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The Therapeutic Effect of Hydroxychloroquine on Patients with Recurrent Miscarriage and the Risk Assessment of its Ocular Retinal Toxicity

Ai Zhang¹, Xianhe Zheng¹, Xiaoli Zhu², Jing Zheng^{1*}

Author's Affiliation:

1. Department of Ophthalmology, Wenzhou TCM Hospital of Zhejiang Chinese Medical University, Wenzhou, Zhejiang, China
2. Department of Gynecology, Wenzhou TCM Hospital of Zhejiang Chinese Medical University, Wenzhou, Zhejiang - China

Corresponding Author:

Jing Zheng
Email:

qqbovov@163.com

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Keywords:

HCQ; Recurrent miscarriage; Ocular retinal toxicity; Effects; Live births; Still birth

Abstract

Background: Recurrent miscarriage (RM) is defined as ≥ 3 pregnancy losses before the 20th week of gestation. The present study examined hydroxychloroquine's (HCQ) effects in pregnant women with a history of spontaneous miscarriage, focusing on potential obstetric benefit (live-birth rate) and potential ocular/retinal safety risks.

Methods: Prospective single-arm cohort at Wenzhou TCM Hospital; all 91 pregnant participants (15–20 gestational weeks; ≥ 1 prior spontaneous miscarriage) received HCQ 400 mg/day for 90 days with assessments at baseline, 3 months, and 6 months; women with a history of induced/elective abortion were excluded.

Results: Within-cohort obstetric trajectories improved over follow-up (live-birth proportion increased), but causality cannot be inferred without a control group. Retinal thickness showed no significant change across baseline, 3 months, and 6 months (ANOVA $p = 0.848$). Inner plexiform layer values were excluded where segmentation failed; age was not associated with retinal-thickness change ($p = 0.99$).

Conclusion: In this mid-pregnancy, single-arm HCQ cohort, retinal thickness did not change significantly over 6 months, while obstetric outcomes improved over time; routine ophthalmic monitoring remains advisable, and controlled studies are warranted to determine efficacy and safety.



Introduction

Recurrent miscarriage (RM) is the loss of pregnancy at least three times before the 20th week of gestation. Even though the World Health Organization reports that RM occurs in 2% to 5% of couples, investigations in low- and middle-income nations have yet to reach conclusive results [1]. Even after comprehensive evaluation, approximately 50% of recurrent pregnancy loss cases remain unexplained [2], while some reviews report unexplained rates as high as 75% depending on definitions and diagnostic work-up [3]. Nonetheless, current evidence indicates that both modifiable and unmodifiable risk factors drive RM. Recent approaches emphasize modifiable risk factors and structured follow-up.

In recent decades, hydroxychloroquine (HCQ) has attracted interest for potential benefit in RM-related immune dysregulation. Concurrently, concerns persist regarding ocular toxicity involving the ciliary body, cornea, and retina [4, 5]. Researchers associate HCQ with potential therapeutic effects on RM, but there are concerns and alarms regarding ocular toxicity in the ciliary body, cornea, and retina [4, 5]. These delved into therapeutic effects among pregnant women, juxtaposing the assessment of risks like ocular retinopathy. This creates a clinical trade-off between potential obstetric benefit and ocular-safety risk.

Many studies associate HCQ with improved obstetric outcomes, including higher live-birth rates [6, 7, 8, 9], and document its benefits in the management of autoimmune diseases [10]. Risk-benefit appraisals generally indicate low teratogenic risk with appropriate dosing, supporting use when maternal indications exist. HCQ downregulates immune responses, thereby reducing inflammation in autoimmune disorders.

Concerns regarding HCQ's ocular effects and retinal interference have risen in recent years. Studies assess changes in retinal nerve fiber layer (RNFL), ganglion cell layer (GCL), and inner plexiform layer (IPL); risk of retinopathy increases primarily with cumulative exposure and duration [4, 5]. Long-term HCQ exposure is a major risk factor for retinal toxicity, which may result in central vision loss or bull's-eye maculopathy [4, 5]. HCQ accumulates in melanin-containing retinal pigment epithelium, with downstream effects on photoreceptors that can manifest as central vision loss and bull's-eye maculopathy [4, 5].

HCQ-induced retinopathy may ultimately result in irreversible visual loss; therefore, appropriate ophthalmic screening is important for detecting retinal toxicity before clinically significant central vision loss develops [12]. Automated visual-field testing and spectral-domain optical coherence tomography (SD-OCT) are recommended primary screening modalities [12]. These considerations underscore the relevance of

evaluating HCQ-related ocular and retinal safety in pregnancy.

Despite detailed pathophysiology, evidence specific to pregnancy remains limited. The above associations raise safety questions for pregnant women with RM. The present study investigated HCQ in pregnant women with RM, assessing obstetric outcomes (live-birth trajectory) and OCT-derived retinal metrics (RNFL, GCL, IPL) across baseline, 3-month, and 6-month visits.

Methods

Description of the Study Area

The study was performed at Wenzhou TCM Hospital of Zhejiang Chinese Medical University. The study site operated under standard hospital access controls and clinical research procedures.

Study Design, Sample Size, and Sampling Method

According to the guidelines, we conducted this study at the Wenzhou TCM Hospital of Zhejiang Chinese Medical University. The study was carried out between 1st May 2021 and 30th September 2022 under the supervision of the research and development department. This was a prospective single-arm clinical follow-up of pregnant women without a history of induced/elective abortion. Participants were consecutively enrolled from clinic attendees; enrolment order was random, but all received the same HCQ regimen. A consecutive, eligibility-based sample was drawn from pregnant women attending the clinic. Eligibility required a documented spontaneous miscarriage (see eligibility criteria), and enrolment occurred at the routine visit.

Eligibility Criteria

Our study included 91 pregnant women who were eligible for the three-tier assessment of HCQ's therapeutic effects and potential risk factors. The inclusion criteria adopted to filter the patients considered the following: ① Consenting pregnant women aged ≥ 18 years; ② Viable singleton pregnancy ≥ 15 to ≤ 20 gestational weeks; ③ History of ≥ 1 spontaneous miscarriage (recurrent miscarriage typically defined as ≥ 2 ; see Table 1); ④ Clinical indication for HCQ without known ocular disease affecting OCT quality. In contrast, the study excluded: ① History of induced/elective abortion; ② Gestational age >20 weeks at screening; ③ No documented history of spontaneous miscarriage.

A Description of the Participant Population

The study was limited to pregnant women with a history of recurrent miscarriage. At enrolment, participants were pregnant at ≥ 15 to ≤ 20 gestational weeks (Table 1). All participants had a history of spontaneous miscarriage and no history of induced/elective abortion

per medical record. The table below captures the key demographic profile of eligible participants in this study.

Participants (n)	91
Gestational weeks	≥ 15 to ≤ 20
Age	≥ 18
Dose	400 mg of HCQ for 90 days
Recurrent miscarriage	≥ 2
Abortion	NIL

Table 1: A brief demographic description.

Interventions and outcomes

All 91 participants received HCQ 400 mg once daily for 90 days, scheduled during routine clinic follow-up. The primary outcomes were obstetric status (live-birth trajectory) and retinal structure assessed by OCT. Retinal thickness was measured at baseline, 3 months, and 6 months; age-change associations were explored. OCT layers analysed included RNFL, GCL, and IPL; retinal safety was interpreted alongside obstetric outcomes. For scans with failed layer segmentation (IPL), values were treated as missing and excluded from inferential analyses.

Statistical Analyses

Descriptive statistics summarized retinal-thickness distributions (min, max, median, and IQR) [13, 14, 15]. A one-way repeated-measures ANOVA compared retinal thickness at baseline, 3 months, and 6 months. Analyses were two-tailed with $\alpha = 0.05$. The alternate hypothesis was that there would be a significant difference in retinal thickness across at least two assessments, including baseline, 3 months, and 6 months.

Pearson's correlation was used to test the association between age and the change in retinal thickness (6-month minus baseline) [16, 17]. The Pearson correlational coefficient was calculated and denoted as "r," ranging from -1 to 1, where $r \approx 0$ was considered negligible association; $r = -1$ was considered a strong negative association; and an $r = 1$ was considered as strong positive association. Statistical significance was defined as $p \leq 0.05$. Analyses used complete-case data for each test; missing OCT layers from segmentation failure were not imputed.

Results

Live Births, Miscarriages, and Possible Changes in Pregnancies

The baseline, 3 months, and 6 months examinations focused on pregnancy outcomes like live births, miscarriages, and possible changes during pregnancy. To decipher HCQ's therapeutic effects, trends, and

patterns in miscarriage incidence, live birth rates, and pregnancy outcomes among the 91 participants, data were collected at baseline, 3 months, and 6 months (Supplementary Table 1).

In Figure 1, notable trends in live births were observed across different time points. At baseline, 68 live births were recorded; this number increased to 77 at 3 months and to 85 at 6 months. This upward trajectory represents within-cohort change over time in a single-arm study and does not establish treatment efficacy. Controlled studies are needed to test efficacy.

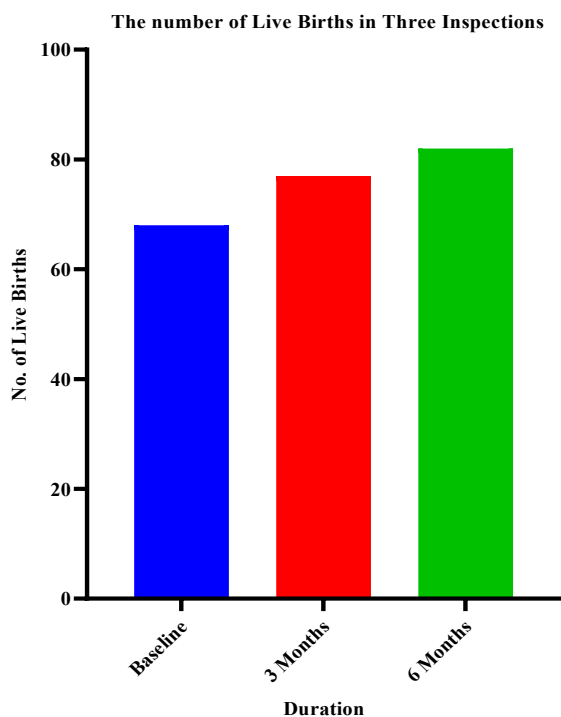


Figure 1: Reported live births at baseline, three and six months after a dose of 400 mg of HCQ for 90 days.

The assessment of miscarriages revealed HCQ's effects on RM. At the baseline, six miscarriages were recorded, and this number slightly increased to 7 at 3 months before decreasing to 6 at 6 months. The small fluctuations across visits are descriptive and not inferential; ongoing clinical monitoring is standard in this population (Figure 2).

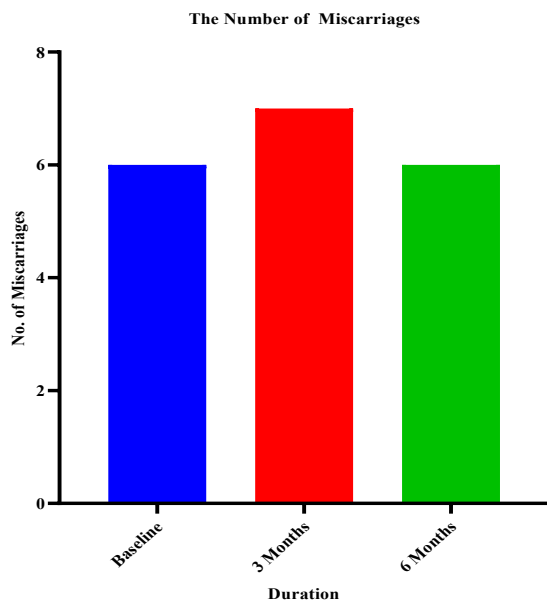


Figure 2: A summary of the incidence of miscarriages at baseline, 3 months, and 6 months after a dose of 400 mg of HCQ for 90 days.

In Figure 3, the incidence of diarrhea among participants at 3 months was recorded at 27%. At 3 months, 27% reported diarrhea, declining to 15.5% at 6 months. Monitoring for gastrointestinal symptoms and adjusting management strategies as needed remains important.

Nausea affected 17.6% at 3 months and 14.3% at 6 months. Nausea is a common side effect of HCQ. Addressing this symptom may involve adjusting the timing of medication administration or providing antiemetic support. A decline in nausea suggests a potential improvement in gastrointestinal tolerance to HCQ. As with diarrhea, ongoing monitoring and supportive measures may be necessary.

Arthritis-type symptoms (joint pain, etc.) were reported by 28.4% at 3 months and 44% at 6 months. Monitoring for the severity of joint symptoms and considering appropriate interventions are essential. Management strategies, including potential adjustments to the treatment plan.

Prolonged QT was noted in 27% at 3 months and 26.2% at 6 months. Prolonged QT is a cardiac side effect associated with HCQ use, and it requires careful monitoring as it can lead to serious cardiac arrhythmias. Regular electrocardiogram (ECG) monitoring is typically recommended in patients receiving HCQ.

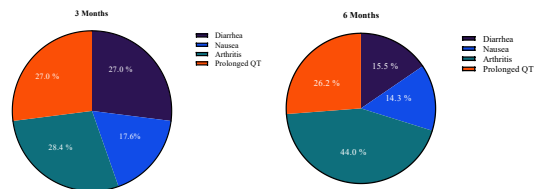


Figure 3: Contrasting the incidence of HCQ-related adverse effects among the participants after a dose of 400 mg of HCQ for 90 days.

Ocular Toxicity and Retinal Measurement Outcomes

Mean retinal thickness was 256.68 μm (SD 10.56; range 238–280 μm ; 25th 248 μm , median 255 μm , 75th 265 μm) (Table 2). These measurements are within the threshold retinal thickness measurements of 248.7 μm in males and 249.2 μm in females.

Count	273.00
Mean	256.68
Std	10.56
Min	238.00
25%	248.00
50%	255.00
75%	265.00
Max	280.00

Table 2: Descriptive statistics for retinal thickness.

The results in Figure 4 show the average retinal thickness (μm) at different time points. The average retinal thickness at baseline was 256.7 μm . This measurement serves as the initial reference point before HCQ administration. It indicates the baseline retinal condition in patients with Recurrent Miscarriage. After 3 months of HCQ treatment, the average retinal thickness increased to 258 μm . Across visits, differences were minor as evaluated by repeated-measures ANOVA. At 6 months, the average retinal thickness decreased to 256.2 μm . This decrease may indicate a stabilization or even a reversal of the earlier observed increase in retinal thickness. It is crucial to note that this change might be interpreted as a positive outcome, as it suggests a possible mitigation of adverse effects on retinal health.

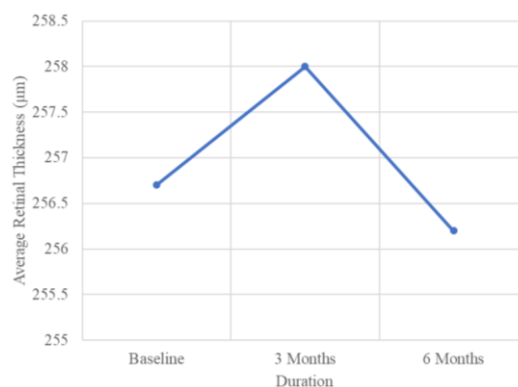


Figure 4: Average changes in retinal thickness at baseline, 3 months, and 6 months after a dose of 400 mg of HCQ for 90 days.

ANOVA was performed to assess retinal thickness following HCQ treatment and determine statistical significance. The ANOVA results yielded an F-statistic of 0.165 and a p-value of 0.848, indicating no statistical significance (Table 3). The lack of statistical significance suggests negligible differences in the retinal thickness measurements at baseline, 3 months, and 6 months. Therefore, we did not reject the null hypothesis. Further, we performed a correlational analysis of age and retinal thickness measurements and did not find statistically significant outcomes ($p = 0.99$) (table 3). These statistical outcomes asserted no relationship between retinal thickness and age.

ANOVA results		Correlational results	
F-statistic	0.164997027963273	Pearson Correlational Coefficient	0.0008729236485382996
P-value	0.847981651892783	P-value	0.9885452533045738

Table 3: Statistical Analysis Outcomes.

We analyzed age distribution by borrowing the spurious relationship between retinal thickness and participants' age. The distribution shown in Figure 5 showed no association between age and retinal change.

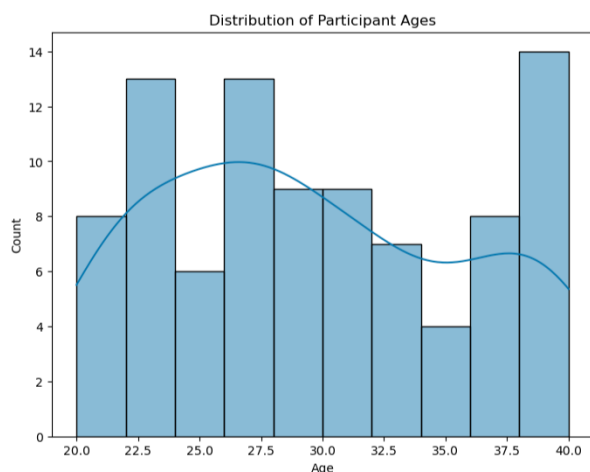


Figure 5: The distribution of the participants' ages.

Retinal Toxicity and Visual Problems

HCQ's retinal toxicity and visual problems invoked significant interest in the investigation. To decipher HCQ's retinal toxicity and visual complications in pregnancy, we independently assessed retinal nerve fiber layer, ganglion cell layer, and inner plexiform layer measurements. We observed trends to reach conclusions about the therapeutic effects of 400 mg of HCQ for 90 days.

In Figure 6, small RNFL and GCL differences were observed across visits, showing that these were not statistically significant and may reflect measurement

variability. Inner plexiform layer (IPL) values were not quantifiable in a subset owing to automated segmentation failure and were not used for inferential analyses.

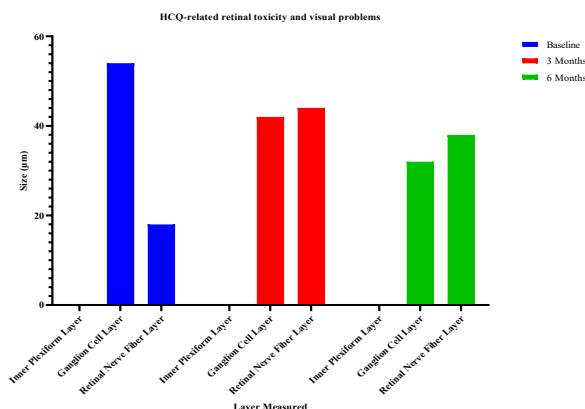


Figure 6: A comparison and trends of HCQ-related retinal toxicity and visual problems after a dose of 400 mg of HCQ for 90 days.

At 3 and 6 months after medication, we examined HCQ's long-term effects on retinal nerve fibers, ganglion cells, and the inner plexiform layers. In this assessment, we were keen to note any subtle effects of the interventions on the patient's eyes. Proportions reporting any long-term effect are summarized in Figure 7. These data are descriptive and do not attribute causality.

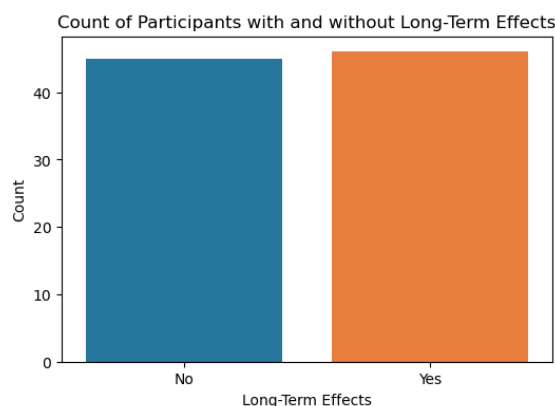


Figure 7: The ratio of participants reporting long-term effects against those who did not report long-term effects after a dose of 400 mg of HCQ for 90 days.

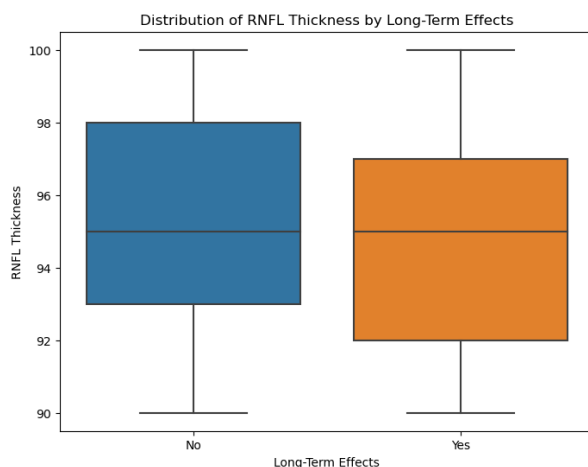


Figure 8: The distribution of retinal nerve fiber layer thickness by long-term effect after a dose of 400 mg of HCQ for 90 days.

HCQ's long-term effects on ocular toxicity and retinal outcomes emerged as a dynamic area of interest. We observed differences in the central tendency and spread of retinal nerve fiber layer (RNFL) measurements between participants who reported long-term effects and those who did not. The clinical data indicate that participants with RNFL thickness exceeding 95µm did not report long-term effects, unlike their counterparts (**Figure 8**). We noted that RNFL thickness determined whether participants would experience long-term effects, with RNFL thickness exceeding $\geq 95\mu\text{m}$ more likely to induce long-term effects.

We examined the distributions of RNFL thickness among participants who reported long-term effects and those who did not, using violin plots. To decipher the varying distribution of RNFL thickness, we observed differences in the shapes of the violin plots for participants reporting long-term effects. We contrasted them with those who did not report long-term effects. The high variability in RNFL thickness in the group did not indicate long-term effects among participants with RNFL thicknesses of 93µm and 98µm. The group reported the lowest variability with an RNFL thickness of 95µm. On the other hand, there was high variability in participants' RNFL thicknesses, with 92µm and 97µm, and minimum variability at 95µm (Figure 9).

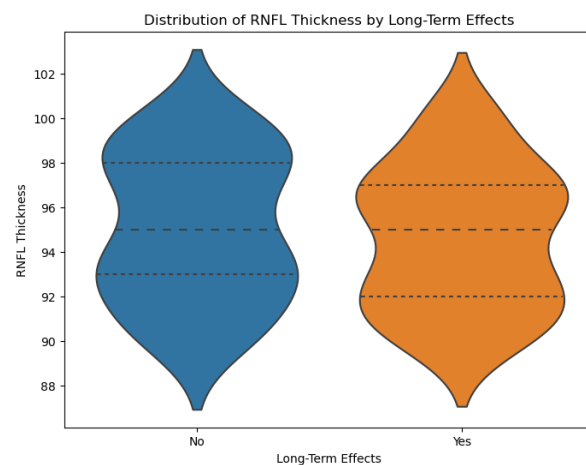


Figure 9: The varying distribution of RNFL thickness by long-term effects after a dose of 400 mg of HCQ for 90 days.

Discussion

Recurrent miscarriage (RM) remains a significant maternal–fetal health concern. Many medications, including HCQ, have been indicated to manage RM without substantial outcomes. HCQ is widely used for rheumatic disease management in pregnancy, with limited teratogenic signal in the literature [10, 18]. HCQ's rationale for the management of rheumatic conditions in pregnancy regards efficacy against inflammation associated with lupus or arthritis that causes premature fetal growth and birth complications. In addition to this, studies supporting its use in pregnancy cite its chances of reducing the incidence of congenital heart block. On the other hand, evidence from other studies reports potential teratogenic effects like respiratory anomalies, urinary defects, oral clefts, and possible miscarriage, among other issues.

To decipher HCQ's therapeutic effects in pregnancy, pregnant women with a history of RM were treated with 400 mg of HCQ for 90 days and assessed at baseline, 3 months, and 6 months. Live-birth counts increased across study visits in this single-arm cohort. A preliminary analysis of the study outcomes strongly indicates a steady increase in live births from baseline to 3 months and 6 months following administration of 400 mg of hydroxychloroquine for 90 days among pregnant women with RM. These within-cohort changes do not establish treatment efficacy and require confirmation in controlled studies.

Our outcomes align with reports from previous studies. HCQ has been reported to increase the rate of successful births among pregnant women with a history of RM by 57% to 67% [6, 9]. These studies report that HCQ prevents flares during pregnancy, increasing the chances of successful births. Flares caused by systemic lupus erythematosus cause adverse outcomes in pregnancy, like pre-eclampsia, loss of the fetus, or

preterm birth. Prior studies report improved obstetric outcomes in selected contexts [8, 19]. Interpretation should account for differences in design, indication, and co-management. In these studies, termination of HCQ treatment was recommended if pregnancy loss occurred within one year of treatment.

Despite a consistent increase in live births, the present study found inconsistent miscarriages among women receiving 400 mg of HCQ intervention for 90 days. A preliminary analysis of the clinical results reveals relatively stable miscarriages at baseline, 3 months, and 6 months. The highest number of incidences of miscarriage was reported at 3 months, a total of 7 miscarriages, then at 3 months and 6 months, each posting 6 miscarriages. Miscarriage counts were relatively stable across visits and are reported descriptively without mechanistic inference. HCQ is generally considered safe when used at appropriate doses for approved indications. However, its safety profile can vary among individuals, and rare but serious side effects such as retinal toxicity have been reported. Healthcare providers must regularly monitor patients for potential adverse effects, particularly given the duration of treatment. While hydroxychloroquine is generally well-tolerated, it is not without risks. Possible risks include adverse effects on the cardiovascular system, gastrointestinal issues, and skin reactions. Additionally, it is important to consider potential drug interactions and contraindications, especially if patients have pre-existing medical conditions or are taking other medications. Common side effects of hydroxychloroquine may include gastrointestinal disturbances, skin reactions, and headaches.

Our study supports results from previous investigations and the position taken by HCQ's literature on miscarriage among pregnant women with RMs. Literature and previous investigations report that HCQ does not increase miscarriage among pregnant women with a history of RM [7, 20]. Findings align with reports that HCQ does not increase miscarriage in relevant clinical settings [7, 20], while emphasizing the need for continued pharmacology.

The study revealed important outcomes indicating HCQ's adverse effects, as well as crucial indicators of therapeutic outcomes. The study showed a mix of positive and negative effects among participants. A preliminary analysis of the outcomes indicates a decrease in some adverse effects, including diarrhea, prolonged QT intervals, and nausea, and an increase in others, such as arthritis. Interestingly, these adverse effects were not reported at baseline assessment, suggesting eradication and relief among participants. The varying incidence of adverse effects hinders conclusive remarks regarding the safety among pregnant women with RM, and raises safety concerns.

The decreasing adverse effects point to HCQ's key therapeutic effects among pregnant women with RM. The literature on HCQ's treatment among pregnant women with RM strongly indicates reduced adverse effects like diarrhea, prolonged QT intervals in the electrocardiogram, and nausea [8, 19].

The decrease in the incidence of diarrhea and nausea is a positive trend regarding the safety profile of HCQ. Gastrointestinal side effects, including diarrhea and nausea, are common concerns with HCQ use. Reducing these adverse effects over time may suggest that patients can adapt to the medication or that healthcare providers implement strategies to manage them effectively. It is consistent with the notion that many patients experience gastrointestinal side effects early in treatment but may see improvement with continued use. The decrease in the incidence of prolonged QT is a crucial aspect of the safety profile. Prolonged QT intervals on electrocardiograms can be associated with serious cardiac arrhythmias. The reduction in prolonged QT suggests that, over time, patients may have adapted to the medication, and careful monitoring or treatment adjustments may have helped minimize this cardiac risk. It highlights the importance of vigilant cardiac monitoring, especially given HCQ's known cardiac side effects. The increase in arthritis as an adverse effect is noteworthy and may prompt closer scrutiny. Arthritis-like symptoms, including joint pain, are recognized side effects of HCQ. The escalation in the incidence of arthritis may necessitate careful evaluation of the balance between therapeutic benefits and potential side effects. This emphasizes the importance of considering both the safety and efficacy of HCQ in patients with RM. Reported adverse events warrant routine monitoring and clinical adjudication, consistent with general safety guidance for HCQ use in pregnancy [21].

We investigated HCQ's ocular effects and retinal changes to unmask its therapeutic effects. The assessment aimed at ascertaining whether HCQ is safe in pregnancy or is a potential cause of retinal toxicity that leads to irreversible vision loss [18, 22]. Our analysis began by examining retinal thickness at baseline, 3, and 6 months. Measured retinal thickness values were within reference ranges reported in prior studies [23]. In the literature, HCQ's effects on parafoveal EZ disruption appear progressive. In the early stage, there is no disruption of the foveal E. In contrast, obvious and severe damage entails parafoveal disruption with an intact foveal EZ and disruption of parafoveal and foveal EZ, respectively.

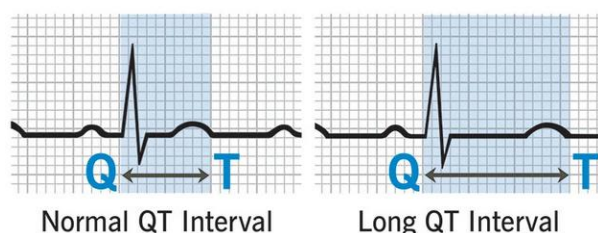


Figure 10: A comparison of prolonged and normal QT intervals.

An examination of retinal thickness measurements revealed slight changes, supported by the minimal thickness variability among the participants: 10.56. We tested the null hypothesis by assessing the changes in retinal thickness in the three assessments. The ANOVA yielded $F = 0.165$, $p = 0.848$, indicating no statistically significant difference across visits; the null hypothesis was not rejected. These data show no detectable change in retinal thickness over 6 months in this cohort, consistent with reports that early structural change may be limited [23, 24, 25]. Further, we did not find a statistically significant correlation between retinal thickness and age. Again, these findings agree with previous studies on pregnancy, which reported no correlation between age and retinal thickness [14, 26].

The increase in retinal thickness at 3 months underscores the potential risk of retinal toxicity associated with HCQ. Retinal toxicity is a known side effect of HCQ, and changes in retinal thickness can serve as an early indicator of ocular complications. Regular ophthalmological assessments are crucial for early detection of retinal toxicity and other ocular issues. These assessments may include detailed macular examinations, perimetry testing, and other relevant tests to monitor retinal health. Timely detection of ocular complications is essential to minimize the risk of long-term visual impairment and ensure patient safety. While retinal thickness is a safety concern, it is essential to assess the overall efficacy of HCQ in managing RM. The fluctuations in retinal thickness should be interpreted alongside the observed benefits and potential risks in the context of the study's primary objectives. Evaluating the efficacy involves considering the impact of HCQ on reducing the recurrence of miscarriages and improving overall pregnancy outcomes.

To decipher the realities and first-hand information on HCQ's effects on retinal measurements, we deliberated the measurements of retinal nerve fibers, ganglionic cell layers, and inner plexiform layers across three different conditions. In the first inspection, the retinal nerve fiber layer was measured at baseline, 3 months, and 6 months, and no significant trend of increase or decrease was noted. The retinal nerve fiber layer increased from baseline at 3 months and decreased

at 6 months. RNFL differences across visits were small and non-significant. Our results concur with previous investigations regarding HCQ's effect on the retinal nerve fiber layers. Evidence strongly suggests negligible impacts on retinal thickness and measurements [24]. We proceeded to investigate HCQ's effects on the measurements of the ganglionic cells' layers. GCL changes were modest, and no significant difference across visits was detected in this cohort [27]. In other studies, HCQ was reported to decrease measurements of ganglionic cell layers, raising crucial clinical questions for further investigation [27]. The consistent decline posited an important trend regarding HCQ's effects on pregnancy. HCQ does not affect the measurements of the inner plexiform in pregnancy. Some previous studies support these outcomes by showing that HCQ treatment does not affect the inner retinal layers [27, 28]. Outcomes from these studies suggest that HCQ treatment affects only the outer nuclear layers, the photoreceptor layers, and the retinal pigment epithelium [29].

We assessed the long-term effects of HCQ in pregnancy by focusing on retinal and ocular toxicity. A preliminary analysis revealed that some participants reported potential long-term effects, whereas others did not. Interestingly, RHFL thickness was the basis of the incidence of long-term effects among pregnant women with RMs. We measured the central tendency of participants who reported long-term effects vs. those who did not and found high variability in the incidence of long-term adverse effects. RNFL distributions by reported effect status are shown for context. These observations are descriptive and do not establish a causal threshold [11, 30].

Further, we examined RNFL thickness variation among participants to determine its distribution. By plotting violin plots of participants who reported long-term effects vs. those who did not, we found that RNFL thickness showed the greatest population variation. A comparison at 3 and 6 months showed greater variability in the group that did not report long-term effects. The high variability was associated with RNFL thickness of $95\mu\text{m}$ and $98\mu\text{m}$. As for the group reporting adverse effects, high variability was noted among participants whose RNFL thickness measured $92\mu\text{m}$ and $97\mu\text{m}$. Interestingly, the lowest variability in the group reporting long-term effects was observed among participants with RNFL measurements of $95\mu\text{m}$.

HCQ's therapeutic effects among pregnant women with RM feature positive and negative outcomes on the incidence of RM and ocular-related risks like vision. Despite several studies, shortcomings and knowledge gaps exist regarding HCQ's safety and efficacy in RM. In this single-arm cohort, live-birth counts increased

across visits, while retinal thickness did not change significantly over 6 months ($p = 0.848$). Routine monitoring remains advisable; controlled studies are needed to determine efficacy and long-term ocular safety.

Author Contributions

All co-authors contributed significantly to designing and executing this study; and writing this manuscript.

Conflict of Interest

The authors declare that there is no conflict of interest.

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