BCIG Position Paper on Bilateral Cochlear Implants

Traditionally patients in the UK have been offered unilateral cochlear implants. However in recent years there has been an increase in the numbers of patients receiving bilateral implants worldwide. Only a relatively small number of these have been in the UK despite published peer reviewed evidence supporting bilateral implantation. A recent survey of all Cochlear Implant Programmes in the UK revealed that Teams are now offering bilateral implants to certain groups of patients, either as part of research studies or due to particular clinical need. Moreover, as information regarding the efficacy of bilateral implantation becomes more widely available, parents and patients themselves are requesting bilateral implants.

There is a great deal of evidence to show binaural benefit in normally hearing subjects (Hawley et al, 2004) and also in binaural hearing aid fittings (Noble, 2006). These benefits include the ability to localise sound, improved listening in quiet and in background noise. These binaural benefits are due to the head shadow effect, binaural redundancy and binaural squelch. There has been evidence to show that patients implanted bilaterally may be able to benefit from some of these binaural advantages (Peters, 2006; van Hoesel 2004; Tyler et al, 2003 and 2006).

Benefits

The expected benefits of bilateral implantation over unilateral implantation are shown to include:

- Improved localisation of sound (Verschuur et al, 2005; Litovsky et al, 2004, 2006a; Laszig et al, 2004; Tyler et al, 2003)
- Improved speech understanding in quiet. (Litovsky et al, 2006b ; Laszig et al, 2004; Tyler et al, 2003)
- Improved speech understanding in background noise. (Litovsky et al, 2006b ; Long et al, 2006; Ramsden et al, 2005; Laszig et al, 2004; Tyler et al, 2003)
- Stimulation of both auditory pathways. (Tyler et al, 2003)
- A guarantee that the better performing ear has been implanted. (Stark et al, 2004)
- Improvements in speech, language and auditory development in children. (Bauer et al, 2006; Litovsky et al, 2006c; Sharma et al, 2005; Kuhn-Inacker et al, 2004)
- In the event that one device fails, the patient is not left without sound.
- Improved enjoyment of music.
- Subjective reports of a more natural sound.

These benefits give adults the potential of improved employment prospects and many other psychosocial benefits. Children have the potential of higher educational achievement and a reduced requirement of additional educational support.

Cost

Bilateral implantation has significant implications in terms of cost.

- Surgical costs: bilateral implants may be implanted in a single surgical session and hence a single in-patient episode (Arnoldner et al, 2005;

Cohen, 2004). Indeed evidence shows that greater benefits are obtained with simultaneous bilateral implantation (Litovsky et al, 2006). Sequential implantation requires two separate surgical sessions and two separate in-patient episodes. There may be compelling medical / surgical reasons for sequential bilateral implantation but the evidence suggests that the delay between the first and second surgery should be within twelve months for optimum benefit (Kuhn-Inacker et al, 2004).

- Device costs: manufacturers of cochlear implants may offer significant discounts on the purchase of two systems for bilateral patients, which represents a cost saving compared to the purchase of two separate systems.
- Clinical costs: Additional clinic time for programming of two devices and rehabilitation are reflected in the maintenance charged to the funding authority and is typically double the cost for a unilaterally implanted patient. However there is some cost saving in that provision of a contra-lateral hearing aid is not required.

Indications

On the basis of the evidence and practice in the UK, the following clinical indications have been identified:

- For all profoundly deaf children in order to stimulate both auditory pathways and optimise speech, language and auditory development and maximise potential academic achievement.
- For all profoundly deaf adults, unable to benefit from bimodal hearing.
- For patients following meningitis or other risk of ossification, where failure to implant may result in obliteration of the cochlea, preventing future auditory stimulation.
- For patients with additional sensory handicap, where there is a greater reliance on binaural hearing.
- For patients who experience a loss of performance in the first implanted ear or loss of device function in the first ear but re-implantation in the same ear is contra-indicated.
- For patients who agree to participate in research studies into bilateral implantation.

The decision as to whether or not to offer bilateral implants should be made by the Cochlear Implant Team on the basis of a full and thorough assessment and this decision-making process should fully involve the patient / parent.

Conclusion

The British Cochlear Implant Group fully supports bilateral implantation when recommended by Cochlear Implant teams following a full assessment and when agreed by the patient / parent. It is recommended that Cochlear Implant Teams agree a policy and protocol for bilateral implants and that arrangements are made to secure appropriate provision for this with the relevant funding authorities. In the light of increasing and convincing evidence it is recommended that when indicated, funding is approved for bilateral implants.

References:

Arnoldner C, Baumgartner WD, Gstoettner W, Hamzavi J: Surgical considerations in cochlear implantation in children and adults: a review of 342 cases in Vienna. Acta Otolaryngol. 2005 Mar;125(3):228-34.

Bauer PW, Sharma A, Martin K, Dorman M: Central auditory development in children with bilateral cochlear implants. Arch Otolaryngol Head Neck Surg. 2006 Oct;132(10):1133-6

Cohen NL: Cochlear implant candidacy and surgical considerations. Audiol Neurootol. 2004 Jul-Aug;9(4):197-202.

Craddock LC: Bilateral Implantation in the UK: Current Practice. Oral presentation at the Ear Foundation Conference on Bilateral Implantation, Nottingham, UK 2006

Hawley ML, Litovsky RY, Culling JF: The benefit of binaural hearing in a cocktail party: effect of location and type of interferer. J Acoust Soc Am. 2004 Feb;115(2):833-43

Kuhn-Inacker H, Shehata-Dieler W, Muller J, Helms J: Bilateral cochlear implants: a way to optimize auditory perception abilities in deaf children? Int J Pediatr Otorhinolaryngol. 2004 Oct;68(10):1257-66.

Laszig R, Aschendorff A, Stecker M, Muller-Deile J, Maune S, Dillier N, Weber B, Hey M, Begall K, Lenarz T, Battmer RD, Bohm M, Steffens T, Strutz J, Linder T, Probst R, Allum J, Westhofen M, Doering W: Benefits of bilateral electrical stimulation with the nucleus cochlear implant in adults: 6-month postoperative results. Otol Neurotol. 2004 Nov;25(6):958-68.

Litovsky RY, Parkinson A, Arcaroli J, Peters R, Lake J, Johnstone P, Yu G: Bilateral cochlear implants in adults and children. Arch Otolaryngol Head Neck Surg. 2004 May;130(5):648-55.

Litovsky RY, Johnstone PM, Godar S, Agrawal S, Parkinson A, Peters R, Lake J :Bilateral cochlear implants in children: localization acuity measured with minimum audible angle. Ear Hear. 2006a Feb;27(1):43-59.

Litovsky R, Parkinson A, Arcaroli J, Sammeth C.: Simultaneous bilateral cochlear implantation in adults: a multicenter clinical study. Ear Hear. 2006b Dec;27(6):714-31

Litovsky RY, Johnstone PM, Godar SP: Benefits of bilateral cochlear implants and/or hearing aids in children. Int J Audiol. 2006c;45 Suppl 1:78-91

Long CJ, Carlyon RP, Litovsky RY, Downs DH: Binaural unmasking with bilateral cochlear implants. J Assoc Res Otolaryngol. 2006 Dec;7(4):352-60. Epub 2006 Aug 29.

Noble W: Bilateral hearing aids: A review of self-reports of benefit in comparison with unilateral fitting. Int J Audiol. 2006;45 Suppl 1:63-71

Peters, BR: Rationale for Bilateral Cochlear Implantation in Children and Adults. Published by Cochlear Limited, Jan 2006.

Ramsden R, Greenham P, O'Driscoll M, Mawman D, Proops D, Craddock L, Fielden C, Graham J, Meerton L, Verschuur C, Toner J, McAnallen C, Osborne J, Doran M, Gray R, Pickerill M.: Evaluation of Bilaterally Implanted Adult Subjects with the Nucleus 24 Cochlear Implant System. Otol Neurol. 2005 26; 988-998.

Sharma A, Dorman MF, Kral A: The influence of a sensitive period on central auditory development in children with unilateral and bilateral cochlear implants. Hear Res. 2005 May;203(1-2):134-43.

Stark T, Engel A, Borkowski G: Bilateral cochlea implantation in varying duration of deafness. Laryngorhinootologie. 2004 Jan;83(1):20-2.

Tyler RS, Dunn CC, Witt SA, Preece JP. Update on bilateral cochlear implantation. Curr Opin Otolaryngol Head Neck Surg. 2003 Oct;11(5):388-93.

Tyler RS, Noble W, Dunn C, Witt S. Some benefits and limitations of binaural cochlear implants and our ability to measure them. Int J Audiol. 2006;45 Suppl 1:113-9.

van Hoesel RJ.: Exploring the benefits of bilateral cochlear implants. Audiol Neurootol. 2004 Jul-Aug;9(4):234-46.

Verschuur CA, Lutman ME, Ramsden R, Greenham P, O'Driscoll M.: Auditory Localization Abilities in Bilateral Cochlear Implant Recipients. Otol Neurol. 2005 26; 965-971