

Retinal Complications of Arterial Hypertension during Pregnancy in the Reference Health Center of Kalaban-Coro (Mali)

Bocary Sidi KONE¹, Mahamoudou COULIBALY⁴, Kalifa TRAORE¹, Cheickna Sylla³, Séma KEITA², Siaka Amara Sanogo³, Sékou Bakary KEITA¹, Bamba Bréhima⁴, Mamadou HAÏDARA⁴, Dramane FOMBA⁵, Yacouba Aba COULIBALY³, Yacouba SYLLA⁶, Modibo DICKO⁶, Seydou Z Dao⁷, Aliou Samaké⁸, Mahamadou Keita⁸, Mamadou KAMPO⁹, Daouda CAMARA¹⁰

¹Mohamed VI Mother and Child Polyclinic in Bamako, Mali.

²Fana Reference Health Centre, Koulikoro, Mali.

³Gabriel Touré University Hospital in Bamako, Mali.

⁴Kalaban Coro Reference Health Centre, Bamako, Mali.

⁵Reference Health Center of Marakala, Ségou, Mali.

⁶Reference Health Centre of Commune I of the District of Bamako, Mali.

⁷Reference Health Centre of Commune II of the District of Bamako, Mali.

⁸Reference Health Centre of Commune VI of the District of Bamako, Mali.

⁹Hospital of Timbuktu, Mali.

¹⁰Reference Health Centre of Kati, Mali.

*Corresponding Author: Dr KONE Bokary Sidi & Dr SYLLA Cheickna | Received: 15.01.2024 | Accepted: 12.03.2024 | Published: 26.04.2024

Abstract: Summary: Our study aimed to investigate the retina complications of arterial hypertension during pregnancy in the reference health center of Kalaban-Coro. This was a descriptive cross-sectional study over a period of five months from August 1 to December 31, 2021. It involved 185 hypertensive patients admitted to the gynecology-obstetrics department. The frequency of the association of high blood pressure and pregnancy was 18.84%. The most represented age group was 25-34 years with a frequency of 44.9%. Most of our patients had normal visual activity in both eyes. Retinal lesions were in 5.4% of patients. Retinal hemorrhage was the most frequent region with 80%. Only one patient had papilloedema, including Stage III, hypertensive retinopathy which disappeared on the 30th day.

Keywords: High Blood Pressure, Pregnancy, Hypertensive Retinopathy

Citation: KONE Bokary Sidi *et al.* Retinal Complications of Arterial Hypertension during Pregnancy in the Reference Health Center of Kalaban-Coro (Mali). Grn Int J Apl Med Sci, 2024 Mar-Apr 2(2): 75-83.

INTRODUCTION

High blood pressure (hypertension) is defined by the WHO as systolic blood pressure (SBP) greater than or equal to 140 mmHg and/or diastolic blood pressure (DBP) greater than or equal to 90 mmHg [1]. It is a real public health problem. More than a billion people suffer from it worldwide [2]. Pregnancy or gestation is the period from conception to the birth of the baby. It begins with fertilization and ends with childbirth. The frequency of hypertension during pregnancy is similar in most Western countries. In 2008, there was a prevalence of 9.3% in France; 10.8% in the United Kingdom; 10 to 15% in the United States and 10% in Australia [3]. On the other hand, in African countries, there is a large difference between frequencies, with rates of 17.05% in Niger [4], 8.9-9.6% in Guinea Conakry [5], 3% in Dakar; and 8.2% in Tunisia and Cameroon [6]. In 2010, the frequency of

hypertension was 8.64% at the CSRéf of the CVI in Bamako (Mali) [7]. Hypertension is the cause of several complications involving the heart, brain, kidneys and eyes. The occurrence of hypertension during pregnancy is part of vasculo-renal syndromes. Ocular complications mainly result in retinal damage or hypertensive retinopathy. Some authors have shown that in pregnant women, vascular retinal alterations correlate with the severity of hypertension [8]. Others have shown that during pregnancy, vasculorenal syndromes are the cause of several ocular complications, including amaurosis and hypertensive retinopathy [2]. The lack of availability of data on ocular complications of hypertension in Mali aroused our interest.

Overall Objective

To study retinal complications of high blood pressure during pregnancy in the Kalaban-coro Referral Health Center (Kalaban-coro Csref).

MATERIALS AND METHODS

Study Framework

Our study took place at the Csref of Kalaban-coro. The Kalaban-coro Csref Type and Period of Study. This was a cross-sectional study with a descriptive focus. It took place from August 1^o December 31, 2021 (5 months).

The Study Population

Our study focused on all hypertensive pregnant women admitted to the Csref of Kalaban-Coro in the obstetrics and gynaecology department.

Inclusion Criteria

These were pregnant women with hypertension at all stages: Regardless of the age of pregnancy, With or without CPN, Admitted to the gynaecology-obstetrics department, Having had at least two ophthalmology visits during their pregnancy and/or in the postpartum period. Non-inclusion criteria: All hypertensive pregnant women who have not had at least two ophthalmology visits.

The Course of the Study

It consisted of the recruitment of hypertensive pregnant patients followed by gynaecology and

obstetrics and referred to ophthalmology for a systematic examination of the fundus.

Data Collection

Data were collected using an individual questionnaire. The variables studied were: sociodemographic data (age, socio-professional category), clinical data (length of hypertension, gestation, gestational age, measurement of SBP and DBP, ophthalmological examination results) and paraclinical data (proteinuria, FO, OCT).

Data Security: The texts were entered in Word 2013. The tables were produced using EXCEL 2010 software.

Ethical Consideration

We obtained the informed and free consent of the patients and the confidentiality of each of them was respected through an individual medical record. The patient's refusal had no impact on her management.

RESULTS

During our study period, 1088 pregnant women were registered in the gynaecological-obstetrics department of the CSRef of Kalaban-Coro; among these, 205 cases of hypertension were identified, i.e. a frequency of hypertension in pregnancy of 18.84%. Of the 205 cases of hypertension in pregnancy, 185 met the inclusion criteria; of these, 10 had evidence of hypertensive retinopathy, i.e. a frequency of 5.40% of hypertensive pregnant women.

Table 1: Distribution of patients by age group

Age range in year	Actual	Percentage
15-24	71	38,4
25-34	83	44,9
35-44	31	16,8
Total	185	100,0

The most represented age group was 25 to 34 years old. The mean age was 29.5 years. The age extremes were 16 years and 43 years, respectively.

Table 2: Distribution of Patients by Profession

Profession	Actual	%
Housewife	158	85,4
Trader/Saleswoman	14	7,6
Official	10	5,4
Pupil	2	1,1
Domestic helper	1	0,5
Total	185	100,0

The household profession was the most represented in our study with 85.4%.

Table 3: Distribution of Patients by Level of Education

Educational attainment	Actual	%
Not in school	155	83,8
Primary	20	10,8
Secondary	6	3,2
Superior	4	2,2
Total	185	100,0



Our patients were out of school in 83.8% of cases.

Clinical Data

Clinical and Paraclinical Data of Pregnancy

Table 4: Distribution of patients by risk factor for hypertension

Risk Factors	Actual	%
No FDR	159	85,9
ATCD Familial d'HTA	13	7,0
CO	10	5,4
Sedentary lifestyle + obesity	3	1,6
Total	185	100,0

Nearly 96% of our patients had no risk factor for hypertension.

Table 5: Distribution of patients by number of NPCs

Number of NPCs	Actual	%
0 CPN	19	10,3
1-2 NPC	88	47,5
3 NPCs	30	16,2
≥4 NPC	48	25,9
Total	185	100,0

Our patients had performed 1 to 2 NPCs in 47% of cases. Only 25.9% had achieved at least 4 NPCs.

Table 6: Distribution of patients by gestation

Gesture	Actual	%
Primigrante	80	43,2
Paucigeste	70	37,8
Multi-gesture	28	15,1
Great multi-gesture	7	3,7
Total	185	100,0

First-time migrants were the most represented in our study with 43.2% of cases.

Table 7: Distribution of Patients by Parity

Parity	Actual	%
Nulliparous	4	2,2
Primiparus	20	10,8
Pauciparous	56	30,3
Multiparous	61	33,0
Large multiparous	44	23,8
Total	185	100,0

Multiparous women were the most numerous in our study with a rate of 33%, followed by pauci pares with 30%.

Table 8: Distribution of patients according to the grade of hypertension at the first ophthalmological examination

Grade of hypertension	Actual	%
Grade I	137	74,1
Grade II	35	18,9
Grade III	13	7,0
Total	185	100,0

Grade I was the most represented during our study with 74.1%. However, 7% were Grade III.

Table 9: Distribution of Patients by Value of Proteinuria

Proteinuria	Actual	%
Trace	27	14,6
A cross	81	43,8
Two crosses	71	38,4



Three Crosses	6	3,2
Total	185	100,0

In our series, 43.8% of our patients had two-cross proteinuria, followed by 38.4% who had one-cross proteinuria.

Ophthalmological Clinical Data

Table 10: Distribution of patients by VA on the first day of ophthalmology examination

AV ODG	OD	OG
	Number of employees (%)	Number of employees (%)
AV \geq 3/10	183(98,9)	183(98,9)
3/10<AV>1/10	1(0,5)	1(0,5)
AV \leq 1/20	1(0,5)	1(0,5)
Total	185(100,0)	185(100,0)

At the first ophthalmological examination, about 99% of our patients had a visual acuity greater than or equal to 3/10. Two patients (1%) had BAV in both eyes.

Table 11: Distribution of patients by fundus at first visit (D1)

Fundus	OD	OG
	Number of employees (%)	Number of employees (%)
Normal	175(94,6)	175(94,6)
Abnormal	10(5,4)	10(5,4)
Total	185(100,0)	185(100,0)

Fundus was normal in 94.6% during the first visit. Abnormal FOs were bilateral in 100% of cases

Table 12: Distribution of patients with abnormal FO according to the clinical signs observed on ophthalmological examination on D1

Fundus	OD n=10	OG n=10
	Number of employees (%)	Number of employees (%)
Retinal hemorrhages	8(80,0)	8(80,0)
Cottony nodules	3 (30,0)	3(30,0)
Dry exudates	3(30,0)	3(30,0)
Arterial narrowing	2(20,0)	2(20,0)
Papilledema	1(10,0)	1(10,0)

Retinal haemorrhage was the most common clinical sign, 80% (n=10).

NB:

For each eye with lesions there were at least three foci of haemorrhage, at least two foci of cottony nodules. Compared to dry exudates, there were at least

five dry exudates per eye. They were arranged in a macular star pattern in a single patient. The arterial narrowing was localized to the superior temporal retinal artery in both patients.

Table 13: Distribution of patients by stage of retinopathy (Kirkendall classification) at first ophthalmological examination (D1)

Stadium	OD n=10	OG n=10
	Number of employees (%)	Number of employees (%)
Stage I	1(10,0)	1(10,0)
Stage II	8(80,0)	8(80,0)
Stage III	1(10,0)	1(10,0)
Total	10(100,0)	10(100,0)

Stage II retinopathy was the most common with 80% (n=10) of cases at first examination.

Table 14: distribution of the 10 patients (with abnormal FO) according to the therapeutic management of their hypertension

	Number n=10	Percentage (%)
Cardiology Consultation	10 (10/10)	100
Obstetric hospitalization	3 (3/10)	30



All women (100%) with hypertensive retinopathy were referred to the centre's cardiology department. However, 30% of the women were hospitalized in the gynaecology-obstetrics department

for their treatment. The average length of their hospitalization was three days. The others were followed on an outpatient basis.

Table 15: Distribution of patients by grade of hypertension at D30.

Grade of hypertension	Actual	%
Grade I	183	99
Grade II	2	1
Grade III	0	0,0
Total	185	100,0

At D30 we recorded a 99% rate of grade I and no cases of grade III.

Table 16: Distribution of patients according to BP value and hypertension grade at D30

Rank of MT	BP value in mmHg	Actual	Percentage (%)
Optimal TA	PAS=120-129 and/or PAD=80-84	8	4,3
High Normal BP	PAS=130-139 and/or PAD=85-89	19	10,2
Grade I	PAS=140-159 and/or PAD=90-99	156	84,3
Grade II	PAS=160-179 and/or PAD≥110	2	1,1
Total		185	100,0

At the D30 examination, 84.3% of our patients had a grade I hypertension, i.e. a SBP=140-159 and/or PAD=90-99mmHg. On the other hand, 4.3% had an optimal BP and 10.2% had a high normal BP.

All of our patients at the second visit had a visual acuity greater than or equal to 3/10.

Table 17: Distribution of patients according to FO status at the various ophthalmological examinations on D1, D30 and D60

FO	D1 n=185		D30 n=185		D60 n=6	
	Actual	%	Actual	%	Actual	%
Normal	175	94,6	175	94,6	2	33,3
Abnormal	10	5,4	10	5,4	4	66,6
Total	185	100	185	100	6	100

During the various ophthalmological examinations, we found that FO was normal in 94.6% of our patients on D1 and D30. At D60 we saw six (6)

patients out of ten (10) who had their abnormal FO on D30, and of these six (6), the FO of two (2) had become normal.

Table 18: distribution of patients according to the evolution of clinical signs from RH to abnormal FO during the different ophthalmological examinations on D1, D30 and D60

Injuries to the FO	D1 n=10		D30 n=10		D60 n=4	
	Actual	%	Actual	%	Actual	%
Arterial strictures	2	20	1	10	1	25
Retinal hemorrhages	8	80	9	90	1	25
Dry exudates	3	30	4	40	2	50
Cottony nodules	3	30	2	20	0	0
Papilledema	1	10	0	0	0	0

Retinal lesions at D30 persisted. But the number of outbreaks and the intensity decreased between D1 and D30.

hemorrhages. The patient who presented with the OP no longer had it on D30.

On D30 we found a reduction in the number of patients with arterial narrowing and cottony nodules. On the other hand, there was an increase in the number of patients who had dry exudates and retinal

On D60 examination of the 10 patients planned, 4 were lost to follow-up and 6 examined:

- FO was normal in two (2) of them,
- retinal hemorrhages persisted in one (1),
- arterial narrowing has persisted in one (1),



– Dry exudates persisted in two (2).

So we see that the retinal lesions have disappeared little by little over time.

Table 19: Distribution of patients by stage of retinopathy on D30

Stage of retinopathy	OD n=10		OG n=10	
	Actual	%	Actual	%
Stage I	1/10	10,0	1/10	10,0
Stage II	9/10	90,0	9/10	90,0
Total	10/10	100,0	10/10	100,0

Stage II was still the most represented at D30 with 90% (n=10).

DISCUSSION

Frequency

The frequency of the association between hypertension and pregnancy was 18.84%. This varies from author to author. It depends on the inclusion criteria in the different series. Thus, our frequency is comparable to that of KEMBOU FEUKOU F [9], and DIALLO FD [10], who found 16.5% and 16% respectively. This frequency was higher than that of COULIBALY B [11], which had found 6.5%. In the COULIBALY B series, the inclusion criterion only took into account postpartum women, unlike ours, which could explain the differences in rates. The frequency of retinal manifestation of hypertension was 5.40%. Diallo JW *et al.*, had found posterior segment lesions in 32.3% in his series on ocular manifestations during severe pre-eclampsia or eclampsia at the Centre Hospitalier Universitaire Sourô Sanou de Bobo Dioulasso [12]. SANKARE Yaya [13], had found 47% retinopathy in Sévaré in Mali. Regarding the specific frequency of signs of hypertensive retinopathy we found 80% retinal hemorrhage, 30% cottony nodule and 10% papilledema. Ngwanou *et al.*, in Yaoundé, Cameroon found 46.5% papilledema, 27.9% cottony nodules, and 16.3% retinal hemorrhage during their study of retinal lesions during preeclampsia/eclampsia and their predictive value on pregnancy outcome [14]. These differences with our result could be explained by a distinction in methodology. Indeed, these different authors studied only cases of preeclampsia/eclampsia, whereas our study focused on all forms of hypertension during pregnancy.

Socio-Demographic Characteristics

Age

In our study, 44.9% of patients were between 25 and 34 years old. The extreme ages are 16 and 43 respectively. This result is comparable to those of other authors [15- 17]. This high incidence of early pregnancy is in line with the age-gestation according to WHO standards. Educational attainment: The study population was out of school in 83.8% of cases. A rate similar to our results was reported by COULIBALY B [18]. i.e. 85.6%. This result is higher than the educational attainment rate of 71% among women with an average age of 29 years in DHS-VI [19]. The low enrolment rate of the study population may be a factor

in the ignorance of the importance of NPCs by many of the patients, whereas regular monitoring of a pregnancy prevents most obstetric pathologies. Our study population resided in the commune of Kalaban-coro in 93.5% which is a peri-urban area.

The Profession

Housewives predominated in our study with 86.4%, followed by shopkeepers with 7.6%. This is easily understandable as 83.8% of our study population was out of school. Lower rates were found by SAMAKE B [20], at the Gabriel Touré University Hospital and FOMBA D N [17], at the Csréf of commune II with 72.3% and 74.1% respectively. This difference can be explained by the fact that our study was carried out in a peri-urban area while theirs was carried out in an urban area.

Number of NPCs

NPCs are an important part of proper pregnancy monitoring. Our study population did not perform any NPC in 10.3% of cases. Only 16.2% performed 3 NPCs and 25.9% performed at least 4 NPCs during pregnancy. This completion rate of NPC 4 is lower than the national rate which was 43% according to the Mali Demographic and Health Survey (EDSM-VI) in 2018 [19]. Our result is also below the WHO standards, which recommend at least 4 PNCs for a normal pregnancy [19]. YANOOGO A S [21], in Burkina Faso had a completion rate of at least 3 NPCs in 79.5%. Our low rate of completion of NPCs can be explained by the lack of awareness of their importance by a large part of the population due to their low level of education.

Gestituous

Primetries were the most represented in our study with 43.2% of cases. This result is similar to those of YANOOGO A S [21], and SANKARE Yaya [13], which had similar rates of 40.9% and 50.0% respectively. In Burkina Faso LANKOANDE J [22], had found primigestes in 59.3% at the Yalgado Ouédraogo University Hospital in Ouagadougou, in its study in eclamptic women. This high rate in primigestes could be explained by an immunological interaction between the trophoblast and maternal tissues [23]. In the literature, 10-15% of nulliparous and 3-5%



multiparous women develop gestational hypertension, 3-7% of nulliparous women and 1-3% of multiparous women will have their pregnancies complicated by pre-eclampsia [24]. This high incidence of complications of hypertension in pregnancy has been highlighted by several authors [23- 26]. According to the general reviews in obstetrics on the epidemiology and pathophysiology of pre-eclampsia [25], pre-eclampsia is linked to the interaction of several phenomena: Placental ischemia remains the focal point of the pathophysiology of pre-eclampsia. It is usually due to an abnormality of the placentation, more specifically the formation of the uteroplacental arteries. Oxidative stress, Inflammatory syndrome, Endothelial dysfunction [25], Environmental factors, Genetic factors, Metabolic factors.

Clinical Data: Risk Factors and History

In our study, the majority of patients had no risk factors for hypertension in 85.9% of cases. This absence of FDR had also been found by KEITA D [16], in 80.5% in his study at the CHU ME "Le Luxembourg". However, familial ATCD of hypertension and the use of estrogen-progestin pills were the most frequent risks with 7% and 5.4% of cases respectively. Personal ATCD of hypertension accounted for 2.2% of cases. Our result is lower than that of KEITA D who had found 11.1% of personal ATCD of hypertension.

Blood Pressure

During our study, 74.1% of our patients had grade I hypertension. Grade II accounted for 18.9%. SANKARE Yaya [13], found grade II high blood pressure in 60.8%. This difference in the grade of hypertension can be explained by the fact that SANKARE Yaya's study included only pre-eclampsics and eclampsics, while ours included all hypertensive women.

Proteinuria

Our patients had proteinuria greater than or equal to 3 crosses on the urine dipstick in only 3.2%. SANKARE Yaya [13], recorded a higher result with a rate of 40.2%. This result is consistent with the difference between the degrees of hypertension in our studies. Visual acuity: Almost all (98.9%) of patients had a visual acuity > 3/10 on D1. YANOGO A S [21], reported similar results with 97.6% visual acuity > 3/10. We noted one case of visual impairment and one case of bilateral blindness. The evolution of this case of blindness was favorable with a total recovery of visual acuity (10/10) at D30. This could be explained by a good adaptation of the treatment. YANOGO A S had found one case of visual impairment and two cases of blindness with complete recovery of visual acuity at 10/10 in his series. We did not find any exudative retinal detachment in our study. On the other hand, some authors believe that an exudative retinal detachment in the macular region is responsible for

blindness with spectacular recovery in hypertensive retinopathy (severe gestational toxemia) by reapplication of the retina, most often with appropriate management of hypertension [27, 28].

Fundus results

In our sample, 5.4% (n=10) of patients had complications such as hypertensive retinopathy. Our result is lower than that of KARKI P [29], which recorded 13.7%. On the other hand, SANKARE Yaya in 2020 recorded 47.0%. This difference could be explained by the fact that 96.8% of our patients had grade I hypertension and in addition SANKARE Yaya had only studied cases of pre-eclampsia and eclampsia. Hypertensive retinopathy was Kirkendall's stage I in 10% (n=10); stage II in 80% (n=10) and stage III in 10% (n=10) in our study. This result is different from that of SANKARE Yaya who had found respectively stage I (67.4%), stage II (30.4%) and stage III (2.2%). Compared to the HTA grade, we recorded 18.9% of grade II (TAS \geq 160mmHg and/or TAD \geq 109mmHg). SANKARE Yaya in his series at Mopti hospital found grade II at 60.8%. This difference can be explained by the fact that the latter included only severe cases of hypertension. The lesions observed were bilateral in all of our patients. Their developments were favourable during the second visit on D30. Severe hypertension is life-threatening for both mother and child and can lead to serious complications in 10% of cases [30].

Without Treatment, Maternal Complications Include

Eclampsia, which occurs in 1% of pre-eclampsias and is responsible for 15% of maternal deaths. HELLP syndrome, it occurs in 20 to 30% of cases of pre-eclampsia. HRP, this complication occurs in 1% of normal pregnancies and in 50% of cases in the context of pre-eclampsia.

Fetal Complications

IUGR has an incidence of 2 to 5%. Of these, 20 to 30% of cases are secondary to pre-eclampsia. MFIU affects 2 to 5% of women with hypertension [30].

Under Treatment

The benefit of antihypertensive therapy is limited to maternal prevention of complications of hypertension. Shantsila E. *et al.*, in a Cochrane Review demonstrated that giving low doses of aspirin to pregnant women resulted in small to moderate benefits, including a reduction in pre-eclampsia (16 fewer cases per 1,000 women treated), preterm birth (16 fewer cases per 1,000 women treated), birth of babies small for their age (7 fewer cases per 1,000 women treated), and fetal or neonatal death (5 fewer cases per 1000 women treated). Overall, 1,000 women were given antiplatelet drugs to reduce the number of pregnancies with adverse events by 20 [31].



CONCLUSION

This study shows that hypertension can lead to serious ocular complications if not properly treated. During this study, 4.5% of our patients experienced complications, 80% of which were retinal hemorrhages. It must be detected and treated quickly by a multidisciplinary team in order to avoid the onset of permanent blindness.

Conflict of Interest: None.

REFERENCES

- WHO. High Blood Pressure Q&A [Internet]. WHO. Available on: <http://www.who.int/features/qa/82/fr/index.html>
- Haute Autorité de Santé (HAS): Management of patients with essential arterial hypertension. Updated 2005. Saint-Denis La Plaine: HAS; 2005 [Internet]. (Accessed 05 June 2021) <http://www.has.sante.fr/portail/upload/docs/application/pdf/201109/hta2005recommandations.pdf>
- CISSE, C. T., Ewagnignon, E., Hojeige, A., & Diadhiou, F. (1997). Eclampsia in Africa: Epidemiology and prognosis at Dakar University Hospital. *The Seminary of the Hospitals of Paris; DA*, 73, 1062-106.
- Bah, AO, Diallo, MH, Conde, AM, & Keita, N. (2001). High blood pressure and pregnancy: maternal and perinatal mortality. *Black African Medicine*, 48 (11), 461-464.
- Toure, I. A., Brah, F., & Prual, A. (1997). Hypertension artérielle (HTA) et grossesse au Niger: Etudes Cas/Témoins à propos de 70 cas. *Médecine d'Afrique noire*, 44(4), 205-208.
- Palot, M., Kessler, P., Visseaux, H., & Botmans, C. Toxemia gravidarum, Department of Anesthesia and Intensive Care, *Reims University Hospital*.
- Traore, L. (2010). Arterial Hypertension and Pregnancy in the Obstetrics and Gynaecology Department of the CSREF CVI [Doctoral Thesis in Medicine]. Bamako.
- Pournaras, J. A. C. (2008). Retinopathy and choroidopathy associated with pre-eclampsia and eclampsia. In Pournaras JAC. *Ocular vascular pathologies. Elsevier Masson, Paris*. 807p.
- Kembou, F. F. (2014). High blood pressure and pregnancy at the Gabriel Touré University Hospital from 2003 to 2012. *Ph.D. in Medicine*, Bamako, 75.
- Diallo, D. (2008). Fatoumata High blood pressure and pregnancy in the gynaecology-obstetrics department of the Gabriel Touré University Hospital. *Ph.D. in Bamako*, 96.
- Coulibaly, B. (2007). *Hypertension in pregnant women in the district of Bamako about 250 cases*. Ph.D. in Bamako, 82.
- Dallo, J. W., & Meda, N. Ocular manifestations during severe pre-eclampsia or eclampsia at the Sourô Sanou University Hospital of Bobo Dioulasso.
- Sankare, Y. (2020). Epidemio-clinical appearance of the fundus in pre-eclamptic and/or eclamptic patients in the ophthalmology department of the Somine Dolo Hospital in Mopti. *Thesis in Medicine Bamako*, 20.
- Ngwanou, N. A., & Koki, G. Retinal Lesions in Preeclampsia/Eclampsia and Their Predictive Value on Pregnancy Outcomes.
- Harioly, N. M., Rasolonjatovo, T., Ndrianirina, M., & Randriambololona, D. (2009). Epidemiological profile of pre-eclampsia and eclampsia admitted to intensive care in adults at the *Befelatanana maternity hospital*, 1(3), 22 -4.
- Keita, D. (2019). Management of pregnancy-associated arterial hypertension at the ME University Hospital "Le Luxembourg": *Prognosis. Ph.D. in Medicine*, 66.
- Fomba, D. N. (2005). Arterial Hypertension and Pregnancy in the Obstetrics and Gynaecology Department of the CSREF of the C II [Doctoral Thesis of Medicine]. Bamako, 97.
- Hypertension and alcohol consumption. *Rev Med Switzerland* 2006;2: 2041-6 www.revmed.ch (accessed 06/06/2022)
- Mali Demographic and Health Survey (DHSS-VI) 2018 p.160 High blood pressure and pregnancy at the Gabriel Touré University Hospital from 2003 to 2012. Ph.D. in Medicine, Bamako, 2014, 75.
- Samaké, B. M., Traoré, M., Goita, L., Niani, M., Traore, Y., Teketé, I., ... & Dolo, A. (2011). Epidemiologic and clinical profile of severe pre-eclampsia at the university hospital of Gabriel Touré. *Le Mali Medical*, 26(4), 5-7.
- Yanogo, A. S. (2015). Fundus aspects in women with severe pre-eclampsia and/or eclampsia who have given birth or seen at the Sourô Sanou University Hospital in Bobo-Dioulasso: *About 127 cases Med's thesis*.
- Lankoande, J., Ouedraogo, A., Ouedraogo, C. M., Ouattara, T., Bonané, B., & Koné, B. (1997). Gynecology-obstetrics at the Yalgado-Ouedraogo National Hospital Center. Eclampsia: epidemiologic, clinical and prognostic aspects. *Sante (Montrouge, France)*, 7(4), 231-235.
- Tsatsaris, T., & Fourmier, N. (2008). Winer: Pathophysiology of Pre-Eclampsia: *Journal of Obstetric Gynecology and Reproductive Biology*, 37,16-23.
- Beillat, T., & Dreyfus, M. High blood pressure and pregnancy [online] available on <http://www.clemedicine.com> accessed on 11/09/2022
- Ant, A. (2012). *Epidemiology and Pathophysiology of Pre-Eclampsia, Obstetrics General Journals No. 164* September 2012.
- Fergusson, A. (2020). *Ocular complications of pre-eclampsia: a series of 7 cases. SFO Congress*.



27. College of University Ophthalmologists of France (COUF). Chapter 23 (ITEM224) Hypertensive Retinopathy.2021
28. Gillmann, K. (2018). Recommendation for the multidisciplinary follow-up of immunoglobulin A nephropathy: the case of an ophthalmological presentation of a hypertensive crisis with retinopathy in the context of Berger's disease. *SFO Congress*.
29. Karki, P., Malla, P., Das, H., & Uprety, D. K. (2010). Association between pregnancy-induced hypertensive fundus changes and fetal outcomes. *Nepalese Journal of Ophthalmology: a Biannual Peer-reviewed Academic Journal of the Nepal Ophthalmic Society: NEPJOPH*, 2(1), 26-30.
30. Aroques, M. (2018). Management of high blood pressure in pregnant women. Pharmaceutical Sciences. 2018. DUMAS-01774092 Ph.D. Thesis in Pharmacy, University of Marseille, April 2018.
31. Shantsila, E., Koziel-Siolkowska, M., Lip, G. Y. H. (2022). Cochrane Review: Antiplatelet and anticoagulant agents in the treatment of high blood pressure. [Online] available on <https://www.cochrane.org> Published on 28 July 2022 (page consulted on 09 August 2022).