

1 What was known before:
2 • There is some data on the occurrence and natural history of peripapillary choroidal
3 neovascularisation (PPCNV) in hospital settings but a paucity of data exists on the epidemiology of
4 PPCNV in community populations • There is no detailed description of the prevalence and features
5 of asymptomatic PPCNV
6
7
8 What this study adds:
9 • This represents the first study to report PPCNV occurs with a population prevalence of 0.29%,
10 and is bilateral in 0.06% in the UK Caucasian population >65 years. • Gender specific prevalence
11 was 0.36% and 0.19% for females and males respectively. • PPCNV are commonly located nasal
12 to the optic disc and are small and asymptomatic early on. • Peripapillary RPE degenerative
13 changes, drusen and RPD, as well as higher grade ARM predispose to PPCNV.

14 **Prevalence of Peripapillary Choroidal Neovascular Membranes**
15 **(PPCNV) in an Elderly UK Population - The Bridlington Eye**
16 **Assessment Project (BEAP): A Cross-Sectional Study (2002-2006).**

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33 **Acknowledgements:** This research was funded in part by a Research Grant from the
34 Macular Society UK, Andover, Hants, UK.

35 The Bridlington Eye Assessment Project was funded by an unrestricted grant from Pfizer.

36 We would also like to thank the following organisations for financial support of the Project:

37 Pharmacia, Yorkshire Wolds and Coast Primary Care Trust, The Lords Feoffees of Bridlington,
38 Bridlington Hospital League of Friends, The Hull and East Riding Charitable Trust, The
39 National Eye Research Centre (Yorkshire), The Rotary Club of Bridlington, The Alexander
40 Pigott Wernher Memorial Trust, Bridlington Lions Club, The Inner Wheel Club of Bridlington,
41 Soroptimist International of Bridlington, and The Patricia and Donald Shepherd Charitable
42 Trust.

43 **Conflicts of Interest:** No conflicting relationship exists for any author regarding this
44 manuscript.

45 **Running Head:** PPCNV Prevalence in an elderly UK Population (BEAP study)

46

47 **Abstract**

48 **Purpose:** There is paucity of data on the epidemiology of peripapillary choroidal
49 neovascularisation (PPCNV). Our aim was to determine prevalence of PPCNV in the elderly
50 UK population of Bridlington residents aged ≥ 65 years.

51 **Methods:** Eyes with PPCNV in the Bridlington Eye Assessment Project (BEAP) database of
52 3475 participants were analysed. PPCNV outline was drawn, its area measured, and clock-
53 hour involvement of disc circumference recorded. Location and shortest distance from the
54 lesion edge to fovea were recorded. Masked grading for age-related maculopathy
55 (ARM)/reticular pseudodrusen (RPD) within the ETDRS grid was assigned for each eye using
56 a modified Rotterdam scale. Peripapillary retinal pigment epithelial (RPE) changes/drusen
57 were recorded. Visual acuity (VA) and demographic details analysed separately were
58 merged with grading data.

59 **Results:** PPCNV were identified in 10 subjects, and were bilateral in 2 (20%), a population
60 prevalence of 0.29%, and 0.06% bilaterality. Gender specific prevalence were 0.36%, 0.19%
61 for females and males respectively. Age ranged from 66 to 85 years (mean 76.3 [SD 6.4].
62 PPCNV were located nasal to disc in 41.7%, measuring 0.46-7.93mm² [mean 2.81mm² (SD
63 2.82)]. All PPCNV eyes had peripapillary RPE changes. One subject had no ARM, 1 angioid
64 streaks, and 30% RPD. No direct foveal involvement, or reduced VA attributable to PPCNV
65 was observed.

66 **Conclusion:** PPCNV were infrequent in this population, more common in females, and often
67 located nasal to the disc, without foveal extension. Peripapillary degenerative changes were
68 universal, and strong association with ARM was observed in eyes with PPCNV. Typically,
69 PPCNV were asymptomatic with VA preservation.

70 **Introduction**

71 Peripapillary choroidal neovascular membranes (PPCNV) form part of the spectrum of
72 diseases that have potential to cause severe visual loss.¹ They are well-recognized but
73 uncommon, reportedly accounting for less than 10% of all newly presenting choroidal
74 neovascular membranes (CNV).^{2,3} In a survey by Browning and Fraser⁴, PPCNVs were
75 associated with Age-Related Macular Degeneration (AMD) in 45% of cases, while 39% were
76 considered idiopathic. PPCNV are also associated with conditions such as inflammatory
77 diseases including presumed ocular histoplasmosis⁵, uveitis⁶⁻⁹, and chorioretinitis¹⁰, and
78 degenerative processes including myopia¹¹ and angioid streaks.⁴ Choroidal osteoma, optic
79 disc drusen and congenital disc anomalies are other rare associations. Our group has
80 previously reported that PPCNV occurred in 9 out of 231 cases of newly presenting CNV in a
81 UK hospital setting (3.9%).² Previous reports on the prevalence and associations of PPCNV
82 are based on case reports or small case series from hospital data. To the best of our
83 knowledge, there are no reports on population prevalence of PPCNV except for our
84 previous report of worse eye prevalence of 0.29% for Grade 4c (PPCNV), compared to 1.8%
85 for neovascular AMD (nAMD) (grade 4b AMD) and 2.5% for geographic atrophy (GA) (grade
86 4a AMD).¹² Furthermore, there is no data available in the literature on the population
87 prevalence of asymptomatic PPCNV.

88 In this study, characteristics of eyes classified as having PPCNV from the Bridlington Eye
89 Assessment Project (BEAP) were investigated.

90 **Methods**

91 The BEAP study methods, including image acquisition and analysis, have been reported
92 previously.¹² In summary, the BEAP is a single centre population based prevalence study,

93 with the primary objective to investigate the utility of screening for eye disease in an elderly
94 population ≥ 65 years, using clinical examination by trained optometrists and digital imaging
95 technology. All individuals registered with a General Practitioner in Bridlington and 65 years
96 and older on the 5th November 2002 were eligible for inclusion in the project. Subjects
97 known to be moving in or out of the area during the study, those that were registered blind
98 or partially sighted, bed bound individuals or those known to have significant dementia
99 were excluded from the study. Subjects were invited by letter on a street-by-street basis in
100 ascending numerical order of postcode. When contacted, each subject was invited to
101 telephone the BEAP to make an appointment to be examined. At its completion in March
102 2006 over 3500 subjects had been examined. All participants were interviewed, in person,
103 by a trained research nurse using structured questionnaire, and examined by one of four
104 specially trained optometrists with structured proforma completed by the research staff.
105 Non-stereoscopic mydriatic fundus photography was performed with a Topcon fundus
106 camera (model TRC NW6S) and a Nikon 10-megapixel camera. Each eye had a 30° colour
107 fundus photograph (CFP) taken centred on the macula. Local ethics committee approval
108 (Ref No. PB/RH/02/288) was obtained and the research adhered to the tenets of the
109 Declaration of Helsinki. All subjects provided informed consent. Masked image grading was
110 performed in accordance with the International Classification System of AMD, using 30°
111 non-mydriatic colour fundus photographs. All photographs of right and left eyes were
112 graded by a single ophthalmologist (CW) who was trained in image grading at the Central
113 Angiographic Reading Facility (CARF), Belfast, Northern Ireland. One in ten (1 in 10)
114 randomly selected right eye images were sent to the CARF for secondary masked grading by
115 certified graders.

116 The diagnosis of PPCNV was clinical, and based on surrogate clinical features of CNV (as
117 previously described)¹² directly adjacent to and contiguous with the optic disc. These
118 include definite RPE detachment, haemorrhagic or serous, and/or subretinal or sub-RPE
119 haemorrhages unassociated with any other vascular lesion and/or intraretinal, subretinal or
120 sub-RPE glial tissue, and/or subretinal or sub-RPE neovascular membrane as characterized
121 by grey/yellowish discoloration. All eyes identified as having PPCNV, or questionable lesions
122 were reviewed and scrutinised by a retinal specialist (WMA). Any differences in opinion
123 were sent to CARF for secondary grading. All images were analysed using the Topcon
124 IMAGEnet 2000 program. All eyes identified with PPCNV (and corresponding contralateral
125 eyes) were subsequently reviewed in greater detail, with demographic details and visual
126 acuity (VA) unknown to the grader. The outline of the PPCNV was drawn and area
127 measured. Location of the lesion was also recorded. The PPCNV area was taken to include
128 only visible membrane (as indicated by a grayish-brown or whitish-grey appearance) and/or
129 areas of sub-retinal or sub-RPE haemorrhage. Areas of obvious peripapillary glial tissue, if
130 associated with haemorrhage were also measured as part of the lesion. Often, the lesion
131 would be located adjacent to the disc, with peripheral edge haemorrhage or exudate. Areas
132 of subretinal fluid (SRF) without any haemorrhage were not in themselves measured as part
133 of the lesion. Only areas of gross exudation immediately adjacent to haemorrhage or
134 membrane were included in the measured area, whereas sparse distal exudates were not.
135 The extent/severity of the PPCNV was recorded using clock hours of involvement of the
136 optic disc circumference. An example of a PPCNV is shown in Figure 1.
137 Signs of age related maculopathy (ARM) within an ETDRS macular grid were recorded using
138 a modified Rotterdam grade as previously described.¹² Retinal pigment epithelial (RPE)
139 changes and presence of drusen in the peripapillary area (one-disc diameter around the

140 optic disc) were specifically recorded along with the closest distance from the edge of
141 changes secondary to the PPCNV, including SRF to the fovea. ARM changes in the
142 contralateral eyes were recorded.

143 VA and demographic details which were analysed separately were then merged with the
144 image grading data.

145 Statistical analysis was performed using Stata 12.0 (StataCorp, College Station, TX) and SPSS
146 v.22 (IBM Corp. Armonk, NY). Patient demographic characteristics that are categorical will
147 be summarised using percentages and continuous normally distributed variables with the
148 presentation of means, standard deviation and associated 95% confidence intervals.

149 Where the continuous variable is non-normally distributed we will present medians and
150 associated quartiles (25th, 75th). Statistical significance will be shown when P-values <0.05.

151 **Results**

152 Amongst the total of 3475 participants with gradable photographs in at least one eye,
153 PPCNV were identified in 10 subjects (Table 1), with bilateral occurrence in 2 individuals
154 (20%). This resulted in a total of 12 eyes with PPCNV, and an overall population prevalence
155 of 0.29%. PPCNV accounted for 12 (13.3%) of a total of 90 cases of CNVMs identified in the
156 BEAP Study. Seven individuals (70%) were female resulting in gender specific prevalence
157 rates of 0.36% (7/1939) and 0.19% (3/1536) for females and males respectively. Bilateral
158 involvement equated to a population prevalence of 0.06%. Ages ranged from 66 to 85 years,
159 with a mean of 76.3 years (SD 6.4). There was no obvious increase in prevalence with age, as
160 shown in Table 2 ($p=0.77$).

161 Eyes with PPCNV had a higher prevalence of the more advanced stages of AMD when
162 compared to the overall BEAP cohort. The prevalence of Rotterdam grade 2, 3 or 4a within
163 the macula in PPCNV eyes was considerably high at 42% compared to that in the general

164 population (see Tables 3 and 4). Only 1 eye in the ten individuals with a PPCNV had
165 minimal/no sign of ARM present (Rotterdam grade 0).

166 One subject (10%) had identifiable angioid streaks. This individual was removed from our
167 initial report of AMD prevalence¹² as the pathology was not felt to be purely age-related.

168 The patient was 81 years of age and had co-morbid large soft drusen within the macula. No
169 individuals with PPCNV had pathological myopia or optic disc pathology, such as disc drusen
170 or disc swelling, or evidence of previous chorioretinitis. None of the eyes with PPCNV had
171 direct involvement of their fovea with SRF, exudate or haemorrhage in the photographs.

172 Visual function was good in all eyes, with none having poor VA secondary to PPCNV. Eyes
173 with reduced vision had co-morbid conditions as summarized in Table 3. Patient Number 10
174 (LogMAR VA 0.22, Snellen VA=20/32) had a co-morbid epiretinal membrane. Patient 2
175 (LogMAR VA of 0.42 [Snellen 20/50]), subsequently underwent cataract surgery and
176 postoperatively had a VA of 0.2 [Snellen 20/30]. Subject 4 had a LogMAR VA of 0.3 [Snellen
177 20/40] at presentation. This eye had a 23-months follow-up in a hospital eye service, after
178 which the patient was reported to have a haemorrhagic peripapillary scar with atrophy and
179 discharged from further follow-up. The VA reduction was attributed in part to secondary
180 macula RPE atrophic changes.

181 Table 3 details demographic and macular changes in participants with PPCNV. Table 4
182 summarises the peripapillary retinal changes, along with size (area) and locations of CNV in
183 relation to the optic disc in all eyes with PPCNV. Three eyes of 3 subjects (30%) with PPCNV
184 had reticular pseudodrusen (RPD). Nine (9) out of 10 individuals (90%) had evidence of
185 drusen $\geq 63\mu\text{m}$ in size within the macular area, including the one with angioid streaks. One
186 individual (10%) had contralateral nAMD; another had bilateral GA with multiple large
187 drusenoid pigment epithelial detachments that appeared completely separate from any

188 PPCNV (which was nasal to the disc). All eyes with PPCNV had RPE hyperpigmentary,
189 hypopigmentary or atrophic changes around the optic disc. One eye (8.33%) had a large
190 PPCNV involving ≥ 6 clock hours. Six (6) of the 12 identified PPCNM had predominantly
191 temporal location with another occurring superiorly. Five of 12 PPCNVs (41.7%) involved
192 retina nasal to the optic disc only. The PPCNV size ranged from 0.46 mm² to 7.93 mm² with a
193 mean of 2.81 mm² (SD 2.82, 95% CI 1.1 - 4.6). The mean area of PPCNV in the 4 eyes with
194 visible exudation was 5.64 mm² (95% CI 0.57 - 10.72). For the 8 eyes with no visible
195 exudation, the membranes measured an average of 1.39 mm² (95% CI 0.47 - 2.31).

196 **Discussion**

197 This study reports the prevalence of PPCNV within an elderly Caucasian population, using
198 data from the largest UK population based screening study of AMD to date. To the best of
199 our knowledge, this represents the first population study specifically to report on the
200 prevalence of PPCNV, as well as describe the characteristics of PPCNV and concomitant
201 ocular findings in affected and fellow eyes, as all previous publications on the subject were
202 based on hospital cohorts, in predominantly symptomatic individuals, with inherent
203 selection bias. Our results indicate that as many as two thirds of PPCNV may remain
204 asymptomatic, compatible with the finding that 40% of the lesions are located nasal to the
205 disc.

206 PPCNVs (grade 4c AMD) were an infrequent finding, considerably lower than the prevalence
207 of grade 4b AMD, in the same population.¹² Our findings are similar to those of some
208 previous published studies^{13, 14}, where there was a female preponderance. RPD are known
209 to have such female predilection.^{12,16} However, it is unlikely that the increased female
210 prevalence of PPCNV in this study is due to the presence of RPD, as the three patients with
211 RPD and PPCNV in the series were male. We have previously reported that PPCNV

212 accounted for 3.9% of newly diagnosed cases of CNV in AMD in a hospital eye service.²
213 Other investigators have reported frequency of $\leq 10\%$ of all CNVs.¹⁵ This relatively low
214 prevalence is confirmed in this study, where PPCNV accounted for 13.3% of all identified
215 CNVs.

216 The majority of PPCNVs in this cross-sectional study were unilateral, similar to what was
217 reported at baseline in hospital based longitudinal studies.^{4,14} In the Silvestri study¹⁴, only 2
218 out of the 14 (14%) individuals had bilateral PPCNV at their initial presentation, whilst
219 others developed contralateral eye involvement over follow up of up to 7 years resulting in
220 54% bilateralism.¹⁴ Similarly, Browning et al reported bilateral involvement in 19 of their 96
221 patients (19.8%)⁴ after a median follow up of 2 years.

222 There is a myriad of reported associations between PPCNV and other conditions, most of
223 which are based on single case reports or small case series. Larger hospital based studies
224 also exist, but may give a poor representation of the true spectrum of disease as small,
225 nasal, age-related PPCNVs may remain asymptomatic. In a series of 115 eyes of 96 patients,
226 Browning et al reported ocular conditions associated with PPCNV as 45.2% ARM, 39.1%
227 idiopathic, 4.3% multifocal choroiditis, 2.6% angioid streaks, 1.7% presumed ocular
228 histoplasmosis, 1.7% choroidal osteoma, 0.9% optic disc drusen and 0.9% congenital disc
229 anomalies.⁴ The definition of ARM was however broad, and included all eyes with ≥ 1 of
230 drusen $>63\mu\text{m}$, pigment clumps, mottled pigment epithelial atrophy, GA and signs of an
231 exudative AMD, including disciform scars in both eyes.⁴ They also reported that 39% of
232 subjects with PPCNV had drusen on colour photography.⁴ Kies and Bird similarly reported 15
233 of their 55 eyes (27%) with PPCNV had identifiable drusen¹³, and Silvestri et al reported that
234 60% of PPCNV were related to age-related degenerative changes.¹⁴ In the present series,
235 the presence of drusen $\geq 63\mu\text{m}$ within the macular area in 90% of cases was much higher

236 than previously published. This higher prevalence of PPCNV in eyes with the more
237 advanced stages of AMD when compared to the overall BEAP cohort could be a chance
238 finding, but suggests a stronger association of PPCNV with ARM than previously published.
239 The lower prevalence of ARM reported within hospital populations could, in part, be
240 explained by the fact that these are symptomatic, and more likely to be large lesions with
241 macula involvement from exudation or SRF which could mask drusen or result in their
242 regression. Alternatively, it could reflect the older age of the cohort included in the present
243 study. RPD or subretinal drusenoid deposits (SDD) cover a large area of the retina including
244 the peripapillary zone^{16,17}, and are known to be associated with nAMD.¹⁸⁻²⁰ We have
245 previously reported their prevalence in 22% of eyes with newly presenting nAMD in a
246 hospital eye service¹⁹, a finding similar to that in participants with PPCNV in this population.
247 Peripapillary degenerative changes in the present series were a more universal finding when
248 compared to the presence of macular drusen. Previous studies on PPCNV have not reported
249 the presence of drusen or pigmentary change in the immediate peripapillary area. Recent
250 studies have reported the presence of peripapillary SDD in association with drusen and
251 other age related changes using multimodal imaging.^{16,17} As drusen and pigmentary changes
252 within the macula are known hallmarks of both GA and CNV, and SDD predispose to CNV, it
253 seems logical to consider these changes in the peripapillary area as potentially pathological
254 for PPCNV. Older reports have speculated on potential relationship of previous unwitnessed
255 episodes of multiple white dot syndromes in the aetiology of the relatively large cohort of
256 presumed idiopathic PPCNVs.^{21, 22} A more plausible explanation would be that localized,
257 age-related changes occurring in the peripapillary area may predispose to localized breaks in
258 Bruch's membrane allowing CNV membranes to develop as reported by Sarks.²³

259 The association with angioid streaks and PPCNV is well established.²⁴⁻²⁷ The number of such
260 cases is small, but suggests that membranes occurring in the region of angioid streaks
261 remain small and asymptomatic and, therefore, are less likely to present to a hospital eye
262 service. Potential overlaps between the aetiologies of PPCNV in patients with angioid
263 streaks and comorbid age-related changes are possible.

264 Some authors have defined a PPCNV as large if it covered more than 3.5 disc areas or
265 involved over 50% of the disc circumference.²⁸ Only one subject (10%) in the current series
266 had >6 clock hours involved. This figure is similar to the 15% prevalence of large membranes
267 reported by Browning et al⁴, but less than the higher prevalence of 87% of large membranes
268 involving more than 6 clock hours reported by Kies and Bird.¹³ There was complete disc
269 encirclement by the PPCNV in 0.9% of Browning's cases⁴ whilst 11% in Kies and Bird series¹³
270 had similar features⁴, probably reflecting selection bias. Caution should however be
271 exercised when comparing the size of CNV lesions, given the different imaging modalities
272 used in the different studies, especially as PPCNV may be larger in surgical excision and
273 indocyanine green angiography than on FFA.^{13, 28-30}

274 The finding of asymptomatic PPCNVs in this study is interesting. Our literature search could
275 not find any studies on the prevalence of asymptomatic PPCNV. Sarks provides the best
276 insight on the subject, with a clinicopathological correlative study of 150 eyes of 80 patients
277 obtained post-mortem²³, which identified CNVMs in the peripapillary area in 14%, macular
278 area in 20%, and in the peripheral retina in 24.6% of eyes. Unlike the large temporal PPCNVs
279 seen in eyes of symptomatic individuals which had extended to the fovea^{14, 23, 31}, Sarks
280 suggested that in older subjects, small and frequently nasal asymptomatic PPCNV occurred
281 with greater frequency than large, temporal membranes with macula involvement, and
282 demonstrated that PPCNVs originate from choroidal vessels passing either through breaks in

283 Bruch's membrane (57%) or from vessels extending around the termination of Bruch's
284 membrane (43%) especially on the nasal side.²³

285 Limitations of our study include utilization only of CFP of field 2. Although the disc and nasal
286 peripapillary areas were well included in these images, the addition of CFP of field 1,
287 centered on the optic disc may have added clearer delineation of nasal PPCNV. Multimodal
288 imaging including SD-OCT around the optic disc, combined with angiography in suspected
289 cases would also have improved case detection, and are recommended in future population
290 studies. Individuals registered as blind or partially sighted were excluded from study
291 inclusion. However, our analysis showed that such subjects were few, and had subfoveal
292 CNV. We cannot be sure that some of these individuals may have had poor vision secondary
293 to PPCNV which could be bilateral or in combination with other visually significant ocular
294 pathology. Such scenarios would make our prevalence measure an underestimation.

295 In conclusion, this study confirms that PPCNV are an infrequent finding in the elderly
296 population compared to macular CNV, and have a clear female preponderance. PPCNV may
297 be asymptomatic especially when small or located nasally. This finding is very distinct from
298 that in previous hospital studies of symptomatic patients, and supports the early
299 histopathological study²³ which suggested that in elderly individuals, PPCNV frequently
300 occurred in a nasal position and are asymptomatic in the majority of cases. This study also
301 reports the universal finding of peripapillary degenerative changes in all eyes with PPCNV,
302 and a strong association between PPCNV and signs of ARM within both the macula and
303 immediate peripapillary areas plus association with RPD. Multimodal imaging such as OCT,
304 FFA and ICG would help identify possible phenotypic variants. More research is also
305 required on the natural history of these lesions, including those that are located nasally.

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398 **Summary**

399 **What was known before**

- 400 • There is some data on the occurrence and natural history of peripapillary choroidal
401 neovascularisation (PPCNV) in hospital settings but a paucity of data exists on the
402 epidemiology of PPCNV in community populations
- 403 • There is no detailed description of the prevalence and features of asymptomatic
404 PPCNV

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406 **What this study adds**

- 407 • This represents the first study to report PPCNV occurs with a population prevalence
408 of 0.29%, and is bilateral in 0.06% in the UK Caucasian population ≥ 65 years.
- 409 • Gender specific prevalence was 0.36% and 0.19% for females and males respectively.
- 410 • PPCNV are commonly located nasal to the optic disc and are small and asymptomatic
411 early on.
- 412 • Peripapillary RPE degenerative changes, drusen and RPD, as well as higher grade
413 ARM predispose to PPCNV.

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420 **Acknowledgements**

421 The authors thank Sheila MacNab (Project Manager), and Stephen Brown, Janet Button, Graham
422 Langton, and Mark Kunz (Optometrists) for their work with the Project; John Bapty, Nigel Connell,
423 Peter Jay, and Gillian Poole for their work as the charity trustees of the Bridlington Eye Assessment
424 Project.

425 **Conflicts of interest:** The authors have no propriety or commercial interest in any of the material
426 discussed in this article.

427 **Commercial Relationships:**

428 Winfried M Amoaku: Consultant for Abbvie, Alimera, Allergan Inc, Bayer, Novartis, Pfizer, Santen,
429 and Thrombogenics, and has undertaken research sponsored by Allergan, Novartis, and Pfizer. He
430 has received speaker fees and travel grants from Allergan, Bausch and Lomb, Bayer, Novartis and
431 Pfizer.

432 Jonathan G Hillman: None

433 Hamish K McNab: None

434 Rajnikant Mehta: None

435 Marco Messina: None

436 Gaspare Monaco: None

437 Ali Poostchi: None

438 Stephen A Vernon: Consultant for Allergan and Alcon, and has undertaken research sponsored by

439 Allergan and Pfizer. He has received speaker fees from Allergan, Alcon, Pfizer, Optivue and Topcon.

440 Craig Wilde: None

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442

443 **Figure Legends**

444 Figure 1. Non-stereoscopic colour fundus photograph. A peripapillary choroidal neovascular
445 membrane involving the temporal 6 clock hours of the optic disc circumference is present, and
446 associated with exudation. There are visible co-morbid reticular pseudodrusen present in the macula
447 and elsewhere.

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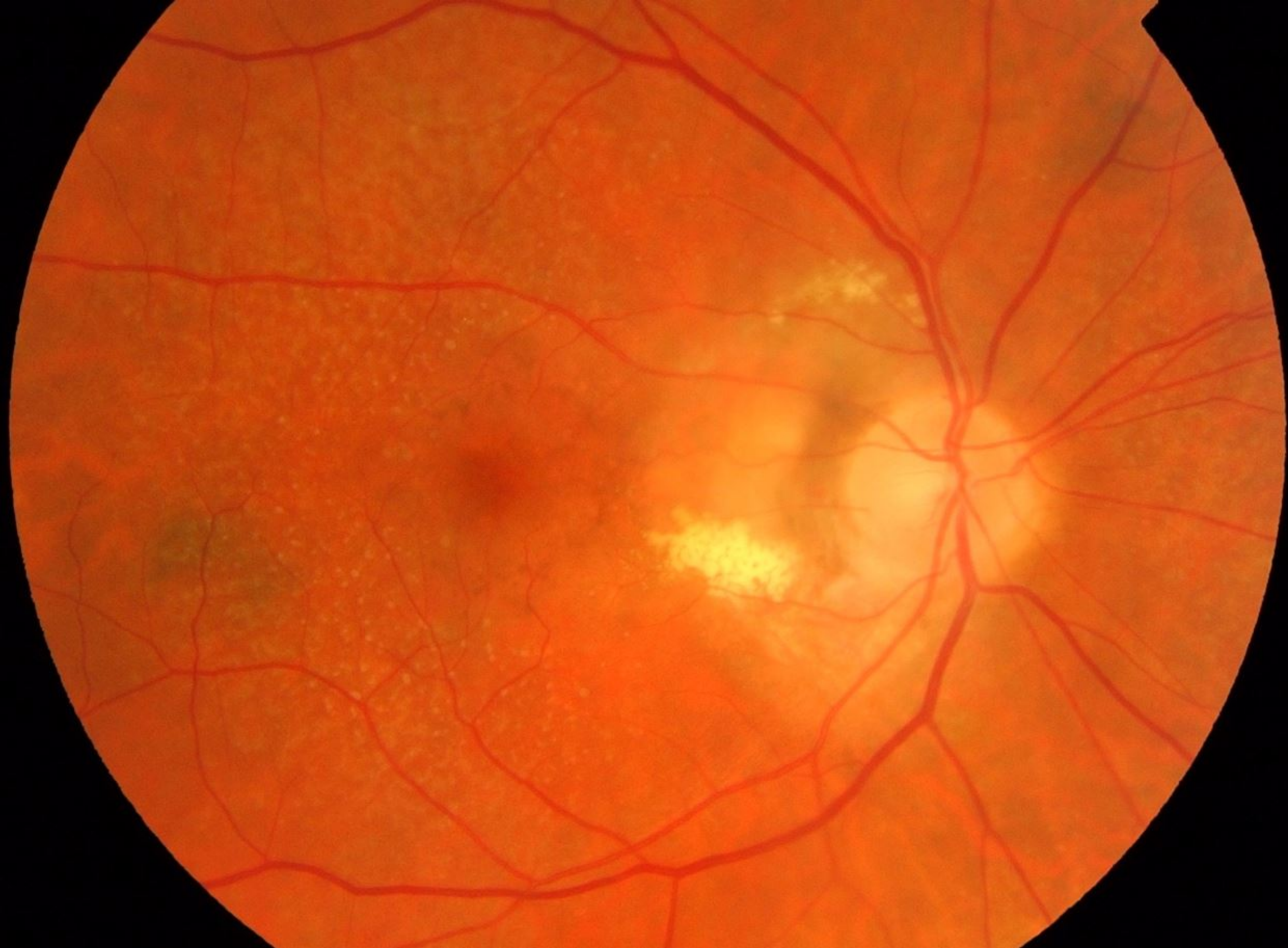


Table 1: Population based prevalence of PPCNV in the Bridlington Eye Assessment Project (BEAP). Data is number (%) [95%CI].

Grade	Right Eye (3340 gradable photos)	Left Eye (3384 gradable photos)	Participants (3475 gradable photos)	Bilateral (3255 participants with gradable photos in both)
PPCNV/4c	6 (0.18) [0.07-0.40]	6 (0.18) [0.07-0.40]	10 (0.29) [0.15-0.54]	2 (0.06) [0.01-0.24]
Mean Age (years)	76.7	73.6	76.3	69.5

Table 2: Age (years) specific prevalence of PPCNV. Data is number (%) [95% CI]

Age range (years)	65-69	70-74	75-79	80-84	85-89	>90	Total
Number of PPCNV eyes (%) [95% CI]	2 (0.24) [0.01-0.91]	1 (0.09) [0.01-0.58]	3 (0.37) [0.07-1.14]	3 (0.56) [0.11-1.72]	1 (0.55) [0.01-3.34]	0 (0.00) [0.00-12.39]	10 (0.29) [0.15-0.54]
Total gradable eyes available	849	1069	808	533	183	33	3475

Table 3: Summary of demographic details of eyes with PPCNV and associated macular age-related changes (Rotterdam Grades), with LogMAR visual acuity (VA)

Number	Affected eye	Age at exam	Sex	(Macular Status) AMD Grade Right	(Macular Status) AMD Grade Left	Right VA (LogMAR)	Left VA (LogMAR)	Cause of Vision loss
1	LE	66	F	1a	1a	0.02	0.14	nil
2	LE	76	F	1a	1a	0.30	0.42	Other: cataracts
3	LE	76	F	1a	1a	0.1	0.1	nil
4	LE	85	M	4b	4, reticular drusen	CF	0.3	ARM
5	RE	83	F	0a	0b	0.2	0.2	nil
6	BE	72	F	1a	1a	0.1	0.1	nil
7	RE	77	M	2a, reticular drusen	2a, reticular drusen	0.2	0.2	nil
8	RE	80	M	3, reticular drusen	3, reticular drusen	0.0	0.0	Nil
9	BE	67	F	4a	4a	0.3	0.4	RE AMD-GA, LE diabetic CSMO
10 (angioid streaks)	RE	81	F	1a	Cannot grade (Non-AMD)	0.22	0.36	RE-ERM, LE-cataract

Table 4: Summary of the peripapillary retinal changes along with size (area) and locations of CNV in relation to the optic disc in all the eyes with PPCNV.

Number	Affected eye	Features of the peripapillary disc area ipsilateral eye	Features of the peripapillary disc area contralateral eye	Maximum drusen diameter (μm) ipsilateral eye	Maximum drusen diameter (μm) contralateral eye	Signs of PPCNVM	Area of PPCNVM (mm^2)	Distance from edge of lesion to fovea (mm)	Clock hours (S=Superior, I=inferior, N=Nasal, T=Temporal)
1	LE	RPE atrophy	RPE hyperpigmentary crescent and some RPE atrophy	90	210	RPE changes and subretinal haemorrhage, visible membrane	3.90	2.89	3 (11-2 S)
2	LE	Alpha zone changes with hypopigmentation and drusen visible	A pigmented crescent of RPE hyperpigmentation temporally with more widespread hypopigmentation	250	130	Peripapillary haemorrhage and RPE changes	1.39	5.68	2.5 (6.30-9 IN)
3	LE	Hypopigmentation around disc with drusen	Focal area of RPE atrophy with scleral show. RPE hyperpigmentation	250	160	Multiple peripapillary subretinal haemorrhages and exudate	6.49	2.18	5 (12.30-5.30 T)
4	LE	There is a rim of RPE atrophy around the disc with extensive atrophy beyond	Extensive atrophy	150	0 (4b)	Haemorrhage surrounded by disciform scar and atrophy	1.23	2.21	1.5 (2.30-4 T)
5	RE	There is a RPE hyperpigmentary crescent and areas of hypopigmentation and atrophy	Small area of RPE atrophy with more widespread hyperpigmentation/hypopigmentation	0	≤ 63	Subretinal haemorrhage	1.42	4.87	2 (4-6 IN)
6	BE	RPE atrophy with hyperpigmentary crescent	RPE atrophy LE with hyperpigmentation and hypopigmentation	200 RE 220 LE	NA	RE-multiple haems and atrophy LE-Haemorrhages and atrophy	0.58 RE 0.46 LE	3.20 RE 3.34 LE	RE: 1.5 (7.5-9 IT) LE: 1.5 (3-4.30 ST)

		RE							
7	RE	RPE atrophy with more widespread hypopigmentation	RPE atrophy with more widespread hypopigmentation	190	210	Subretinal haemorrhage	0.63	5.07	2 (12-2 SN)
8	RE	RPE atrophy and reticular drusen	RPE atrophy and reticular drusen	170	190	Gross exudation, visible membrane, retinal thickening	7.93	1.52	6 (12-6 T)
9	BE	RPE atrophy and hyperpigmentation with drusen RE	RPE atrophy and hyperpigmentation and hypopigmentation	450	230	RE: Gross exudation, haemorrhage and retinal thickening LE: subretinal haemorrhage and pigmentary changes	RE: 7.21 LE: 1.49	RE: 6.29 LE: 3.19	RE: 5 (12-5 N) LE: 1 (1-2 ST)
10	RE	Angioid streaks with RPE atrophy and hyperpigmentation	Angioid streaks	265	Cannot grade as poor quality photo, but questionable PPCNVM with haemorrhage	Haemorrhage with exudate	0.94	5.59	1 (4.5-5.5 IN)