The Pattern and Distribution of Retinal Breaks in Eyes With Rhegmatogenous Retinal Detachment

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• PURPOSE: To identify which presenting features of rhegmatogenous retinal detachment (RRD) suggest the presence of multiple retinal breaks and to ascertain relevant patterns in retinal break location.
• DESIGN: Observational single-center case series.
• METHODS: We collected data from 851 eyes undergoing surgery for RRD between January 2001 and September 2011. Data recorded included patient demographics; extent of RRD; and the size, location, and number of retinal breaks. Statistical regression was used to identify risk factors for the presence of multiple breaks and to analyze patterns in break location.
• RESULTS: Of 851 patients, 7 patients were excluded because of insufficient data. Of 844 patients analyzed, 60% were male. The mean age was 62 years. Three hundred twenty-eight eyes (38.9%) had solitary breaks, whereas 58.8% had breaks in more than 1 quadrant. The superotemporal (ST) quadrant was involved most frequently (582 eyes; 69%). The superonasal and inferotemporal quadrants were involved in 341 (40%) and 274 (32%) eyes, respectively. The inferonasal (IN) quadrant was involved the least frequently (144 eyes; 17%). Of 328 eyes with only 1 break, it was most likely to be in the ST quadrant (182 eyes; 55%) and least likely to be in the IN quadrant (19 eyes; 6%). The risk of having multiple breaks was highest for patients with inferior breaks. Eyes with an IN quadrant break were almost twice as likely to harbor further breaks compared with eyes with an ST quadrant break. Vitreous hemorrhage at presentation was associated with larger breaks. ST quadrant breaks were most likely to be detached (92%), whereas IN quadrant breaks were least likely to be detached (60%).
• CONCLUSIONS: The ST quadrant is the most likely location for retinal breaks, the most frequently involved quadrant in eyes with solitary breaks, and has the highest proportion of detached breaks. By contrast, the IN quadrant is the least likely location for a break, the least frequently involved quadrant in eyes with solitary breaks, and the most likely location for attached breaks. The presence of an inferior (especially IN quadrant) retinal break should raise suspicion that the eye harbors further breaks. (Am J Ophthalmol 2014;157:221–226.

Accepted for publication Sep 16, 2013.

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ALMOST HALF OF PATIENTS WITH RHEGMATOGENOUS retinal detachments (RRDs) have multiple retinal breaks.[1] However, little is known regarding the factors predisposing patients to retinal break multiplicity or what presenting clinical features implicate the presence of more than 1 break. Up to 20% of RRDs have no break visualized before surgery, despite thorough retinal examination.[2–4] With wide-angle viewing systems and specific maneuvers during pars plana vitrectomy, the proportion of operated eyes with no seen breaks falls to approximately 2%.[3,5] Despite this, most failures of primary RRD surgery arise from undetected breaks.[6,7] Excluding new breaks, uncertain breaks, and breaks in previously attached retina, undetected breaks accounted for 60% of all redetachments in 1 series.[8] New breaks induced during surgery are considered distinct from this group and have not been considered in this analysis. It is already known that retinal breaks occur most commonly in the superotemporal (ST) quadrant,[9] but to the authors' knowledge, no previous studies have analyzed the relationship of break location with other parameters such as break multiplicity.

The primary aim of this study was to identify whether any presenting clinical features are predictive of having more than 1 retinal break and, if so, what level of importance these features contribute. In doing so, these presenting features would give the surgeon a higher index of suspicion for looking for additional breaks during surgery, thus reducing the incidence of primary failure. Our secondary aims were to analyze patterns in retinal break location to further our understanding of the pathogenesis of RRD.

METHODS

ETHICAL APPROVAL FOR THE STUDY WAS OBTAINED FROM the local research ethics committee (Guys & St. Thomas' NHS Foundation Trust). In this observational case series, intraoperative surgical data of all patients with RRD attending a single author's vitreoretinal service (T.H.W.) between January 2001 and September 2011 were entered prospectively into an electronic patient record (VITREOR, Microsoft Access format; available with the book *Vitreoretinal Surgery*[10]) with retrospective analysis.

0002-9394/$36.00
http://dx.doi.org/10.1016/j.ajo.2013.09.011

Only the first eye of patients with retinal detachment (RD) on preoperative clinical examination were included. We excluded patients who had any previous vitreoretinal intervention or who were younger than 40 years (to avoid the influence of RRD from young myopes with atrophic holes and attached vitreous), and also eyes with aphakia, anterior chamber lens implants, giant retinal tears, retinal dialysis, macular hole-related RD, retinoschisis-related RD, and a dislocated lens nucleus noted before cataract surgery.

The electronic patient record requires the documentation of demographic characteristics, extent of RD, presence of retinal break size, and location and number of breaks found during surgery. A digital retinal drawing of intraoperative clinical findings pertinent to the RD was saved immediately after surgery. All patient data and retinal fundus drawings were anonymized then classified (retrospectively) by a masked observer (T.H.W.). The total number of breaks in all quadrants was recorded for the affected eye as a discrete variable (ie, 1, 2, 3, etc). The presence of a break (or breaks) in each quadrant was recorded as a categorical variable (ie, present or absent).

Drawings were divided into 4 quadrants centered at the fovea: ST, superonasal (SN), inferotemporal (IT), and inferonasal (IN). The observer recorded whether the eye had any breaks (true or false) in any of the 4 quadrants. This method was used to avoid any conflict of dependent variables that would arise by counting the numbers of breaks in each quadrant and using these as independent variables, a procedure that has been used in prior studies and has resulted in erroneous statistical analysis because multiple breaks in the same eye are not independent variables.[11,12] The presence of inferior breaks was recorded, specifically noting whether breaks were present between 5 and 7 o'clock (true or false), or at 4 to 5 o'clock or 7 to 8 o'clock (true or false), and whether these were in attached or detached retina. These inferior breaks can present particular challenges in surgical management compared with breaks elsewhere; hence, similar subdivisions were not applied to superior, nasal, or temporal breaks. Eyes were regarded as having an anterior break if a break was identified anterior to a line halfway between the equator and the ora serrata. Eyes had a posterior break if a break was seen posterior to a line of similar distance posteriorly from the equator.

In addition, breaks were classified as small (<0.5 disc diameters [DD]), medium (0.5 to 2.0 DD), or large (>2 DD) according to their longest meridian in relation to the optic disc diameter. Eyes were recorded (true or false) as having small, medium, or large breaks. Thus, a single eye could be recorded as having small, medium, and large breaks if all sizes were present. The presence of proliferative vitreoretinopathy (PVR), vitreous hemorrhage, procedures undertaken, and outcomes also were recorded prospectively.

Seven hundred sixty-one patients (90%) underwent 20- or 23-gauge 3-port pars plana vitrectomy and 83 patients (10%) underwent primary scleral buckling alone. When performing pars plana vitrectomy, the authors always remove vitreous up to the vitreous base with the aid of a wide-angle viewing system (BIOM; Oculus Optikgeräte GmbH, Wetzlar, Germany). A blunt instrument then is used for deep scleral indentation and retinal inspection with concurrent endoillumination, as previously described.[5] The sclera is rolled in a posteroanterior fashion up to the ora then anteroposteriorly and repeated circumferentially across the entire vitreous base. Patients who underwent a primary scleral buckle had binocular indirect ophthalmoscopy with indentation at the time of surgery to ensure that all breaks were treated appropriately.

Regression models were constructed to test the association of several outcomes in relationship with others hypothesized to be risk factors. For binary outcomes (such as presence or absence of a retinal tear in a specific quadrant, multiplicity of breaks in the examined patient's eye, etc), logistic regression models were used. Ordered logistic regressions were used for the analysis of number of retinal breaks. Stata 12 software (Stata Corp, College Station, Texas, USA) was used for all analyses, and *P* values less than .05 were considered significant.

RESULTS

DATA FROM A TOTAL OF 851 PATIENTS WITH AN RRD IN THEIR first eye between January 2001 and September 2011 were part of this study. Seven patients (0.8%) were excluded because of insufficient data. The mean age ± standard deviation of the 844 included patients was 62 ± 11 years. Five hundred six subjects (60%) were men, and in 468 (55%), the affected eye was the right eye. Almost one third (n = 252; 30%) of patients were pseudophakic with posterior chamber intraocular lens implants. The others were phakic (n = 592; 70%), of whom 45% (n = 265) had evidence of cataracts of varying severity. The overall primary success rate for this cohort was 87% (n = 734), with a 3% final failure rate (n = 24). Ten percent of patients (n = 86) required further surgery, but achieved final retinal reattachment with multiple surgical procedures.

Most patients had horseshoe tears (n = 592; 70%), with 10% (n = 88) having round holes and the rest mixed. More than one third (n = 328; 38.9%) of eyes had solitary breaks, and 58.8% (n = 496) had breaks in more than 1 quadrant. The proportion of patients in the groups with multiple breaks approximately halved for every additional break found (Figure 1). There was no statistical association between the macular status of the RD and multiplicity of breaks (*P* = .3546, Fisher exact test) with 57.8% of patients with multiple breaks having fovea-off RD and 54% with single breaks having fovea-off RD.

The ST quadrant was most frequently involved (582 eyes; 69%). The SN and IT quadrants were involved in 341 (40%) and 274 (32%) eyes, respectively. The IN