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Presentation of retinopathy of prematurity and associated risk factors in a referral center in Iraq

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ABSTRACT

BACKGROUND: The aim of the study was to report the prevalence of retinopathy of prematurity (ROP) and its classification in a sample of premature Iraqi newborns and to investigate the associated risk factors.

MATERIAL AND METHODS: An observational retrospective cohort study carried out at the Ophthalmology Department, Hemayat Al-Tifil Hospital, Medical City Complex in Baghdad, Iraq. The data were collected from patients' case files from December 2019 until the end of March 2021, targeting premature newborns with gestational age < 37 weeks who had dilated fundus examination and completed the follow-up.

RESULTS: During the study period, 269 cases were enrolled with a mean gestational age of 31.3 ± 2.2 weeks, 9.3% aged less than 28 weeks, and a birth weight of 1558.7 ± 476.8 grams. From the total sample, 19 (7.1%) had type 1 ROP (T1ROP), 43 (16%) had type 2 ROP (T2ROP), and 70 (26%) had any ROP. T1ROP was significantly associated with low gestational age (16% of cases aged < 28 weeks), respiratory distress syndrome (20%), and low birth weight (21.4% in cases with birth weight less than 1051 g). In multivariate regression analysis, poor weight gain maintained a statistically significant association with T1ROP.

CONCLUSION: The incidence of T1ROP in the study sample was comparable to results in other countries. Factors that were associated with increased risk for ROP after multivariate analysis were only poor weight gain.

KEY WORDS: ROP; retinopathy; prematurity; G-ROP

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INTRODUCTION

Retinopathy of prematurity (ROP) is a developmental vascular proliferative disorder that takes place in the retina of premature infants with incomplete retinal vascularization. ROP is a significant cause of severe visual dysfunction in childhood [1].

Premature birth [≤ 30 weeks' gestational age (GA)] and low birth weight (BW) ≤ 1500 g are the most significant risk factors for developing ROP [2]. In multivariate analysis, low BW, low GA, assisted ventilation for longer than one week, surfactant therapy, high blood transfusion volume, cumulative illness severity, low caloric intake, hyperglycemia, and insulin therapy, have been independently associated with higher rates of ROP [3–7]. Breastmilk feeding appears to play a protective role in preventing ROP [8, 9].

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Other possible risk factors include sepsis, fluctuations in blood gas measurements, intraventricular hemorrhage, bronchopulmonary dysplasia, systemic fungal infection, and early administration of erythropoietin for the treatment of anemia of prematurity [10]. Poor longitudinal weight gain and elevated serum concentrations of insulin-like growth factor 1 (IGF-1) and insulin-like growth factor-binding protein 3 (IGFBP-3) have also been used to identify infants at risk for ROP [11, 12].

The advantages of digital imaging include the ability to record the fundus images and possibly utilize them for telemedicine in places with few experienced ophthalmologists in ROP [13], easier for the children, facilitate teaching, documentation, and increased parents' awareness about ROP [14]. Also, some developed countries, like Australia, had already made guidelines about the use of RetCam imaging for ROP screening in addition to indirect ophthalmoscopy [15]. The sensitivity of RetCam in detecting type 1 ROP (T1ROP) was reported to reach 100% [14, 16, 17]. Figure 1 shows stage 2 ROP of a patient enrolled in this study.

The risk factors used for predicting ROP were adapted from the Postnatal Growth and ROP study done by Binenbaum et al. (2017), 18 and were modified in 2018, 19 and were validated again in 2020 and found to be generalizable for predicting those children who need retinal examination and are likely to develop T1ROP, 20 the six criteria included by the Postnatal Growth and Retinopathy of Prematurity (G-ROP) are:

- BW less than 1051 g;
- GA less than 28 weeks;
- weight gain of less than 120 g during age 10–19 days;
- weight gain of less than 180 g during age 20–29 days;
- weight gain of less than 170 g during age 30–39 days;
- or hydrocephalus (falsely increasing the weight gain).

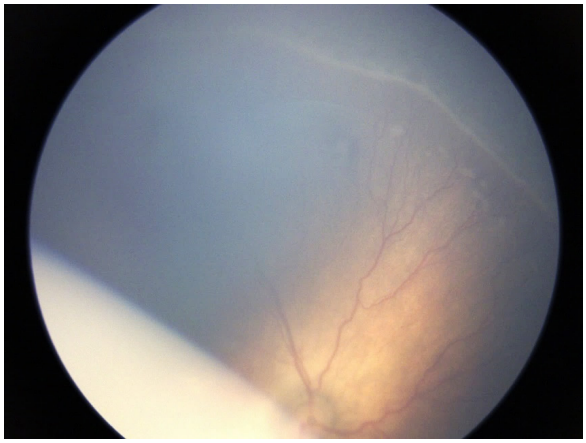

FIGURE 1. Fundus photograph showing the ridge between vascularized and avascular retina characteristic of retinopathy of prematurity ROP stage 2 (single long arrow). Small isolated new vessels (popcorn) tufts lie on the retinal surface (short arrows). (One of the patients enrolled in this study)

Aims of the study

1. To report the prevalence of retinopathy of prematurity and its classification in a sample of premature Iraqi newborns.
2. To investigate the associated risk factors for developing retinopathy of prematurity.

MATERIAL AND METHODS

This study was designed as an observational retrospective cohort study. The study was carried out at the Ophthalmology Department, Hemayat Al-Tifil Hospital, Medical City Complex in Baghdad, Iraq. The data were enrolled from patients' case files from December 2019 until the end of March 2021.

The source of information was the case files of newborns that included the required information. All the files with complete information were enrolled. All the included newborns were examined by a single experienced paediatric ophthalmologist. The Highest stage and the nearest zone were selected at any point during follow-up. The same applied to patients with bilateral disease. Figure 2 illustrates the enrollment procedure.

Inclusion criteria were as follows:

- completed the follow-up examinations until the specialized ophthalmologist recommended halting the screening visits;
- GA less than 37 weeks;
- the examination was done strictly by RetCam and not by manual indirect ophthalmoscopy;
- complete history written by the pediatrician who referred the baby for retinal examination.

Exclusion criteria were as follows:

- incomplete data regarding the targeted variables;
- loss to follow-up before being excluded from the screening program.

The variables included the patient's gestational age at birth, sex, birth weight, perinatal history, his-

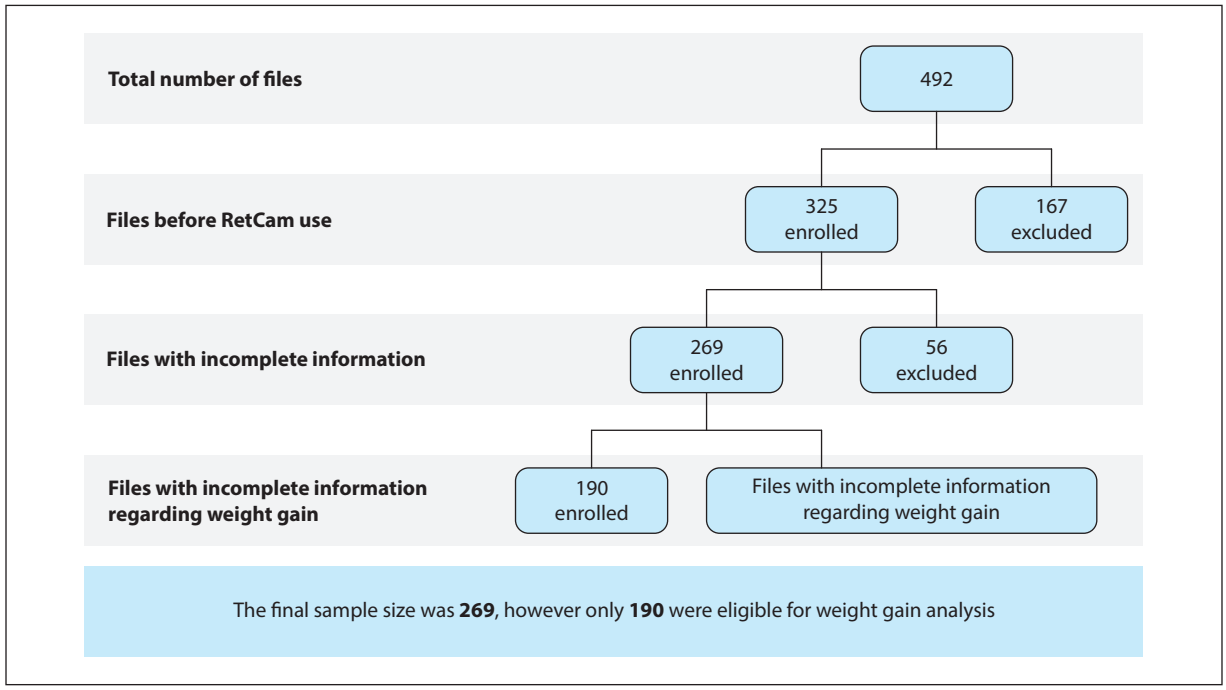

FIGURE 2. Flowchart of sample enrollment procedure

tory of sepsis, respiratory distress syndrome (RDS), and oxygen (O2) supplementation. Regarding screening for retinopathy of prematurity, the data included examination dates, stage, zone, presence of plus disease, and weight gain for the first 40 days of life.

All participants were examined using RetCam Shuttle/Ophthalmic Imaging System (Clarity Medical Systems, United States) after adequate pupillary dilatation using Cyclopentolate eye drops 0.5% followed by phenylephrine 1% after 5–10 minutes.

Classification of ROP was based on the Early Treatment of Retinopathy of Prematurity (ETROP) cooperative group classification, which included T1ROP and type 2 ROP (T2ROP), and the groups that did not fit the definition of ETROP were zone III, stages I and II, without plus disease.

Statistical analysis

Data input, handling, and tabulation were performed using International Business Machines Corporation® Statistical Package for the Social Sciences (SPSS®) version 23. Frequencies and percentages were used for descriptive statistics. The chi-square test was used to assess the association between categorical variables. Binary logistic regression models were used to predict the presence of T1ROP, T2ROP, or any ROP type. Any p-value less than 0.05 was considered statistically significant throughout the study period.

RESULTS

During the study period, 269 patients were enrolled. 221 (82.2%) had bilateral disease, and 48 (17.2%) had unilateral disease, the mean GA of 31.3 ± 2.2 weeks, 9.3% aged less than 28 weeks, 42.4% between 31 and 33 weeks +6 days, 149 (55.4%) males, and they had a mean birth weight of 1558.7 ± 476.8 grams.

There, 199 (74%) children had normal retinal examination during the follow-up period, 19 (7.1%) had T1ROP, 43 (16%) had T2ROP, 6 (2.2%) had zone 3 with stages I or II, and two patients had stage IV disease (Fig. 3). T1ROP formed 27.1% of the total number of children with ROP, while T2ROP was evident in 61.4%.

There was a statistically significant association between T1ROP, T2ROP with GA (Tab. 1 and 2): the rate of ROP is higher with lower GA, as T1ROP was seen in 16 % of children aged < 28 weeks, 12.2% between 28 to 30 weeks + 6 days, 3.5% between 31–33 weeks + 6 days, and none in children older than 34 to 36 weeks. There was no statistically significant influence of sex on ROP. All cases with T1ROP were singleton, 7(30.4%) of cases with T2ROP were twins, and 3 (16.7%)

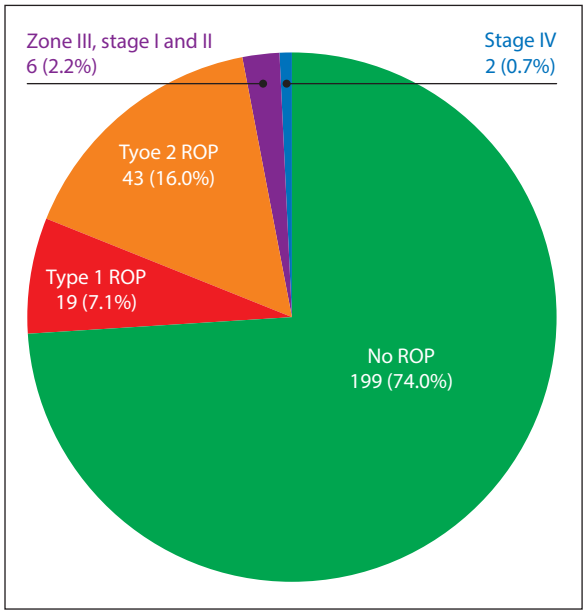

FIGURE 3. Distribution of study sample according to screening results (n = 269)

were triplets, with no statistically significant association between multiple gestations and ROP. There was no statistically significant association between sepsis and development of ROP, as 2 (5.7%) had T1ROP and sepsis, while 17 (7.3%) had T1ROP but no sepsis. RDS was significantly associated with T1ROP, as 9 (20%) of cases with RDS had T1ROP, compared to 10 (4.5%) cases without RDS but with T1ROP. However, no significant association between T2ROP and RDS was observed. There was no statistically significant association between neonatal intensive care unit (NICU) admission and T2ROP or T1ROP, but T1ROP was more frequent in newborns with a history of NICU admission (12.3%) compared to those without NICU admission (5.7%), however, cases with a history of NICU admission showed a significantly higher rate of any ROP (40.4%) compared to those without history of NICU admission (22.2%). There was no statistically significant association between T1ROP and O2 supply. However, the rate of

Table 1. Distribution of type 1 retinopathy of prematurity (T1ROP) cases according study variables

Variables	T1ROP		p-value
	No. (%)	No. (%)	
	Yes	No	
Gestational age			
Less than 28 weeks	4 (16)	21 (84)	0.008
28–30 weeks + 6 days	11 (12.2)	79 (87.8)	
31–33 weeks + 6 days	4 (3.5)	110 (96.5)	
34–36 weeks	0 (0)	40 (100)	
Sex			
Male	10 (6.7)	139 (93.3)	0.802
Female	9 (7.5)	111(92.5)	
Pregnancy type			
Singleton	19 (8.3)	209 (91.7)	0.159
Twin	0 (0)	23 (100)	
Triple	0 (0)	18 (100)	
Sepsis	2 (5.7)	33 (94.3)	0.738
RDS	9 (20)	36 (80)	0.001
Nicu	7 (12.3)	50 (87.7)	0.140
O2			
Nil	6 (4.8)	118 (95.2)	0.420
Mask	7 (9)	71 (91)	
CPAP	6 (9)	61 (91)	
G-Rop criteria			
BW < 1051 g	6 (21.4)	22 (78.6)	0.008
GA < 28 week	4 (16)	21 (84)	0.086

→

Table 1. Distribution of type 1 retinopathy of prematurity (T1ROP) cases according study variables

Variables		T1ROP		p-value
		No. (%)	No. (%)	
		Yes	No	
WG 10–19 days	< 120 g	7 (26.9)	19 (73.1)	< 0.001
	≥ 120 g	6 (3.7)	158 (96.3)	
WG 20–29 days	< 180 g	7 (31.8)	15 (68.2)	< 0.001
	≥ 180 g	6 (3.6)	162 (96.4)	
WG 30–39 days	< 170 g	5 (19.2)	21 (80.8)	0.019
	≥ 170 g	8 (4.9)	156 (95.1)	

GA — gestational age; RDS — respiratory distress syndrome; NICU — neonatal intensive care unit; CPAP — continuous positive airway pressure; G-ROP — The Postnatal Growth and Retinopathy of Prematurity; BW — birth weight; WG — weight gain

Table 2. Distribution of type 2 retinopathy of prematurity (T2ROP) cases according study variables

Variables		T2ROP		p-value
		No. (%)	No. (%)	
		Yes	No	
Gestational age				
Less than 28 weeks		9 (36)	16 (64)	**0.017**
28–30 weeks + 6 days		16 (17.8)	74 (82.2)	
31–33 weeks + 6 days		12 (10.5)	102 (89.5)	
34–36 weeks		6 (15)	34 (85)	
Sex				
Male		21 (14.1)	128 (85.9)	0.346
Female		22 (18.3)	98 (81.7)	
Pregnancy type				
Singleton		33 (14.5)	195 (85.5)	0.137
Twin		7 (30.4)	16 (69.6)	
Triple		3 (16.7)	15 (83.3)	
Sepsis		7 (20)	28 (80)	0.487
RDS		7 (15.6)	38 (84.4)	0.931
NICU		13 (22.8)	44 (77.2)	0.113
O2				
Nil		11 (8.9)	113 (91.1)	**0.011**
Mask		16 (20.5)	62 (79.5)	
CPAP		16 (23.9)	51 (76.1)	
G-ROP criteria				
BW < 1051 g		10 (35.7)	18 (64.3)	**0.006**
GA < 28 week		9 (36)	16 (64)	**0.008**
WG 10–19 days	< 120 g	9 (34.6)	17 (65.4)	0.098
	≥ 120 g	33 (20.1)	131 (79.9)	
WG 20–29 days	< 180 g	7 (31.8)	15 (68.2)	0.275
	≥ 180 g	35 (20.8)	133 (79.2)	
WG 30–39 days	< 170 g	11 (42.3)	15 (57.7)	**0.008**
	≥ 170 g	31 (18.9)	133 (81.1)	

GA — gestational age; RDS — respiratory distress syndrome; NICU — neonatal intensive care unit; CPAP — continuous positive airway pressure; G-ROP — The Postnatal Growth and Retinopathy of Prematurity; BW — birth weight; WG — weight gain

Table 3. Diagnostic value of the Postnatal Growth and Retinopathy of Prematurity (G-ROP) criteria according to retinopathy of prematurity (ROP) type

Variables	Sensitivity	95% CI	Specificity
T1ROP	92.3%	64% to 99.8%	70.1%
T2ROP	73.8%	58% to 86.1%	77.0%
Any ROP	79%	66.8% to 88.3%	87.5%

T1ROP — type 1 retinopathy of prematurity; T2ROP — type 2 retinopathy of prematurity; CI — confidence interval

Table 4. Univariate binary logistic regression model for predicting type 1 retinopathy of prematurity (T1ROP)

Variables	Mean OR	Lower 95% CI	Upper 95% CI	p-value
Sepsis	0.77	0.171	3.503	0.739
RDS	5.35	2.034	14.075	0.001
NICU	2.33	0.874	6.231	0.091
O2 supply	1.94	0.713	5.258	0.195
BW < 1051 g	4.78	1.654	13.830	0.004
GA < 28 week	2.91	0.885	9.559	0.079
Weight gain of < 120 g during age 10–19 days	9.70	2.952	31.883	< 0.001
Weight gain of < 180 g during age 20–29 days	12.60	3.750	42.337	< 0.001
Weight gain of < 170 g during age 30–39 days	4.64	1.389	15.518	0.013

GA — gestational age; RDS — respiratory distress syndrome; NICU — neonatal intensive care unit; OR — odds ratio; CI — confidence interval

T1ROP was higher in children who were put on O2 mask or continuous positive airway pressure (CPAP) (both 9%) compared to those without O2 supplementation (4.8%). There was significantly higher T2ROP among newborns with a history of O2 mask (20.5%) or CPAP (23.9%) compared to no O2 (8.9%). Birth weight less than 1051 g was significantly associated with T1ROP (21.4%) and T2ROP (35.7%) compared to children weighing more than 1051 g 5.4% and 13.7%, respectively (Tab. 1 and 2).

There were 4 (16%) patients with GA < 28 weeks and T1ROP compared to 15(6.1%) with GA ≥ 28 weeks but no T1ROP, while in T2ROP, 36% of newborns with GA < 28 weeks had T2ROP compared to 13.9% T2ROP in newborns with GA ≥ 28, with a statistically significant association between GA < 28 weeks and ROP. Newborns with WG < 120 g during 10-19 days of age had significantly higher rates of T1ROP and T2ROP than newborns with better WG, 26.9% and 34.6%, compared to 3.7% and 20.1%, respectively. Newborns with WG < 180 g during 20–29 days of age had significantly higher rates of T1ROP than newborns with better WG, 31.8% compared to 3.76%, respectively. Newborns with WG < 170g during 30-39 days of age had significantly higher rates of T1ROP and T2ROP than newborns with better WG, 19.2% and 42.3%, compared to 4.9% and 18.9%, respectively (Tab. 1 and 2).

The sensitivity of G-ROP criteria in screening for T1ROP was 92.3%, while for T2ROP, it was 73.8%, and for any ROP, it was 79% (Tab. 3).

Univariate regression analysis showed the following factors increased the risk for developing T1ROP, and those included: RDS [odds ratio (OR) = 5.35], weight < 1051 g (OR = 4.78), and the three weight gain cut-off values during 10–19 days of life (OR = 9.70), 20-29 days of life (OR = 12.6) and 30–39 days of life (OR = 4.64) (Tab. 4).

Following multivariate regression, only two variables remained statistically significant: weight gain < 120 g during 10–19 days and weight gain < 180 g during 20–29 days, with 7.36 and 11.69 odds for developing T1ROP, respectively (Tab. 5).

DISCUSSION

ROP is a significant cause of severe visual impairment in childhood, and prompt and timely detection through active screening is the most effective method for diagnosing high-risk group cases that require close follow-up or therapeutic intervention. Identifying the population at risk currently depends upon GA and birth weight [21]. Howev-

Table 5. Multivariate binary logistic regression model for predicting type 1 retinopathy of prematurity (T1ROP) (total = 190)

Variables	Mean OR	Lower 95% CI	Upper 95% CI	p-value
RDS	1.68	0.395	7.159	0.482
BW < 1051 g	1.08	0.200	5.798	0.932
Weight gain of < 120 g during age 10–19 days	7.36	1.827	29.637	0.005
Weight gain of < 180 g during age 20–29 days	11.69	2.486	54.958	0.002
Weight gain of < 170 g during age 30–39 days	0.74	0.126	4.333	0.738

RDS — respiratory distress syndrome; BW — birth weight; OR — odds ratio; CI — confidence interval

er, there is still a need for an accurate, accessible, and generalizable screening program that can detect T1ROP in all at-risk populations [22].

The GA of newborns that were examined in the current study was comparable to the results of Mahmood et al. (2019) in Iraq, Al-Najaf, who reported that only 22% had GA < 30 week 23, while in the United States, Ludwig et al. (2017) reported that more than 50% of screened children had GA < 28 weeks [24]. This could be due to the limited survival of newborns less than 28 weeks in a developing country like Iraq, as the World Health Organization reported that 90% of children born in low-income countries die within the first days of life. The suboptimal use of technical resources in middle-income countries (like Iraq) is causing more disability among premature newborns who survive the neonatal period [25]. It is worth knowing that in Iraq, 20% of under-5-years' deaths are due to prematurity [26].

In the current study, the total ROP cases were 70 (26%) of the study sample, while 19 (7.1%) had T1ROP, which is a term made by the ETROP identifying cases requiring treatment, and as shown in Table 6, these results were comparable to local reports, neighboring countries, in addition to international values, however, the differences can be explained by the disparities in inclusion criteria, namely the GA, and BW, as usually cases with lower GA and BW have more frequent and severe ROP, also the other factor is the study designs (prospective *vs* retrospective), and the duration of data collection, all these are variables that were not uniformly identified between the studies shown in Table 6. The terminology of ROP was also not uniform, as in some studies, they defined treatable ROP as stages 3, 4, and 5, and labeled it as "severe ROP" or "treatment requiring ROP" [27, 28].

In the current study, the variables that were not associated with T1ROP were sex, multiple gestation, sepsis, NICU admission, and history of O2 supplementation, and although GA, BW, and RDS initially showed statistically significant association with T1ROP, they failed to show substantial influence on T1ROP in multiple regression analysis. These results were in concordance with the results of Ali et al. (2017) in Egypt, who reported that ROP showed no statistically significant association with sex, multiple gestations, or early onset sepsis (first 72 hours of life), while factors that increased the risk for treatable ROP included younger GA and lower BW (no cut-off values specified), longer admission, longer incubator-O2 duration, late-onset sepsis (after 72 hours of life), intraventricular hemorrhage, and total parenteral nutrition 31. Some aspects were in concordance with the results of Ludwig et al. (2017) in the United States, who studied 153,706 newborns and reported that some variables showed no statistically significant influence on ROP after multivariate regression analysis. Those included race, mechanical ventilation (invasive and non-invasive), RDS, and intraventricular hemorrhage, while the factors that increased the risk for ROP included female gender (1.09 times), GA < 24 months (16.3 times), and BW 700–999 g (4.08 times) [24]. In another large study carried out in South Korea by Hong et al. (2021), who enrolled 141,964 newborns and reported that GA < 28 weeks increased the odds for ROP by 4.29 times, and males were less likely to develop ROP by 0.97 times [35]. In this study, the history reported in the patients' files was documented by the neonatal pediatrician, which might have missed reporting some critical risk factors related to ROP. In real-life situations, the clinical course of a baby provides some insight for the neonatologist and the pediatric ophthalmologist towards the possibility of having ROP, different diseases adding further burden upon the already premature baby, increasing the risk for ROP. However, many studies reporting various predisposing factors may indicate that the exact pathologies of newborns with "unstable clinical course" are in-

Table 6. Review of some published literature regarding the rate of retinopathy of prematurity (ROP) in premature newborns

Author (year)/country	Number of cases	Rate of ROP	Duration of data collection	Inclusion criteria
Mahmood et al. (2019)/Iraq [23]	100	9%	4 months	< 36-week GA
Al Balawi et al. (2020)/Saudi Arabia [29]	108	33%	25 months	< 34-week GA ± < 1500 g BW
Jacob et al. (2016)/Oman [30]	452	T1ROP:8.3% Others: 46.4%	11 years	≤ 32-week GA ± < 1500 g BW
Ali et al. (2017)/Egypt [31]	108	T1ROP:10.2% Others: 41.7%	12 months	< 37-week GA ± < 2500 g BW
Roohipoor et al. (2016)/Iran [32]	1932	T1ROP:8.3% Total: 30%	12 months	< 37-week GA ± < 3000 g BW
Araz-Ersan et al. (2013)/Turkey [27]	2950	Severe:15.8% Total: 40.8%	Four years	< 37-week GA
Kang et al. (2019)/Taiwan [28]	11180	Severe:2.4% Total: 36.6%	10 years	≤ 32-week GA ± ≤ 1500 g BW
Grang et al. (2021)/India [33]	318	34.9%	2 yeas	< 34-week GA ± < 1750 g BW
Holmström et al. (2018)/Sweden [34]	5734	Treated ROP 2008: 5.2% 2015: 7.7%	7 years	≤ 30-week GA

GA — gestational age; BW — birth weight

significant. Rather, any child with such a clinical course, regardless of birth weight or GA, is at an increased risk for ROP, irrespective of the exact cause of illness.

One solution to this issue of "unstable clinical course" is to define a predictive model to uniformly identify such cases, such as G-ROP that utilizes weight gain during the first 40 days of life as a marker for healthy child growth and development, it was developed using the most extensive dataset (7,483 children) and may provide the most robust model for clinical use [18, 19]. G-ROP is not the only screening tool that incorporates weight gain, others like "Weight, insulin-like growth factor 1, neonatal retinopathy of prematurity" (WINROP) [36], ROP-Score [37], and Children's Hospital of Philadelphia ROP (CHOP-ROP) [38], which uses an algorithm that requires either a computer machine or internet access to operate, the other screening tool is The Colorado Retinopathy of Prematurity (CO-ROP) that uses three easily-calculated-criteria [39]. However, the validation study reported that it needed further modification before generalization and clinical implementation [40].

In the current study, weight gain of < 120 g and < 180 g during 10–19 days and 20–29 days were associated with 7.4 and 11.78 times, respectively, for having T1ROP and were the only variables that remained significant in the multivariate regression model. Chaves-Samaniego, in Spain, reported that lower daily WG was seen in children who had ROP requiring treatment compared to better WG seen in children with ROP that needed only follow-up [41]. Bal et al. (2019) in the United States reported that early slow WG (29–33 weeks postmenstrual age) was significantly associated with severe ROP [42]. Lyu et al. (2016) in China reported that WG in the second week < 12.8% of BW was significantly associated with the development of severe ROP [43]. Weight gain use as a screening parameter stems from its role as a surrogate measurement for IGF-1 [44], and since IGF-1 was shown to play a permissive role for vascular endothelial growth factor (VEGF) activity in children with ROP, i.e., when lower serum IGF-1, the more VEGF local amount increase in the retina without activation, until IGF-1 production reaches a threshold for VEGF activation leading to proliferative retinopathy and ROP [19, 45].

In the current study, the sensitivity of G-ROP criteria in screening for T1ROP was 92.3% [95% confidence interval (CI): 64% to 99.8%], while for

T2ROP it was 73.8% (95% CI: 58% to 86.1%), and for any ROP it was 79% (95% CI: 66.8% to 88.3%). The G-ROP screening criteria were validated in 2020 among Japanese newborns and showed to have 100% (95% CI: 99.4% to 100%) sensitivity for T1ROP, 98.7% (95% CI: 97.5% to 99.3%) for T2ROP [20]. Also, it was validated in 2021 by Ahmed et al. (2021) in a multi-institutional study (Egypt and the United Kingdom) and reported that the sensitivity was 100% both in Egypt (95% CI: 91.1% to 100%) and the United Kingdom (95% CI: 65.5% to 100%) 46. In Turkey, Ozge et al. (2020) studied 242 premature babies. They reported that G-ROP criteria detected treatable ROP with a sensitivity of 91.2% (95% CI: 76.3% to 98.1%) and a specificity of 34.1%, while for any ROP the sensitivity was 88.3% (95% CI: 81.4% to 93.3%), and the specificity was 51.7% [47]. In Italy, Caruggi et al. (2021) studied 475 newborns retrospectively and reported 100% sensitivity of G-ROP regarding the detection of T1ROP 48. The lower diagnostic values in our study may be caused by ethnic disparities, social/ economic factors, clinical course in neonatal care unit and related practices, and the fact that premature newborns have lower GA in all the studies done in developed countries, those causes might hinder the direct implementation of G-ROP criteria into our practice without doing enough modification by identifying the optimal cut-off values for the WG in Iraqi premature population.

STUDY LIMITATIONS

This study was carried out retrospectively in a single center, so recall and observation bias were not controlled efficiently, even after the exclusion of some cases with inadequate or missing information, which caused the sample size with adequate weight gain information to decrease.

CONCLUSIONS

The children screened had older GA and higher BW than children in developed countries. The incidence of type 1 ROP in the study sample was comparable to results in other countries.

Factors that were associated with increased risk for ROP included respiratory distress syndrome, birth weight < 1051 g, and weight gain. However, after multivariate analysis, only poor weight gain remained significant.

RECOMMENDATIONS

Development of a national registry for documenting all possible information about premature newborns screened for ROP.

Formation of a multicenter study for modification of weight gain criteria suitable for the premature Iraqi population, as the current screening programs are all targeted for developed countries' settings.

Conflict of interest

The authors declare no conflict of interest.

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