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Outcomes of pars plana vitrectomy for rhegmatogenous retinal detachment at Charlotte Maxeke Johannesburg Academic Hospital in Johannesburg, South Africa

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Background: Pars plana vitrectomy (PPV) for rhegmatogenous retinal detachment is performed as a standard of care in central hospitals in South Africa. Clinical outcomes of such a procedure need to be reported on regularly.

Aim: The aim of this study was to describe the visual acuity and anatomical outcomes of pars plana vitrectomy (PPV) for rhegmatogenous retinal detachment at a central academic hospital in Johannesburg, South Africa.

Setting: Pars plana vitrectomy surgery for rhegmatogenous retinal detachment in a central hospital in South Africa.

Methods: Retrospective case series of patients who had PPV for rhegmatogenous retinal detachment at Charlotte Maxeke Johannesburg Academic Hospital during the 5-year period from 01 January 2010 to 31 December 2014.

Results: Ninety-nine patients with rhegmatogenous detachment, comprising 62% men and 38% women, were included in the study. The mean age (± standard deviation) was 48 (±18.4) years. The most common cause of rhegmatogenous detachment was trauma followed by cataract surgery, accounting for 37% and 21% of all causes, respectively. Sixty-three percent of these detachments involved the macula at the time of presentation, and 58% had proliferative vitreoretinopathy (PVR). Eighty-three eyes (84%) obtained vision improvement or stabilisation and retinal attachment. Forty eyes (40%) had visual acuity improvement, and 43 eyes (43%) retained the same vision. Successful anatomical reattachment of the retina was obtained in 93% (n = 92) of eyes, including those that needed a repeat surgery.

Conclusion: This study found that the majority of patients whose files were reviewed benefited from surgical intervention for rhegmatogenous retinal detachment in terms of stabilisation or improvement of vision.

Keywords: retinal detachment; sub-Saharan Africa; rhegmatogenous; black; outcomes.

Introduction

Rhegmatogenous retinal detachment is the most common type of retinal detachment, with an incidence ranging from 12.9 to 17.9 per 100 000 people per year.[1] It is caused by accumulation of liquefied vitreous from the vitreous cavity through a retinal tear or hole into the subretinal space. The two conditions required for the development of a rhegmatogenous detachment are a retinal break (or tear) and the liquefied vitreous. The presence of one condition without the other will not cause a detachment.

The risk factors associated with rhegmatogenous detachment include retinal degenerations such as myopia with lattice degeneration, cataract surgery and blunt or penetrating ocular trauma.[2,3,4,5] Systemic diseases like Marfan and Stickler syndromes are also risk factors for retinal detachment.

Myopia is a significant contributor amongst all nontraumatic rhegmatogenous detachments.[6,7,8] Compared to emmetropes, the risk of detachment is four times greater in low myopes and 10 times greater in high myopes.[6,7]

Lattice degeneration is a known predisposing lesion to rhegmatogenous retinal detachment and typically causes atrophic holes or a posterior vitreous detachment (PVD) with a horseshoe tear. It

contributes up to 30% of all predisposing factors to retinal detachment.[7,8]

Cataract surgery is a common procedure performed worldwide and is a very important risk factor for the development of retinal detachment.[6,7,9] There is a fourfold increase in the risk of developing retinal detachment after cataract surgery.[6] A tear in the posterior capsule at the time of cataract surgery has been identified as one of the most significant risk factors for the development of retinal detachment following cataract surgery.[6,7]

Trauma has been found to be a common cause of rhegmatogenous retinal detachments in young patients.[10]

The success of retinal detachment repair can be measured against functional outcomes (visual acuity) and anatomical outcomes (reattachment rate). In rhegmatogenous detachment, the overall anatomic reattachment is between 75% and 95% by scleral buckling or vitrectomy following the first surgery.[2,4,5,8]

Poor anatomical outcomes are seen in detachments associated with large or posterior breaks, trauma, long duration of detachment and those complicated with proliferative vitreoretinopathy (PVR).[2,3,4,5] The main causes of failure for primary repair or re-detachments are PVR, new break formation and missed or reopened breaks.[8,9,10]

The functional outcome or visual acuity is determined by the pre-operative visual acuity, the sparing or involvement of the macula, axial length, the type of retinal tear and the duration of the detachment.[8,9] The visual outcome may also be worsened by secondary factors such as macular oedema and epiretinal membrane formation.

Postoperative complications such as endophthalmitis, PVR, macular pucker and diplopia have been reported and may alter the outcome of the surgery.[11]

In some cases, particularly those with severe PVR, more than one surgical procedure may be required to reattach the retina. Interestingly, this repeated retinal detachment surgery does not seem to influence the anatomical or visual outcomes.[12]

The two common surgical methods for rhegmatogenous retinal detachment repair are scleral buckling and pars plana vitrectomy (PPV).[4]

Methods

Objectives

The objectives of this study were to describe the visual acuity and anatomical outcomes after three months following rhegmatogenous retinal detachment surgery. The outcome measures were a change in Snellen visual acuity and the presence or absence of anatomical reattachment of the retina after three months following retinal detachment surgery; another outcome measure was removal of silicone oil (where oil was inserted during the primary retinal detachment surgery).

Study design

This was a retrospective case series of patients who had PPV surgery for rhegmatogenous retinal detachment at Charlotte Maxeke Johannesburg Academic Hospital between 01 January 2010 and 31 December 2014. We included all patients who had PPVs for retinal detachment surgery for rhegmatogenous retinal detachment. We excluded patients with incomplete medical records, patients who had retinal surgery for other indications such as vitreous haemorrhage, tractional retinal detachments, macular disorders (macular holes, epiretinal membranes), endophthalmitis, cataract surgery complications other than retinal detachment and intraocular foreign body without retinal detachment.

Sample size and statistical analysis

Descriptive statistics were used to analyse the demographics, including age, race and gender as well as the clinical characteristics such as the aetiology of the retinal detachment.

Surgical success was defined as anatomical reattachment plus improvement in vision or anatomical reattachment plus stabilisation of vision. Surgical failure was defined as a detachment of the retina at 3 months following surgery or removal of silicone oil.

The identification of risk factors for surgical failure was performed in a univariate manner with Student's *t*-test (two-sided) for continuous data and Fisher's exact test (two-sided) for categorical data. A p-value of < 0.05 was considered statistically significant.

Ethical considerations

Ethics approval and permission to conduct the study were obtained from the Human Research Ethics Committee (Medical) at the University of the Witwatersrand (clearance certificate no. M141195).

Results

Total study population

A review of the theatre lists for the specified period identified possible 853 records for review. Figure 1 indicates a flow chart of records excluded from the study. The final number of rhegmatogenous retinal detachment cases identified for analysis was 99 patients.

The mean age (SD, standard deviation) of these patients was 48 years (18.4); 62% were male and 38% female. The most common cause of rhegmatogenous retinal detachment in this study was trauma, followed by cataract surgery, high myopia, PVD and previous cytomegalovirus (CMV) retinitis associated with retroviral disease (Table 1). The duration of vision loss in patients with rhegmatogenous detachments displayed a median of 8 weeks (range: 1–104).

Eighty-three eyes (84%) had a successful outcome (improvement or stabilisation in vision plus anatomical

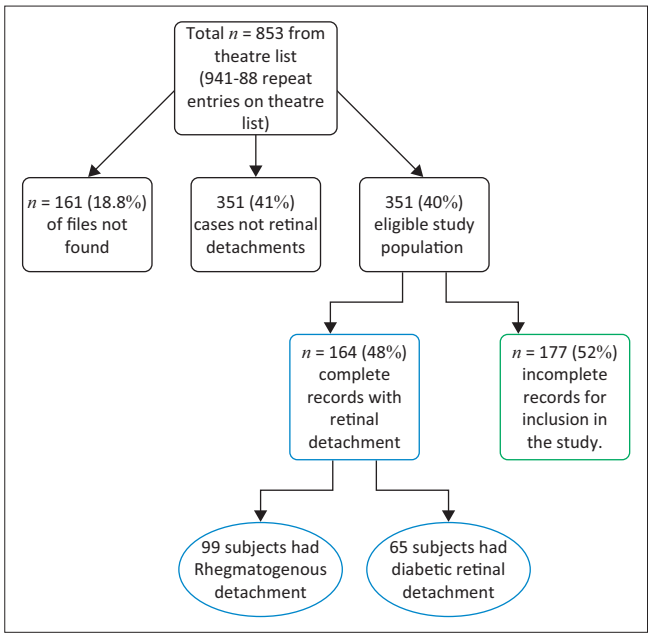

FIGURE 1: A flow chart of records excluded from the study.

TABLE 1: Causes of rhegmatogenous retinal detachment.

Causes	*n*	%
Trauma	37	37.4
Cataract surgery	21	21.2
High myopia	19	19.2
Posterior vitreous detachment (PVD)	9	9.1
Unknown	9	9.1
CMV retinitis	4	4.0

CMV, cytomegalovirus.

reattachment). Forty eyes (40%) had visual acuity improvement, 43 eyes (43%) retained the same visual acuity and 16 eyes (16%) had vision loss. Successful anatomical reattachment was obtained in 92 eyes (93%), and seven eyes (7%) remained detached after multiple surgical repairs.

Factors associated with outcomes

A total of 83 patients (83.8%) had successful surgical outcomes, compared to 16 patients (16.2%) whose surgical outcome was considered unsuccessful. Nine of these 16 unsuccessful surgeries had anatomic reattachment but decreased visual acuity. The mean age of those who had successful outcomes was significantly lower than those with failure (44 ± 18.5 vs 57 ± 13.68 years, respectively; $p = 0.0089$).

Fifty-eight percent ($n = 57$) of eyes were complicated by PVR, and 42.0% had no PVR. Outcomes measured against PVR using Fisher's exact test suggest that eyes with PVR had poorer outcomes than eyes without PVR, however, and this was found to be insignificant with a p-value of 0.17.

The primary causative hole was found superiorly (above) the horizontal meridian in 33.3% ($n = 33$) of the detachments, with inferior holes in 22.2% ($n = 22$) of the detachments; 19.2% ($n = 19$) had multiple holes in different quadrants, 5.1% ($n = 5$) had a dialysis, 3.0% ($n = 3$) were macular holes and in 16.2% ($n = 16$) of cases, the causative hole was not identified. There was no significance in outcomes between inferior and superior holes with a p-value of 0.24 (Fisher's exact test); see Table 2.

TABLE 2: Successful compared with unsuccessful surgical cases.

Variable	Successful outcome cases	Unsuccessful (failure) outcome	Total	*P*
PVR presence				0.17
PVR present	45	12	57	
PVR absent	38	4	42	
Total	83	16	99	
Position of holes				0.24
Superior holes	30	3	33	
Inferior holes	17	5	22	
Total	47	8	55	
Macular status				0.40
Macular off	51	12	63	
Macular on	32	4	36	
Total	83	16	99	

PVR, proliferative vitreoretinopathy.

Most of the detachments (that is, 64% [$n = 63$]) involved the macula, and 36% were macula-sparing detachments. Macula-involving detachments had relatively poorer outcomes than macula-sparing detachments; however, this difference was not statistically significant (p-value 0.40 Fisher's exact).

Discussion

In this descriptive study of outcomes of retinal surgery done for rhegmatogenous retinal detachments, the mean age of 48 years (median: 53) at presentation and the preponderance of male patients are comparable to the study by Nwosu et al. that was performed in a Nigerian eye hospital. The median age for their rhegmatogenous detachment patients was 56 years, with more male patients than female patients (31 vs 21).[13] A study by Asaminew et al. from an Ethiopian hospital found the median age for patients with rhegmatogenous detachments to be 42 years.[14]

The well-known risk factors for the development of rhegmatogenous detachments are myopia, cataract surgery, peripheral degenerations and trauma.[1,2,3,4,5,6] In their study from India, Pandey et al. found that cataract surgery was the most common cause of rhegmatogenous detachment, followed by high myopia, trauma and peripheral degeneration.[2] A study by Thelen et al. in a German hospital found that 62.0% of their detachments were secondary to cataract surgery, and only 8.5% were trauma-related.[4]

However, in Africa, the pattern of disease is different. In this study, trauma was the most common cause of rhegmatogenous retinal detachment, accounting for 37.0% of cases, followed by cataract surgery, high myopia and PVD. Another South African study by Peters similarly found that trauma accounted for the majority (29.8%) of the retinal detachments in her study. The prevalence of trauma-related retinal detachment in South Africa is higher than in countries outside of Africa, which correlates with the

complex social challenges in Africa, including high unemployment rates, substance abuse, lack of education and high rates of crime and violence. Nwosu et al. also found that trauma was the most common predisposing factor for retinal detachments in their Nigerian hospital.[13] Similarly, in the Ethiopian study by Asaminew et al., trauma was also found to be the most common risk factor, followed by myopia and posterior uveitis.[14]

Africa has high rates of HIV infection and other systemic infections. Posterior uveitis or retinitis (such as CMV retinitis) is not mentioned as a cause of rhegmatogenous detachment in non-African studies such as India, Asia or Germany. However, in the African studies, infectious and inflammatory causes contribute to the development of retinal detachments. In this study, 4% of patients who were immunocompromised had retinal detachments as sequelae of CMV retinitis, with secondary atrophic holes in the retina. The Nigerian and Ethiopian studies also both found posterior uveitis as a common risk factor for the development of retinal detachments in their patients.[13,14]

The duration of vision loss, PVR, the pre-operative macula status and visual acuity are important factors that influence the success of rhegmatogenous retinal detachment surgery.[2,3,4,5,6]

Surgical management improved or stabilised vision in 84.0% of patients in this study. These study results are comparable to those by Pandey et al. (India); in their study, visual acuity improved in 43.3%, remained the same in 53.3% and worsened in 3.3%[2] Nwosu et al. (Nigeria) found that 88.9% of their patients improved or stabilised vision; however, their surgical method was cryoretinopexy and scleral buckling rather than PPV.[15] The authors commented that they would expect better outcomes if they had vitrectomy equipment to tackle more complex cases.[15]

In this study, 93.0% of eyes had successful anatomical reattachment after three months following surgery. Nwosu et al. (Nigeria) reported 83.3% anatomical success at six months (including patients that had a second surgery).[15] The study by Thelen et al. (Germany) found that the overall reattachment rate of 4325 nontraumatic retinal detachment patients was 84.0%; however, in trauma patients with detached maculae, the reattachment rate was 73.5%.[4]

Proliferative vitreoretinopathy is an important cause of unfavourable surgical outcomes for retinal detachment repair. In this study, the presence of PVR was associated with poor anatomical and functional outcomes, although not statistically significant. Pournaras et al. and Nwosu et al. found that PVR contributed to the surgical failure.[12,15] Fifty-seven percent of patients in this study presented with PVR. Peters found 33.3% of PVR; there was 19.2% PVR in the Nigerian study and 20.0% in the Indian study.[2,10,13] Ethiopia had the highest rate of grade C PVR (69.1%).[14] There is a significant difference in the PVR rate amongst the three African countries (South Africa, Nigeria, Ethiopia) and the reason for this is not clear.

Most of the rhegmatogenous retinal detachments were associated with superior retinal holes in this study, and these seemed to have favourable outcomes compared to detachments associated with inferior retinal holes. Nwosu et al. found 73.1% of the holes in the superior retina, and Asaminew et al. found 45.5% of the holes superiorly.

Macular involvement in rhegmatogenous retinal detachments is a known poor prognostic factor. The macula was detached in the majority of patients in this study. This trend has similarly been reported in studies from India, Nigeria and Ethiopia.[2,13,14]

The outcomes of surgery for retinal detachment at Charlotte Maxeke Johannesburg Academic Hospital are comparable to those found in other studies, within the limitations of the study.

The study was done retrospectively, looking at the clinical records of patients who had retinal surgery from 2010 to 2014. The retrospective nature of the study is the major limiting factor, as a very large proportion of the potential study population was excluded purely based on missing and/or incomplete records. This impacted on the sample size, which in turn may have influenced the outcome, as well as the relative significance of variables that may or may not have influenced the outcome in these eyes. Because of the retrospective nature of the study, the data captured identified 'trauma' as a cause of rhegmatogenous retinal detachment, without specifying the type of trauma (blunt vs. penetrating), which is another limitation of this study.

Conclusion

This study, notwithstanding its major limitation of not finding the majority of patients' records, demonstrates that the surgical intervention for rhegmatogenous RD in this Johannesburg hospital is mostly successful in terms of stabilisation or improvement of vision and anatomical attachment of the retina. Our results are comparable with those found in other African countries and developed countries from elsewhere in the world. The differences in aetiology and presentation of retinal detachments in African countries and in more developed areas could be attributed to both socio-economic and inherent genetic factors in Africa.

The discrepancy between anatomical and functional outcomes is caused by death of the photoreceptors. This occurs in rhegmatogenous retinal detachments involving the macula that have a delay in treatment. Better awareness, screening and referral systems are required in order to diagnose and treat patients early before they reach advanced disease stages.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

M.M.'s contribution included project conceptualisation and design, data collection and analysis and write-up of the manuscript. M.A.M.'s contribution included project conceptualisation and design, data analysis, review of the manuscript, supervision of the project and funding acquisition.

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Data availability

Raw data of this research is available on request from the corresponding author, M.M.

Disclaimer

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