RESEARCH PAPER

The Small Eye with Big Risks – Lessons from a Nanophthalmos Case Series

Dr.Rutvi Patel[1], Dr.Deepashri Mutalik[2], Dr.Mounesh Patil[3], Dr.Bakul Gharge[4], Dr.Smitha K.S.[5]

[1]Junior resident, MBBS, Jawaharlal Nehru Medical College, Belagavi.
[2]Assistant Professor, Department of Ophthalmology, Jawaharlal Nehru Medical College, Belagavi.
[3]Assistant Professor,Department of Ophthalmology, Jawaharlal Nehru Medical College, Belagavi.
[4]Junior resident, MBBS, Jawaharlal Nehru Medical College, Belagavi.
[5]Professor, Department of Ophthalmology, Jawaharlal Nehru Medical College,Belagavi.
Corresponding Author: **Dr.Rutvi Patel**
rutvi2908@gmail.com

ABSTRACT

Background: Nanophthalmos is a rare developmental ocular disorder characterized by a markedly reduced axial length, high hypermetropia and anatomical crowding of the anterior segment. Despite the small size of the globe, affected eyes are at considerable risk of vision-threatening complications, including angle-closure glaucoma and uveal effusion. Early recognition is particularly important in children to allow timely refractive correction and long-term surveillance.

Purpose: To describe the clinical presentation, biometric characteristics, optical coherence tomography findings and management of pediatric patients with nanophthalmos, with particular emphasis on the association between reduced axial length and severe hypermetropia.

Methods: This descriptive case series included three children aged 5, 10 and 12 years with bilateral nanophthalmos evaluated at a tertiary-care ophthalmology centre. All three children were born of consanguineous marriages and presented with bilateral diminution of vision. Comprehensive ophthalmic evaluation included visual acuity assessment, refraction, intraocular pressure measurement, slit-lamp biomicroscopy, posterior segment examination, ocular biometry with axial length measurement and optical coherence tomography of the posterior pole. Management was individualized according to visual status, intraocular pressure and anatomical risk.

Results: All three patients had bilateral nanophthalmos, representing six affected eyes. Axial length was markedly reduced in all eyes, ranging from 15.83 to 17.98 mm, with a mean of approximately 16.97 mm. Severe hypermetropia was present throughout the series, with spherical refractive errors ranging from +10.00 to +15.00 D. The anterior chamber was shallow in all patients, ranging from Van Herick grade I–II to grade II. Intraocular pressure ranged from 10 to 19 mmHg.

Conclusion: Pediatricnanophthalmos is a rare but clinically important condition characterized by extreme axial shortening, severe hypermetropia, shallow anterior chambers and characteristic posterior segment changes.

Keywords: Nanophthalmos; axial length; hypermetropia; papillomacular retinal folds; angle-closure glaucoma; uveal effusion; pediatric ophthalmology.

How to cite this article: Rutvi Patel, DeepaMutalik, MounePatil, Bakul Gharge, Smitha K.S.. The Small Eye with Big Risks – Lessons from a Nanophthalmos Case Series. Int J Drug Deliv Technol. 2026;16(79s):1029-1038. DOI: 10.25258/ijddt.16.79s.175.

INTRODUCTION

Nanophthalmos is a rare developmental ocular disorder characterized by a markedly small but otherwise relatively well-formed globe. It represents part of the spectrum of microphthalmic disorders and is typically associated with a reduced axial length, high hypermetropia, shallow anterior chamber, relatively large lens-to-globe volume ratio, and increased scleral thickness [1]. Although

the exact diagnostic cut-off for axial length varies among studies, affected adult eyes commonly have an axial length of approximately 20–21 mm or less. Unlike complex microphthalmos, nanophthalmos generally occurs without major structural ocular malformations. However, the apparently simple reduction in globe size produces substantial anatomical crowding and altered ocular fluid dynamics, making these eyes particularly vulnerable to both spontaneous and treatment-related complications [1,2].

The crowded anterior segment is one of the most important clinical characteristics of nanophthalmos. A shallow anterior chamber, narrow iridocorneal angle, increased lens thickness relative to globe size, and anterior displacement of the lens–iris diaphragm predispose patients to pupillary block and secondary angle-closure glaucoma [2,3]. Angle closure may become progressively more frequent with advancing age as the crystalline lens enlarges. In a large clinical series, nanophthalmos was associated with varying degrees of visual impairment and a high incidence of angle-closure glaucoma, highlighting glaucoma as one of the major causes of long-term visual morbidity in these patients [3]. Management can be particularly difficult because conventional glaucoma procedures themselves may precipitate serious complications, including hypotony, choroidal detachment, uveal effusion, and aqueous misdirection [4].

Posterior segment complications are equally important. The abnormally thick and relatively impermeable sclera is believed to interfere with transscleral protein transport and vortex vein drainage, resulting in choroidal congestion and accumulation of fluid within the suprachoroidal space [1,2]. Consequently, patients may develop uveal effusion, choroidal detachment, exudative retinal detachment, retinal folds, macular abnormalities, and optic-disc crowding. These structural changes may cause significant visual loss even in the absence of advanced glaucoma. Therefore, careful evaluation of both anterior and posterior segments, supported by ocular biometry, ultrasonography, optical coherence tomography, and gonioscopy where appropriate, is important for recognizing the complete clinical spectrum of the disease [1,2].

Surgical intervention in nanophthalmic eyes represents a major challenge. Cataract formation is common with advancing age, but cataract surgery is technically demanding because of the extremely shallow anterior chamber, limited working space, high intraocular lens power requirements, and increased susceptibility to sudden changes in intraocular pressure. Reported complications include uveal effusion, choroidal detachment or haemorrhage, corneal endothelial damage, severe inflammation, cystoid macular oedema, retinal detachment, aqueous misdirection, and postoperative intraocular pressure elevation [5,6]. In one clinical series of nanophthalmic eyes undergoing cataract surgery, complications occurred in more than one-quarter of treated eyes, emphasizing that even routine intraocular surgery can become a high-risk procedure in this anatomical setting [5].

Recognition of these risks has encouraged modifications in surgical planning. Meticulous preoperative assessment, control of intraocular pressure, maintenance of anterior chamber stability, careful phacoemulsification techniques, and consideration of scleral decompression procedures have been proposed to reduce complications. A randomized controlled trial demonstrated that prophylactic sclerostomy performed with cataract surgery reduced the likelihood of intraoperative or postoperative complications and particularly reduced postoperative uveal effusion [7]. Such findings illustrate the importance of individualized surgical strategies rather than applying standard cataract or glaucoma procedures to nanophthalmic eyes without modification.

Nanophthalmos also has an important genetic component. Both sporadic and familial forms have been described, with pathogenic variants in genes including MFRP, PRSS56, TMEM98, BEST1, and CRB1 implicated in abnormal ocular growth [1]. More recent genetic studies have reinforced the important contribution of MFRP and PRSS56 variants in patients with nanophthalmos [8]. Recognition of familial disease may therefore have implications not only for the affected patient but also for counselling and ophthalmic screening of relatives.

MATERIALS AND METHODS

Study Design and Setting

This study was designed as a descriptive clinical case series of pediatric patients diagnosed with nanophthalmos and evaluated at the Department of Ophthalmology, a tertiary-care referral centre. Three consecutive pediatric patients presenting with diminution of vision and subsequently diagnosed with bilateral nanophthalmos were included. The case series comprised one female and two male children aged 12, 5 and 10 years, respectively. All three children were born of consanguineous marriages.

The study was undertaken to characterize the clinical presentation and ocular biometric profile of nanophthalmos, with particular emphasis on the relationship between markedly reduced axial length and high hypermetropic refractive error. In addition, the study evaluated anterior and posterior segment findings, optical coherence tomography characteristics and the management required to minimize the risk of potentially vision-threatening complications.

Patient Selection

Children presenting to the ophthalmology service with decreased visual acuity and clinical features suggestive of a developmentally small eye were evaluated for inclusion. Patients were considered to have nanophthalmos when they demonstrated a structurally small globe with marked reduction in axial length together with high hypermetropia and supportive anterior or posterior segment findings.

All three included patients demonstrated bilateral involvement. Axial length was markedly reduced in every affected eye, measuring less than 18 mm, while refractive assessment demonstrated high hypermetropia greater than +10.00 dioptres.

Patients with a small eye associated with major congenital structural ocular abnormalities were to be differentiated clinically from isolated nanophthalmos. Particular attention was given to differentiation from posterior microphthalmos because of its overlapping biometric and refractive characteristics.

Clinical History

A detailed ophthalmic history was obtained from the patients and their parents or guardians. Information collected included:

- age and sex;
- presenting ocular complaints and duration of symptoms;
- duration and previous use of spectacles;
- history of previous ophthalmic treatment or intervention;
- relevant developmental and ocular history;
- family history where available; and
- history of consanguinity.

The principal presenting symptom in all three cases was diminution of vision in both eyes.

Visual Acuity Assessment

Distance visual acuity was assessed separately for each eye using an age-appropriate visual-acuity chart. In younger children, visual acuity was assessed using a pediatricoptotype-based chart where feasible. When standard chart-based visual acuity could not be reliably obtained, functional visual acuity was recorded using counting-finger assessment at a measured distance.

Uncorrected visual acuity, presenting visual acuity with existing spectacles where applicable, and best-corrected visual acuity (BCVA) were documented individually for the right eye (OD) and left eye (OS).

Refractive Assessment

Objective and subjective refraction were performed as clinically appropriate for age and cooperation. The refractive error was documented in terms of spherical power, cylindrical power and cylinder axis.

Particular emphasis was placed on quantifying the degree of hypermetropia because severe hypermetropic refractive error represents an important functional consequence of reduced ocular axial length in nanophthalmos. All three patients demonstrated refractive errors exceeding +10.00 D.

Best spectacle correction was prescribed according to the refractive findings and functional visual requirements of the individual patient.

Intraocular Pressure Assessment

Intraocular pressure (IOP) was measured in both eyes during the initial ophthalmological examination and subsequently during follow-up. IOP values were documented separately for OD and OS.

Because nanophthalmic eyes are anatomically predisposed to anterior chamber crowding and angle-closure mechanisms, periodic monitoring of IOP was incorporated into the clinical surveillance strategy even in patients without elevated IOP at initial presentation.

Outcome Measures

The principal outcomes assessed in the case series were:

Primary outcomes

1. axial length of each eye;

2. magnitude of refractive error;
3. presenting and best-corrected visual acuity; and
4. OCT characteristics of the posterior pole.

Secondary outcomes

1. anterior chamber depth;
2. intraocular pressure;
3. presence of papillomacular retinal folds;
4. occurrence of angle-closure or uveal effusion;
5. requirement for medical or surgical intervention; and
6. clinical status during follow-up.

Statistical Analysis

Considering the descriptive nature of the study and the small sample size of three patients, statistical analysis was primarily descriptive. Clinical, refractive, biometric and imaging findings were tabulated separately for each patient and each eye. Continuous variables, including axial length, refractive error and IOP, were summarized using individual values and ranges where appropriate.

Categorical clinical characteristics were expressed as frequencies and proportions. Because of the limited sample size and the purpose of the study as a clinical case series, no formal inferential hypothesis testing was undertaken. The relationship between reduced axial length and increasing hypermetropic refractive error was interpreted descriptively and clinically.

RESULTS

Three pediatric patients with bilateral nanophthalmos were included in the case series. The patients were aged 5, 10 and 12 years, with a mean age of 9.0 years. Two patients were male and one was female. All three children were reported to have been born of consanguineous marriages and presented with bilateral diminution of vision. Two patients had a previous history of spectacle use. The clinical characteristics of the study participants are summarized in Table 1.

Table 1. Baseline demographic and clinical characteristics of the three patients

Characteristic	Case 1	Case 2	Case 3
Age, years	12	5	10
Sex	Female	Male	Male
Consanguineous marriage	Yes	Yes	Yes
Main presenting complaint	Diminution of vision, both eyes	Diminution of vision, both eyes	Diminution of vision, both eyes
Duration of symptoms	6 months	3 months	3 months
Previous spectacle use	Yes, since 7 years	Not documented	Yes, since 4 years
Laterality of nanophthalmos	Bilateral	Bilateral	Bilateral

Overall, 66.7% (2/3) of the patients were male and 33.3% (1/3) were female. Bilateral involvement and parental consanguinity were present in all three patients.

All patients demonstrated reduced visual acuity at presentation. Case 1 had counting-finger vision at 2 m in both eyes without spectacles and achieved a best-corrected visual acuity (BCVA) of 6/24 in both eyes. Case 2 demonstrated greater visual impairment, particularly in the left eye, whereas Case 3 achieved BCVA of 6/24 bilaterally with refractive correction. The individual visual acuity and intraocular pressure measurements are shown in Table 2.

Table 2. Visual acuity and intraocular pressure findings

Parameter	Case 1 OD	Case 1 OS	Case 2 OD	Case 2 OS	Case 3 OD	Case 3 OS
Presenting visual acuity	CF 2 m	CF 2 m	6/24*	CF 2 m	CF 1.5 m	CF 2 m
Vision with existing glasses	6/36	6/36	Not documented	Not documented	6/24	6/24
BCVA	6/24	6/24	6/60	CF 3 m	6/24	6/24
IOP, mmHg	11	13	18	19	10	12

*Visual acuity in Case 2 was assessed using the LEA chart.

The overall mean intraocular pressure across the six eyes was 13.83 mmHg, ranging from 10 to 19 mmHg. Case 2 had the highest IOP values, measuring 18 mmHg in the right eye and 19 mmHg in the left eye.

Marked shortening of the ocular axial length was observed in all six eyes. Axial length ranged from 15.83 to 17.98 mm, with an overall mean of 16.97 mm. The mean axial length was 17.55 mm for right eyes and 16.39 mm for left eyes.

Case 1 had the shortest measured axial length of 15.83 mm in the left eye and demonstrated spherical hyperopia of +15.00 D in both eyes. Case 2 had axial lengths of 17.98 and 16.83 mm and spherical refractive errors of +11.00 D and +13.25 D in the right and left eyes, respectively. Case 3 had axial lengths of 16.83 and 16.50 mm and a spherical component of +10.00 D in both eyes.

Table 3. Axial length and refractive characteristics

Case	Eye	Axial length (mm)	Sphere (D)	Cylinder (D)	Axis	BCVA
Case 1	OD	17.83	+15.00	—	—	6/24
	OS	15.83	+15.00	—	—	6/24
Case 2	OD	17.98	+11.00	+0.75	170°	6/60
	OS	16.83	+13.25	+1.25	40°	CF 3 m
Case 3	OD	16.83	+10.00	+1.00	90°	6/24
	OS	16.50	+10.00	+1.00	80°	6/24

All six eyes had an axial length below 18 mm. The mean spherical component of refractive error across all eyes was approximately +12.38 D, illustrating the marked hypermetropic refractive profile accompanying the short axial length.

Slit-lamp examination demonstrated relatively preserved external and anterior segment structures in all cases. The eyelids and conjunctiva were normal and the corneas were clear in all six eyes. The pupils were round, regular and reactive, and the crystalline lenses were clear.

The most important anterior segment abnormality was reduced anterior chamber depth. Case 1 and Case 3 demonstrated Van Herick grade II anterior chambers bilaterally, whereas Case 2 had more marked shallowing, graded Van Herick I–II in both eyes.

Table 4. Comparative anterior segment findings

Finding	Case 1	Case 2	Case 3
Eyelids	Normal OU	Normal OU	Normal OU
Conjunctiva	Normal OU	Normal OU	Normal OU
Cornea	Clear OU	Clear OU	Clear OU
Anterior chamber	VH grade II OU	VH grade I–II OU	VH grade II OU
Iris	No significant abnormality documented	No significant abnormality documented	No significant abnormality documented
Pupil	Round, regular, reactive OU	Round, regular, reactive OU	Round, regular, reactive OU
Lens	Clear OU	Clear OU	Clear OU

OU, both eyes; VH, Van Herick grade.

Thus, all patients demonstrated some degree of anterior chamber shallowing, with Case 2 showing the greatest degree of anterior chamber crowding.

Optical coherence tomography demonstrated characteristic posterior pole abnormalities associated with the markedly shortened globe. The principal OCT finding across the case series was the presence of papillomacular retinal folds with relative preservation of the outer retinal layers. These findings were consistent with the anatomical effects of extreme axial shortening described in the study documents.

The OCT images also demonstrated increased retinal thickness in individual scans. The available OCT report for Case 1 showed an average retinal thickness of approximately 317.7 µm in the right eye, while the corresponding left-eye scan reported 318.1 µm, although the left-eye scan showed poor image quality. In Case 2, the right-eye scan showed an average retinal thickness of 362.1 µm, while the left-eye macular scan showed an average thickness of 412.0 µm with central thickness of 731 µm. The OCT images of Case 3 demonstrated retinal folds involving the papillomacular region.

Because OCT acquisition quality varied among patients, particularly in younger children, retinal thickness measurements should be interpreted descriptively rather than subjected to formal statistical comparison.

Table 5. Posterior segment and OCT characteristics

Parameter	Case 1	Case 2	Case 3
Papillomacular retinal folds	Present	Present	Present
Outer retinal layers	Relatively preserved	Relatively preserved	Relatively preserved
Marked short axial globe	Present	Present	Present
OCT structural abnormality	Retinal/papillomacular folds	Prominent retinal folds and increased macular thickness	Papillomacular retinal folds
Acute uveal effusion documented	No	No acute event documented	No
Acute angle closure documented	No	No acute event documented	No

Management was individualized according to visual function, IOP and anatomical risk. Cases 1 and 3 were treated conservatively with appropriate refractive correction, regular ophthalmic follow-up and serial IOP monitoring. Case 2 required additional medical management and was commenced on topical dorzolamide 2% eye drops in both eyes. Because of the greater anatomical and clinical risk in the left eye, sclerotomy was advised under guarded visual prognosis.

No immediate severe complication, including acute angle closure or clinically documented uveal effusion, was reported during the available follow-up period.

Table 6. Management and observed outcome of the three cases

Case	Principal management	IOP-lowering treatment	Surgical intervention/advice	Reported outcome
Case 1	Refractive correction, regular follow-up and IOP monitoring	No	No	Stable; no acute complication reported
Case 2	Refractive correction, IOP surveillance and medical therapy	Dorzolamide 2% OU	Sclerotomy advised for left eye	Guarded visual prognosis; no acute angle closure or uveal effusion reported during available follow-up
Case 3	Refractive correction, regular follow-up and IOP monitoring	No	No	Stable; no acute complication reported

All three children had bilateral nanophthalmos, giving a total of six affected eyes. Axial length was below 18 mm in every eye, with a mean value of 16.97 mm and a range of 15.83–17.98 mm. Severehypermetropia was present throughout the series, with spherical refractive powers ranging from +10.00 D to +15.00 D. Anterior chamber shallowing was present in all patients, ranging from Van Herick grade I–II to grade II.

Papillomacular retinal folds constituted the principal OCT abnormality and were accompanied by preservation of the outer retinal layers. Two patients were adequately managed conservatively, while one required topical ocular hypotensive treatment and was advised surgical intervention because of higher clinical risk. No acute angle-closure episode or uveal effusion was documented during the available follow-up.

Given the small sample size and descriptive case-series design, inferential statistical analysis and significance testing were not performed.

Figure 1. Comparison of axial length in the right and left eyes of the three patients with nanophthalmos

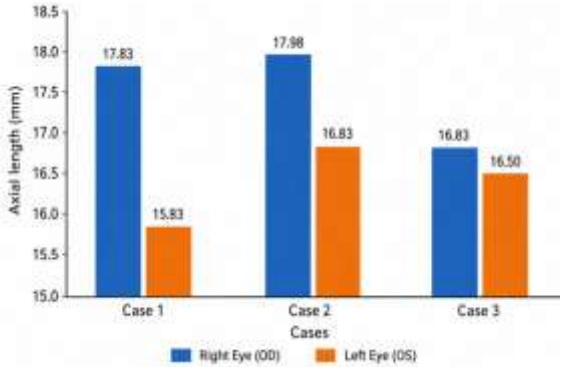

Figure 1 compares the axial length of the right eye (OD) and left eye (OS) among the three patients with nanophthalmos. All six eyes showed markedly reduced axial length, with values below 18 mm. In Case 1, axial length was 17.83 mm in the right eye and 15.83 mm in the left eye. Case 2 showed measurements of 17.98 mm and 16.83 mm in the right and left eyes, respectively, while Case 3 had axial lengths of 16.83 mm and 16.50 mm, respectively.

Figure 2. Relationship between axial length and spherical refractive error in the six nanophthalmic eyes

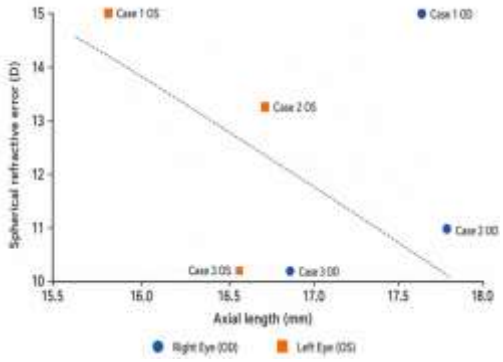

Figure 2 illustrates the relationship between axial length and spherical refractive error in the six eyes affected by nanophthalmos. All eyes demonstrated marked axial shortening accompanied by high hypermetropia. Case 1 showed the greatest spherical hypermetropia of +15.00 D in both eyes, with axial lengths of 17.83 mm in the right eye and 15.83 mm in the left eye. In Case 2, the right eye had an axial length of 17.98 mm with +11.00 D, while the left eye measured 16.83 mm with +13.25 D. Case 3 demonstrated axial lengths of 16.83 mm and 16.50 mm with a spherical refractive error of +10.00 D in both eyes.

Figure 3. Management approach among patients with nanophthalmos in the case series

Figure 3.Graphical summary demonstrating conservative management in Cases 1 and 3 and additional topical IOP-lowering therapy with advised sclerotomy in Case 2.

DISCUSSION

The present case series highlights the characteristic clinical and biometric spectrum of nanophthalmos in three pediatric patients and demonstrates how a markedly small globe may carry substantial long-term visual risk. All three patients had bilateral disease, severe axial shortening, high hypermetropia and shallow anterior chambers. The axial length ranged from 15.83 to 17.98 mm, with a mean of approximately 16.97 mm, while the spherical refractive component ranged from +10.00 to +15.00 D. These findings are consistent with the classic description of nanophthalmos as a structurally small eye characterized by extreme axial hyperopia and disproportionate crowding of otherwise relatively normally developed intraocular structures [9].

The close association between short axial length and high hypermetropia observed in our patients represents one of the most clinically important features of nanophthalmos. Reduction in the anteroposterior dimension of the globe shifts the focal point posterior to the retina, resulting in marked axial hyperopia. Demircan et al. reported a mean axial length of 18.8 ± 1.5 mm and a mean refractive error of approximately +10.6 D in nanophthalmic eyes [10]. In comparison, the present patients demonstrated even shorter axial lengths, with all six eyes measuring below 18 mm, which may explain the marked refractive errors encountered in this series.

Visual impairment was evident in all three cases despite refractive correction. Cases 1 and 3 achieved a best-corrected visual acuity of 6/24 bilaterally, whereas Case 2 had poorer visual function, particularly in the left eye. In children with marked hypermetropia, persistent retinal image defocus during the visual developmental period may contribute to amblyopia and incomplete visual recovery even after optimal correction. Therefore, early recognition and appropriate spectacle correction are particularly important in pediatricnanophthalmos. The present findings emphasize that high hypermetropia in childhood should prompt ocular biometric assessment rather than being regarded solely as an isolated refractive error.

A particularly important finding was the presence of papillomacular retinal folds on OCT with relative preservation of the outer retinal layers in the affected children. Retinal or papillomacular folds are well-recognized features in severely shortened eyes. Nowilaty et al., in their biometric and molecular characterization of posterior microphthalmos, similarly documented high hyperopia and characteristic papillomacular folds or wrinkles [11]. Although posterior microphthalmos and nanophthalmos overlap in their posterior segment phenotype, differentiation remains clinically important because nanophthalmos involves both anterior and posterior segments and carries a greater tendency toward anterior segment crowding and angle-related complications.

The shallow anterior chamber observed in all three patients is another major clinical concern. Cases 1 and 3 had Van Herick grade II anterior chambers, whereas Case 2 demonstrated grade I–II shallowing. Quantitative anterior-segment OCT studies have shown that patients with nanophthalmos have significantly narrower anterior chamber angles compared with healthy individuals [12]. This anatomical configuration occurs because a relatively normal-sized crystalline lens occupies a disproportionately large proportion of the reduced globe volume. Progressive lens enlargement with age may further narrow the iridocorneal angle, increasing susceptibility to pupillary block and angle-closure glaucoma. Kimbrough et al. described angle-closure glaucoma as a major complication of nanophthalmos, establishing the importance of continued glaucoma surveillance in these anatomically predisposed eyes [13].

Although acute angle closure was not observed in the present pediatric series, Case 2 had comparatively higher IOP values of 18 and 19 mmHg, together with a shallower anterior chamber, and consequently required topical dorzolamide. Cases 1 and 3 were managed conservatively with refractive correction, regular follow-up and IOP monitoring. The absence of established glaucoma at presentation should not be interpreted as absence of future risk. Nanophthalmos, angle closure and uveal effusion may represent interconnected manifestations of the underlying abnormal ocular anatomy, and long-term monitoring remains essential [14].

Another important concern is the predisposition to uveal effusion. Thick and abnormal scleral tissue can impair transscleral fluid movement and compromise vortex-vein outflow, leading to choroidal congestion, choroidal detachment and exudative retinal detachment. Brockhurst first emphasized the association between nanophthalmos and uveal effusion and demonstrated that intraocular surgery may precipitate serious choroidal and retinal complications in susceptible eyes [15]. None of the three children in our series developed an acute uveal effusion during the documented follow-up, but this absence reinforces the value of preventive surveillance rather than eliminating future concern.

Case 2 was advised sclerotomy because of the greater anatomical and clinical risk. Scleral decompression procedures have been employed in nanophthalmic eyes to facilitate transscleral fluid drainage and reduce the consequences of abnormal scleral resistance. Jin and Anderson described laser and unsuturedsclerotomy as an approach for the management of nanophthalmos-related complications [16]. However, any surgical intervention in these eyes requires particularly careful planning because rapid alterations in intraocular pressure and fluid dynamics may themselves precipitate choroidal effusion or other complications.

All three children were born of consanguineous marriages. While this observation cannot establish a specific mode of inheritance in such a small series, it raises the possibility of an underlying recessively inherited ocular-growth disorder. Familial nanophthalmos has been associated with pathogenic variants in genes regulating ocular growth. Orr et al. identified pathogenic PRSS56 variants segregating in families with nanophthalmos and severe hyperopia [17]. Genetic testing was not documented in the supplied clinical records; therefore, a molecular diagnosis cannot be assigned in the present series. Nevertheless, genetic counselling and, where feasible, molecular evaluation may be valuable, particularly in familial or consanguineous presentations.

The principal limitation of this study is the small sample size inherent to a rare-disease case series. Additionally, the available records do not provide a uniform long-term follow-up duration or molecular genetic testing. Nevertheless, the cases demonstrate a consistent and clinically meaningful pattern: extreme axial shortening, severe hypermetropia, anterior chamber crowding and papillomacular retinal folds occurring in young patients before the appearance of major sight-threatening complications. Early biometric identification, prompt refractive rehabilitation, repeated IOP assessment, careful posterior-segment imaging and lifelong surveillance may therefore provide the best opportunity to preserve vision and anticipate complications in these deceptively small but high-risk eyes.

CONCLUSION

This case series highlights the characteristic clinical profile and important management challenges associated with pediatricnanophthalmos. All three patients demonstrated bilateral disease with markedly reduced axial length, severe hypermetropia, shallow anterior chambers and characteristic papillomacular retinal folds on optical coherence tomography. These findings emphasize that nanophthalmos, despite its rarity, carries significant lifelong risks because of the crowded ocular anatomy and the potential development of angle-closure glaucoma, uveal effusion and other vision-threatening complications.

REFERENCES

1. Carricondo PC, Andrade T, Prasov L, Ayres BM, Moroi SE. Nanophthalmos: a review of the clinical spectrum and genetics. J Ophthalmol. 2018;2018:2735465. doi:10.1155/2018/2735465.
2. Yang N, Zhao LL, Liu J, Ma LL, Zhao JS. Nanophthalmos: an update on the biological parameters and fundus abnormalities. J Ophthalmol. 2021;2021:8853811. doi:10.1155/2021/8853811.
3. Rajendrababu S, Shroff S, Uduman MS, Babu N. Clinical spectrum and treatment outcomes of patients with nanophthalmos. Eye (Lond). 2021;35(3):825-830. doi:10.1038/s41433-020-0971-4.
4. Yalvac IS, Satana B, Ozkan G, Eksioglu U, Duman S. Management of glaucoma in patients with nanophthalmos. Eye (Lond). 2008;22(6):838-843. doi:10.1038/sj.eye.6702742.
5. Steijns D, Bijlsma WR, Van der Lelij A. Cataract surgery in patients with nanophthalmos. Ophthalmology. 2013;120(2):266-270. doi:10.1016/j.ophtha.2012.07.082.
6. Wu W, Dawson DG, Sugar A, Elner SG, Meyer KA, McKey JB, et al. Cataract surgery in patients with nanophthalmos: results and complications. J Cataract Refract Surg. 2004;30(3):584-590.
7. Rajendrababu S, Babu N, Sinha S, Balakrishnan V, Vardhan A, Puthuran GV, et al. A randomized controlled trial comparing outcomes of cataract surgery in nanophthalmos with and without prophylactic sclerostomy. Am J Ophthalmol. 2017;183:125-133. doi:10.1016/j.ajo.2017.09.008.
8. Ota J, Inooka T, Okado S, Maeda N, Koyanagi Y, Kominami T, et al. Pathogenic variants of MFRP and PRSS56 genes are major causes of nanophthalmos in Japanese patients. Ophthalmic Genet. 2023;44:423-429. doi:10.1080/13816810.2023.2208220.
9. Singh OS, Simmons RJ, Brockhurst RJ, Trempe CL. Nanophthalmos: a perspective on identification and therapy. Ophthalmology. 1982;89(9):1006-1012.
10. Demircan A, Altan C, Osmanbasoglu OA, Celik U, Kara N, Demirok A. Subfovealchoroidal thickness measurements with enhanced depth imaging optical coherence tomography in patients with nanophthalmos. Br J Ophthalmol. 2014;98(3):345-349. doi:10.1136/bjophthalmol-2013-303465.
11. Nowilaty SR, Khan AO, Aldahmesh MA, Tabbara KF, Al-Amri A, Alkuraya FS. Biometric and molecular characterization of clinically diagnosed posterior microphthalmos. Am J Ophthalmol. 2013;155(2):361-372.e7. doi:10.1016/j.ajo.2012.08.016.
12. Kara N, Baz O, Altinkaynak H, Altan C, Demirok A. Assessment of the anterior chamber angle in patients with nanophthalmos: an anterior segment optical coherence tomography study. Curr Eye Res. 2013;38(5):563-568. doi:10.3109/02713683.2013.774025.
13. Kimbrough RL, Trempe CS, Brockhurst RJ, Simmons RJ. Angle-closure glaucoma in nanophthalmos. Am J Ophthalmol. 1979;88(3 Pt 2):572-579. doi:10.1016/0002-9394(79)90517-8.
14. Areiter E, Neale M, Johnson SM. Spectrum of angle closure, uveal effusion syndrome, and nanophthalmos. J Curr Glaucoma Pract. 2016;10(3):113-117.

15. Brockhurst RJ. Nanophthalmos with uveal effusion: a new clinical entity. Arch Ophthalmol. 1975;93(12):1289-1299. doi:10.1001/archopht.1975.01010020923001.
16. Jin JC, Anderson DR. Laser and unsuturedsclerotomy in nanophthalmos. Am J Ophthalmol. 1990;109(5):575-580. doi:10.1016/S0002-9394(14)70689-0.
17. Orr A, Dubé MP, Zenteno JC, Jiang H, Asselin G, Evans SC, et al. Mutations in a novel serine protease PRSS56 in families with nanophthalmos. Mol Vis. 2011;17:1850-1861.