e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(5); 867-871

Original Research Article

Tubercular Uveitis: Correlation of QuantiFERON-TB Gold and HRCT Chest Findings with Choroidal Granulomas

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Received: 01-01-2026 / Revised: 25-04-2026 / Accepted: 12-05-2026

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Conflict of interest: Nil

Abstract

Background: Tubercular uveitis is a diagnostic challenge because ocular microbiological confirmation is uncommon and systemic evidence may be subtle or absent.

Aim: To evaluate the correlation of QuantiFERON-TB Gold and HRCT chest findings with choroidal granulomas among patients with presumed tubercular uveitis.

Methods: This prospective observational study included 75 patients from 1 March 2025 to 31 January 2026. Ocular phenotype, QuantiFERON-TB Gold category, HRCT chest pattern and 12-week clinical response were analyzed.

Results: Choroidal granuloma was identified in 28 (37.3%) patients. QuantiFERON-TB Gold was positive in 64 (85.3%) and HRCT was abnormal in 51 (68.0%). Choroidal granuloma was significantly more frequent in abnormal HRCT than normal HRCT groups (47.1% vs 16.7%; P=0.010). Concordant QuantiFERON positivity plus abnormal HRCT predicted granuloma (OR 4.70, 95% CI 1.45-15.25; P=0.010). Inflammation improved in 86.8% of evaluable patients at 12 weeks.

Conclusion: Combined interpretation of QuantiFERON-TB Gold and HRCT chest findings improves diagnostic confidence for choroidal granulomatous tubercular uveitis in high-burden settings.

Keywords: ocular tuberculosis; tubercular uveitis; QuantiFERON-TB Gold; HRCT chest; choroidal granuloma; interferon-gamma release assay.

DOI: 10.25258/ijcpr.18.5.140

Introduction

Tubercular uveitis remains one of the most challenging phenotypes within infectious uveitis because direct microbiological confirmation from ocular tissue is uncommon and treatment decisions often depend on a composite interpretation of ocular morphology, immunological evidence of Mycobacterium tuberculosis infection, chest imaging and response to therapy [1-5]. In tuberculosis-endemic regions such as eastern India, a positive QuantiFERON-TB Gold test is clinically meaningful but not diagnostic by itself, because it may indicate latent infection rather than active ocular disease [3,4]. Conversely, ocular tuberculosis may occur without respiratory symptoms or radiographic evidence of active pulmonary disease, making the relationship between ocular signs and systemic investigations particularly important [5,6]. Choroidal granulomas are among the more specific posterior segment signs of presumed intraocular tuberculosis and may appear as solitary or multifocal yellow-white lesions, sometimes accompanied by vitritis, subretinal fluid, retinal vasculitis or optic-disc edema [1,3,6]. The Collaborative Ocular Tuberculosis Study (COTS) has emphasized that phenotype-specific probability, endemicity, exclusion of mimickers and immunological/radiological support should guide antitubercular therapy rather than any single test result [2-4]. Interferon-gamma release assays (IGRAs), including QuantiFERON-TB Gold, detect sensitization to M. tuberculosis-specific antigens

and have advantages over tuberculin skin testing in Bacillus Calmette-Guerin-vaccinated populations, but their performance varies across geographic settings, immune status and ocular phenotype [3,10,11]. Reported sensitivity and specificity ranges are wide, and a positive IGRA does not distinguish latent infection from active ocular involvement [3,10]. Therefore, correlation with high-resolution computed tomography (HRCT) of the chest may add value by identifying fibrotic scars, calcified lymph nodes, nodules, tree-in-bud change or miliary disease that are often missed by chest radiography [5]. British Thoracic Society guidance recommends immunological testing and chest imaging in suspected ocular tuberculosis and also cautions that ocular disease may be present despite limited systemic evidence [5]. In Indian practice, HRCT is frequently used when ocular phenotype is strongly suggestive, when chest radiography is equivocal, or when a decision regarding antitubercular therapy requires additional systemic support. The present study was designed to evaluate the correlation between QuantiFERON-TB Gold status, HRCT chest patterns and choroidal granulomas in patients with presumed tubercular uveitis at a tertiary care centre in Bihar. By focusing on the diagnostic intersection between ocular phenotype and systemic markers, this study aims to generate pragmatic evidence for clinical decision-making in a high-burden setting.

Materials and Methods

This prospective observational study was conducted in the Department of Ophthalmology, Government Medical College and Hospital, Purnea, Bihar, India, from 1 March 2025 to 31 January 2026. Seventy-five consecutive patients with presumed tubercular uveitis were enrolled after written informed consent. Inclusion criteria were age >=12 years, active or recently active uveitis with at least one ocular feature compatible with ocular tuberculosis, and availability of QuantiFERON-TB Gold testing and HRCT chest. Patients with proven alternative infectious or non-infectious uveitis, recent completed antitubercular therapy, severe media opacity precluding posterior segment assessment, or incomplete records were excluded. All patients underwent best-corrected visual acuity assessment, slit-lamp biomicroscopy, intraocular pressure measurement, dilated fundus examination, fundus photography where feasible, optical coherence tomography and targeted laboratory testing to exclude mimickers. Ocular phenotypes were classified as choroidal granuloma, serpiginous-like choroiditis, retinal vasculitis, granulomatous anterior uveitis, or intermediate/panuveitis. QuantiFERON-TB Gold results were categorized as negative, low-positive, moderate-positive and high-positive using laboratory-reported interferon-gamma values. HRCT chest was interpreted by a radiologist blinded to the ocular phenotype and grouped as normal, inactive fibrotic scar, calcified nodes/granuloma, tree-in-bud/active nodules, or miliary/disseminated pattern. The primary outcome was the association between choroidal granuloma and concordant systemic evidence, defined as positive QuantiFERON-TB Gold with abnormal HRCT. Secondary outcomes included distribution of ocular phenotypes, HRCT patterns and improvement at 12 weeks after clinician-directed therapy. Data were analyzed using descriptive statistics, chi-square/Fisher exact test for categorical variables, independent t test/Mann-Whitney U test for continuous variables and logistic regression for predictors of choroidal granuloma. A two-sided P value <0.05 was considered statistically significant.

Results

Among 75 patients, mean age was 38.6 +/- 13.9 years and 42 (56.0%) were male. Bilateral involvement was observed in 29 (38.7%) patients. Choroidal granuloma was the most frequent index phenotype, present in 28 (37.3%), followed by serpiginous-like choroiditis in 14 (18.7%), retinal vasculitis in 13 (17.3%), granulomatous anterior uveitis in 11 (14.7%) and intermediate/panuveitis in 9 (12.0%). QuantiFERON-TB Gold was positive in 64 (85.3%) patients; high-positive values were observed in 19 (25.3%). HRCT chest was abnormal in 51 (68.0%), most commonly showing inactive fibrotic scars (24.0%), calcified nodes/granulomas (20.0%) and tree-in-bud/active nodules (14.7%). Choroidal granuloma was present in 24 of 51 patients (47.1%) with abnormal HRCT compared with 4 of 24 (16.7%) with normal HRCT (P=0.010). It was also more frequent in QuantiFERON-positive patients than negative patients (26/64, 40.6% vs 2/11, 18.2%), although the difference did not reach statistical significance because of the small negative subgroup (P=0.18). Concordant positivity, defined as positive QuantiFERON-TB Gold plus abnormal HRCT, was present in 47 (62.7%) patients and carried the highest probability of choroidal granuloma (23/47, 48.9%; odds ratio 4.70, 95% CI 1.45-15.25; P=0.010). At 12 weeks, inflammation improved in 59/68 (86.8%) evaluable patients, with complete or partial granuloma regression in 24/28 (85.7%).

Table 1: Baseline demographic and clinical characteristics (N=75)

Variable	Value
Age, years, mean +/- SD	38.6 +/- 13.9
Age group 12-30 years	21 (28.0%)
Age group 31-50 years	36 (48.0%)
Age group >50 years	18 (24.0%)
Male sex	42 (56.0%)
Female sex	33 (44.0%)
Bilateral uveitis	29 (38.7%)
History of previous TB contact	18 (24.0%)
Systemic symptoms suggestive of TB	13 (17.3%)
Mean presenting BCVA (logMAR)	0.58 +/- 0.32

Table 2: Ocular phenotype and systemic test distribution

Ocular phenotype	N	%	QFT positive n (%)	Abnormal HRCT n (%)	Choroidal granuloma n (%)
Choroidal granuloma	28	37.3	26 (92.9)	24 (85.7)	28 (100)
Serpiginous-like choroiditis	14	18.7	12 (85.7)	9 (64.3)	0
Retinal vasculitis	13	17.3	11 (84.6)	8 (61.5)	0
Granulomatous anterior uveitis	11	14.7	8 (72.7)	5 (45.5)	0
Intermediate/panuveitis	9	12.0	7 (77.8)	5 (55.6)	0

Table 3: HRCT chest pattern and association with choroidal granuloma

HRCT pattern	All patients n (%)	Choroidal granuloma n (%)	Odds ratio vs normal	P value
Normal	24 (32.0)	4 (16.7)	Reference	-
Inactive fibrotic scar	18 (24.0)	7 (38.9)	3.18 (0.79-12.82)	0.10
Calcified nodes/granuloma	15 (20.0)	6 (40.0)	3.33 (0.78-14.30)	0.10
Tree-in-bud/active nodules	11 (14.7)	8 (72.7)	13.33 (2.35-75.74)	0.003
Miliary/disseminated pattern	7 (9.3)	3 (42.9)	3.75 (0.57-24.68)	0.17
Any abnormal HRCT	51 (68.0)	24 (47.1)	4.44 (1.32-14.94)	0.010
QFT positive + abnormal HRCT	47 (62.7)	23 (48.9)	4.70 (1.45-15.25)	0.010

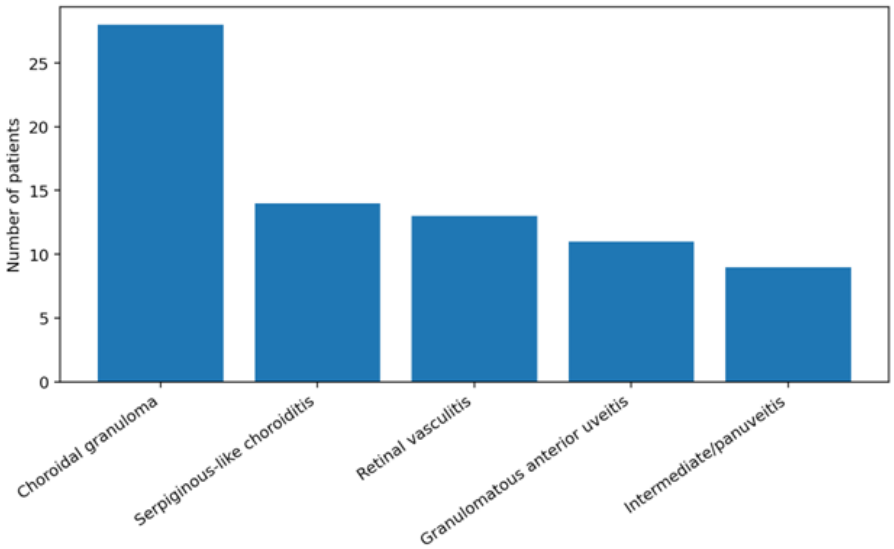

Figure 1: Distribution of ocular phenotypes among patients with presumed tubercular uveitis

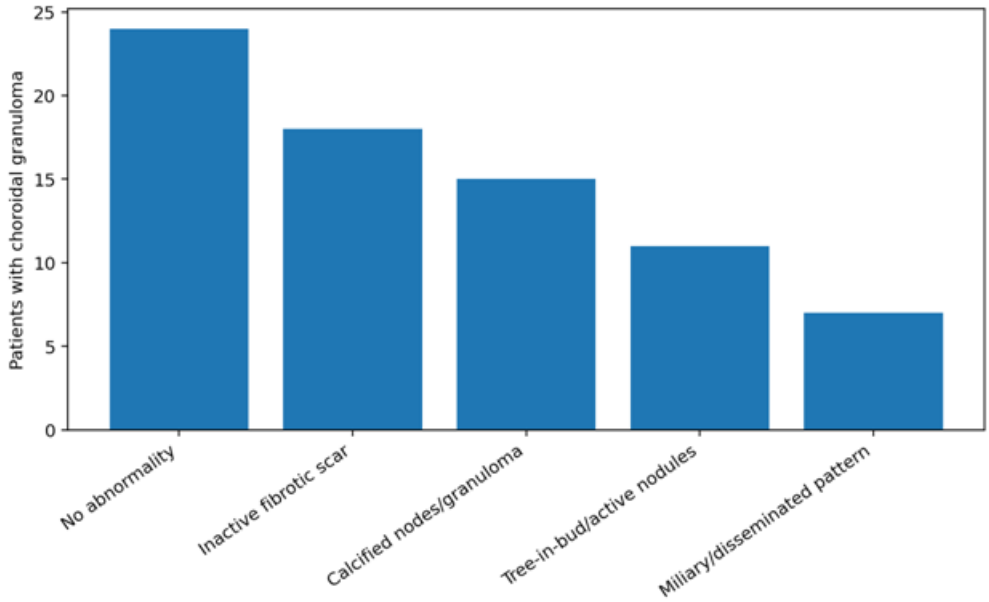

Figure 2: Choroidal granuloma frequency across HRCT chest patterns

Discussion

This study demonstrates a clinically important association between HRCT abnormalities and choroidal granulomas in patients with presumed tubercular uveitis from a high-burden region of India. The principal finding was that choroidal granuloma occurred in nearly half of patients with abnormal HRCT compared with fewer than one-fifth of those with normal HRCT. The strongest association was seen when QuantiFERON-TB Gold positivity and abnormal HRCT were concordant, supporting the concept that the diagnostic probability of ocular tuberculosis increases substantially when immunological evidence is reinforced by thoracic imaging [3-5]. These findings are consistent with COTS recommendations, which advise phenotype-sensitive decision-making rather than reliance on a single positive test [3,4]. Choroidal granuloma is a biologically plausible marker of hematogenous mycobacterial dissemination to the highly vascular choroid and has long been recognized as a typical posterior segment manifestation of intraocular tuberculosis [1,6]. However, the lesion is not always accompanied by pulmonary symptoms, and systemic work-up may show only healed lesions or calcified nodes. Our results therefore support HRCT as a useful adjunct in patients with posterior uveitis and suspected tubercular etiology, particularly when the ocular phenotype is granulomatous and the decision to initiate antitubercular therapy is uncertain. The QuantiFERON-TB Gold positivity rate of 85.3% in this cohort reflects the high pre-test probability created by selective inclusion of patients with clinically suspected tubercular uveitis. Previous studies have shown that IGRA may be more specific than tuberculin skin testing in BCG-vaccinated populations, but positive results require careful interpretation in endemic regions where latent infection is common [3,10,11]. In our data, QuantiFERON positivity alone was less discriminatory than the combined QuantiFERON-HRCT approach, because several patients without choroidal granuloma also had positive IGRA. This observation agrees with contemporary diagnostic frameworks that view IGRA as supportive rather than definitive [5,7]. The abnormal HRCT rate of 68.0% is also clinically relevant. Many abnormalities were inactive scars or calcified nodes, not microbiologically active pulmonary disease; nevertheless, such patterns can strengthen the inference of previous or latent TB infection in a patient with compatible ocular inflammation [5]. Tree-in-bud and active nodular changes showed the highest granuloma proportion in this study, suggesting that more active thoracic patterns may cluster with posterior granulomatous disease. Similar imaging-enriched diagnostic reasoning has been emphasized in reports of ocular TB where chest CT identified lesions not evident on radiography and helped guide treatment decisions [5].

The treatment-response pattern further supports the clinical relevance of combined testing. More than 85% of evaluable patients improved by 12 weeks, and most choroidal granulomas regressed with clinician-directed antitubercular therapy and adjunctive anti-inflammatory treatment. COTS-1 reported that antitubercular therapy was associated with favorable clinical outcomes in tubercular uveitis, although recurrence and treatment failure differ by phenotype and duration of therapy [2]. Consensus guidelines generally recommend

antitubercular therapy for tubercular choroiditis when ocular signs are typical and supported by immunological or radiological evidence [3]. Our findings align with this approach and suggest that HRCT may be particularly valuable in patients with granulomas and positive IGRA, because concordant systemic evidence identifies a subgroup with high post-test probability. The study has limitations: it was single-centre, microbiological confirmation was not attempted in most cases, sample size was moderate, and treatment response cannot be considered a diagnostic gold standard. Selection bias is possible because only patients with complete QuantiFERON and HRCT data were included. Despite these limitations, the study provides real-world evidence from Bihar, where delayed recognition of ocular TB can lead to irreversible visual morbidity. A structured algorithm combining ocular phenotype, IGRA category, HRCT pattern and exclusion of mimickers may improve diagnostic confidence and reduce both under-treatment and over-treatment.

Conclusion

In this prospective cohort of 75 patients with presumed tubercular uveitis, choroidal granulomas showed a significant association with abnormal HRCT chest findings, particularly when accompanied by QuantiFERON-TB Gold positivity. Concordant immunological and radiological evidence identified the subgroup with the highest probability of granulomatous posterior involvement and favorable early inflammatory response. HRCT chest should therefore be considered a valuable adjunct to ocular phenotype and IGRA in the diagnostic evaluation of suspected tubercular uveitis in TB-endemic settings.

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