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Editorials

Macular holes

Despite macular holes first being described in 1869 by Knapp[1] in Germany and in 1900 by Collins[2] in Britain, little attention seemed to have been given to this condition for many years thereafter. The original descriptions implicate trauma as being the most important predisposing cause but myopia,[3] intraocular inflammation,[4] cataract surgery,[5 6] central vein occlusion,[7] and diabetic maculopathy[8] have all subsequently been associated with the condition. As far back as 1955, Schepens[9] noted the importance of the vitreous configuration in the development of macular holes but the importance of this observation appeared to have been overlooked subsequently, and this may well have been due to the difficulties of performing detailed examinations of the vitreous structure. In 1953, Irvine[10] described aphakic macular oedema and suggested vitreomacular traction as contributing to its development. This concept was reviewed again in the late 1960s by Tolentino and Schepens[11] and Reese *et al*[12] and it is in these papers that the observation of improvement in visual acuity following spontaneous relief of vitreomacular traction is described. The next step was to consider the possibility of dividing the vitreomacular adhesions but in the pre-vitrectomy era there was no obvious means of doing this. Reese and colleagues[12] were well aware of the limitations of treatment at that time and conclude their paper by suggesting that 'Increasing or decreasing vitreous pressure or disruption of the symphisis by ultrasonics might be worthwhile'.

More recently, the concept of idiopathic macular holes has been established.[13] These tend to occur in the sixth and seventh decades, with a female preponderance, and no obvious systemic predisposing factors and, although systemic hypertension has been found in up to 48% of patients[14] this may be of limited significance since a prevalence of 37% is to be expected in this age group.[15] None the less, since impaired choroidal blood flow has been implicated in this condition, possibly as the first stage in its development,[16] the role of hypertension still needs to be considered.

It is, however, the role of the vitreous which is of most relevance to the development of macular holes and this is comprehensively described by Gass[17] with the description of four stages in the development of macular hole formation. The strong correlation between vitreomacular attachment and the subsequent progression to full thickness hole formation is described in this paper as well as in others.[14 18–20]

Based on these observations, the next step was to see whether vitreous surgery might be effective in arresting the development of full thickness macular holes and to try and establish the optimal stage for surgical intervention. The results of various trials are now available and the indications for surgery are becoming clearer. In stage 1 holes, surgery would appear to have no effect on the prognosis with nearly 40% of both operated and observed groups going on to develop full thickness macular holes.[21] It is, however, essential to distinguish between stage 1 holes with vitreomacular attachment and those where vitreomacular separation has already occurred, since their natural history is quite different. This study[21] comparing surgery for stage 1 holes excluded those with vitreomacular separation since it was already established that a pre-existing posterior vitreous detachment reduced the chances of progression considerably.[22] This is confirmed by Hikichi *et al* in their paper published in this issue of the *BJO* (p 517), who show a 33% risk of developing a full thickness macular hole in patients with vitreomacular attachment compared with a 0% risk in eyes with posterior vitreous separation. Stage 2 holes, however, may benefit from timely vitrectomy, with one study showing 61% of operated eyes with improved acuity and 27% maintaining preoperative vision.[22] This is in marked contrast with previous studies[24 25] as well as the one by Hikichi *et al*, all of which report 70–85% rate of progression to stage 3 or 4 macular holes with commensurate reduction in vision. Vitrectomy for stage 3 and 4 macular holes suggests anatomical success in preventing enlargement of the holes in 73% and increased acuity in 52%,[26] but again this has to be compared with the natural history. The majority of patients with stage 3 or 4 macular holes have acuities of around 6/60 and although the macular holes may enlarge further, it is unlikely that the visual acuity will deteriorate significantly. When considering only the affected eye there can be little doubt that the clearest indication for surgery is the presence of a stage 2 hole. This is not only shown by the results of surgery, but also by the careful documentation of the natural history of macular holes, such as is reported by Hikichi *et al*.

Whereas all the techniques described so far are intended to prevent or arrest the development of a full thickness macular hole, it is also possible to influence the reparative process which can occur after the development of a macular hole. Gass[17] described the window defect found on fluorescein angiography in stage 2, 3, or 4 macular holes and showed this to be caused by the defect in the neurosensory retina. This window defect had been

observed to disappear[27] indicating that some type of reparative process was occurring, and a subsequent clinicopathological study[28] clearly demonstrated that the defect was being repaired by glial cell proliferation. Glaser and his colleagues realised the potential of augmenting this reparative process with the use of transforming growth factor β2 during vitrectomy and showed not only encouraging results when used together with vitrectomy,[29] but also that epiretinal membrane peeling may not be necessary if transforming growth factor β2 is used during vitrectomy,[30] thus reducing the chances of iatrogenic retinal tears.

The issue of surgery for macular holes is, however, much more complex than simply comparing the results of surgery and the natural history in one eye. Most patients presenting for consideration of surgery will be in their sixth or seventh decade and the risks of any surgical procedure have to be considered. In addition, there is the possible association with systemic hypertension.[14] It has been suggested that there is an excess of women who have undergone hysterectomy in patients presenting with macular holes,[14] and this has to be considered since such women are known to be more prone to ischaemic heart disease. But for many patients in this age group who present with a normal fellow eye their main concern will be the likelihood of the sight deteriorating in their good eye, and it is helpful to review the literature on this. Bronstein *et al*[31] found a 22% rate of progression to full thickness macular hole overall with a 3 year follow up, but showed a wide range depending on the appearance of the macula. With a normal fellow eye there was a 12% chance of developing a full thickness macular hole in 3 years. Where macular pigment defects were present, the risk increased to 33%, and where a macular cyst was found, the risk increased to 50%. This study did not, however, take into account the vitreous configuration and, as shown by Trempe *et al*,[32] there was a 29% rate of developing full thickness macular holes over 4 years where vitreomacular attachment was found, compared with 0% where the vitreous had separated from the macula. One other study suggests that the risk of developing a full thickness macular hole in the fellow eye is as low as 1% in 5 years if examination of that eye is normal.[33] The publication of a further study on the natural history of macular holes in this issue of the *BJO* is, therefore, to be welcomed to help clarify this. In order to be able to advise an individual patient it is thus necessary to examine the macular retina carefully, possibly with fluorescein angiography, and also to note carefully the vitreomacular relations. The examination needs to be undertaken thoroughly since it is easy to misinterpret findings, and in one study[34] only one out of 21 referrals with suspected macular holes was confirmed as being a true macular hole. Finally, it must be realised that in this age group a vitrectomy carries with it a 20–25% risk of requiring cataract surgery within 5 years[30 35] and prospective patients must be made aware of this.

The indications for surgery in macular holes are gradually becoming clearer but there is still plenty of scope for further studies in order that the patients most at risk may be identified and offered surgery at an appropriate stage in the evolution of their disease. The paper by Hikichi is one against which the results of any surgical procedure should be compared.

TOM BARRIE

West Glasgow Hospitals University NHS Trust,
Glasgow Eye Infirmary,
Glasgow G3 7NB

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