

LIGHT COAGULATION IN DIABETIC RETINOPATHY

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The credit for the introduction of the light coagulation equipment must go to Gerd Meyer-Schwickerath (1960) of Gerd who was struck by the idea of its clinical application after observing several cases of burns at the macula following an eclipse of the sun on 10 July 1945. It took four years to translate this concept into the first clinically usable instrument.

Equipment

A. Zeiss White Light Coagulator:

The intense white light produced by the white light coagulator has, as its source of energy, a xenon arc. White light is transmitted by the clear media of the eye and focussed on to the retina, where it is absorbed by the pigment epithelium which transforms it into heat, thereby producing coagulation of anything in contact with it. The Zeiss machine has until recently been the standard equipment; however the instrument is of enormous dimensions, it is not very manoeuvrable and costs around £7,000.

B. The O'Malley Log 2 Portable Light Coagulator:

This portable xenon arc light coagulator devised by P. O'Malley (1973) in Chicago was developed in an attempt to simplify the operative procedure and to make this form of therapy more widely available. The key to the small size of the instrument is a parabolic reflector built into the lamp. The reflector redirects the radiation so efficiently that a 150-watt

lamp performs the same function as the 2,000 watt lamp in Meyer-Schwickerath's instrument. The power unit weighs only 20 kg. and can be run off regular household current. The entire unit housing the delivery system weighs only 3 kg. and is highly manoeuvrable on an articulated arm similar to an 'Anglepoise' lamp. Its present price of £2,800 makes it more accessible, and it is the machine in routine use in our Unit.

C. The Argon Laser:

The Laser is a more recent development, the word having been coined by using the first letters of the phrase 'light amplification by stimulated emission of radiation'. The argon laser for current ophthalmic use is a continuous wave instrument whose green beam of light is developed from the inert gas argon, and besides all the activities of the white light coagulator has the property of being absorbed by haemoglobin. Blood vessels not lying in contact with the pigment epithelium can be coagulated directly. This superb quality makes it eminently suitable for the closure of vessels feeding a proliferation into the vitreous, even of those arising from the optic disc; hence it justifies its actual considerable cost, which is in excess of £15,000. In Edinburgh we are fortunate to be in possession of this equipment made available by a grant supported by the Scottish Home and Health Dept.

Indications for Treatment by Light Coagulation:

The aim of treatment is to break the

cycle of neovascularisation, bleeding and fibrosis; an attempt is made to produce fibrosis on the flat retina before bleeding has occurred. It is considered unwise to treat retinopathy so advanced that it has reached an avascular fibrotic stage as light coagulation may initiate further vitreous and retinal connective tissue contracture.

Lesions amenable to treatment (Chawla 1972):

1. Microaneurysms and round haemorrhages.
2. Blot haemorrhages.
3. Surface new vessels.
4. Surface feeding vessels to intravitreal formations.

Other criteria for treatment adopted in this department include:

- a. Venous abnormalities such as sausageing, indicative of circulation upset.
- b. When one eye has suffered an intravitreal bleed, the other eye is treated in anticipation.
- c. Retinopathy similar to that producing intravitreal bleeding in other patients.

Preparation of Patient:

The patient is placed in a recumbent position. Maximal dilatation of the pupil should be achieved using Phenylephrine 10% and Cyclopentolate 1% — some diabetic eyes are notoriously difficult to dilate. Small pupils make a view of the fundus more difficult and produce overheating of the iris. A retrobulbar injection of 2-3 ml. Lignocaine 2% with hyalase is undertaken to produce satisfactory anaesthesia and abolish ocular motility. The cornea is kept moist by intermittent irrigation with saline. For treatment by the argon laser, a retrobulbar injection is not considered necessary; the patient sits with the head supported at a slit lamp microscope through which the laser beam is delivered. A fundus-viewing contact lens is inserted after topical anaesthesia.

Most of these sessions are carried out on an outpatient basis; the local post-operative treatment by atropine and

steroid is determined by the extent of the therapy. The light incident on the iris can provoke an iritis; care is therefore taken to direct the beam through the centre of the pupil.

Operative Technique:

Great care is taken to identify lesions amenable to treatment. In selected cases preoperative fluorescein angiographic studies and fundus photography are carried out. About 75 to 200 exposures are fired per session; these are delivered by a trigger control in the incorporated ophthalmoscope. In the case of the argon laser a foot pedal operates release of the beam. A note of the number and the sites of application is kept in the patient's records.

Subhyaloid haemorrhages often gravitate to a pool below the site of the actual bleed although a fine trail of clot can be traced to the vessels responsible. Coagulation is confined to the actual new vessels and to the area immediately around them. The initial choroidal reaction is a white plaque of indistinct outline with a fluffy surface. The borders of the coagulated area must extend beyond the edge of the fan of vessels.

For central new vessels not amenable to direct photocoagulation the technique of pattern bombing is adopted destroying large areas of the retina. The rationale here stems from observations that patients with healed chorioretinitis, unilateral carotid disease, myopia and open angle glaucoma appear to have a much milder degree of retinopathy. More and more eyes are subjected to this burn up.

The goal in proliferative retinopathy is to close off permanently the flow of blood into the proliferating systems. Larger veins are avoided; attempts to close vessels in a single sitting is more likely to result in haemorrhage which should be avoided at all costs.

Vitreous Feeders:

A technique of embolisation may be used. Their occlusion may be accomplished by heating the vessel sufficiently

to coagulate blood at the point of treatment. This coagulated blood will be forced forward forming an embolus downstream in one of the branches resulting in complete cessation of flow and drying out of the frond. If the size of a vitreous feeder is smaller than one-third the size of a major vein, it may be attacked directly.

Diabetic Maculopathy:

This can be approached by:

a. Direct method — treating the centres of circinate rings and leaking blood vessels or by

b. Indirect method — placing applications in peri- and paramacular locations or by peripheral pattern bombing.

Light is directed away from the fovea to forestall accidental misplacement.

Complications of Treatment:

1. Haemorrhage: Small intraretinal haemorrhages are frequent but are quickly absorbed. Vitreous haemorrhages are more serious and are more likely to occur with treatment by the laser due to the inherent fragile nature of the vessels at which the beam is directed.

2. Coagulation of paramacular areas may produce paracentral scotoma.

3. Sector field defects.

4. Retinal oedema and exudative retinal detachment.

5. Retinal detachment — by contraction of fibrous bands producing a retinal tear.

Rationale and Comment:

Light Coagulation seems an effective procedure in the direct local attack on new blood vessels, which if left to develop unchecked, give rise to repeated haemorrhages and traction effects which inevitably results in loss of vision. It seems a

paradox that in aiming to improve visual prognosis, destruction of the retina has to be produced. Yet this is understandable if one accepts the theory that neovascularisation is due to vasoformative factors released from hypoxic tissue without adequate drainage. In destroying the vessels and the underlying retina one removes the effect and the cause at the same time.

As with all novel techniques one asks the following questions: Are we accomplishing what we are proposing to do? Are we causing new problems? The justification for using these techniques at all is the fact that the disease is forcing our hand to try some treatment even if it is only a delaying action. As indices of success one assesses pallor of the disc and a return of the veins to normal indicating that the circulation has become more balanced; preservation of sight and remissions must also be taken into account. One must bear in mind the bleak figures published by Arnall Patz (1968) when he assessed the average survival time following total blindness at five years. If light coagulation can preserve sight in this period of stolen time, then it has some place in the treatment of diabetic retinopathy.

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