NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE

Interventional procedure consultation document

Insertion of an epiretinal prosthesis for retinitis pigmentosa

Retinitis pigmentosa is a disease that affects light-sensitive cells in the back layer of the eye (retina), typically leading to progressive and sometimes severe loss of vision. In this procedure small electrodes are implanted onto the retina. A camera, mounted on a pair of glasses, sends information to the electrodes, which stimulate healthy cells in the retina and help the person to see basic images.

The National Institute for Health and Care Excellence (NICE) is examining insertion of an epiretinal prosthesis for retinitis pigmentosa and will publish guidance on its safety and efficacy to the NHS. NICE's Interventional Procedures Advisory Committee has considered the available evidence and the views of specialist advisers, who are consultants with knowledge of the procedure. The Advisory Committee has made provisional recommendations about insertion of an epiretinal prosthesis for retinitis pigmentosa.

This document summarises the procedure and sets out the provisional recommendations made by the Advisory Committee. It has been prepared for public consultation. The Advisory Committee particularly welcomes:

- comments on the provisional recommendations
- the identification of factual inaccuracies
- additional relevant evidence, with bibliographic references where possible.

Note that this document is not NICE's formal guidance on this procedure. The recommendations are provisional and may change after consultation.

The process that NICE will follow after the consultation period ends is as follows.

- The Advisory Committee will meet again to consider the original evidence and its provisional recommendations in the light of the comments received during consultation.
- The Advisory Committee will then prepare draft guidance which will be the basis for NICE's guidance on the use of the procedure in the NHS.

For further details, see the Interventional Procedures Programme process guide, which is available from the NICE website.

Through its guidance NICE is committed to promoting race and disability equality, equality between men and women, and to eliminating all forms of discrimination. One of the ways we do this is by trying to involve as wide a range of people and interest groups as possible in the development of our interventional procedures guidance. In particular, we aim to encourage people and organisations from groups who might not normally comment on our guidance to do so.

In order to help us promote equality through our guidance, we should be grateful if you would consider the following question:

Are there any issues that require special attention in light of NICE's duties to have due regard to the need to eliminate unlawful discrimination, advance equality of opportunity, and foster good relations between people with a characteristic protected by the equalities legislation and others?

Please note that NICE reserves the right to summarise and edit comments received during consultations or not to publish them at all where in the reasonable opinion of NICE, the comments are voluminous, publication would be unlawful or publication would otherwise be inappropriate.

Closing date for comments: 22 January 2015

Target date for publication of guidance: April 2015

1 Provisional recommendations

1.1 Current evidence on the safety and efficacy of insertion of an epiretinal prosthesis for retinitis pigmentosa is limited in quality and quantity. Therefore, this procedure should only be used in the context of research.

1.2 NICE encourages further research on this potentially beneficial technology. Outcomes should include the impact on quality of life and activities of day-to-day living, and durability of implants. NICE may update the guidance on publication of further evidence.

2 Indications and current treatments

2.1 Retinitis pigmentosa is the encompassing term for a group of degenerative eye conditions that cause progressive loss of retinal photoreceptors. The disease is often inherited. Patients initially experience ring scotoma and night vision problems which in most

cases slowly progress, leading to the loss of all peripheral vision. Central vision is usually preserved until late stages of the disease, but can be lost earlier with severe disease.

2.2 Conservative treatments are aimed at early identification and treatment of complications such as cataract or macular oedema. Some newer treatments aim to slow the progression of the condition. Surgical treatments are being developed, including subretinal and epiretinal prostheses, as well as optic nerve implants to restore basic sight.

3 The procedure

3.1 Retinitis pigmentosa causes loss of retinal photoreceptors but inner retinal cells (ganglion and bipolar cells) remain intact. Insertion of an epiretinal prosthesis aims to restore perception of light, movement and shapes by surgically implanting an array of electrodes onto the retina. The electrodes emit electrical impulses to stimulate the sensory neurons of surviving retinal cells, which send visual information to the brain.

3.2 An epiretinal prosthesis system has two key components; an eye implant and external camera system. The eye implant consists of an episcleral receiver unit and an epiretinal electrode array. The external camera system comprises an eyeglass-mounted video camera and a small patient-worn computer (video processing unit, VPU).

3.3 Insertion of the eye implant is performed with the patient under general anaesthesia, usually in one procedure that may take several hours. The surgeon performs core and peripheral vitrectomies, followed by dissection of any epiretinal membrane in the area where the electrode array will be placed. The electrode array is then inserted through a temporal sclerotomy and secured

onto the retina using a retinal tack. It is connected to the receiver unit by a cable that penetrates the sclera in the pars plana.

3.4 After surgery, when the implant is set up and fully functional, the video camera records real-time images and sends them to the VPU. The VPU converts the images into data that are wirelessly transmitted to the episcleral receiver unit. The episcleral receiver unit relays the data to the electrode array, which produces electrical impulses that bypass damaged photoreceptors and stimulate the retina's remaining cells. Visual information is then transmitted by the optic nerve to the brain, creating a visual percept.

4 Efficacy

This section describes efficacy outcomes from the published literature that the Committee considered as part of the evidence about this procedure. For more detailed information on the evidence, see the interventional procedure overview.

4.1 The Committee considered evidence from 7 case series that included a total of 129 patients. However, there is likely to have been considerable overlap between studies with patients taking part in more than one study.

4.2 In a case series of 30 patients implanted with an epiretinal prosthesis, improvements in visual acuity were reported in 23% (7/30) of patients at follow-up of up to 2.7 years. Visual acuity improved from worse than 2.9 logMAR (logarithm of the minimum angle of resolution) to between 2.9 and 1.6 logMAR (p value not reported).

4.3 In the case series of 30 patients, patients were asked to locate a white square that randomly appeared on a black LCD touchscreen. Significantly better square localisation test results were reported in

96% (27/28) of patients when their prosthesis systems were switched on. No further details were provided.

4.4 In the case series of 30 patients, patients were asked to indicate the path of a white bar that swept across a black LCD touchscreen. Significantly better direction of motion test results were observed in 57% (16/28) of patients when their prosthesis systems were switched on. No further details were provided.

4.5 In the case series of 30 patients, patients were asked to stand in the centre of a room, or offset left of centre by 3 feet, or offset right of centre by 3 feet. They were asked to find a rectangular 'door' 20 feet away and to place their hand on it. The mean success rate was 60% when the prostheses were switched on compared against 5% when the prostheses were switched off, at 24–month follow-up.

4.6 In a case series of 6 patients, the mean percentage of successful grasps of a white cube placed on a black surface was 69% when prostheses were switched on compared against 0% when prostheses were switched off, at 3–year follow-up. There was no significant difference between the proportion of successful grasps when patients' eyes were 'patched' (both eyes taped closed) or 'unpatched'.

4.7 Specialist advisers listed key efficacy outcomes as improvement in vision (recognition of words or objects, as well as perception of light, movement or direction), performance in spatial or motor tasks and improved quality of life.

5 Safety

This section describes safety outcomes from the published literature that the Committee considered as part of the evidence about this procedure. For more detailed information on the evidence, see the interventional procedure overview ***[add URL]***.

5.1 All the adverse events presented to the Committee came from a single case series of 30 patients; each affected patient may have experienced more than 1 adverse event.

5.2 Serious retinal complications were reported in 10% (3/30) of patients. A retinal tear was reported in 1 patient (timing not reported and no further details were provided). Rhegmatogenous retinal detachment that required surgical repair was reported in 1 patient. Tractional retinal detachment was reported in 1 patient at 5–month follow-up: the patient had incurred blunt trauma to the eye with the implant, resulting in proliferative vitreoretinopathy that progressed to retinal detachment. This was repaired by vitrectomy, partial retinectomy and silicone oil.

5.3 Replacement of retinal tacks was required within the first few days of implantation in 7% (2/30) of patients.

5.4 Conjunctival dehiscence was reported in 10% (3/30) of patients. Neither the timing nor the clinical significance of these dehiscences was described. They were treated by additional sutures and/or placement of additional tissue.

5.5 Conjunctival erosion was reported in 7% (2/30) of patients. Timing of occurrence was not reported.

5.6 Presumed endophthalmitis was reported, within 8 weeks of surgery, in 10% (3/30) of patients. This resolved in all cases with antibiotic treatment.

5.7 Hypotony was reported in 10% (3/30) of patients within 1 year of surgery. All cases of hypotony required surgical treatment:
2 patients needed intraocular silicone tamponades and 1 patient had the implant removed.

5.8 Severe Inflammatory uveitis was reported in 1 patient. Timing of occurrence was not reported and no further details were provided.

5.9 Intraocular inflammation, hypotony without choroidal detachment, suture irritation and ocular pain were reported in up to 23% (7/30) of patients. All were reported as non-severe events. No exact figures were reported, timing of occurrence was not reported, and no further details were provided.

5.10 Inflammatory conjunctivitis, corneal filaments, epiretinal membrane, high intraocular pressure (controlled by anti-glaucoma medications), epiphora, mild hyphaema, inflammatory uveitis with few keratic precipitates, and mild vitreous haemorrhage were reported in up to 10% (3/30) of patients. All were reported as non-severe events. No exact figures were reported, timing of occurrence was not reported, and no further details were provided.

5.11 A single occurrence was reported of each of the following: limited conjunctival dehiscence; corneal abrasion; mild peripheral corneal vascularisation; cystoid macular oedema; decrease in light perception; dry eye; transient headache; iris vessel engorgement; stable tractional retinal detachment; transient nausea; transient increased nystagmus; scleritis; and transient vertigo. Each occurrence was considered non-severe.

5.12 Specialist advisers did not highlight any anecdotal adverse events additional to those reported in the literature. Specialist advisers listed theoretical adverse events as loss of residual existing vision, phthisis bulbi, suprachoroidal haemorrhage, secondary neovascularisation, allergic reaction to the implant, failure of the implant, extrusion of the implant, and complications associated with vitrectomies.

6 Committee comments

6.1 The Committee noted that insertion of an epiretinal prosthesis for retinitis pigmentosa is intended for patients with end-stage disease who have no useful sight and no other treatment options. It

recognised that even minor improvements in vision may help these patients, but it wanted evidence that any changes in metrics of vision result in improvements in quality of life and activities of daily living. These considerations underpinned the specific recommendations about research in section 1.2.

6.2 The Committee recognised that the technology of epiretinal prostheses and related devices is evolving and that further developments may result in substantial changes to outcomes.

6.3 The Committee noted the importance of careful patient selection, including psychological counselling to ensure that patients have realistic expectations. It also noted the need for continued expert care of patients and their epiretinal prostheses after the procedure.

7 Further information

7.1 For related NICE guidance, see the NICE website.

Bruce Campbell
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December, 2014