Experience of Baha Attract System in Malaysia

Goh Bee See¹,², Nor Azirah Salahuddin¹, Asma Abdullah¹,²

ABSTRACT

Introduction: Bone conduction implants have been used internationally for decades. It is accepted as the mainstay treatment for conductive and mixed hearing loss for rehabilitation. It is commonly indicated for canal atresia, chronic ear infection as well as single-sided deafness. The mechanism of bone anchored hearing aid is by a process called direct bone conduction. The Baha Attract system is a transcutaneous bone conduction implant which uses magnet retention to connect the sound processor with the osseointegrated implant.

Objective: We would like to evaluate the outcome of the system which involved nine patients particularly in terms of surgery, complication and clinical performance.

Design: Case series.

Case presentation: This is a retrospective review of medical files from year 2014-2016 for patients using Baha Attract system in Otorhinolaryngology clinic, UKMMC. A total of 9 patients were identified. The main indication in our series is microtia with canal atresia/stenosis which accounts for about 67% (n = 6) and 33% (n = 3) were implanted due to single sided deafness (SSD). The mean preoperative unaided air conduction threshold (0.5 kHz, 1 kHz, 2 kHz frequencies mean) was 81 dB (range 47-120). The average postoperative BAHA-aided sound field hearing threshold was 27.6 (range 12-45) dB. The overall mean functional gain was 53.1 dB (range 20-108).

Discussion: Baha Attract system has the advantages in terms of aesthetic and hygienic concern. It was designed with a single-point transmission for better and efficient sound transmission by focusing the vibration in a single point. This design is preferred compared to multiple screws as the vibration energy will spread over several contact points resulting in lower transmission efficiency. The Baha Attract operation is a minor procedure and safe to be performed with minimal post-operative complications. From audiological perspective, majority of current studies showed good clinical performance with the Baha Attract system.

Conclusion: Baha Attract system is a new innovation that has proven to be an effective hearing device. The surgery is safe in adult as well as paediatric patients with minimal minor complications that can be treated conservatively. The overall mean functional gain was 53.1 dB.

KEY WORDS

Baha, bone conduction implant, hearing aids, conductive hearing loss, single sided deafness

INTRODUCTION

Bone conduction implants have been used internationally for decades. It is accepted as the mainstay treatment for conductive and mixed hearing loss for rehabilitation. The first implant was reported in 1977 by Tjellström and Granström¹. It is commonly used for canal atresia /stenosis which accounts for about 67% (n = 6) and 33% (n = 3) were implanted due to single sided deafness (SSD). The mechanism of this device is by a process called direct bone conduction. The electronic sound processor will convert the sound signal into vibration which then transmits the sound to a titanium stud that is embedded in the skull through the percutaneous abutment. The sound will then be transmitted to the inner ears by passing the impairment in the external and middle ears.

Despite the good performance of the Baha implant, it has few drawbacks that related to the skin-penetrating abutment and has been reported in literature. Local infection and soft-tissue reactions occurred in approximately a quarter of patients (range 8-9%), with about 10% needing revision surgery (range 5-42%). Some patients also had complications such as skin or tissue overgrowth surrounding the external abutment. Implant extrusion and loss, through infection or trauma is reported to be around 15%, predominantly in paediatric patients. In addition, it also needs lifelong daily hygienic care and the cosmetic aspect has been one of the major issues. Therefore, the manufacturer had innovated a new system to improve and overcome the drawbacks from percutaneous Baha implant. The new system is the non-skin penetrating device called the Baha Attract system. This system uses magnet retention to connect the Baha sound processor with the osseointegrated implant. In this study, we aimed to share our experience of Baha Attract system in Malaysia. We would like to evaluate the outcome of the system which involved nine patients particularly in terms of surgery, complications and clinical performance.

Received on April 4, 2019 and accepted on July 4, 2019

1) Department of Otorhinolaryngology-Head and Neck Surgery, Universiti Kebangsaan Malaysia
Kuala Lumpur Malaysia
2) Institute of Ear, Hearing and Speech (Institute-HEARS), Universiti Kebangsaan Malaysia
Kuala Lumpur Malaysia
Correspondence to: Goh Bee See
(e-mail: irenegbs@yahoo.com)
This is a retrospective review of medical files from the year 2014 till 2016 for Baha Attract patients in Otorhinolaryngology clinic, Universiti Kebangsaan Malaysia Medical Centre. The Baha Attract was launched in April 2014 in Malaysia. A total of 9 patients were identified. Table 1 summarized demographic, surgical indications and complications of the cases. There were 4 females and 5 male patients. The mean age at implantation was 16 years old with a range from 10 to 25 years old. Of these 9 patients, 78% (n = 7) were implanted on the right side and 22% (n = 2) were implanted on the left side. Four millimetres implant were used in 5 patients and three millimetres implant in another 4 patients according to the thickness of the skull during surgery. Intraoperatively, it was noted that all patients have less than 6mm skin thickness, thus no skin reduction was performed.

The main indication among our patients was microtia with canal atresia/stenosis which accounts for about 67% (n = 6) and 33% (n = 3) were implanted due to single sided deafness (SSD). Among these 6 patients with microtia and canal atresia/stenosis, four of them had primarily conductive hearing loss and two had mixed hearing loss. Mean air bone gap was 55.6 decibels (dB). Two of the patients had no post-operative Baha evaluation as the patients defaulted follow up. Hence we only presented the other 7 patients audiological measurements for aided levels (Table 2). The mean preoperative unaided air conduction threshold (0.5 kHz, 1 kHz, 2 kHz frequencies mean) was 81 dB (range 47-120). The average postoperative Baha-aided sound field hearing threshold was 27.6 (range 12-45) dB. The overall mean functional gain was 53.1 dB (range 20-108). Among all the patients, complications were observed only in 2 patients which include wound breakdown and seroma at post-operative day 5 which were managed conservatively.

CASE SERIES

This is a retrospective review of medical files from the year 2014 till 2016 for Baha Attract patients in Otorhinolaryngology clinic, Universiti Kebangsaan Malaysia Medical Centre. The Baha Attract was launched in April 2014 in Malaysia. A total of 9 patients were identified. Table 1 summarized demographic, surgical indications and complications of the cases. There were 4 females and 5 male patients. The mean age at implantation was 16 years old with a range from 10 to 25 years old. Of these 9 patients, 78% (n = 7) were implanted on the right side and 22% (n = 2) were implanted on the left side. Four millimetres implant were used in 5 patients and three millimetres implant in another 4 patients according to the thickness of the skull during surgery. Intraoperatively, it was noted that all patients have less than 6mm skin thickness, thus no skin reduction was performed.

The main indication among our patients was microtia with canal atresia/stenosis which accounts for about 67% (n = 6) and 33% (n = 3) were implanted due to single sided deafness (SSD). Among these 6 patients with microtia and canal atresia/stenosis, four of them had primarily conductive hearing loss and two had mixed hearing loss. Mean air bone gap was 55.6 decibels (dB). Two of the patients had no post-operative Baha evaluation as the patients defaulted follow up. Hence we only presented the other 7 patients audiological measurements for aided levels (Table 2). The mean preoperative unaided air conduction threshold (0.5 kHz, 1 kHz, 2 kHz frequencies mean) was 81 dB (range 47-120). The average postoperative Baha-aided sound field hearing threshold was 27.6 (range 12-45) dB. The overall mean functional gain was 53.1 dB (range 20-108). Among all the patients, complications were observed only in 2 patients which include wound breakdown and seroma at post-operative day 5 which were managed conservatively.

DISCUSSION

Baha Attract system is a non-penetrating bone conduction implant which uses magnet retention to connect the sound processor with the implant. The internal osseointegrated titanium implant is coupled to an implantable magnet and the external sound processor is coupled to another magnet which is covered by a soft wear pad. Compared to percutaneous Baha implant, this system has few advantages in term of aesthetic and hygienic concern.

The Baha Attract system was designed with a single-point transmis-

### Table 1. Demography, indication for surgery and complication

<table>
<thead>
<tr>
<th>Case no.</th>
<th>Age (years)</th>
<th>Gender</th>
<th>Indication for surgery</th>
<th>Complication</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>M</td>
<td>Bilateral microtia</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>M</td>
<td>Right microtia</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>F</td>
<td>Left microtia</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td>M</td>
<td>Bilateral microtia</td>
<td>Wound breakdown (conversion of BAHA connect with rotational flap in one setting)</td>
<td>Conservative</td>
</tr>
<tr>
<td>5</td>
<td>17</td>
<td>F</td>
<td>SSD</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>F</td>
<td>Right microtia</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>17</td>
<td>M</td>
<td>SSD</td>
<td>Post op seroma</td>
<td>Conservative</td>
</tr>
<tr>
<td>8</td>
<td>18</td>
<td>F</td>
<td>Right microtia</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>11</td>
<td>M</td>
<td>SSD</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

SSD: Single-sided deafness

### Table 2. The hearing outcome of BAHA Attract system

<table>
<thead>
<tr>
<th>Case no.</th>
<th>Age at surgery (years)</th>
<th>Implant</th>
<th>Preoperative air conduction threshold (dB)</th>
<th>Postoperative Baha-aided soundfield threshold (dB)</th>
<th>Gain (dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>4mm</td>
<td>73</td>
<td>15</td>
<td>58</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>4mm</td>
<td>77</td>
<td>20</td>
<td>57</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>3mm</td>
<td>67</td>
<td>32</td>
<td>35</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td>3mm</td>
<td>80</td>
<td>42</td>
<td>36</td>
</tr>
<tr>
<td>5</td>
<td>17</td>
<td>3mm</td>
<td>103</td>
<td>45</td>
<td>58</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td>3mm</td>
<td>47</td>
<td>27</td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>17</td>
<td>4mm</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>8</td>
<td>18</td>
<td>4mm</td>
<td>73</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>9</td>
<td>11</td>
<td>4mm</td>
<td>120</td>
<td>12</td>
<td>108</td>
</tr>
</tbody>
</table>

Mean*: 81, 27.6, 53.1

*data unavailable
* of 7 patients
Experience of Baha Attract System in Malaysia

In recent years, the Baha Attract system has been used for better and efficient sound transmission by focusing on vibration in a single point. This design is preferred compared to multiple screws as the vibration energy will spread over several contact points, resulting in lower transmission efficiency. In order to ensure sufficient magnetic retention, optimal pressure and comfort to patient, the Baha Attract system was specifically designed with a soft wear pad and it is also available in different magnet strength that is suitable for scalp flap ranging from 3 to 6 mm thickness. The soft wear pad will distribute the pressure evenly on its skin-contact surface. This pad has slow recovery foam which responds to the compressive force that will mould and adapt to the underlying surface, hence creating homogeneous pressure over the entire tissue contact area.

In our case series, all of the patients were operated under general anesthesia. Iseri et al and Gawęcki et al have reported the Baha operation can be done under local anaesthesia according to patient’s preferences and in adult patients without any difficulties. Thus, Gawęcki et al suggested this operation to be done under local anaesthesia in adults. None of our patients require soft tissue reduction and bone polishing in this series. This is due to all of our patients have the skin thickness of less than 6 mm. However, soft tissue reduction was performed in most of the previous studies reported with about one-third of the patients among their group. Good and satisfactory wound healing was observed in all reported cases at present.

The Baha Attract operation is a minor procedure and safe to be performed. Despite that, complications may still occur. In this series, the post-operative complications were minor and mainly related to soft tissue healing. In our study group, one patient developed wound breakdown post-operatively that was treated conservatively with daily dressings. In this particular patient, he had prior percutaneous Baha implanta
tion. He had multiple local skin infection and tissue overgrowth surrounding the abutment that required multiple revision of the skin overgrowth around the abutment. Thus, he opted for Baha Attract system. During the surgery, rotational flap was done for skin closure as the soft tissue around abutment was unhealthy and was removed. The wound subsequently healed with conservative management. Another patient had seroma but resolved spontaneously and one patient had pain at operation site. After loading the sound processor. The pain improved after reducing the loud sound gain. Compared to other studies, Iseri et al and Briggs et al reported cases complicated with skin erythema and pain disappeared without treatment and reduce magnet strength. There were also few cases with numbness reported by Gawęcki et al and suggested the degree of paraesthesia could possibly be reduced by placing the incision superior to magnet position rather than anterior. Hematoma is one of the known complications that can occur in Baha Attract surgery. A study conducted by Marsella et al noted a case with minimal tenting of skin covering magnet that was operated in an 8-year-old patient. The internal magnet was not placed with full contact of the skull bone caused by steeper curvature of the child calvarial bone. However, this did not happen among our patients with the youngest age of 10-year-old.

In terms of audiological perspective, majority of present studies showed good clinical performance with Baha Attract system. The mean unaided pre-operative pure-tone hearing threshold was 81 dB in our cases. It showed very good functional gain in our series with overall mean of 53.1 dB compared to other studies ranging from 18.4 to 32.9 dB. Marsella et al observed better gain in central frequencies (500-2000 Hz) and small gain at lower (250 Hz) and higher (4000 Hz) frequencies. In other study reported by Briggs et al showed statistically significant improvement in pure-tone average and speech recognition test. Whereas Gawęcki et al presented significant improvement in speech understanding in noise. Therefore, all the studies suggested that Baha Attract system is a good alternative bone conduction hearing device and had showed to be effective audiologically with minimal surgical complications.

CONCLUSION

The Baha Attract system is a new innovation that has been proven to be an effective bone conduction device. The surgery is safe either in adults or paediatric patients with minimal and minor complications. Hearing improvement is good with the overall mean functional gain was 53.1 dB.

REFERENCES