Epidemiology of Giant Retinal Tears in the United Kingdom: The British Giant Retinal Tear Epidemiology Eye Study (BGEES)

Ghee Soon Ang, John Townend, and Noemi Lois

PURPOSE. To determine the incidence of giant retinal tear (GRT) in the United Kingdom and to provide epidemiologic data, clinical characteristics, treatment methods, and short-term outcomes in affected and fellow eyes.

METHODS. Patients with a newly developed GRT (90° or greater in circumferential extent associated with posterior vitreous detachment) were identified prospectively over a 13-month period (January 2007–January 2008, inclusive) by active surveillance through the British Ophthalmic Surveillance Unit. Questionnaire-based data were obtained from reporting ophthalmologists at baseline and 12 months.

RESULTS. Sixty patients (62 eyes) developed a new GRT, giving a U.K. annual incidence of 0.094 (95% CI 0.072–0.120) cases or 0.091 (95% CI 0.069–0.117) patients per 100,000. The GRTs were mostly idiopathic (54.8%), affected middle-aged (mean, 42.2 years), white British (93.5%) males (71.7%), with presenting vision worse than 20/40 in 59.7%, foveal detachment in 45.2%, and proliferative vitreoretinopathy of grade C (PVR-C) or worse in 11.3%. Treatment in most was managed by pars plana vitrectomy (93.5%) with laser retinopexy (52.5%) and silicone oil endotamponade (75.8%). Prophylactic 360° laser or cryotherapy was applied to 39.0% of the fellow eyes. At mean follow-up of 11.3 months, eventual retinal reattachment was attained in 94.7%, although only 42.1% achieved vision of ≥20/40. Neither GRT nor RD developed in any of the 19 nontraumatic, noniatrogenic, prophylactically treated fellow eyes.

CONCLUSIONS. This study is the first population-based prospective effort to evaluate the epidemiology of GRT. Although only a minority presented with PVR-C and high retinal reattachment rates were achieved, fewer than half had vision sufficient for driving in the GRT eye. (Invest Ophthalmol Vis Sci. 2010;51:4781–4787) DOI:10.1167/iovs.09-5036

A giant retinal tear (GRT) is defined as a full-thickness retinal break extending circumferentially for ≥3 clock hours (≥90°) in the presence of a posteriorly detached vitreous.1–5 GRTs are rare; their incidence has not been well established in the literature. The reported estimates of 0.05 per 100,000 of the general population per year or 0.5% to 8.3% of all cases of rhegmatogenous retinal detachment (RD)4,6–8 come from retrospective, single center, hospital-based studies, as is the case with regard to other characteristics of eyes harboring GRTs. Thus far, there have been no prospective, population-based studies conducted to evaluate the incidence of GRT. In 1997, a national audit of primary surgery for rhegmatogenous RD was conducted in the United Kingdom that provided valuable information on outcomes and complications of RD repair.9–10 However, this retrospective survey recorded data obtained during a very short period within that year and was not designed to evaluate incidence of GRT. It also did not allow any conclusions to be drawn with regard to outcomes and complications of the surgical repair of GRT, as there were only five GRTs in the audit.

The purpose of this study was therefore to prospectively estimate the incidence of GRT in the general population in the United Kingdom and to gain knowledge on the etiology and the demographic and clinical characteristics of GRT. In addition, we sought to determine the preferred surgical approach for the treatment of GRT, anatomic and visual outcomes and complications of the surgery, and the frequency and preferred method of prophylaxis in fellow eyes of patients with GRT.

METHODS

Patients with newly diagnosed GRT were identified prospectively through active surveillance by the British Ophthalmological Surveillance Unit (BOSU) during a 13-month period from January 2007 to January 2008 inclusive. BOSU operates a monthly active surveillance scheme throughout the United Kingdom.11 It was developed to assist in the investigation of uncommon ocular conditions that are of public health or scientific importance. The surveillance scheme involves all permanently employed ophthalmologists in the United Kingdom with clinical autonomy (consultants and associate specialists), who form the reporting base. Before the initiation of a study, the BOSU informs all ophthalmologists about the new ocular condition under investigation, including the specific case definition. At the end of each month, a report card is sent to each ophthalmologist, who then returns it specifying whether a new case had been seen that month. After case notification, incident and follow-up questionnaires are sent by the investigators to the reporting ophthalmologists. In the present study, as an additional measure to achieve as complete an ascertainment as possible, units that had not reported a case of GRT, but that were covering a population sufficiently large to reasonably be expected to yield a case of GRT, were independently contacted to confirm the absence of GRT cases during the 13-month study period.

The baseline incident questionnaire collected data on age, sex, ocular history, predisposing factors, visual acuity and clinical features at presentation, surgical technique, and prophylaxis in the fellow eye. Proliferative vitreoretinopathy (PVR) was graded according to the Silicone Study Group classification.12–13 The follow-up questionnaire,
sent at 1 year, collected data on anatomic and visual outcomes and intraoperative and postoperative complications in the affected eye, as well as complications of prophylaxis in the fellow eye, when performed. In addition, information about the development of GRT or RD in the fellow eye was noted.

This study was conducted in accordance with the tenets of the Declaration of Helsinki. Approval was granted by the North West Multi-center Research Ethics and the NHS Grampian Research and Development committees.

RESULTS
Incidence
From January 2007 to January 2008 inclusive, 81 report cards for GRT were returned to the BOSU. Of these, 61 contained confirmed or possible cases of GRT, and 20 were not suitable for inclusion in the study. The latter (n = 20) referred to 10 duplicate/repeat reports, 8 incorrect diagnoses, and 2 GRTs that did not present during the specified study period. Of the 61 confirmed or possible cases of GRT, 48 were confirmed as definite. In 10 of these 61 cases, the ophthalmologists had not retained information on the patient reported and thus could not recall or retrieve any data. In the three others, the ophthalmologists who had reported the cases never returned completed questionnaires despite multiple reminders. There were an additional 14 cases of confirmed GRT not ascertained via the BOSU that were directly reported to the investigators (see the Methods section). Therefore, a total of 62 GRTs were confirmed over the 13-month study period: 48 (77.4%) from BOSU and 14 (22.6%) without BOSU. Follow-up data were available for 58 (93.5%) of the 62 cases.

In mid-2007, the U.K. Office for National Statistics projected the population to be 60,975,000. With 62 cases of confirmed GRT in 60 patients over 13 months, the estimated annual incidence of GRT in the United Kingdom was 0.094 cases per 100,000 individuals (95% CI 0.089–0.142 cases per 100,000). Therefore, the results suggest an annual incidence of GRT in the UK of between 0.094 and 0.114 cases per 100,000 individuals. Since we did not know whether these possible cases were bilateral or unilateral, we were not able to estimate the corresponding upper limit of incidence based on the number of patients.

Presenting Features
Baseline characteristics, available for 62 eyes of 60 patients, are summarized in Tables 1 and 2. The baseline characteristics were no different between the GRTs reported to BOSU and those directly reported to the investigators. GRTs most often affected middle-aged (mean age, 42.2 years; range, 5–79), white British (93.3%) males (71.7%). GRT occurred most commonly in those aged between 41 and 60 years (45.2%; 28/62). In six (9.7%) patients the eye affected by GRT was the second eye, with the first eye having had a previous GRT. Most GRTs were idiopathic (34 eyes, 54.8%); when pseudophakic eyes were excluded from this group, idiopathic GRT was still the most common type observed (n = 28; 45.2%). The median presenting vision was 20/80 (range, 20/15–light perception). A significant proportion of eyes presented with vision of 20/40 or better (40.3%), attached fovea (54.8%), and no PVR (69.4%). Cases of traumatic GRT (10 eyes) also occurred commonly in middle-aged (mean age, 40.0 years; range, 17–65), white British (100%) males (80%). Most were due to blunt trauma (90%), and the GRT developed within 1 month of the injury (70%).

Surgical Treatment
Data regarding the intraoperative management techniques used in the surgical repair of these cases are presented in Table 3. Nearly all GRTs (93.5%) were treated by pars plana vitrectomy (PPV). In three instances, PPV was not the initial treatment. One (1.6%) of these three cases was treated with cryotherapy and scleral buckle surgery, as it was initially thought to be a retinal dialysis but was subsequently confirmed to be a GRT. The retina in this eye remained attached at the last available fol-
Management Data

<table>
<thead>
<tr>
<th>Management Data</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Affected eyes</td>
<td></td>
</tr>
<tr>
<td>Vitrectomy</td>
<td>58 (93.5)</td>
</tr>
<tr>
<td>Laser retinopexy alone</td>
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<tr>
<td>Cryobuckle</td>
<td>1 (1.6)</td>
</tr>
<tr>
<td>No available data</td>
<td>1 (1.6)</td>
</tr>
<tr>
<td>Perfluorocarbon liquid</td>
<td>53 of 59 (89.8%)</td>
</tr>
<tr>
<td>Proliferative vitreoretinopathy membrane peel</td>
<td>5 of 12 (41.7%)</td>
</tr>
<tr>
<td>Anterior flap resection</td>
<td>20 of 59 (33.9%)</td>
</tr>
<tr>
<td>Lens removal (phakic eyes)</td>
<td>4 of 48 (8.3%)</td>
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<td>Local laser retinopexy</td>
<td>31 (52.5)</td>
</tr>
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<td>360° barrier laser</td>
<td>30 (50.4)</td>
</tr>
<tr>
<td>Local cryopexy</td>
<td>20 (33.9)</td>
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<td>360° cryotherapy</td>
<td>3 (5.1)</td>
</tr>
<tr>
<td>360° scleral buckling</td>
<td>5 (8.1)</td>
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<tr>
<td>Silicone oil</td>
<td>47 (75.8)</td>
</tr>
<tr>
<td>Gas</td>
<td>9 (14.5)</td>
</tr>
<tr>
<td>Heavy silicone oil</td>
<td>2 (3.2)</td>
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<tr>
<td>Fellow eyes</td>
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</tr>
<tr>
<td>360° treatment</td>
<td>16 (39.0)</td>
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<tr>
<td>360° laser</td>
<td>10 (24.4)</td>
</tr>
<tr>
<td>360° cryotherapy</td>
<td>6 (14.6)</td>
</tr>
<tr>
<td>Local treatment of breaks/degenerations</td>
<td>3 (7.3)</td>
</tr>
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</table>

Data are expressed as n (%) of 62 affected eyes and 41 fellow eyes, unless otherwise noted.

Outcomes

Outcomes data were available for 57 (91.9%) of the 62 cases and are summarized in Table 4. The mean follow-up duration for this cohort of patients was 11.3 months. Retinal reattachment was achieved in 87.7% of the cases with a single procedure and in 94.7% after multiple surgeries, with visual improvement of at least one Snellen line in 36.8%. In 42.1% of the eyes a vision of 20/40 or better was achieved, which is within the U.K. Driver and Vehicle Licensing Agency (DVLA) vision standard for driving.15 In the eyes that did not attain postoperative vision of 20/40 or better, the commonest known reasons for poor vision were macular disease, such as epiretinal membranes and holes (17.6%), cataract (17.6%), and posterior capsular opacification (11.8%). The commonest postoperative complication was cataract (31/44 phakic eyes) followed by raised intraocular pressure requiring treatment (16 eyes; 27.6%).

Fellow Eye

The median presenting BCVA for the fellow eye was 20/40 (range, 20/15–light perception). Of the 50 nontraumatic, noniatrogenic GRT fellow eyes, vitreoretinal disease was noted in 13 (26.0%). Prophylaxis was not performed in any of the traumatic or iatrogenic fellow eyes. Prophylaxis was considered not applicable in nine (18.0%) eyes: Six (12.0%) had previous or current GRT, and three (6.0%) had previous or current non-GRT RD (Table 2). Prophylactic treatment over 360° was performed in 16 (39.0%) of the 41 nontraumatic, noniatrogenic fellow eyes that could have undergone treatment. Prophylactic treatments included 360° laser photocoagulation, which was used in 10 (24.4%) eyes and 360° cryotherapy, which was used in six (14.6%) eyes. Local treatment with either laser photocoagulation or cryotherapy was applied to three eyes (two with retinal breaks and one with a localized dialysis). One patient declined prophylaxis. Table 3 summarizes the prophylactic treatments.

None of the 19 prophylactically treated fellow eyes had a GRT or an RD at the end of follow-up. Of the 22 nontraumatic, noniatrogenic fellow eyes that did not receive prophylaxis, 1 (4.5%) developed a GRT 3 months after presentation, and 1 of the 10 traumatic fellow eyes developed an RD after a subsequent alleged assault (Table 4).

Discussion

Our estimated incidence of GRT (0.094–0.114 cases per 100,000 annually) in the general U.K. population suggests that it may occur more commonly than previously thought (~0.05 per 100,000 yearly).4 This disparity may have occurred because previous estimates were generally derived from retrospective data from single tertiary referral centers. The design of the present study (prospective nationwide surveillance) allows the capture of most GRTs, including the more straightforward cases that would be unlikely to be referred to highly specialized hospitals, thereby giving higher incidence rates. However, there is a possibility that the incidence of GRT is even higher than that reported herein, because of incomplete ascertainment, which is a known limitation of surveillance studies.11 Unfortunately, it was not possible to determine the exact number of cases that were unreported; similarly, it was not possible to know whether reported cases in which data were not collected were unilateral or bilateral.

GRTs are thought to be most commonly idiopathic or spontaneous. These have been estimated to represent 28% to 78% of all GRTs.1–3,16–21 The wide range of incidence may be due, at least partly, to the definition of idiopathic GRT used in previous (and possibly outdated) studies: In some case series, idiopathic GRTs were considered to be those that were nontraumatic, whereas in others, idiopathic referred to the absence of...
**Table 5. Summary of the Six Largest Case Series on GRTs**

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Study Duration (mo)</th>
<th>Mean Follow-up Duration (mo)</th>
<th>Mean Presenting Age (y)</th>
<th>Traumatic GRT (%)</th>
<th>Presenting Vision 20/40 or Better (%)</th>
<th>PVR (%)</th>
<th>GRT &gt; 180° (%)</th>
<th>Final Vision 20/40 or Better (%)</th>
<th>Final Vision Worse Than 20/200 (%)</th>
<th>Retinal Reattachment after Primary Surgery (%)</th>
<th>Retinal Reattachment at Last Visit (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaver and Billington</td>
<td>Retrospective single-center consecutive case series</td>
<td>56</td>
<td>60</td>
<td>36</td>
<td>17.1</td>
<td>N/A</td>
<td>N/A</td>
<td>45.3</td>
<td>17.2</td>
<td>51.6</td>
<td>50.0</td>
<td>73.4</td>
</tr>
<tr>
<td>Kertes et al.</td>
<td>Prospective multicenter selected case series</td>
<td>55</td>
<td>13.7</td>
<td>41.9</td>
<td>25.3</td>
<td>13.3</td>
<td>40.7</td>
<td>24.7</td>
<td>14.8</td>
<td>51.2</td>
<td>50.6</td>
<td>90.7</td>
</tr>
<tr>
<td>Scott et al.</td>
<td>Prospective multicenter selected case series</td>
<td>23</td>
<td>3.8</td>
<td>41</td>
<td>*</td>
<td>N/A</td>
<td>38.2</td>
<td>19.3</td>
<td>N/A</td>
<td>50.9</td>
<td>N/A</td>
<td>78.8</td>
</tr>
<tr>
<td>Sirimharaj et al.</td>
<td>Retrospective single-center consecutive case series</td>
<td>96</td>
<td>24.5</td>
<td>44.2</td>
<td>30.6</td>
<td>40.3</td>
<td>29.0</td>
<td>27.4</td>
<td>54.8</td>
<td>12.9</td>
<td>77.4</td>
<td>93.5</td>
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<tr>
<td>Al-Khairi et al.</td>
<td>Retrospective single-center consecutive case series</td>
<td>144</td>
<td>29.7</td>
<td>30.3</td>
<td>20.5</td>
<td>17.9</td>
<td>*</td>
<td>23.1</td>
<td>17.9</td>
<td>N/A</td>
<td>78.6</td>
<td>94.0</td>
</tr>
<tr>
<td>Lee et al.</td>
<td>Retrospective single-center</td>
<td>180</td>
<td>N/A</td>
<td>39.6</td>
<td>13.3</td>
<td>N/A</td>
<td>9.4</td>
<td>5.5</td>
<td>41.4†</td>
<td>29.3†</td>
<td>71.7†</td>
<td>84.8†</td>
</tr>
</tbody>
</table>

* Excluded from the study.
† n = 99 cases.
any known predisposing factors, including high myopia and previous intraocular surgery.\textsuperscript{1,5,16–21} If eyes with predisposing factors other than trauma (such as high myopia and previous intraocular surgery) had also been excluded, then it is likely that the incidence of true idiopathic GRT would be less than that reported in the various case series. In the present study, GRT was defined as idiopathic in the absence of any known predisposing factors, including hereditary vitreoretinopathy, myopia greater than −6 D, aphakia, complicated cataract surgery, and trauma. According to this definition, the incidence of idiopathic GRT was 54.8%.

The most common predisposing factors for the development of a GRT in the present study were trauma (16.1%), hereditary vitreoretinopathies (14.5%), and high myopia (9.7%). In other published series, the GRTs were attributed to trauma in 9% to 43%, inherited vitreoretinopathies (such as Stickler syndrome) in 1% to 8%, and high myopia in 12% to 47%.\textsuperscript{1,5,16–34} Apart from two prospective multicenter studies, these statistics come mostly from single center, hospital-based, retrospective studies with relatively small sample sizes and therefore inherent weaknesses including selection biases. The Perfluoron Study Group and Vitreon Collaborative Study Group were both prospective, noncomparative, observational, multicenter series with large sample sizes, but cases were selected to fulfill the inclusion criteria and therefore the studies cannot be considered suitable to provide epidemiologic data.\textsuperscript{29,30} Whereas the incidence in the present study of traumatic GRT was lower than that generally found in the literature, that of GRT from hereditary vitreoretinopathies was higher than expected. A possible explanation of this is that some of the highly myopic eyes in previously reported series had concurrent undiagnosed inherited vitreoretinopathies. Another possibility may be that these cases could have been referred to highly specialized centers and were therefore missed by the retrospective evaluation. GRTs have been described after both routine and complicated ocular surgery, including vitrectomy and refractive surgery.\textsuperscript{35–40} Such incidences occurred rarely in the present study, with only two (3.2%) cases reported intraoperatively during vitrectomy. No eyes in this study were described to have other rarer conditions associated with GRT, such as aniridia, lens coloboma, retinitis pigmentosa, and acute retinal necrosis.\textsuperscript{31–37}

Overall, the mean age of 42.2 years and predominantly male preponderance (71.7%) were both consistent with data in previous reports.\textsuperscript{3,16,20,28,50,51} The proportion of eyes presenting with a BCVA of 20/40 or better was 40.3%, within the 0% to 50% range observed in other published studies.\textsuperscript{20,21,24,27,28,30,54,48–50} However, only 16.2% presented with BCVA worse than 20/200, and this was better than the 33% to 91% described in other studies.\textsuperscript{19,24,27–30} These relatively good levels of presenting vision may be considered a reflection of the comparatively low number of fovea-off detachments (45.2%), greater than 180° GRT (12.9%), and PVR grade C (PVR-C) or greater (11.3%) in the present study. In contrast, other publications have reported fovea-off RDs in 31% to 94%, GRT greater than 180° in 6% to 62%, and severe PVR in 9% to 62%.\textsuperscript{16–19,21,23,24,26–28,30,51}

Although a small randomized clinical trial for GRT with PVR-C or greater found no difference in the 5-year anatomic reattachment, visual outcomes, and complications between postoperative tamponade with silicone oil or long-acting perfluoropropane (C3F8) gas,\textsuperscript{52} silicone oil is still the tamponade of choice in most centers across the world, including the United Kingdom.\textsuperscript{17–19,22–25,27,53,54} This preference is reflected in the present study, where silicone oil was found to have been used in 75.8% of cases, even though only 11.3% presented with PVR-C or worse.

In the present study, the retinal reattachment rate for GRT without PVR was 82.1% after the primary procedure, with final reattachment of 94.9% at last follow-up; for GRT with PVR, these rates were 72.2% and 94.4%, respectively. These percentages are similar to the published rates in the literature of 68% to 91% reattachment after one procedure and 94% to 100% at the last visit for GRT without PVR\textsuperscript{16,20,48–50} and 70% to 90% reattachment after the first operation and 74% to 97% at the final visit for GRT with PVR\textsuperscript{33,34,52,53,55,56}. These results are also comparable to the 82.0% (95% CI, 77.9–85.7) retinal reattachment rate after primary surgery by retinal specialists in the 1997 U.K. national audit of primary surgery for rhegmatogenous RD.\textsuperscript{39} With regard to visual acuity, GRT without PVR achieved final BCVA of 20/40 or better in 46.2% and worse than 20/200 in 17.9%; for GRT with PVR, these BCVAs were achieved in 33.3% and 27.8%, respectively. This result was also comparable to the BCVA outcomes of previously published series: 20/40 or better in 18% to 50% and worse than 20/200 in 0% to 6% for GRT without PVR\textsuperscript{16,20,48–50} and 20/40 or better in 10% to 64% and worse than 20/200 in 20% to 58% for GRT with PVR\textsuperscript{33,34,52,53,55,56}. As with other characteristics of GRT discussed herein, it is not possible to draw comparisons between previous case series and the current data due to methodological differences among studies. It must also be pointed out that the better reported outcomes quoted were generally drawn from smaller case series with sample sizes of fewer than 30 cases. Data from the six largest case series on GRT (which include two prospective multicenter studies from the Vitreon Collaborative Study Group and Perfluoron Study Group respectively and four retrospective single hospital case series) are summarized in Table 5.

The fellow eye of patients with nontraumatic GRTs is at an increased risk of GRT and RD. In a large series of 228 fellow eyes of nontraumatic GRTs in a study by Freeman,\textsuperscript{4} the 124 eyes that did not receive prophylactic treatment had an 11.3% incidence of GRT over a mean follow-up of 3.7 years.\textsuperscript{57} Furthermore, RDs not associated with GRT may occur in up to 36% of fellow eyes.\textsuperscript{1,4,5,57} It should be noted that in the present study, among the nontraumatic and noniatrogenic cases at presentation, 12.0% were fellow eyes of patients who had a history of GRT, compared with 6.6% in the Freeman\textsuperscript{4} series. In addition, present or previous RD, retinal breaks (other than GRT), or retinal changes predisposing toward the development of RD were observed in 26.0% of fellow eyes of nontraumatic and noniatrogenic GRT. Although somewhat lower than the 31% to 81% reported in the literature,\textsuperscript{3,16,20,48–50,54} the rate still represents a high proportion of fellow eyes at risk of visual loss due to RD. Various prophylactic methods have therefore been proposed to prevent or limit the occurrence of GRT and/or RD in fellow eyes, including 360° encircling scleral buckle, cryotherapy, or laser photocoagulation.\textsuperscript{4,5,10,15,54,57–62} There is no strong evidence, however, to support or refute the value of these procedures in preventing a GRT, and they are not without possible adverse effects.\textsuperscript{65} Furthermore, it is not certain which method is most effective.\textsuperscript{63} In the present study, none of the 19 eyes that received prophylactic treatment (whether 360° or local) developed a GRT or an RD throughout the follow-up, whereas 1 (1.6%) of the untreated fellow eyes developed a GRT 3 months after presentation. Caution should be taken, however, when interpreting these results due to the relatively short follow-up and the fact that the status of the vitreous of the fellow eye was not recorded.\textsuperscript{1,4,5,57,62,64–66}

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References


