INDIRECT ARGON LASER DRAINAGE OF SUBRETINAL FLUID

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SUMMARY

We report on a new method of subretinal fluid drainage which uses the indirect ophthalmoscopic delivery of argon laser energy to perforate the choroid. This carries all the theoretical advantages of drainage with the endolaser probe but is simpler and less expensive. We present a prospective series of 31 patients in whom this method was applied. Satisfactory drainage was obtained in 28. There were 4 cases of limited subretinal haemorrhage attributable to the laser, and 1 case of subfoveal haemorrhage. No cases of retinal perforation or incarceration were observed.

Trans-scleral drainage of subretinal fluid (SRF) facilitates repair of very bullous retinal detachments by allowing more accurate localisation and cryopexy of breaks, by augmenting the effect of external buckles and by creating volume for internal tamponade.

A variety of drainage techniques have been described, including simple trans-scleral needle perforation,[1] scleral cut-down (sclerotomy) with choroidal diathermy and perforation,[2–4] monitored SRF aspiration[5] and photocoagulation with the endolaser probe.[6–9] This last method has a number of theoretical advantages but its use remains limited due to the high cost of the laser probes.

We report a new method of SRF drainage, using the argon laser delivered via the indirect ophthalmoscope and focused with a hand-held condensing lens to penetrate the choroid, and present the results of a pilot study on a prospective series of patients in whom this method was applied.

PATIENTS AND METHODS

Thirty-one patients presenting at Moorfields' Eye Hospital with bullous, rhegmatogenous retinal detachments between 1 October 1993 and 28 February 1995 underwent indirect laser drainage (ILD) as part of a retinal re-attachment procedure. Twenty-nine of these underwent an external scleral buckling procedure and a further two had ILD in conjunction with a vitrectomy.

In all patients the site of drainage was selected in the area of the highest retinal elevation. A 2 mm sclerotomy was created with a razor fragment to expose the choroid. In the early stages of the study a pair of scleral spreading forceps was used to maintain sufficient choroidal exposure, but in the later cases it was found that adequate exposure could be obtained by applying bipolar diathermy to the superficial sclera at the margins of the sclerotomy.

The argon laser was set on pulse duration of 0.5 s and power of 600–800 mW. The aiming beam was focused on the exposed choroid with a 20 dioptre lens, and the laser was activated with the foot pedal. In most cases a single shot was sufficient to obtain free flow of SRF. In the early stages of the study multiple shots of lower energy (400 mW) were used. A maximum of 10 applications were tried, after which conversion to suture needle drainage would be carried out.

Once free flow of SRF had been obtained, the drainage site was immediately observed using the laser indirect ophthalmoscope while maintaining continuous digital pressure on the globe for as long as free flow of SRF was required.

The procedure was completed with monitored cryotherapy or indirect laser retinopexy, air or gas injection if indicated, and placement of an appropriate scleral buckle.

The completeness of drainage was assessed at the end of the procedure and the presence and location of any complications such as retinal perforation, retinal incarceration or subretinal haemorrhage were noted. Drainage was classified as complete when no

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subretinal fluid was visible, and partial when residual SRF was still visible on completion of the procedure. Drainage of SRF was considered 'adequate' when a bubble of air (1 ml or more) could be injected into the vitreous cavity and 'sufficient' retinopexy could be applied around the retinal breaks. 'No drainage' describes the situation where conversion to another type of drainage method was necessary to initiate free flow of subretinal fluid intraoperatively.

Haemorrhage was noted as absent or present and its location classified in a manner similar to Burton *et al.*[10] as: (1) extramacular, i.e. remaining outside the vascular arcades; (2) macular, i.e. extending within the vascular arcades but remaining outside the foveal area; or (3) foveal.

RESULTS

Thirty-one patients were included in the study. Seventeen of these were male and 14 female. The age range was 22–86 years, with an average age of 60.6 years.

Twenty-eight patients underwent a primary procedure and 3 had revision of scleral buckles. Cryotherapy and scleral buckling alone were performed in 12 cases. This was combined with intravitreal injection of air or SF_6 gas in 17 patients. In 2 cases, ILD was carried out in conjunction with vitrectomy, scleral buckle and fluid–gas exchange.

Results are considered with regard to adequacy of drainage of SRF, and incidence of complications.

Adequacy of Drainage of SRF

Seventeen patients had complete drainage, and 11 had partial drainage which was judged to be adequate for the satisfactory completion of the procedure. One patient had partial inadequate drainage. Two patients had no drainage with the laser and suture needle choroidotomy was required to initiate free flow of SRF.

Operative Complications

Choroidal Haemorrhage. Twenty-six patients had no haemorrhage, but in 4 patients extramacular haemorrhages occurred. One of the latter had complete drainage, 2 had partial adequate drainage, and the fourth required needle drainage (although the site of the haemorrhage indicated that the laser and not the needle had been responsible). The haemorrhage resolved with time without any effect on visual acuity in 3 patients; the fourth was the patient with inadequate drainage whose retina remained detached but declined further surgery. There was 1 case of macular haemorrhage; this patient subsequently required a vitrectomy, with a satisfactory outcome.

Incarceration. No cases of retinal incarceration in the drainage site were encountered.

Iatrogenic Hole Formation. No cases of retinal perforation due to the drainage procedure were noted.

Surgical Outcome

The retinas of all 17 of the patients with complete drainage, and 10 of the patients with partial drainage, remained attached. Four patients with partial or no drainage required further intervention, of whom 1 required pneumatic retinopexy, 2 required vitrectomy, and 1 was advised to have vitrectomy but refused further treatment.

DISCUSSION

It is widely recognised that drainage is the most hazardous part of the retinal re-attachment procedure[11] and therefore, in treating patients with retinal detachment, consideration must be given to whether drainage is necessary at all. Lincoff and Kreissig,[12] for example, state that 88% of detachments can be treated with non-drainage procedures, which has the advantage of avoiding intraocular haemorrhage or infection, maintaining clear media, and reassuring the surgeon that a re-attached retina seen on the first post-operative day indicates adequate closure of all retinal breaks. This must be balanced against the advantages of drainage in appropriate cases, particularly when combined with air injection in the treatment of superior bullous detachment.[13,14]

Numerous indications for drainage have been described.[15] These include difficulty in localisation of retinal breaks, the need for internal tamponade with air or gas, retinal immobility, and the need to avoid raising the intraocular pressure in patients with glaucoma. There are, however, some potential complications of SRF drainage, major ones being subretinal haemorrhage, retinal incarceration and retinal perforation.[16] Although we had no cases of retinal perforation or incarceration, in 5 patients (16.1%) we observed a choroidal haemorrhage at the laser choroidotomy site. This compares with rates quoted in the literature of 3.1–12.7% for conventional scleral cut-down,[10,16–18] 14–28.3% for suture needle drainage,[1,10] 22.2% for monitored needle aspiration[10] and 0–5.5% for external argon laser endoprobe drainage.[6–9,19]

In this study, drainage of SRF was accomplished using ILD in all but 2 cases. Both of these occurred early in the study when multiple low-energy laser applications were used. It is possible that this resulted in thermal coagulation of the choroid rather than in its disruption such as was subsequently easily achieved with a single application of laser at a higher energy setting. Nevertheless, in these 2 cases a needle choroidotomy resulted in satisfactory drainage of SRF.

There are theoretical advantages of laser choroidotomy over sharp perforation as the heat generated by the absorption of the laser light provides a degree of coagulation of the choroid at the same time as perforation is achieved. This is reflected in the low rates of haemorrhage quoted for endolaser probe drainage,[6–9] one recent paper claiming a complete absence of subretinal haemorrhages with this technique.[19] The disadvantages of this method are the high cost of endoprobes (at present the cost is £120 per unit), and the fact that a relatively large choroidotomy is produced, as the size of the choroidotomy corresponds to the unfocused beam emerging from the endoprobe tip. An unacceptable number of cases of retinal incarceration have been noted by some (D. Wong, personal communication, 1993).

The advantages of indirect laser drainage are:

1. The exposed choroid can be viewed under the magnification of the condensing lens such that remaining scleral fibres can be divided and large choroidal vessels can be avoided.
2. The size of the choroidotomy is controlled by focusing the aiming beam and a relatively small choroidotomy can be produced.
3. Because the laser delivery system is incorporated in an indirect ophthalmoscope, an instant view of the retina and an internal view of the drainage site is available.
4. Because the surgeon's hands are free, the intraocular pressure can be maintained by digital pressure from the moment that free flow is obtained.
5. As the intraocular volume is reduced, a rapid air or gas injection can be performed while viewing with coaxial illumination to check that the tip of the needle is safely within the vitreous cavity.
6. Immediate cryotherapy or indirect laser photocoagulation around flattened tears can be performed using the same ophthalmoscope.
7. There is a major saving on cost. The initial cost of the indirect delivery system is high but it is already available to most vitreoretinal surgeons for other indications and there is no need to purchase a new endoprobe for each case.

The disadvantages of indirect laser are:

1. As with any newly described surgical technique, there is a learning curve to be surmounted before the surgeon becomes adept and comfortable with the method.
2. The need to follow the guidelines of laser safety regulations is especially important with a system of delivery where laser radiation is not confined by an endoprobe. The possibility that a surgeon might inadvertently move his head during delivery makes it even more important that goggles are worn and that outside personnel are prevented from entry into theatre.
3. It can be seen that complications such as haemorrhage may still arise with this method.

It is difficult to make direct comparisons between series in view of differences in sample size, case mix and surgical practices, but it would seem from this small prospective pilot study that the technique of indirect laser drainage is effective, and comparable to other methods of trans-scleral drainage at least in terms of the incidence of haemorrhagic complications.

Increased experience with the technique seems worthwhile in view of its effectiveness, its ease and the savings to be made in the cost of endolaser probes if the vitreoretinal surgeon prefers laser to needle drainage of SRF. There is a need for a randomised, controlled clinical trial to determine the relative efficacy and complication rates of ILD versus other techniques.

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