Bhutan Health Journal

REVIEW ARTICLE

OPEN ACCESS

https://doi.org/10.47811/bhj.189

Systematic Review of Vitreoretinal Diseases in Bhutan

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ABSTRACT

Understanding disease epidemiology is critical for planning and implementing health programs, particularly in countries like Bhutan with limited resources and data. We reviewed published data on vitreoretinal diseases in Bhutan and found 16 such publications. Of those, two were population-based Rapid Assessment of Avoidable Blindness surveys, and others included hospital-based national survey publications and five case reports. The Rapid Assessment of Avoidable Blindness survey conducted in 2009 reported that posterior segment disorders caused 22.1% of blindness, while a similar follow-up survey in 2018 reported it had reduced to 7.8%. This improvement perhaps was due to national Vitreoretinal services established in early 2012. Hypertensive retinopathy was the most common disorder (18.9%), and other disorders included diabetic retinopathy, diabetic macular edema, retinal detachment, age-related macular degeneration, macular hole, myopic retinal degeneration and vitreous haemorrhage. Even rare disorders like seasonal hyper-acute pan-uveitis, acute retinal necrosis, central retinal artery occlusion, and nephrotic maculopathy had been treated. Bhutan, with its serene environment, is no exception to the varied vitreoretinal disease spectrum. Bhutan needs to focus on changing lifestyles, while still improving human resources and management strategies.

Keywords: *Blindness; Epidemiology; Retinal degeneration; Retinal diseases; Vision*

INTRODUCTION

Apart from cataract and refractive errors, vitreoretinal (VR) diseases remain significant contributors to visual loss globally[1]. In Bhutan, the 2009 Rapid Assessment of Avoidable Blindness (RAAB) survey reported that VR or posterior segment disorders accounted for 22.1% of visual impairment and blindness[2]. The follow-up RAAB survey in 2018-2019 reported a reduction in prevalence to 7.7%[3]. While this represents a significant achievement, visual impairment continues to deeply affect individuals' well-being, extending beyond their eyesight. The associated social, mental health and economic consequences highlight the need for a comprehensive approach to understanding and addressing VR diseases.

Bhutan officially graduated from the United Nations' Least Developed Country category on 13 December, 2023[4]. It is one of the few countries in the world that provides free healthcare and education to its citizens. Despite financial constraints and a shortage of trained healthcare professionals, Bhutan has achieved remarkable progress across many health indicators[5]. The country continues to face challenges posed by its rugged mountainous terrain, which hampers patient referrals and delays timely medical care.

Bhutan had its first national ophthalmologist in 1987, marking the start of in-country training for allied ophthalmic personnel. By 2020, the country had 12 ophthalmologists, 9 optometrists, and 55 ophthalmic assistants (OA) and ophthalmic nurses (ON)[6]. Primary eye care is delivered through 33 primary health centres and 18 district level hospitals, largely staffed by OAs and optometrists[6]. The 2 regional referral hospitals, eastern regional referral hospital (ERRH) and central regional referral hospital (CRRH), have a team of general ophthalmologists, optometrists, OAs and ON, and provide comprehensive eyecare services, including surgical services. The Jigme Dorji Wangchuck National Referral Hospital (JDWNRH) in Thimphu is the apex health center, offering sub-speciality eyecare[7].

The first VR specialist of Bhutan completed his training in 2011, and founded the VR Unit comprising VR clinics, retinal laser services and VR surgeries, at the JDWNRH in March 2012[8]. The VR clinic was well-equipped, including a slit-lamp (BM 900, Haag-Streit, Switzerland), binocular indirect ophthalmoscope (Model 125, Welch Allyn, USA), B-scan, Humphrey and FDT perimeters, Spectral Domain Optical Coherence Tomography (OCT) (Cirrus-HD 4000, Carl Zeiss Germany) and fundus camera VISUCAM-524 (Carl Zeiss, Germany). The Laser Unit was equipped with frequency doubled Nd:YAG laser (VISULAS 532s, Zeiss Medical Technology, U.K.), slit-lamp and binocular indirect ophthalmoscopic (BIOM) delivery method in the out-patient department and the green diode micropulse laser system (OcuLight Green, IRIDEX, Germany) in the operating room. The VR Operating Room was empowered with a Constellation Vision System vitrector (Alcon Company, Texas, USA). Regular VR services were provided only at the JDWNRH, while ERRH and CRRH provided these services only during scheduled visits

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by the VR specialist. Patients from across the country were otherwise referred to the JDWNRH[7].

The first dedicated Eye Hospital in Bhutan, the Gyalyum Kesang Choeden Wangchuck National Eye Centre (GKCWNEC), was inaugurated in 2019 and named after Her Majesty to honour Her Majesty the Royal Grandmother's lifelong support for eye care services. Functioning as the ophthalmology department of the JDWNRH, it provides both speciality and sub-specialty services[9]. Despite this progress, eye care services, especially VR services, are often affected due to limited human resources, including specialist shortages and reliance on expatriate specialists, which is costly[10]. Currently, there are two national VR specialists in the GKCWNEC with additional advanced equipment, including an Oertli OS4 operating microscope with Resight lens system.

Rationale of the review

The primary purpose of this review is to compile and describe the pattern and presentation of VR diseases in Bhutan. It also aims to understand the accessibility, resources and effectiveness of current VR services, thereby informing future strategies. By presenting the available baseline information, it seeks to guide future national surveys and strengthen strategies to enhance Bhutan's eye health programs.

METHODS

Eligibility criteria

We included only published journal articles conducted from 2000 to 2024 on VR diseases in Bhutan.

Information sources

The main sources of information were published journal articles. The main search tool was the Web of Science (Web of Science, Clarivate, London, UK), supplemented by additional searches on PubMed and Google.

Search strategy

The key words or the terms used to search for relevant literature included avoidable blindness in Bhutan, epidemiology of VR diseases in Bhutan, pattern of VR diseases in Bhutan, national survey of VR diseases in Bhutan, posterior segment disorders in Bhutan, myopic degeneration in Bhutan, RAAB survey in Bhutan, diabetic retinopathy and diabetic macular oedema in Bhutan, age-related macular degeneration in Bhutan, neuro-ophthalmological disorders in Bhutan, retinal vein occlusion in Bhutan, retinal laser therapy in Bhutan, anti-VEGF treatment in Bhutan, and surgical management of VR diseases in Bhutan.

Selection process

Publications were included if they reported on VR diseases in Bhutan between 2000 and 2024, specifically focusing on epidemiology, diagnosis, management or reported complications.

Data collection process

The selected publications were pooled, and the data from each publication was collected and compiled in this review.

Study risk of bias assessment

A potential selection bias exists due to the limited number of publications on VR diseases during the period. Most available studies were authored by the first author of this review article, which may give an impression of bias in the selection of articles. This limitation has been acknowledged in the review.

RESULTS

We found 16 publications on VR diseases or posterior segment disorders in Bhutan between 2000 to 2024 (Table 1). Among these, two were articles from the population-based RAAB survey[2,3], nine were derived from hospital-based national surveys[7,11-18], and five were case reports[19-23].

Blindness surveys and establishment of VR services

The first population-based national blindness survey, the RAAB survey conducted in 2009, included participants aged 50 years and above. It identified cataract as the leading cause of blindness and visual impairment, with posterior segment disorders accounting for 22.1%[2]. A follow up survey in 2018-2019 reported similar findings, with cataract remaining the main cause of blindness, while blindness and visual impairment due to posterior segment disorders had decreased to 7.7%[3]. In both surveys, VR and neuro-ophthalmological conditions were grouped together as posterior segment disorders, providing no specific details on the patterns, types or the management of individual VR diseases.

Pattern of VR diseases

Between 2013 and 2016, the first hospital-based national survey on VR diseases was led by the first VR specialist, resulting in nine publications that provided the country's first comprehensive data to guide national health policies[7,11-18]. The survey included 2,913 new VR patients and found that diabetic retinopathy (DR) and diabetic macular oedema (DMO) were the most common conditions, followed by age-related macular degeneration (AMD). Other reported VR diseases included retinal vein occlusion (RVO), retinal detachment (RD), glaucoma, posterior vitreous detachment (PVD), macular scars, macular holes, retinitis pigmentosa, retinal vasculitis, central serous chorioretinopathy (CSCR), hereditary maculopathy and endophthalmitis. Uncommon diseases such as seasonal hyper-acute pan-uveitis (SHAPU), and posterior dislocated cataract or

Table 1. Summary and comparison of different studies on vitreoretinal diseases

Authors	Study Disease	Study Year	Publication Year, Journal	Age of patients	Main findings
Lepcha, et. al.	Avoidable causes of blindness (RAAB Survey) in Bhutan	2009	2013, Ophthalmic Epidemiology	≥ 50 years (included)	• The first national report on blindness • Bilateral blindness:1.5% • The most common cause of vision loss: cataract • Vision loss from retinal disorders: 22.1%
Lepcha, et. al.	Avoidable causes of blindness (RAAB Survey) in Bhutan	2017-2018	2019, PLOS One	≥ 50 years (included)	• Bilateral blindness: 1.0% (33% reduction from 2009) • The most common cause of vision loss: cataract • Vision loss from retinal disorders: 7.7%
Rai, et. al	Pattern of VR diseases in Bhutan: hospital-based national survey	2013-2016	2020, BMC Ophthalmology	47.2 ± 21.8 years (presented)	• The first national report on VR diseases • VR diseases included DR/DMO, AMD, RD, myopic degeneration, hypertensive retinopathy, macular hole, NODs, RVO • RD more common among females (p = 0.007)
Rai, et. al	Myopia, myopic degeneration in Bhutan	2013-2016	2020, Graefe's Archive for Clinical and Experimental Ophthalmology	Females: 23.9 ± 13.5 years; Males: 27.6 ± 18.6 years (presented)	• The first national report on myopia/refractive errors • Myopia 92.1% of all refractive errors • Myopia prevalence highest among urban females (20.9%) • Myopia increased by being a student (4.96 ×) or professional (1.96 ×), and decreased by rural living (1.75 ×), all p ≤ 0.03
Rai, et. al	Surgical management of VR diseases in Bhutan	2013-2016	2020, New Frontiers in Ophthalmology	56.2 ± 22.3 years (presented)	• The first national report on VR surgery • Besides 214 major VR surgeries, 381 cases received anti-VEGF injections, and 36 paediatric cases received EUA ± retinal laser ± VR surgery • RD the most common indication for VR surgery, followed by VH and MH
Rai, et. al	Retinal laser services in Bhutan	2013-2016	2020, BMC Ophthalmology	54.1 ± 4.1 years (presented)	• The first national report on retinal laser • DR/DMO (66%) was the most common indication for retinal laser, followed by RVO (13.3%). • PRP was the most common type of laser performed (49.2%), followed by modified grid laser (30.2%), sectoral laser (6.0%), and prophylactic laser (4.8%).
Rai, et. al	Severity of AMD in Bhutan	2013-2016	2022, BMC Ophthalmology	71.9 ±11.3 years (presented)	• The first national report AMD and its severity • Half of total AMD cases had late-stage disease at their first presentation. • One-third of patients with late-stage AMD or half of those with wet AMD had disciform scar. • Three quarters of PCV patients were < 50 years of age impacting workforce. • AMD patients also presented with signs of very advanced disease such as GA and RPE tear.
Rai, et. al.	Prevalence and severity of DR in Bhutan	2013-2016	2023, Japanese Journal of Ophthalmology	57.2 ± 2.0 years (presented)	• The first national report on DR prevalence/severity • DR Prevalence: 42.7% • DMO prevalence: 14.2% • Mild NPDR was the most common DR (51.9%), followed by moderate NPDR (24.4%) • 12.5% of total patients had proliferative DR at their first presentation • Duration of diabetes was the major determinant of DR, the odds rising by 1.27× with each year of disease (p < .0001)

Rai, et. al.	Incidence and pattern of Neuro-ophthalmological disorders in Bhutan	2013-2016	2023, Clinical Ophthalmology	44.6 ± 21.7 years (presented)	• The first national report on NODs • Common systemic diseases: hypertension, diabetes, and ISOL. • Common diagnostic tests performed: Neuroimaging, and visual field tests • NOD incidence: 7.8% p. a • Common NOD: OA, ON, papilloedema, and TON. • Female gender increased the odds for glaucomatous OA by 2.65× (p=0.044), and age by 1.09× per year (p<0.001). • Female gender increased the odds for ON by 2.57× (p=0.03)
Rai, et. al.	Profile of patients treated with anti-VEGF intravitreal injections in Bhutan	2013-2016,	2023, Clinical Ophthalmology	65.2 ± 13.5 years (presented)	• The first national report on anti-VEGF treatment • Common indications: wet AMD, RVO, DMO/DR, and myopic CNVM. • Most of the treated eyes had poor BCVA: 30.7% had <3/60 to PL and 13.4% had < 6/60 to 3/60.
Rai, et. al.	Pattern and prevalence of RVO in Bhutan	2013-2016	2024, Clinical Ophthalmology	50.5 ± 20.2 years (presented)	• The first national report on RVO • RVO prevalence was 4.8% among VR patients • In 8 cases, RVO was diagnosed incidentally due to poor outcome of cataract surgery. • BRVO was the most common type, followed by CRVO, and HCRVO. • STBRVO was the most common subtype.
Rai, et. al.	A case report on intraocular foreign body with RD	2015	2016, Bhutan Health Journal	60-year-old man	• Presented with HM vision after hammer-chisel eye injury. • Eye examination revealed RIOFB, and right eye RD, confirmed with B-scan. • RD surgery with IOFB removal was performed. • Silicon oil removal and cataract surgery were performed 4 months later restoring BCVA to 6/18.
Dorji, et. al.	A case report on choroidal osteoma	2021	2021, Nepal Journal of Ophthalmology	35-year-old woman	• Presented with poor vision in left eye. • With eye examination, OCT, angiogram and A- and B-ultrasound, confirmed choroidal osteoma with CNVM. • Successfully treated with anti-VEGF injections.
Dorji, P.	A case report on ocular sarcoidosis	2021	2021, Bhutan Health Journal	26-year-old man	• Presented with blurry vision in the left eye. • Eye exam revealed iritis, iris nodules, vitritis and optic disc swelling. Chest x-ray and CT scan showed radiopaque nodule in lung fields and paratracheal lymphadenopathy. • Successfully treated with oral prednisolone.
Dorji, et. al.	A case report on angioid streak	2021	2022, Bhutan Health Journal	29-year-old female	• Diagnosed case of pseudoxanthoma elasticum was referred. • Fundus exam and fundus photographs showed chorioretinal streaks with hypofluorescent fissures.
Dorji, et. al.	A case report on Coat's disease	2022	2022, Bhutan Health Journal	4-year-old boy	• Presented with whitish right eye and HM vision • Dilated fundus exam revealed tortuous telangiectatic retinal vessels and total serous RD - Coat's disease. • External subretinal fluid drainage, cryopexy and retinal laser were performed successfully restoring vision to 6/36

AMD: age-related macular degeneration; anti-VEGF: anti-vascular endothelial growth factor; CNVM: choroidal neovascular membrane; CRVO: central RVO; BCVA: best corrected visual acuity; BRVO: BRVO; branch retinal vein occlusion; DMO: diabetic macular oedema; DR: diabetic retinopathy; EUA: examination under anaesthesia; GA: geographic atrophy; HCRVO: hemicentral RVO; ISOL: intracranial space-occupying lesions; ITBRVO: inferotempoal BRVO; MH: macular hole; PCV: NODs: neuro-ophthalmological disorders; NPDR: nonproliferative DR; OA: optic atrophy; ON: optic neuritis; polypoidal choroidal vasculopathy; RD: retinal detachment; RIOFB: retained intraocular foreign body; RPE: retinal pigment epithelium; RVO: retinal vein occlusion; STBRVO: superotemporal BRVO; TON: traumatic optic neuropathy; VH: vitreous haemorrhage; VR: vitreoretinal;

intraocular lenses were also identified[24].

The survey offered important insights into the social and systemic factors influencing eye health in Bhutan. Over half of the participants (51.9%) had no formal education and had limited awareness of eye diseases while traditional healing practices were widely accepted by the participants in rural communities. Diabetes and hypertension were the most frequent associated systemic conditions and RD was found to be significantly more common among females (p = 0.007). Besides ophthalmological diagnostic procedures, haematological tests, magnetic resonance imaging (MRI), computerised tomography (CT) scanning, X-rays of the chest, skull and orbit, and Mantoux skin tests were commonly performed. In children, the diagnosis was confirmed by examination under anaesthesia (EUA) if necessary, following a proper pre-anaesthetic check-up[7].

Age-related macular degeneration

The study identified 521 new patients with AMD, with a mean age of 71.9 ± 11.3 years and a predominance of males (p = 0.005). Notably, 44.9% of patients presented with late-stage disease at their first visit, and 30% of these had already developed disciform scars. Geographic atrophy (GA) accounted for 3% of late-stage cases. A concerning finding was that 74% of patients with polypoidal choroidal vasculopathy (PCV) were below 50 years of age, indicating a potential long-term impact on the working-age population[14].

Most patients had monastic education and 83.5% had not attended modern schooling. Late stage forms such as GA and disciform scar, for which no effective treatment exists, comprised a considerable proportion of AMD cases. Although treatment was available in the form of intravitreal injection of anti-vascular endothelial growth factor (anti-VEGF), it had to procured by the hospital's pharmacy division after filling out a special form in the name of the patient, which delayed treatment[14].

Diabetic retinopathy

The study included 843 new patients with diabetes, with a mean age of 57.2 ± 12.0 years, who presented for VR evaluation. DR was present in 42.7% of these patients and clinically significant macular oedema (CSMO) in 14.2%. Mild non-proliferative DR (NPDR) was the most frequent stage of DR, although 12.5% of affected patients already had proliferative DR (PDR) at their first presentation. The duration of diabetes was the strongest predictor of DR, with the risk increasing by 1.27 times for each additional year of disease (p < 0.0001), independent of age or co-morbidities such as hypertension[16].

Low literacy emerged as an important contributing factor, as 65.8% of participants had not received modern education[16]. Treatment approaches included retinal laser therapy (RLT), intravitreal anti-VEGF injections and VR surgeries for complications. Comprehensive care also involved coordination with physicians and endocrinologist for optimal management of diabetes and dyslipidaemia.

Retinal vein occlusion

This study identified 141 new cases of RVO, with a mean age of 50.5 ± 20.2 years, and a male predominance (62.4%) (p=0.031). Interestingly, eight cases were detected incidentally during evaluation for poor visual outcomes following cataract surgery. Hypertension and diabetes were the most frequently associated systemic conditions and key risk factors for RVO[18].

RVO accounted for 4.8% of all new patients presenting to the national VR clinics. Among the subtypes, branch RVO (BRVO) was the most common, followed by central and hemi-central RVO. Amongst BRVO, the superotemporal variant was the most frequent, followed by the inferotemporal variant[18].

Retinal laser services

This study included 685 patients who required RLT. This included eight with bilateral retinopathy of prematurity (ROP). The most frequent indication for RLT was DR/CSMO, followed by RVO, DMO, localised tractional retinal detachment (TRD), retinal breaks, and retinal vasculitis. Pan-retinal photocoagulation (PRP) was the most commonly performed RLT, followed by modified grid, sectoral and prophylactic or barrage laser treatments[13].

Surgical management of VR diseases

In this study, 214 patients underwent major VR surgeries, while 36 paediatric and neonatal patients underwent EUA followed by VR surgery or RLT. Additionally, 381 patients received intravitreal anti-VEGF injections. There was a significant male predominance (59.4%, p <0.001). RD was the most common indication for VR surgery, followed by vitreous haemorrhage, macular hole, posterior dislocated cataract or intraocular lens, retained intraocular foreign bodies (RIOFB), vitreomacular traction, and fibrovascular membrane. Nine cases of endophthalmitis were also managed – five traumatic, two post-penetrating keratoplasty, one post cataract surgery, and one endogenous endophthalmitis[12].

Anti-Vascular endothelial growth factor (anti-VEGF)

This study included 381 patients who received anti-VEGF injections, aged 65.2 ± 13.5 years, with significant male dominance at 60.4% (p-value = 0.004). The most common indication was nAMD, followed by RVO DMO/DR, and myopic choroidal neovascular membrane. Although, DR/DMO was a very common presentation to the VR clinics, it was not commonly treated with intravitreal anti-VEGF injection due to poor availability. Instead, DR/DMO was commonly treated with RLT and anti-VEGF was reserved for cases not responding to RLT[17].

Myopic degeneration

The study examined rural-urban and gender differences in the prevalence of myopia. It included individuals with refractive errors who presented to the VR clinics for their first retinal evaluation, specifically to assess for degenerative changes. Notably, Female patients tended to present at a younger age than their male counterparts. Among the cohort, myopia accounted for 92.1% of all refractive errors, with an overall myopia prevalence of 12.3%. The prevalence of myopia was highest among the urban females (20.9%), followed by urban males (11.9%), rural females (6.8%), and rural males (5.2%). The likelihood of developing myopia was found to be 4.96 times higher among students and 1.96 times higher among professionals, while it was 1.75 times lower among individuals living in rural areas (all $p \leq 0.038$)[13]. The findings supported the dopamine theory of myopia development and progression and highlighted the importance of regular sunlight exposure and greater inclusion of outdoor activities in school curricula in Bhutan[25,26].

Neuro-ophthalmological disorders

During the time period of 2000 – 2024, Bhutan lacked a neuro-ophthalmologist. Hence, patients with neuro-ophthalmological disorders (NODs) were managed by the VR specialist. This study included 226 new patients with NODs presenting to the VR clinics. The mean age at presentation was 44.6 ± 21.7 years with males accounting for 54.0% of cases. Females presented at a younger age than males (40.9 ± 22.0 vs 47.8 ± 20.9 years; $p = 0.014$). The most common presenting symptom was loss of vision, followed by head or orbital trauma. Optic atrophy was the most frequent NOD with an overall incidence of 7.8%, followed by optic neuritis, papilloedema, and traumatic optic neuropathy. Female gender increased the odds of developing glaucomatous optic atrophy by 2.65 times ($p = 0.044$), and optic neuritis by 2.57 times ($p = 0.03$)[15].

A case report on intraocular foreign body

This case report describes a 60-year-old farmer who sustained an eye injury while using a hammer and chisel. He was found to have a metallic RIOFB causing subtotal retinal detachment with macular involvement in his right eye. He vision was limited to hand movements in the affected eye, while the left eye had normal vision (6/6). He underwent a 23-guage pars plana vitrectomy with removal of the RIOFB using an intraocular magnet, followed by fluid-air exchange and injection of silicone oil. Five months later, the silicone oil was removed with cataract extraction and implantation of intraocular lens, resulting in a visual improvement to 6/18[19].

A case report on choroidal osteoma

A 35-year-old female presented with decreased vision in her left eye. Based on clinical examination, ocular ultrasonography, fundus fluorescein angiography and macular OCT, she was diagnosed with choroidal osteoma associated with choroidal neovascular membrane (CNVM). The CNVM resolved following three monthly intravitreal injections anti-VEGF, bevacizumab[20].

A case report on ocular sarcoidosis

A 26-year-old male patient presented with blurring of vision in his left eye, without any systemic symptoms. Ocular examination revealed anterior chamber inflammatory reaction with an iris nodule, along with vitritis and optic disc swelling in the posterior segment. Chest X-Ray and contrast enhanced CT scan of the chest revealed radiopaque nodules in both lung fields and enlarged paratracheal lymph nodules, confirming the diagnosis of ocular sarcoidosis despite normal blood test results. The patient was successfully treated with a six-month course of oral prednisolone[21].

A case report on angioid streak

A 29-year-old female with a dermatological diagnosis of pseudoxanthoma elasticum was referred to the retinal specialist for fundus evaluation. Her anterior segment examination, including visual acuity was normal. Dilated fundus examination and coloured fundus photography revealed dark brown chorioretinal streaks radiating from the optic disc toward the posterior pole, with asymmetric distribution in both eyes. Autofluorescence imaging revealed hypofluorescent fissures, while OCT and OCT angiography did not show any sign of neovascularisation[22].

A case report on Coat's disease

A 4-year-old boy was brought by his father with a one-month history of a whitish appearance in his right eye. Visual acuity was limited to hand movement in the affected eye, while the left eye had 6/6 vision. Dilated fundus examination revealed tortuous, telangiectatic retinal vessels with total serous retinal detachment, consistent with stage 3 Coat's disease. A CT scan of the orbit was performed to exclude retinoblastoma. The child underwent external subretinal fluid drainage, cryopexy and retinal laser therapy, resulting in successful retinal reattachment and restoring vision to 6/36[23].

DISCUSSION

With the increasing burden of diabetes and its complications such as DR and DMO, it is essential to continually monitor disease patterns and severity to design effective screening and management strategies. A major barrier to managing of VR diseases in Bhutan is illiteracy and poor understanding of disease among the public. Over half of the study participants (51.9 – 83.5%) had no formal education[7,14]. Many older individuals rely on traditional or monastic teachings and prefer local healing practices, including the indigenous or traditional medical system

known as sowa rigpa, meaning the science of healing[27,28]. While sowa rigpa may benefit minor ailments, it is not effective for VR diseases, and delays in seeking modern care often result in complications. Strengthening public awareness is therefore crucial.

Most studies showed a male predominance in seeking eye care. This trend requires further investigation through population-based surveys to understand barriers preventing females from seeking medical services. Similar male dominance in healthcare seeking has also been observed in neighbouring countries such as India, Nepal, Bangladesh and Pakistan[29-33]. In contrast, Sri Lanka reported more females sought care[34]. Interestingly, Bhutanese studies found that females presented earlier than males, unlike Nepal, where females presented almost a decade later than their age-matched male counterparts[7,30]. Globally, females are disproportionately affected by sight-threatening conditions, accounting for 65% of AMD, 61% of glaucoma and cataract cases, and 66% of blindness35. The World Health Organisation (WHO) estimates that 64.5% of all visually impaired people worldwide are females[36]. Hence, understanding and addressing gender disparities in eye care access is essential.

Late stages presentation was common across studies; 12.5% of DR cases had PDR, 44.9% of AMD cases were in late-stages with disciform scarring, and optic atrophy was the most frequent NOD[14-16]. Reasons for such late presentations could include faith in local / traditional healers, poor health literacy, difficult terrain and limited transport. Bhutan's mountainous geography hinders access and follow-up. In a study in Nepal with the terrain, social and economic background is similar to Bhutan, patients presented early when their dominant eyes were affected[30]. Improving referral pathways, extending regular VR services to ERRH and CRRH, and integrating VR screening into the national eye health programs, that are currently focussed on cataract and refractive errors, would enhance early detection and care.

Systemic diseases like hypertension and diabetes were common co-morbidities. High altitude, poor diet, high salt and fat consumption contribute to these non-communicable diseases (NCD). Every 100 metres increase in altitude produces a 20% increase in the prevalence of hypertension[37]. Bhutanese diet is rich in salt, butter, oil and meat[38]. A dietary study in South Asia found that the average salt intake in Bhutan was 9.0 grams/day, lowest being in India at 6.7 grams/day and highest in Nepal at 9.1 grams/day39. The fat-rich diet in Bhutan may explain the high rate of AMD in Bhutan40. Reducing salt intake, promoting heaty diets and managing diabetes and hypertension are vital to prevent associated ocular complications like DR/DMO, hypertensive retinopathy and RVO.

Despite challenges, VR care in Bhutan has made significant progress since the establishment of the VR Unit at the GKCWNEC. The unit now performs a wide range of procedures, from retinal laser therapy to complex VR surgeries using advanced systems such as Constellation Vision System Vitrector and OS4 Oertli Vitrectomy machine with ReSight Lens system[7,12-26]. Common surgeries include repair of RD, management of vitreous haemorrhage, macular holes and RIOFB. However, managing complex VR disorders may be difficult due to limited resources[14,15,18]. Anti-VEGF therapy, although available, is not consistently accessible as it must be procured on a named-patient basis. This causes treatment delays and patient loss to follow-up[17]. Maintaining anti-VEGF in stock for regular use and introducing longer acting anti-VEGF agents like faricimab could greatly improve outcomes[41].

With global advancements in diagnostics and therapeutics, Bhutan remains at crossroads between providing basic eyecare services and embracing new technologies. In VR diseases, Functional and structural retinal changes often precede clinically detectable diseases, especially in DR, where retinal neurodegeneration occurs early before the development of classical retinal vasculopathy biomarkers such as retinal haemorrhages, exudation and other vascular changes[42-44]. Emerging diagnostic tools such as flicker electroretinography, objectiveFIELD Analyzer (OFA), microperimetry, static SAP, low luminance visual acuity, contrast sensitivity, and BCVA provide valuable insights into early functional loss[45-49]. Other advantages of OFA are that it is non-contact, objective, and provides both retinal sensitivity and response delay reports unlike other perimetric methods[50,51]. The evolving concept of "Functional diabetic retinopathy" (FDR) targets these early changes of DR before structural damage occurs[52-54]. Incorporating such technologies, even gradually, would strengthen Bhutan's capacity to provide timely, evidence-based eye care services and reduce preventable blindness.

LIMITATIONS

Most of the search result publications on VR diseases were authored by the author of this review article because he led the first and the only national survey on VR diseases. The other two population-based blindness surveys clubbed all VR diseases as posterior segment disorders providing no details on VR diseases[2,3]. Additionally, being population-based surveys, proper examination of the retina was not possible or performed to diagnose VR disease individually.

CONCLUSIONS

Bhutan faces challenges in managing VR diseases due to limited specialists, limited of limited medical resources, and poor healthcare accessibility. Regular VR services are confined to JDWNRH, making it difficult for patients from other regions of the country to seek timely care or follow-up. Expanding regular VR services to the regional referral hospitals, strengthening community screening and referral systems, and promoting public education on healthy lifestyles, disease awareness, dispelling myths on local healing, safe work practices are essential to enhance access and outcomes.

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AUTHORS CONTRIBUTION

BBR: Concept, design, data collection, manuscript writing, editing and review.

TM: Concept, design, data collection, manuscript writing, editing and review.

Authors agrees to be accountable for all respects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST

TM: Declares that he may earn royalties from the sale of the OFA.

GRANT SUPPORT AND FINANCIAL DISCLOSURE

None