

ORIGINAL ARTICLE

## Bone Anchored Hearing Aid (BAHA) in children: Experience of a tertiary referral centre in Portugal



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### KEYWORDS

Child;  
Hearing loss;  
Hearing aid;  
Bone conduction;  
Tertiary care centres

### Abstract

**Objectives:** The aim of this study is to describe the experience of a tertiary referral centre in Portugal, of the placement of BAHA in children.

**Methods:** The authors performed a retrospective analysis of all children for whom hearing rehabilitation with BAHA was indicated at a central hospital, between January 2003 and December 2014.

**Results:** 53 children were included. The most common indications for placement of BAHA were external and middle ear malformations ( $n=34$ , 64%) and chronic otitis media with difficult to control otorrhea ( $n=9$ , 17%). The average age for BAHA placement was  $10.66 \pm 3.44$  years. The average audiometric gain was  $31.5 \pm 7.20$  dB compared to baseline values, with average hearing threshold with BAHA of  $19.6 \pm 5.79$  dB. The most frequent postoperative complications were related to the skin ( $n=15$ , 28%). There were no major complications.

**Conclusions:** This study concludes that BAHA is an effective and safe method of hearing rehabilitation in children.

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### PALABRAS CLAVE

Niño;  
Hipoacusia;  
Audífono;  
Conducción ósea;  
Centros de atención terciaria

### Prótesis auditivas osteointegradas en niños: experiencia de un centro terciario de referencia en Portugal

### Resumen

**Objetivos:** El objetivo de este estudio es describir la experiencia de un centro terciario de referencia en Portugal, en la colocación de prótesis auditivas osteointegradas (BAHA) en los niños.

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**Métodos:** Los autores realizaron un análisis retrospectivo de todos los niños con indicación para rehabilitación auditiva con BAHA en un hospital central, entre enero de 2003 y diciembre de 2014.

**Resultados:** Se incluyeron 53 niños. Las indicaciones más frecuentes para la colocación de BAHA fueron las malformaciones del oído externo y medio ( $n=34$ ; 64%) y la otitis media crónica con otorrea de difícil control ( $n=9$ ; 17%). La edad media de la colocación de BAHA fue de  $10,66 \pm 3,44$  años. La ganancia de audiometría promedio fue de  $31,5 \pm 7,20$  dB en comparación con los valores basales, con un umbral medio de audición con BAHA de  $19,6 \pm 5,79$  dB. Como complicaciones postoperatorias, las más frecuentes se relacionaron con la piel ( $n=15$ ; 28%). No hubo complicaciones mayores.

**Conclusiones:** En este estudio se concluye que la BAHA es un método eficaz y seguro de rehabilitación auditiva en niños.

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## Introduction

In the hearing rehabilitation we face various pathologies and consequently different challenges. In certain pathologies or congenital malformations, hearing by air conduction is not feasible, so the bone conduction is the only way to restore hearing.

Tjellstrom, Swedish otolaryngologist and professor at Sahlgrenska University in Gothenburg, developed the concept of bone-anchored hearing aids (BAHA), having been the first results in adults presented in 1983.<sup>1</sup>

The BAHA system consists of a titanium implant placed surgically on the mastoid, fixed by bone integration process, and a percutaneous abutment, which fits the sound processor.<sup>2</sup> This, captures the sound, processes it according to the individual needs and transforms it through the transducer in vibrations that are transmitted through direct bone conduction to the inner ear, without requiring the functional middle ear.

The use of bone-anchored hearing aids in children<sup>3,4</sup> began in 1984 and since then hundreds of children in the world have already been operated.<sup>5</sup>

After 35 years of experience and more than 100,000 patients implanted worldwide, the BAHA, is now a universally accepted device for rehabilitation of adults and children with certain types of hearing loss.

In 1996 the *Food and Drug Administration* (FDA) allowed its use in the United States of America in cases of bilateral conductive or mixed hearing loss in adults.<sup>6</sup>

In 1999, the FDA extended its approval for use in children older than 5 years and in 2001 for bilateral implantation.<sup>7</sup>

After several years of research and development, patients with unilateral hearing loss, either of conduction or sensorineural, can now also benefit from this system, having the FDA approved this indication in 2002.<sup>8,9</sup>

The BAHA system does not affect the ear structures, so there is no risk of aggravating the hearing of the patient. Furthermore it is a reversible process if the patient does not adapt to it.<sup>10</sup>

The surgery can be performed in one or two surgical times, being the two surgical times procedure recommended for younger children.<sup>11</sup>

The sound processor is only adapted 2–4 months after surgery.<sup>12</sup>

Younger children or non-candidates for surgery may use conventional bone conduction hearing aid applied in stem glasses, headband or BAHA® Softband system in which the processor is set to the skull by an elastic band.

The high degree of satisfaction of rehabilitated patients with this system makes the BAHA a reliable method of success.<sup>7</sup>

The accurate selection of patients is critical to obtain good results, and the limitations of the equipment and the contraindications to its use must always be present.<sup>9</sup>

In Portugal, the first BAHA was placed in 2003 in our centre.<sup>9</sup> Since then, this hospital has been the referral centre for the entire North region of Portugal. We have experienced most of the early and late stages of this rapidly developing technique. The aim of this study is to present our current experience of BAHA implantation in children, and to highlight the main indications, results and complications.

## Material and methods

The authors performed a retrospective analysis of all children with indication for hearing rehabilitation with BAHA at a tertiary referral centre, between January 2003 and December 2014.

The study included patients younger than 18 years who underwent hearing rehabilitation with BAHA and at least one year of follow-up.

Exclusion criteria were: patients without audiometric evaluation or incomplete medical file.

The information was collected from medical records relating on age, gender, medical history, audiometry, clinical indications for placement of BAHA, as well as information about the surgery and its complications. All children included in the study performed preoperatively a CT scan of the temporal bone.

Hearing assessment was performed through pure tone audiometry, free field audiometry with and without the use of hearing aids.

The hearing loss is presented in *pure tone average* (PTA), determined by the average of pure tone thresholds of frequencies 500, 1000, 2000 and 4000 Hz. Only the audiometric results obtained after 3 months of use of hearing aids were analyzed.

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