote monitoring system. There was no statistical significance difference of proteinuria in both groups at day 42 ($p=0.54$).

5.4.Postpartum complications

5.4.1. At recruitment

During recruitment, the most frequents complication for both groups was blurred vision (61.9% vs 55.9%), although not statistically significant. However, dyspnea was significantly more common in the exposed group (11.9% vs 1.1%, $p=0.008$). This differs from a 2024 study in Cameroon where headache was the most frequent complication (45.2%) [51].

The high blood pressure values at recruitment likely contributes to these complications, indicating a higher incidence of complication in the exposed group compared to the non-exposed group

5.4.2. Out of Hospital Facility

The incidence of having headache, blurred vision and dyspnea was slight higher in the exposed group compared to the non-exposed group. However, three patients (3.5%) in the non-exposed group experienced seizures compared to none in the exposed group during their time out of hospital facility. This aligns with a 2018 study where rate of postpartum readmission among women with hypertensive disorders of pregnancy was 4.43% [58] .This could be attributed to preeclampsia being the second risk factor for early hospital readmission during the postpartum period, compounded by low socioeconomic status, which may lead to difficulty in renewing antihypertensive drugs[59]. The trend towards better management of severe symptoms like seizures and overall blood control highlights the potential benefits of remote monitoring in these patients.

5.4.3. Day 42 checkup

During the day 42 checkup, the exposed group exhibited a higher incidence of complications compared to the non-exposed group. However, there was a significantly lower occurrence of headache in the exposed group (22.6%) versus the non-exposed group (30.9%). This discrepancy could be attributed to more effective management and control of blood pressure, which is a contributing factor to headache.

5.5. Comparing the mean difference in blood pressure and proteinuria between day 42 and recruitment

The exposed group demonstrated a significantly higher mean increase in systolic blood pressure (27.14mmHg) compared to the non-exposed group (19.9mmHg), with a p-value of 0.001. This suggests a strong association between exposure and an elevation in systolic blood pressure throughout the study. Additionally, the mean diastolic blood pressure was higher in the exposed group (16.7mmHg) than in the non-exposed group (12.32mmHg). While proteinuria levels were slightly elevated in the exposed group (0.22), this difference was not statistically significant compared to the non-exposed group.

The substantial increase in systolic blood pressure among the exposed group could have significant clinical implications, as sustained high blood pressure poses a known risk for

cardiovascular disease. Conversely, the lack of a significant difference in proteinuria levels between the exposed and non-exposed group suggests that exposure does not notably impact kidney function.

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5.6.LIMITATIONS

- A potential limit to this study was its restriction to two hospitals in Yaounde, which may constrain the generalizability of the findings to other regions of Cameroon or different populations with diverse sociodemographic characteristics.

CONCLUSION

5.7.CONCLUSION:

At the end of this study, with main aim to assess the importance of remote auto blood pressure in the surveillance of cases of preeclampsia/eclampsia in the postpartum period. We could conclude as follows:

- The average age of the study population was 30.4 ± 8.1years, with the most affected age group being 35-39years, and majority were primiparas.
- The was a significant lower occurrence of complications in the exposed group compared to the non-exposed group.
- The use of remote blood pressure measurement reduced seizures.

RECOMMANDATIONS

RECOMMENDATIONS

To pregnant women

- Encourage all pregnant women to have their personal sphygmomanometers for regular blood pressure monitoring
- Emphasize the importance of maintaining vigilance and prioritizing their health throughout pregnancy.

To health care providers

- Enhance education and training regarding the significance of remote blood pressure monitoring for all pregnant women.
- Advocate for the integration of remote monitoring tools in standard prenatal and postnatal care protocols

To the FMBS of Yaounde

- Longitudinal studies tracking blood pressure and proteinuria over extended periods beyond the postpartum could provide deeper insights into the long-term benefits and potential limitations of the intervention.
- Investigating additional interventions that specifically target proteinuria could enhance overall management strategies for postpartum preeclampsia/eclampsia

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APPENDIX

APPENDIX I: ETHICAL CLAIRANCE

NDANGOH Peter NANJOH Junior,

7th year general medicine,

Faculty of Medicine and Biomedical Sciences,
University of Yaoundé 1.

P.O. Box 1364 Yaoundé.

Phone number; 237 696582104

ndangohpeter6@icloud.com

12th January 2024

The president,

Institutional Ethical Review Board,

Faculty of Medicine and Biomedical Sciences,

University of Yaoundé 1

Dear Professor,

Subject; An application for ethical clearance.

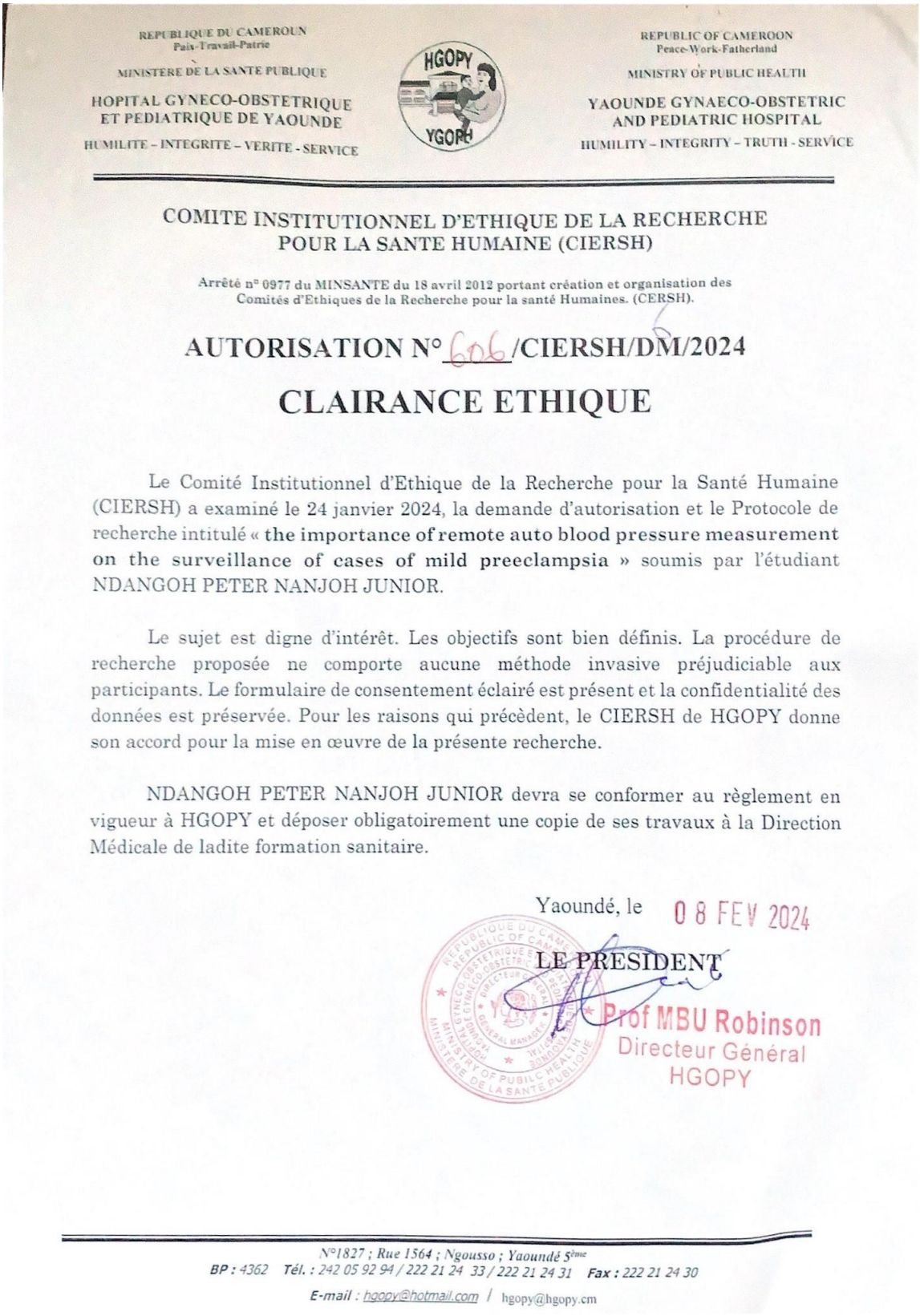
We are honored to write you to seek ethical clearance to carry out our research study. We wish to carry out a research entitled; The importance of remote auto blood pressure measurement on the surveillance of cases of preeclampsia/eclampsia during the postpartum period, specifically at the Yaoundé Central Hospital and the Yaoundé Gynecology Obstetric and Pediatric Hospital, under the supervision of Professor MBU ROBINSON ENOW and Dr. EBONG Clifford Attached to this demand is a copy of the research proposal. While hoping for a positive response, do accept our profound gratitude.

Yours sincerely,

NDANGOH Peter NANJOH

Attachment: -Copy of protocol

APPENDIX II: RESEARCH AUTHORISATION I



REPUBLIQUE DU CAMEROUN
Paix-Travail-Patrie

MINISTERE DE LA SANTE PUBLIQUE

HOPITAL GYNECO-OBSTETRIQUE ET PEDIATRIQUE DE YAOUNDE

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REPUBLIC OF CAMEROON
Peace-Work-Fatherland

MINISTRY OF PUBLIC HEALTH

YAOUNDE GYNAECO-OBSTETRIC AND PEDIATRIC HOSPITAL

HUMILITY – INTEGRITY – TRUTH - SERVICE

COMITE INSTITUTIONNEL D'ETHIQUE DE LA RECHERCHE POUR LA SANTE HUMAINE (CIERSH)

Arrêté n° 0977 du MINSANTE du 18 avril 2012 portant création et organisation des Comités d'Ethiques de la Recherche pour la santé Humaines. (CERSH).

AUTORISATION N° 606 /CIERSH/DM/2024

CLAIRANCE ETHIQUE

Le Comité Institutionnel d'Ethique de la Recherche pour la Santé Humaine (CIERSH) a examiné le 24 janvier 2024, la demande d'autorisation et le Protocole de recherche intitulé « **the importance of remote auto blood pressure measurement on the surveillance of cases of mild preeclampsia** » soumis par l'étudiant NDANGOH PETER NANJOH JUNIOR.

Le sujet est digne d'intérêt. Les objectifs sont bien définis. La procédure de recherche proposée ne comporte aucune méthode invasive préjudiciable aux participants. Le formulaire de consentement éclairé est présent et la confidentialité des données est préservée. Pour les raisons qui précèdent, le CIERSH de HGOPY donne son accord pour la mise en œuvre de la présente recherche.

NDANGOH PETER NANJOH JUNIOR devra se conformer au règlement en vigueur à HGOPY et déposer obligatoirement une copie de ses travaux à la Direction Médicale de ladite formation sanitaire.

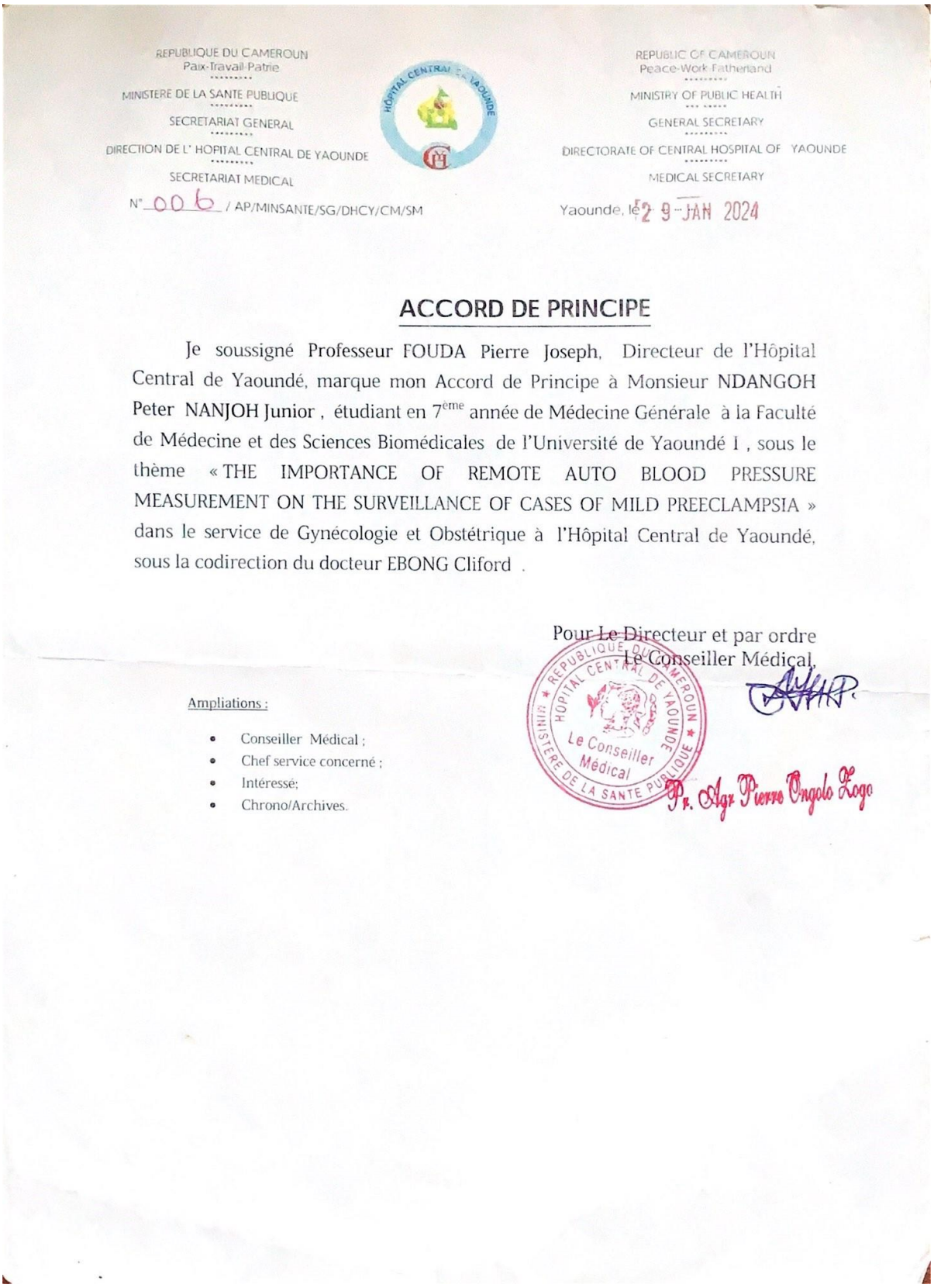
Yaoundé, le 08 FEV 2024

LE PRESIDENT

Prof MBU Robinson
Directeur Général
HGOPY

N°1827 ; Rue 1564 ; Ngousso ; Yaoundé 5ème
BP : 4362 Tél. : 242 05 92 94 / 222 21 24 33 / 222 21 24 31 Fax : 222 21 24 30
E-mail : hgopy@hotmail.com / hgopy@hgopy.cm

RESEARCH AUTHORISATION II



REPUBLIQUE DU CAMEROUN
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SECRETARIAT GENERAL
DIRECTION DE L' HOPITAL CENTRAL DE YAOUNDE
SECRETARIAT MEDICAL
N° 006 / AP/MINSANTE/SG/DHCY/CM/SM

REPUBLIC OF CAMEROUN
Peace-Work-Fatherland
MINISTRY OF PUBLIC HEALTH
GENERAL SECRETARY
DIRECTORATE OF CENTRAL HOSPITAL OF YAOUNDE
MEDICAL SECRETARY
Yaounde, le 29 JAN 2024

ACCORD DE PRINCIPE

Je soussigné Professeur FOUDA Pierre Joseph, Directeur de l'Hôpital Central de Yaoundé, marque mon Accord de Principe à Monsieur NDANGOH Peter NANJOH Junior , étudiant en 7ème année de Médecine Générale à la Faculté de Médecine et des Sciences Biomédicales de l'Université de Yaoundé I , sous le thème « THE IMPORTANCE OF REMOTE AUTO BLOOD PRESSURE MEASUREMENT ON THE SURVEILLANCE OF CASES OF MILD PREECLAMPSIA » dans le service de Gynécologie et Obstétrique à l'Hôpital Central de Yaoundé, sous la codirection du docteur EBONG Cliford .

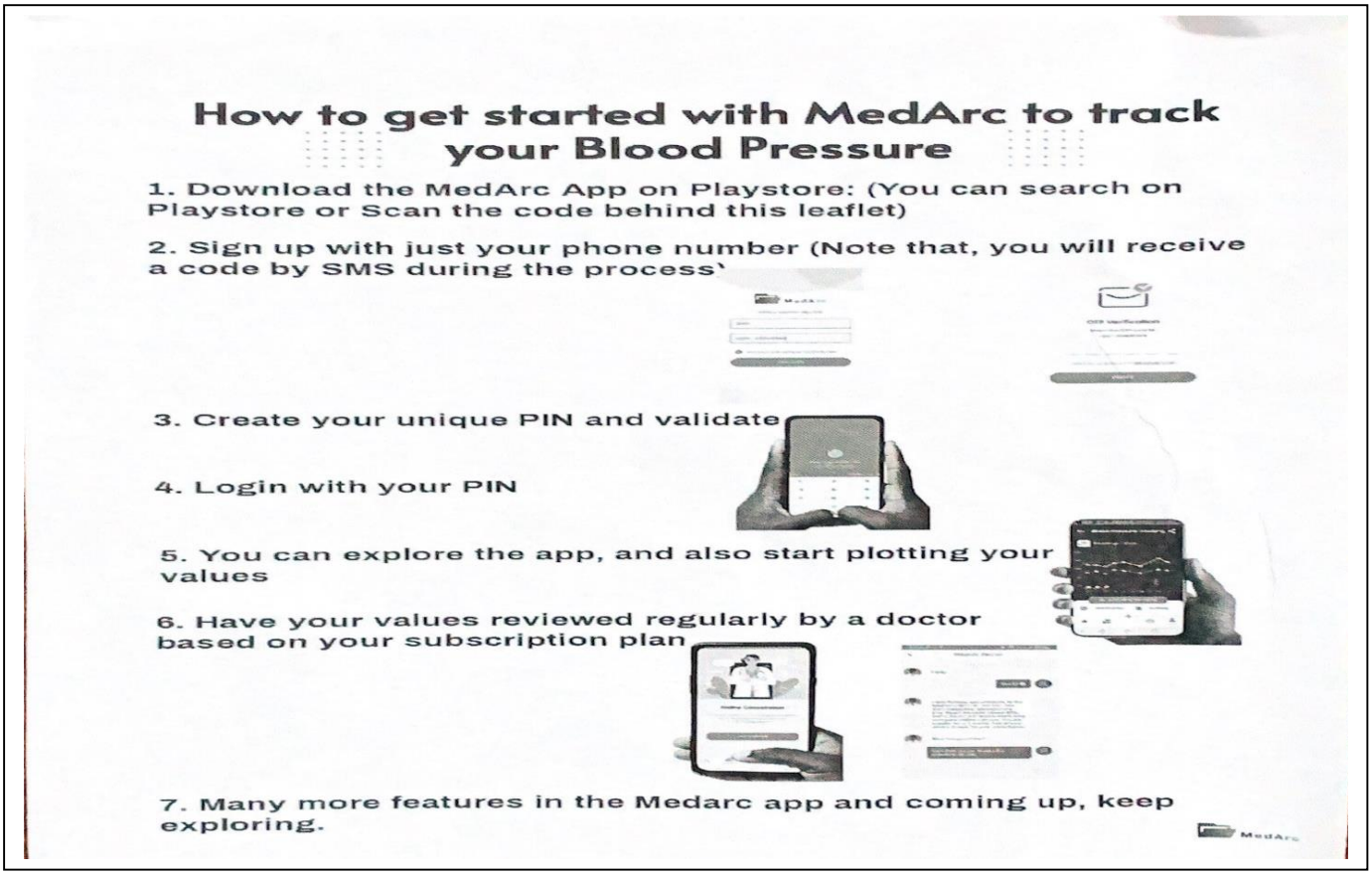
Pour Le Directeur et par ordre
Le Conseiller Médical,

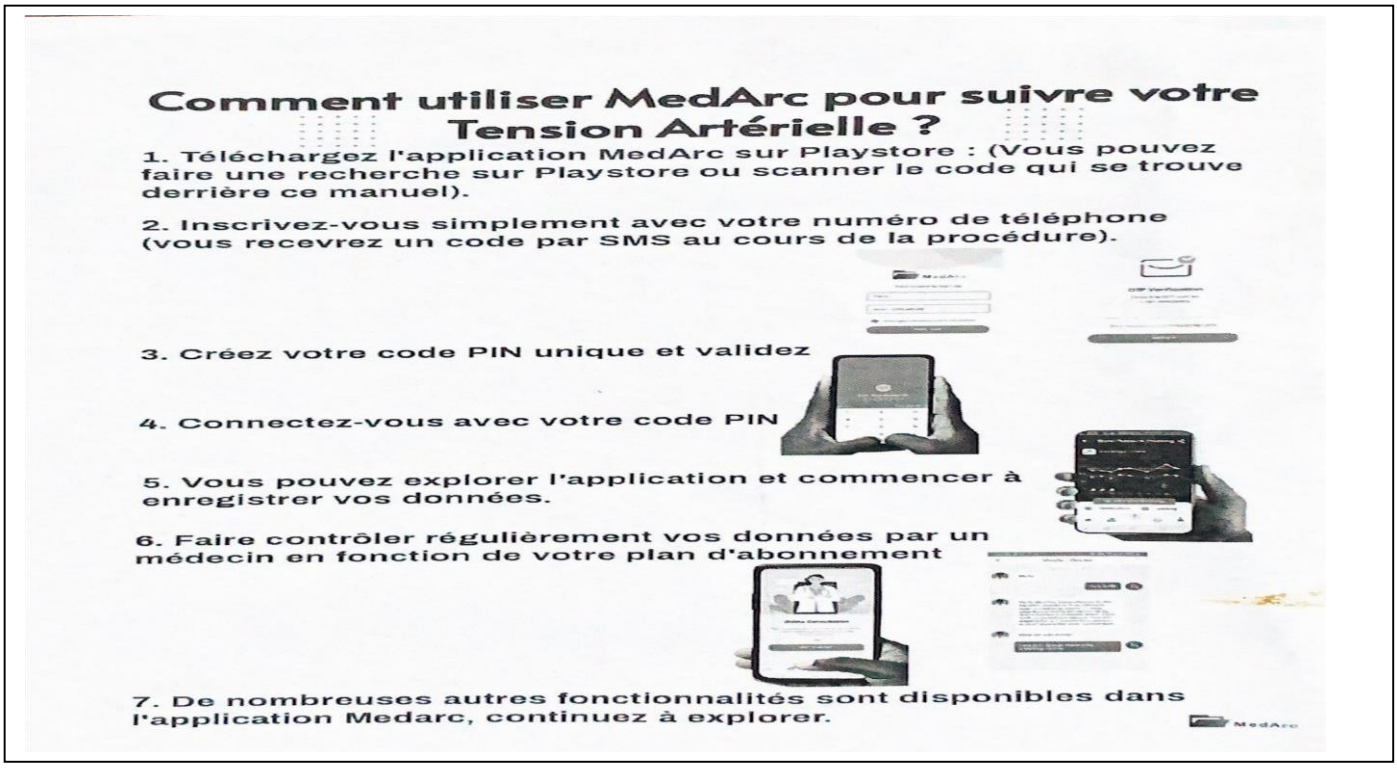
Pr. Agr Pierre Engolo Logo

Ampliations :

- Conseiller Médical ;
- Chef service concerné ;
- Intéressé;
- Chrono/Archives.

APPENDIX III: Educational program on how to use MedArc





APPENDIX IV: TOPIC: THE IMPORTANCE OF REMOTE AUTO BLOOD PRESSURE MEASUREMENT IN THE SURVEILLANCE OF CASES OF PREECLAMPSIA/ECLAMPSIA DURING THE POSTPARTUM

Date : ___/___/____ Patient code : ___/___/___/___

Questionnaire No : ____

Number	Variable	Answer
	1. Socio-obstetrical profile	
1.	**Group**: 1 = Exposed; 2 = Unexposed	
2.	**Recruitment site**: 1 = Gynaecologic, Obstetric and pediatric hospital Yaoundé; 2 = Yaoundé Central Hospital	
3.	**Age** (in years): ……	
4.	**Marital status**: Cohabitation= 1; Married = 2; Divorced = 3; Widow=4;single	
5.	**Level of education**: None = 1; Primary = 2; Secondary = 3; University = 4	
6.	**Occupation**: Civil = 1; Private = 2; Informal = 3; student = 4; housewife = 5; unemployed = 6	
7.	**Region of origin**: Extreme north = 1; North = 2; Adamawa = 3; Centre = 4; Littoral = 5; North West = 6; South West = 7; West = 8; East = 9; South = 10	
8.	**Religion**: Christian = 1; Muslim = 2; Others = 3; Animist = 4	
9.	Gravidity formula: G P P A L	
10.	Do you have a new sexual partner? Yes=1; NO=2	
11.	History of preeclampsia? Yes=1; No=2	
12.	Are you hypertensive? Yes = 1; No = 2	

2. History of Pregnancy		
13.	Gestational age at time of diagnosis (in weeks):	
14.	Number of antenatal consultations done:	
15.	Gestational age at first antenatal consultation:	
16.	What were the blood pressure values when the diagnosis of preeclampsia was made?	
17.	How was proteinuria assessed? Dipstick=1; 24H proteinuria=2; others=3	
18.	If Dipstick, what was the result? +2=1; ≥+3=2	
19.	If 24h proteinuria, what was the results? >300mg- 1g=1; >1g=2	
20.	At how many weeks did you put to birth?	
21.	By what means did you put to birth? Vaginal delivery=1; Caeserean section=2	
22.	Did you have any complication? Yes=1; No=2	
23.	If yes:	
24.	HELLP syndrome? Yes=1; No=2	
25.	Eclampsia? Yes=1; No=2	
26.	Placenta abruptio? Yes=1; No=2	
27.	Pulmonary oedema? Yes=1; No=2	
28.	Acute renal failure? Yes=1;No=2	
29.	Ischemic stroke? Yes=1; No=2	
30.	Maternal death? Yes=1 No=2	
31.	Intra uterine death? Yes=1 No=2	
32.	Disseminated intravascular coagulation? Yes=1; No=2	
33.	Fetal death? Yes=; No=2	
3. Intra Postpartum follow-up		
34.	Blood pressure value?	
	Complaints: headache=1 , blurred vision=2, right upper quadrant pain=3, epigastric pain=4, edema=5, oliguria=6,	

	DAY 1	shortness of breath=7, seizure=8 ,maternal death=9, neonatal death=10, None=11	
		Which antihypertensive treatment are you taking? Labétalol (transdate)=1, Nicardipine (loxen) =2, Alphaméthyldopa (aldomet)=3, Nifédipine (adalate) =4, Magnesium sulphate=5	
		Did you have a consultation with the cardiologist before being discharged? 1=yes ; 2=No	
		Did you have a consultation with the Nephrologist before being discharged? 1=yes ; 2=No	
35.	DAY 2	Blood pressure value?	
		Complaints: headache=1 , blurred vision=2, right upper quadrant pain=3, epigastric pain=4, edema=5, oliguria=6, shortness of breath=7, seizure=8 ,maternal death=9, neonatal death=10, None=11	
		Which antihypertensive treatment are you taking? Labétalol (transdate)=1, Nicardipine (loxen) =2, Alphaméthyldopa (aldomet)=3, Nifédipine (adalate) =4, Magnesium sulphate=5	
		Did you have a consultation with the cardiologist before being discharged? 1=yes ; 2=No	
		Did you have a consultation with the Nephrologist before being discharged? 1=yes ; 2=No	
36.	DAY 3	Blood pressure value?	
		Complaints: headache=1 , blurred vision=2, right upper quadrant pain=3, epigastric pain=4, edema=5, oliguria=6, shortness of breath=7, seizure=8 ,maternal death=9, neonatal death=10, None=11	
		Which antihypertensive treatment are you taking? Labétalol (transdate)=1, Nicardipine (loxen) =2, Alphaméthyldopa (aldomet)=3, Nifédipine (adalate) =4, Magnesium sulphate=5	
		Dipstick,what was the result? Trace=1; +2=2; ≥+3=3; Not done=5	
		Did you have a consultation with the cardiologist before being discharged? 1=yes ; 2=No	
		Did you have a consultation with the Nephrologist before	

		being discharged? 1=yes ; 2=No	
37.	DAY 4	Blood pressure value?	
		Complaints: headache=1 , blurred vision=2, right upper quadrant pain=3, epigastric pain=4, edema=5, oliguria=6, shortness of breath=7, seizure=8 ,maternal death=9, neonatal death=10, None=11	
		Which antihypertensive treatment are you taking? Labétalol (transdate)=1, Nicardipine (loxen) =2, Alphaméthyldopa (aldomet)=3, Nifédipine (adalate) =4, Magnesium sulphate=5	
		Did you have a consultation with the cardiologist before being discharged? 1=yes ; 2=No	
		Did you have a consultation with the Nephrologist before being discharged? 1=yes ; 2=No	
38.	DAY 5	Blood pressure value?	
		Complaints: headache=1 , blurred vision=2, right upper quadrant pain=3, epigastric pain=4, edema=5, oliguria=6, shortness of breath=7, seizure=8 ,maternal death=9, neonatal death=10, None=11	
		Which antihypertensive treatment are you taking? Labétalol (transdate)=1, Nicardipine (loxen) =2, Alphaméthyldopa (aldomet)=3, Nifédipine (adalate) =4, Magnesium sulphate=5	
		Did you have a consultation with the cardiologist before being discharged? 1=yes ; 2=No	
		Did you have a consultation with the Nephrologist before being discharged? 1=yes ; 2=No	
39.	DAY 6	Blood pressure value?	
		Complaints: headache=1 , blurred vision=2, right upper quadrant pain=3, epigastric pain=4, edema=5, oliguria=6, shortness of breath=7, seizure=8 ,maternal death=9, neonatal death=10, None=11	
		Which antihypertensive treatment are you taking? Labétalol (transdate)=1, Nicardipine (loxen) =2, Alphaméthyldopa (aldomet)=3, Nifédipine (adalate) =4, Magnesium sulphate=5	

		Did you have a consultation with the cardiologist before being discharged? 1=yes ; 2=No	
		Did you have a consultation with the Nephrologist before being discharged? 1=yes ; 2=No	
4. Out of hospital facility			
40.	DAY 8-41	Blood pressure value?	
		Presenting complaint: headache=1 , blurred vision=2, right upper quadrant pain=3, epigastric pain=4, edema=5, oliguria=6, shortness of breath=7, seizure=8, neonatal death=10, None=11	
		Are you still taking your antihypertensive drugs?Yes=1;N0=2	
		If yes,Which antihypertensive treatment are you taking? Labétalol (transdate)=1, Nicardipine (loxen) =2, Alphaméthyldopa (aldomet)=3, Nifédipine (adalate) =4, Magnesium sulphate=5	
5. Day 42 check-up			
41.	Day 42	Blood pressure value?	
		Presenting complaint: headache=1 , blurred vision=2, right upper quadrant pain=3, epigastric pain=4, edema=5, oliguria=6, shortness of breath=7, post-partum visit=8	
		Are you still taking your antihypertensive drugs? Yes=1;N0=2	
		If yes,Which antihypertensive treatment are you taking? Labétalol (transdate)=1, Nicardipine (loxen) =2,Alphaméthyldopa (aldomet)=3, Nifédipine (adalate) =4, Magnesium sulphate=5	
		Dipstick, what was the result? Trace=1; +2=2; ≥+3=3; Not done=5	
		Are you versed with android phones? Yes=1; No=2	
		Did you come back 6weeks after delivery for check-up? Yes=1; No=2	
		Are you satisfied with this app? Yes=1; No=2	
		If no, Did you lose your data? Yes=1; No=2	
		If no, Late responding? Yes=1; No=2	
		If no,Consumes much data? Yes=1; No=2	