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Original article

Pneumatic displacement of submacular haemorrhage

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Abstract

Purpose: To evaluate the outcomes of pneumatic displacement of submacular hemorrhage secondary to choroidal neovascular membrane (CNV) ($n = 9$) and retinal arterial macroaneurysm (RAM) ($n = 3$).
Methods: This is a retrospective case series study of 12 eyes from 12 patients in Aberdeen Royal Infirmary, Aberdeen, UK. The mean duration of visual loss was 10.8 ± 4.11 days. All cases received intravitreal injection of expansile gas within 24 h of presentation (C3F8 in 11 cases and SF6 in one case) and postured face down for five days. Anterior chamber paracentesis was done right after gas injection. Intravitreal anti-VEGF was injected at the same time in cases with CNV. Further anti-VEGF injections were done in CNV cases as needed afterwards. Cases were followed up for 6 months.
Results: The submacular hemorrhage was successfully displaced from underneath the fovea in all but one case. The bleeding disappeared totally in 44% of cases and was inferiorly displaced in 56%. VA improvement at 6 months was statistically significantly higher than baseline VA. All cases but 2 (one because of subfoveal fibrosis and one because of late presentation) experienced improved VA. The mean VA improved from 1.37 ± 0.18 logMAR at baseline to 0.83 ± 0.26 logMAR at 6 months. No complication related to the procedure was reported.
Conclusion: Pneumatic displacement of submacular hemorrhage appears to be a safe and effective technique to treat the condition. It is an easy procedure that can be done in outpatient setting. Further studies are needed to validate our results.

Keywords: Pneumatic displacement, Submacular hemorrhage, Retinal arterial macroaneurysm, CNV, Exudative AMD

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Introduction

Submacular haemorrhages (SMH) are associated with a variety of conditions including age-related macular degeneration (AMD), retinal artery macroaneuyrsm (RAM), ocular trauma, pathological myopia and presumed ocular histoplasmosis syndrome (POHS).[1,2] Retrospective reports of the natural history of SMH demonstrated poor prognosis. Without treatment, SMH usually end up with poor final vision.[3] This is due to retinal damage from the haemorrhage itself, which is toxic to the photoreceptors. The layer of blood also acts as a diffusion barrier, impairing nutrient diffusion between the retinal pigment epithelium (RPE) and choroid as well as the photoreceptors.[1] Bennett et al. found that patients with fovea-involving SMH secondary to AMD had a mean visual acuity of 20/1700 at final follow-up with observation.[4]

The intervention for SMH can be done using vitrectomizing techniques or non-vitrectomizing techniques. Vitrectomizing techniques usually involve doing Pars-Plana vitrectomy (PPV) with intravitreal or subretinal injection of

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recombinant tissue-Plasminogen activator (rt-PA) to liquefy clotted blood and facilitate displacement with gas tamponade. Several case series reported successful displacement of the SMH (secondary to exudative AMD) and significant VA improvement with vitrectomizing techniques.[5–7] In non-vitrectomizing techniques intravitreal expansile gases are injected to displace the SMH from underneath the fovea with or without other adjuvants. Heriot first described a simple technique for managing SMH by combined intravitreous injection of tissue plasminogen activator (t-PA) with expansile gas to pneumatically displace SMH.[8] This technique reported a high anatomic success rate with few complications. Following that, other case series showed favourable outcomes using intravitreal t-PA in addition to expansile gases to displace SMH secondary to exudative AMD.[9,10] Kitagawa and colleagues[11] recently published their positive results of using intravitreal injections of rt-PA, perfluoropropane (C3F8) and ranibizumab mainly in cases of polypoidal choroidal vasculopathy (PCV). They achieved total displacement of the SMH in 85% of cases ($n = 20$) and partial displacement in 15% of cases with significant VA improvement. However, they had vitreous haemorrhage or retinal detachment in 20% of cases that needed additional surgical intervention. De Jong and co-workers recently compared the outcomes of PPV, subretinal rt-PA, C3F8 and bevacizumab to intravitreal injection of rt-PA, C3F8 and bevacizumab in cases of SMH secondary to exudative AMD. The authors found no difference between the 2 groups.[12]

In cases of SMH related to RAM, some case series studies reported successful displacement of the SMH and VA improvement with PPV + subretinal t-PA injection and gas tamponade.[13,14] However, several complications were reported with this technique including recurrence of SMH, vitreous haemorrhage, macular holes, retinal detachment, and hyphema requiring further interventions to address them. Some case series studies reported successful displacement of SMH with Intravitreal injection of t-PA and expansile gas.[15] Mizutani et al. reported 100% recurrence of haemorrhage following intravitreal injection of t-PA and gas in cases of SMH secondary to RAM ($n = 4$) and recurrence of haemorrhage in 10% of cases treated with intravitreal gas only ($n = 10$). Based on this the authors did not recommend the use of intravitreal t-PA in SMH secondary to RAM.[10]

In this retrospective case series study we present the efficacy, safety, and visual outcomes of pneumatic displacement of SMH in cases of CNV and RAM without the use of rt-PA.

Methods

This study is a retrospective review of 12 consecutive patients who underwent intravitreal injection of expansile gas for pneumatic displacement of SMH, from 2009 to 2013 at Aberdeen Royal Infirmary, Scotland, UK. Each patient had a complete ophthalmological examination at initial presentation, which included visual acuity (VA), slit lamp biomicroscopy, fundus examination and Goldmann applanation

Table 1. Patients' data, causative pathology, gas used, and VA change.

Patient no.	Age (years)	Gender	Time from onset of symptoms to treatment (days)	Cause of haemorrhage	Gas used	Time to first FU (weeks)	Visual acuity (logMAR)			
							Initial presentation	1st follow-up	3 months	6 months
1	92	M	7	AMD	C3F8	4	1.6	0.48	0.3	0.1
2	89	F	0	AMD	C3F8	6	2	0.9	1	0.9
3	79	F	15	RAM	C3F8	4	0.9	0.7	0.6	0.6
4	95	F	28	AMD	C3F8	8	2.3	2.3	2	1.78
5	80	F	5	AMD	C3F8	6	2	2.8	2.8	2.8
6	86	F	1	AMD	C3F8	3	1	0.78	0.48	0.70
7	87	F	0	AMD	C3F8	2	2	2	0.3	0.3
8	89	F	3	RAM	C3F8	6	2	0.7	0.78	0.48
9	79	F	0	AMD	C3F8	5	0.6	0.48	0.4	0.3
10	85	F	42	AMD	C3F8	5	1	0.9	0.6	0.15
11	63	M	1	Inflammatory CNV	SF6	4	0.78	0.6	0.48	0.48
12	83	F	28	RAM	C3F8	4	1.18	1	1	1.18

M = Male. F = Female. AMD = age-related macular degeneration. RAM = retinal arterial macroaneurysm. CNV = choroidal neovascular membrane. FU = follow-up.

Table 2. Anti-VEGF use in the study.

Patient no.	Concurrent anti-VEGF injection	Anti-VEGF used	Prior anti-VEGF treatment	No of injections prior to haemorrhage	No of injections 6 months post-haemorrhage
1	Yes	Ranibizumab	No	0	6
2	Yes	Ranibizumab	No	0	3
3	No	None	No	0	0
4	Yes	Bevacizumab	No	0	2
5	Yes	Ranibizumab	Yes	12	1
6	Yes	Ranibizumab	No	0	4
7	Yes	Ranibizumab	No	0	3
8	No	None	No	0	0
9	Yes	Ranibizumab	No	0	4
10	Yes	Ranibizumab	No	0	3
11	Yes	Bevacizumab	Yes	1	4
12	No	None	No	0	0