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Review Articles

Defining the Optimal Timing for Cochlear Implant Activation: A Review of the Literature and Current Practice Variability

Abdul Hadi Shahid[1], **Syed Qasim Hashmi**[2*], **Marium Noor**[3] **and Kshuf Nauman**[1,4]

[1]*Medical College, Aga Khan University, Stadium Road, Karachi 74800, Pakistan*
[2]*Department of Otolaryngology-Head and Neck Surgery, Ruth Km Pfau Civil Hospital, Karachi, Pakistan*
[3]*Sindh Institute of Child Health and Neonatology, Karachi, Pakistan*
[4]*Punjab Medical College, Faisalabad, Pakistan*
[*]*Corresponding author*

Corresponding author:
qasim.hashmi96@gmail.com

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Abstract

Background: Hearing loss is among the top three non-fatal disabling conditions in low- and middle-income countries (LMICs), where cochlear implantation (CI), the gold standard for severe-to-profound sensorineural hearing loss, remains underused. Conventionally, device activation occurs 2-4 weeks postoperatively however, early activation (EA) within days of surgery has shown promising benefits.
Objective & Methods: Literature reveals inconsistencies in defining EA and late activation (LA). Some studies report device activation as early as 1 to 7 days postoperatively, while others classify activation within 8 to 14 days as either EA or LA. Traditionally, activation has been reported between 9 and 46 days postoperatively. This lack of consensus complicates the development of standardized postoperative activation timelines and impedes evidence-based clinical guidelines. This narrative review aims to compare the outcomes, feasibility, and safety of EA versus traditional activation in CI patients while highlighting the variability in definitions and activation timelines across studies. A thorough literature search was conducted using PubMed, Scopus, Google Scholar, and Google.
Results: Seventeen studies were included, comprising 3 systematic reviews, 2 literature reviews, and 12 primary studies. Most studies reported EA on the first postoperative day, demonstrating benefits such as faster auditory rehabilitation, improved speech recognition, reduced anxiety, and higher patient satisfaction. EA was not associated with increased complications and was cost-effective, particularly for patients from remote areas. However, long-term impedance outcomes were similar between EA and LA.
Conclusion: First-day EA appears feasible, safe, and beneficial. Still, large-scale prospective studies are needed to establish optimal activation timing and support standardized CI care protocols.

Keywords: Cochlear Implantation; Device Activation Timing; Early Activation; Sensorineural Hearing Loss; Clinical Guidelines

1. Introduction

Hearing loss is one of the top three non-fatal disabling conditions in low- and middle-income countries (LMICs). It is typically treated with either hearing aids or cochlear implantation (CI) [1]. For individuals with severe to profound hearing loss that cannot be corrected with hearing aids, CI is considered the gold standard procedure for advanced sensorineural hearing loss [2, 3]. This procedure significantly restores hearing capacity, improves speech recognition, and enhances the patient's well-being [3]. While technological advancements in CI have increased its utilization,

especially in high-income countries, its use remains uncommon in LMICs, with less than 1% of the global CI users residing there. To restore hearing, an external sound processor is installed after implant placement, followed by device activation once the healing period is achieved [3]. Traditionally, a 10-12 cm endaural incision was made during surgery, causing significant flap edema. As a result, a waiting period of 3-6 weeks was recommended before device activation to allow proper healing and prevent infection. This delay often led to reduced patient satisfaction and financial burdens, especially for those traveling long distances [4]. Recent advancements in surgical techniques have led to improved wound healing outcomes in patients undergoing CI with small incision methods. These techniques are associated with reduced retro-auricular wound size, minimized postoperative swelling, and a lower incidence of surgical complications. Notably, the newer approach allows for earlier activation (EA) of the CI device, potentially within 2-3 days post-surgery. Thus, it eliminates the need for multiple follow-up appointments, though regular monitoring of magnet strength remains necessary. However, early CI activation is not universally recommended and requires thorough individual medical and audiological evaluations to assess its feasibility. In particular, patients with thin flap thickness are at increased risk of flap erosion due to magnetic pressure, and older patients may exhibit variable wound healing responses, thereby making EA of CI device less advisable, even with the small incision technique [4, 5]. In contrast, early CI fitting and activation, occurring between 24 hours and 2 weeks postoperatively, have been demonstrated to be safe in pediatric patients, with no reported complications [14].

Conventionally, CI electrode array implantation is associated with increased electrode impedance among patients with the standard 2-4 weeks postoperative activation period, a phenomenon linked to intra-cochlear fibrosis and inflammation. Early electrical stimulation, initiated immediately or within hours after surgery, has been shown to reduce impedance within the initial hours of device use, a benefit that can be utilized with EA of CI device. Nevertheless, long-term impedance levels do not appear to be significantly influenced by early electrical stimulation, as no notable differences in impedance have been observed between EA and traditional LA after one-month [4, 6].

Nowadays, atraumatic CI surgery is performed to preserve long-term acoustic hearing in patients with low-frequency residual hearing. Early device fitting in these patients is associated with an earlier listening experience [5]. Some studies have reported device activation as early as 1 day to 7 days post-implantation, compared to the standard activation timeline of 9-46 days [7]. In children and young adults, device activation 5 days postoperatively is commonly reported and does not interfere with the wound healing process or increase the risk of infection [7, 8]. However, EA was associated with an increased incidence of postoperative pain, reported in about 23.8% of patients. Furthermore, the proportion of patients desiring EA of CI device within 1 day of surgery decreased from 43% to 7.5% over the period of 3 weeks postoperatively [9].

In one study, EA was defined as device activation within 8 days postoperatively, while conventional LA was categorized as activation occurring after 8 days. Similarly, another study classified device activation within 10 to 14 days postoperatively as part of the traditional LA group [8]. Multiple studies have highlighted the potential benefits of EA following CI surgery compared to the traditional timeline. However, inconsistencies exist in the exact definitions of EA and LA across published studies, making it difficult to draw definitive comparisons and conclusions regarding the optimal postoperative timeframe for device activation in CI surgery. This lack of consensus has led to discrepancies in the reported effectiveness and feasibility of early versus late activation, hindering the development of standardized guidelines that could be widely adopted in CI surgery. Therefore, our study aims to conduct a narrative review comparing the outcomes, feasibility, and safety of early versus traditional device activation CI patients, while addressing the variability in activation timelines and definitions across studies to support the development of standardized postoperative guidelines.

2. Results

Our narrative review included 17 studies, of which 3 were systematic reviews and 2 were literature reviews. Among the remaining primary 12 studies, 7 were retrospective studies, 2 were prospective studies, 2 were case-control studies, and 1 was an RCT. Ten studies, including 1 systematic review and 1 literature review, reported on EA on the first post-implantation day following CI surgery. Regarding the included outcomes, 12 studies, including 3 systematic reviews, 1 literature review, and 1 RCT, reported aspects of electrode impedance levels among CI patients. Four studies, including a systematic review and an RCT, addressed magnetic strength, MCL, and DR. Seven studies, including 2 systematic reviews, investigated complications associated with EA in CI patients. Aspects related to speech recognition and hearing perceptions were explored in 7 studies, including 1 systematic review. Lastly, 7 studies, including 2 systematic reviews and 2 literature reviews, examined the feasibility, safety, patient satisfaction, and economic aspects of EA following CI surgery (Table 1).

2.1. Efficacy (Electrode Impedance and Speech Recognition Ability)

In CI surgery, studies have shown varying trends in electrode impedance (EI) changes. A systematic review reported that EI decreases intraoperatively and in the first few hours to the first post-op day, then increases over the following week [10]. Another study on CI patients with EA on the same day of surgery found an EI increase during the first post-op day and the following week [6]. However, a previous study reported decreased EI in CI patients with EA on the same day and the next day compared to the standard activation (10-14 days) [6]. Similarly, a study with average EA on the 2nd post-op day found lower EI in the EA group with OTE sound processors compared to late activation (LA) at 28 days, with no EI increase observed [4]. Another study, with EA on the 5th post-op day, also showed lower EI compared to standard activation at 28 days [12].

Conversely, some studies on CI patients with EA on the 1st day reported an EI increase at 1-month follow-up [4, 13]. One study found lower EI in the EA group at 1 month compared to the 28-day activation group, with no significant EI differences at 12 months [14]. This was supported by a literature review and two systematic reviews, one of which cited 8 studies supporting EA on the 1st day [7, 9, 10]. However, a recent study reported a long-term decrease in EI (up to 0.93 kΩ) in CI patients with EA on the 1st day compared to LA at 28 days, with this trend continuing over a 2-year follow-up period [15].

In one study, the pure tone average (PTA) decreased postoperatively from 33.2 dB to 46.8 dB recorded during the 1st fitting session in patients who underwent EA [5]. However, the PTA was significantly better in the EA group (44.1 dB) compared to the LA group (45.0 dB). A subsequent 12-month follow-up showed a decrease in residual low-frequency hearing loss in both groups [5]. In previous studies, no significant difference was found in speech recognition ability between the EA and LA groups, as measured by the Freiburg monosyllabic word test and various speech perception scores [11, 16]. In contrast, another study reported better postoperative speech recognition in patients who underwent EA compared to those in the LA group [5]. Additionally, patients who underwent EA showed significantly better word scores (37.1% and 60.7%) compared to the

LA group (22.3% and 53.8%) at the 1st fitting and 12-month follow-up sessions, respectively. Multisyllabic and monosyllabic word scores also improved postoperatively among CI surgery patients with EA, achieving 91.1% and 60.7%, respectively, with better multisyllabic word scores compared to the LA group (53.8%). Moreover, it was reported that patients with EA had a shorter duration of hearing loss and less hearing aid experience (14.5 years) compared to the LA group [8]. Another study found that word recognition at 60 dB and intelligibility thresholds were comparable between the EA on the 1st post implantation day group and the LA group, with no significant differences in audiometric performance [17]. Other studies showed favorable outcomes in terms of hearing and speech perception associated with early device activation performed on the 1st post-implantation day [10, 18]. However, a systematic review reported no direct association but concluded that EA did not negatively impact speech recognition ability [10].

2.2. Magnetic strength, MCL and DR

In studies on magnetic strength, MCL, and DR in CI surgery patients, results vary depending on activation timing. One study found that stronger magnets were needed in 1.2% and 8.8% of patients with LA on 28th day and EA on 2nd day, respectively [4]. Another study showed a higher likelihood of magnetic strength adjustments in patients with EA on the 14th day compared to those with LA [3]. However, some studies reported no need for magnetic strength adjustments in CI patients with EA on the 1st day [11]. One study noted a reduction in magnet strength at 7 days post-op to prevent skin necrosis [17]. A literature review highlighted a study where 35% of EA patients required magnet reduction around 3 months post-op, compared to 5% in the control group [9].

In terms of maximum comfort level (MCL) and Dynamic Range (DR) levels, CI patients with EA on the 1st day had higher levels at 1 month and maintained significantly better levels up to 12 months [14]. Patients with EA on the 5th day also exhibited higher MCL levels compared to those with LA at 28 days [12]. Similar trends were observed in other study, showing higher MCL levels in EA patients during follow-up compared to the initial switch-on session [14]. However, one study reported lower MCL levels in patients with EA on the 1st day compared to LA at 28 days [11].

2.3. Safety and Complications

In a previous study, CI surgery patients were found to have a higher incidence of minor complications when EA was performed on the 14th day compared to device activation on the 28th day [3]. In another study, 23.8% of patients who underwent EA on the 2nd day reported postoperative pain associated with CI device usage [9]. In contrast, only minor complications, such as pain and swelling, were reported in patients who underwent EA on the 1st day, as observed in 12 studies included in a systematic review [7]. Another study identified complications such as pain, vertigo, infection, swelling, skin hyperemia, Ear canal crusting, scar formation, and device bed swelling; however, these were deemed too negligible to impact the feasibility and efficacy of EA performed on the 1st day post implantation [8]. Additionally, a systematic review reported that minor complications associated with EA typically resolved within a few weeks after device activation [10]. Notably, early EA was found to be more commonly associated with flap-related complications [10].

In contrast, the same previous studies also reported no significant differences in complication rates between the EA and LA groups during follow-up visits, which were at 3 months for patients with EA on the 2nd day and at 12 months for those with EA on the 14th day [8]. Furthermore, a systematic review and meta-analysis reported no significant differences between EA on the 1st day and the conventional group [7]. Similarly, another study found no major complications or adverse events among patients who underwent EA on the 5th day compared to those with late activation (average 28th day) [12]. Consistently, a previous study reported no minor or major postoperative complications, such as edema, dehiscence, infection, or pain, among patients who underwent EA on the 1st day compared to those with late device activation (ranging from 3 to 6 weeks) [11]. Similarly, in other studies, no major complications were found associated with EA on 1st day following CI surgery [16, 18].

2.4. Patient Satisfaction and Economics

In a previous study, CI patients who underwent EA on the 1st day showed increased active involvement, enhanced tolerance for increasing thresholds, and reduced stress [17]. The literature also highlights reduced anxiety and a shorter period of uncertainty for these patients, with many resuming daily activities within two days. This benefit extended to their families as well [8]. A systematic review reported reduced anxiety and better satisfaction among patients and their families following EA on the 1st day [7]. One study demonstrated that EA, on average on the 2nd day, was clinically safe and feasible for all patients using BTE sound processors. However, for OTE sound processors, careful monitoring was required, which might delay device activation [4]. Another study found EA to be feasible in 97% of cases [3]. Furthermore, a study showed that EA within the first few hours after surgery was safe and convenient for many patients [8].

A systematic review revealed that three studies reported higher patient satisfaction with EA, while one study highlighted its economic advantages [7]. Despite fluctuating impedance levels, which eventually stabilized to levels comparable with conventional activation, EA was concluded to be safe and feasible for CI patients in a systematic review [10]. Another study concluded that same-day or next-day EA was feasible, time-efficient, and cost-effective [6]. It was especially beneficial for patients with OTE processors and those traveling from remote areas, as it reduced hospital visits [4, 12]. In a previous study, long-term preservation of residual low-frequency hearing was observed in CI patients who underwent EA with electric acoustic stimulation (EAS) or hybrid processors. Additionally, patients achieved satisfactory outcomes even in cases of complete postoperative loss of residual hearing, as their processors were reprogrammed to standard mode [5]. In another study, EA on the 5th day was found to be optimal for patients living in remote areas or those wanting to restore hearing, as it did not interfere with wound healing or increase the risk of infection [12]. Moreover, a systematic review noted that EA performed on the 1st day reduced patient expenses by including device activation and auditory perception within the same hospital stay, thereby minimizing follow-up sessions during the first year [7]. Another study found that 50% of CI surgery patients were foreigners, and undergoing EA on the 1st day provided significant financial relief to them and their families [8].

3. Discussion

EI is an electrophysiological measure used in CI surgery, both intraoperatively and postoperatively. It refers to the resistance to current flow between the intracochlear electrode and the extracochlear ground, which affects the electrical signal transmitted to the auditory nerve [9]. Studies have shown a decrease in EI during surgery, at device activation, and on the 2nd post-op day in both EA groups (same and next day) [6]. This suggests that the EI reduction during the early post-op period is independent of electrical stimulation. Similarly, decreased EI was observed for several days post-op in a previous study, which was linked to changes in the electrode array environment, such as the dissipation of air bubbles and the delayed effects of steroid use in the middle ear [16]. However, electrically stimulated electrodes tend to have lower EI compared to unstimulated ones, indicating that the decrease in EI due to electrical stimulation is not time dependent [6, 14]. This decreased EI was also reported in patients whose devices were activated between 10 to 14 days, but with no long-term effect on impedance levels after one month [6]. In a study of EA on the 5th post-op day, an initial reduction in EI was observed, with no significant difference in impedance levels between the EA and LA groups in follow-up sessions [12]. However, a recent study of CI patients with EA on the 1st day reported a decreasing trend in EI over two years, particularly in the apical section, which processes low frequencies and is associated with residual hearing [15]. EA promotes earlier electrical stimulation, which helps prevent fibrous tissue growth, has anti-proliferative effects, and enhances nerve fiber reinnervation [6]. It results in lower electrode impedance values and improved functional signal transmission [6, 15].

Patients with EA on the 2nd day typically require stronger magnetic strength compared to the LA group. However, magnet strength must be carefully monitored and often reduced post-op to limit edema and prevent skin conditions, including necrosis [4, 16]. In contrast, no adjustments in magnet strength are needed for patients with EA on the 1st day [11].

EA in CI patients enables earlier auditory processing compared to LA, resulting in higher MCL and DR levels, depending on the patient's ability to adapt and tolerate electrical stimulation [19, 20]. A wider DR helps CI patients hear a greater variety of sounds, leading to better hearing outcomes [14]. However, a previous study reported that reducing MCL has long-term benefits, as it ensures a wider DR, which is particularly important for younger patients. It also reduces the likelihood of facial nerve stimulation and may improve overall hearing outcomes. Additionally, a lower initial MCL means less current is used, which helps conserve battery life. Higher EI requires more current to stimulate target neurons, prompting clinicians to increase stimulation levels and refit the implant processor during subsequent mapping sessions. This undermines the benefits of the EA approach by requiring patients to return to clinics more frequently. This could be addressed by using the progressive MAPs, incorporating slightly higher MCL values on the implant's speech processor for future use [12].

Postoperative complication rates were found to increase until device activation and then decrease one month after CI device usage among patients with traditional device activation [3]. Thus, it highlights the importance of EA in CI surgery patients. However, EA of the CI implant is associated with a weaker magnet and flap thinning over the magnet, which are linked to flap-related complications, device removal, and skin breakdown [10]. Therefore, greater caution is required to prevent skin necrosis and sepsis postoperatively [10, 16]. Although swelling and edema are common complications following CI procedures, regardless of activation time, these are more prominent when EA is performed on the 1st and 2nd post-implantation days [7, 10]. To address this, various new minimally invasive surgical approaches have been adopted to ensure EA, including smaller incisions with restricted retraction, copious irrigation for debris clearance, slow and clean electrode array insertion to reduce air bubbles, and avoiding monopolar cauterization to minimize postoperative pain, swelling, and promote quicker healing with reduced operative time [8, 9]. Additionally, many studies have reported no medical complications associated with EA on the 1st post implantation day for most patients [11]. Furthermore, there were no significant differences compared to late device activation during follow-up sessions [10, 11].

CI surgery patients who underwent EA showed a significant improvement in speech recognition ability earlier than those with conventional LA, as observed during follow-up sessions at 3-month intervals [5]. It was found that patients underwent EA on the 1st post implantation day had better word scores, with no significant difference in word recognition or intelligibility thresholds [16]. It was proposed that long-term hearing loss reduces speech recognition ability, as the initially CI-assisted auditory signal does not immediately contribute to speech recognition since it is not yet aligned with corresponding speech output [5]. Patients with EA on 1st day were found to have shorter durations of hearing loss, better preoperative residual hearing, and less hearing aid experience, which facilitated better outcomes compared to the LA group [8]. Several studies have reported favorable hearing and speech perception outcomes associated with earlier device activation especially those performed on 1 day post-operatively [8, 10]. However, further studies are needed to establish a direct association between speech recognition ability and earlier device activation, as well as its long-term impact [10].

Most studies, including a systematic review, have demonstrated the feasibility and safety of EA on the 1st post-implantation day [7, 8, 17, 22]. Benefits include anxiety reduction, quicker auditory restoration, fewer follow-up sessions, and promising long-term preservation of residual hearing, all of which contribute to higher satisfaction rates among CI surgery patients. EA offers significant advantages by providing a longer duration of neural plasticity and minimizing the time between surgery and activation [8]. This facilitates better CI adaptation due to earlier auditory input and a quicker restoration of the hearing experience. While the day of surgery can be hectic for both the surgeon and the patient, activating the device within hours or on the same day may add further mental strain and burden to patients, especially when several important matters need to be discussed with them [9]. In contrast, device activation on the next day or the 1st post-implantation day is considered a better option [8]. Many studies support this approach, showing that it reduces anxiety, stress, and uncertainty while providing earlier auditory perception, enhancing tolerance, and increasing satisfaction among CI surgery patients. This approach is appropriate when medical and surgical conditions are favorable, including stable wound status, adequate flap thickness, and absence of postoperative complications or other medical limitations [12]. Moreover, earlier device activation is especially beneficial for patients from remote areas with limited resources, as it reduces hospital visits, lowers economic costs, and lessens the burden on healthcare systems. This allows healthcare facilities to accommodate more new patients, reduce waiting times, and increase the number of CI recipients [16].

Furthermore, lack of uniform definitions EA and LA across studies can be attributed to several interrelated factors, as evident from the included literature. Heterogeneity in surgical techniques and perioperative practices plays a major role. Studies employing minimally invasive approaches and careful soft-tissue handling (e.g., Chen et al., Roux-Vaillard et al., Soncini et al.) reported feasibility of EA within the first 24 hours, whereas studies using more conventional approaches favoured activation after several days to allow resolution of postoperative edema (Bruschke et al., Batuk et al.). Differences in flap thickness, wound closure techniques, and electrode insertion strategies influence postoperative swelling and impedance stabilization, thereby affecting activation timing. Variation in patient populations contributes significantly to definitional inconsistency. Adult-only cohorts (Bruschke et al., Roux-Vaillard et al.) tend to tolerate very early activation (1-3 days), while pediatric populations (Alhabib et

al., Alsabellha et al., Sun et al.) often show broader activation windows due to differences in healing, cooperation during fitting, and anesthetic considerations. Additionally, studies differ in baseline characteristics such as duration of deafness, residual hearing, and prior hearing aid experience, which may influence clinician preference for earlier or delayed activation. Differences in implant systems and processor designs affect activation feasibility. Batuk et al. highlighted that BTE processors allowed safer early activation compared to OTE processors, which may require additional monitoring due to magnet-related flap concerns. This technological variability results in institution-specific activation protocols rather than uniform definitions. Additionally, studies primarily assessing electrode impedance (Alhabib et al., Alahmadi et al., Saoji et al.) often define EA as within 24-48 hours, whereas studies emphasizing speech recognition, satisfaction, or long-term hearing preservation (Bruschke et al., Roux-Vaillard et al.) allow wider EA ranges (1-13 days). Systematic and narrative reviews further compound variability by aggregating studies with different operational definitions (Parker et al., Alahmadi et al., Coelho et al., Alshalan et al.). Finally, institutional logistics and follow-up feasibility, especially for patients traveling from remote areas, influence activation timing (Hagr et al., Alsabellha et al.). In such contexts, EA is often implemented earlier to reduce hospital visits, further widening the definition spectrum.

A key limitation in the current literature is the heterogeneity in definitions of EA and LA, which limits comparability across studies and reduces the strength of pooled conclusions. Additional sources of variability include differences in study design, sample size, surgical technique, implant system, processor type, patient characteristics, and outcome measures, as well as the predominance of short- to mid- term follow-up and retrospective analyses. To address this, a pragmatic framework for standardized definitions is proposed: very early activation (VEA) within 24 hours post-implantation, including same-day or next-day activation (Chen et al., Roux-Vaillard et al., Soncini et al., Hagr et al., Alhabib et al., Sun et al.); EA between postoperative days 2 and 7 (Bruschke et al., Batuk et al., Saoji et al., Alsabellha et al.); and LA at $\geq$21-28 days (3-6 weeks) postoperatively. Adoption of these standardized categories would improve comparability, enhance meta-analytic robustness, and facilitate evidence-based guideline development. Future prospective studies with longer follow-up should consistently report activation timing using these definitions and stratify outcomes by age, processor type, and surgical approach to better determine optimal CI activation strategies and support their safe integration into clinical practice.

4. Conclusion

In summary, most of the literature reports EA performed on the 1st post-implantation day following CI surgery, highlighting numerous benefits. Its application should be guided by medical and surgical considerations, including stable wound status, adequate flap thickness, absence of infection or excessive swelling, and patient readiness for mapping. First-day EA can facilitate quicker auditory restoration, reduced anxiety, improved speech recognition, enhanced neural plasticity, better CI adaptation, and preservation of residual hearing, leading to higher patient satisfaction. It also minimizes the time between surgery and activation, prevents the surgery day from becoming overly hectic, reduces follow-up visits, lowers healthcare costs, and eases the burden on healthcare systems, particularly for patients from remote areas. However, the magnitude and consistency of these benefits vary, and long-term outcomes remain uncertain. Careful patient selection and individualized clinical judgment are therefore essential, and further large-scale, prospective studies are needed. Establishing standardized definitions and clear eligibility criteria will support the safe implementation of first-day EA in routine clinical practice.

Author Contributions

Conceptualization: Abdul Hadi Shahid, Syed Qasim Hashmi; Methodology: Marium Noor, Kshuf Nauman; Formal analysis: Abdul Hadi Shahid; Writing—original draft: Abdul Hadi Shahid; Writing—review and editing: Syed Qasim Hashmi, Marium Noor, Kshuf Nauman; Supervision: Syed Qasim Hashmi.

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Data Availability

Not applicable.

Ethics Statement

This article is a narrative review based on previously published literature and does not involve human participants or animals; therefore, ethical approval and informed consent were not required.

Conflict of Interest

The authors declare no conflict of interest.

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Figures and Tables

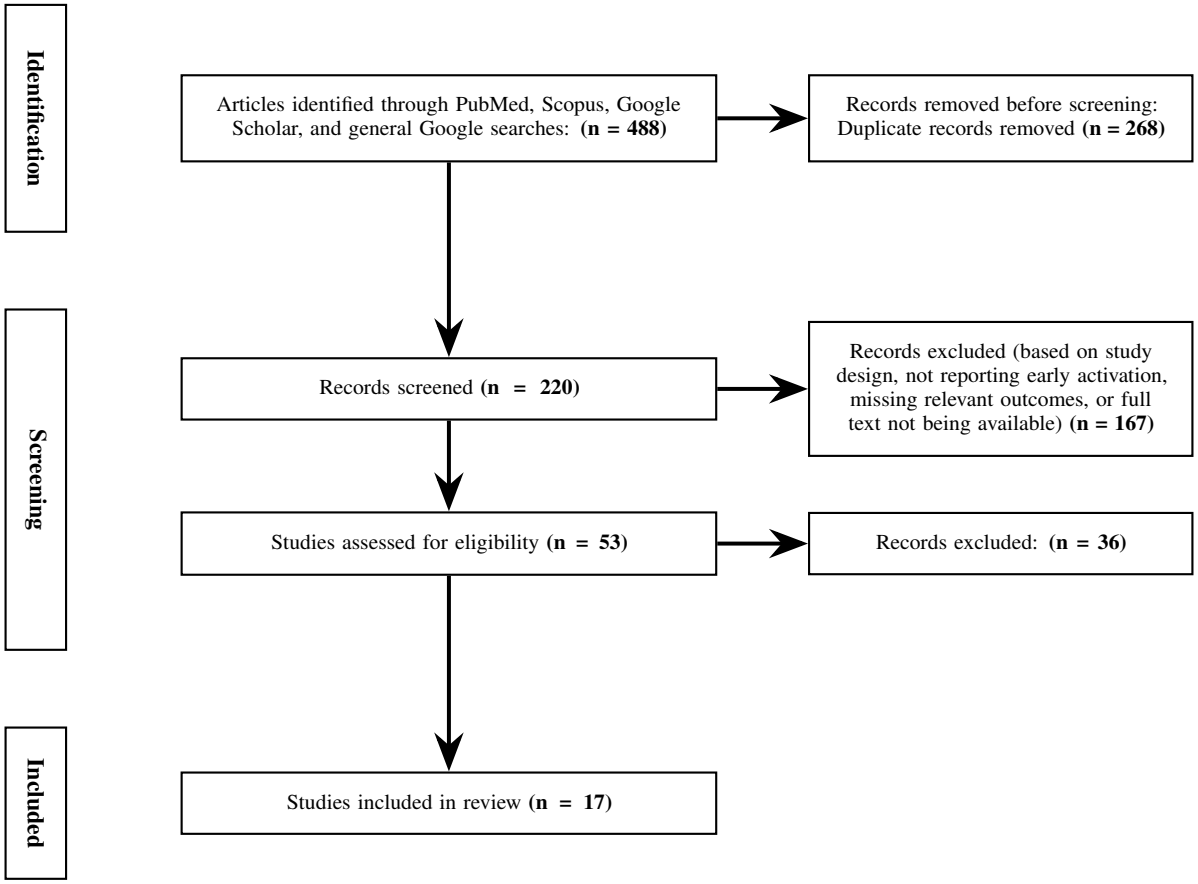

Figure 1. Figure 1. Flowchart illustrating the literature screening and study selection process

Table 1. Summary of all studies on patients' EA and/or LA following CI surgery included in our review

Study description	Sample size (n), gender, mean age, time of study	Study type & population	Primary outcome measures	Geographic origin	Time of Device activation
Stefanie Bruschke et al. [3] Long-Term Follow-Up of Early Cochlear Implant Device Activation	127 F=30 & M=37 Mean: 62.7 yrs 2021	Prospective longitudinal study CI surgery patients ≥18 years with 12 months follow-up Retrospective analysis CI users with at least 6 months of experience	Potential side effects, minor/major complications Average daily processor usage Speech recognition	Germany	EA: 3 days (median) (1-13 days) LA: 28 days (median) (4-6 weeks)
Merve Ozbal Batuk et al. [4] Is Early Cochlear Implant Device Activation Safe for All on-the-Ear and off-the-Ear Sound Processors?	294 CI Users, Mean: 12.8 yrs 2019	Prospective longitudinal study CI surgery patients >18 years with sufficient residual low-frequency hearing and 12 months follow-up	Electrode Impedance values Associated complications	Turkey	EA: 2 days (1–8 days) LA: 28 days (9-46 days)
Stefanie Bruschke et al. [5] Residual low-frequency hearing after early device activation in cochlear implantation	57 F=31 & M=26 Mean: 58.1 yrs 2023	Retrospective study analysis CI surgery patients those electrode impedance measured intraoperatively, at device activation, and one-month after device activation	Duration of profound hearing loss/Hearing aid experience Speech recognition ability Pure tone average (PTA)	Germany	EA: 3 days (median) LA: 28 days (median) (3-6 weeks)

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Study description	Sample size (n), gender, mean age, time of study	Study type & population	Primary outcome measures	Geographic origin	Time of Device activation
Aniket A Saoji et al. [6] Does early activation within hours after cochlear implant surgery influence electrode impedances?	51 2022	Retrospective study analysis CI surgery patients those electrode impedance measured intraoperatively, at device activation, and one-month after device activation	Electrode impedance	USA	EA: Same day or 1st day LA: 10-14 days
Rosalyn Parker et al. [7] Early Activation of Cochlear Implants: A Systematic Review and Narrative Synthesis	15 studies 2024	Systematic review	Impedance level Magnet strength Complication rate	NA	EA: 1st day LA: 9-46 days
Asma Alahmadi et al. [8] A Literature Review on Cochlear Implant Activation: From Weeks to Hours	19 studies 2023	Comprehensive literature search	Feasibility and safety	NA	EA: 1st day, 2.5 days, 5th day LA: 4 to 6 weeks
Daniel H Coelho et al. [9] Very early activation of cochlear implants: A review of the literature	20 studies 2023	Literature review	Feasibility and safety Electrode impedance Audiometric outcomes	NA	EA LA
Afrah Alshalan et al. [10] Early activation after cochlear implantation: a systematic review	19 studies 2023	Systematic review	Impedance levels Feasibility	NA	EA LA
Arianna Soncini et al. [11] Early fitting in cochlear implant surgery: preliminary results	15 44.6 yrs 2023	Case control study retrospective analysis CI surgery patients with at least 1 yrs follow-up	Electrode impedance Complication MCL PTA	Italy	EA: 1st day LA: 3-6 weeks
Rabea M Alsabellha et al. [12] Cochlear Implant Device Activation and Programming 5 Days Postimplantation	23 mean: 11.3 yrs 2014	Randomized controlled trial. All CI surgery patients with a history of profound bilateral sensorineural hearing loss	Electrode impedance Maximum comfortable loudness (MCL) values	Saudi Arabia Jordan	EA: 5th day LA: 28th day
Abdulrahman Hagr et al. [13] Feasibility of one-day activation in cochlear implant recipients	29 M=11 & F=18 Mean: 5 years 2013	Retrospective study CI surgery patients with a history of bilateral profound sensorineural hearing loss	Electrode impedance MCL Adverse events	Saudi Arabia Jordan	EA: 1st day
Salman F Alhabib et al. [14] Effect of early activation of cochlear implant on electrode impedance in pediatric population	52 2021	Retrospective cohort study Pediatric CI surgery patients with profound sensorineural hearing loss	Electrode impedance	Saudi Arabia	EA: 1st day LA: 28th days
Asma Alahmadi et al. [15] Cochlear Implantation: Long-Term Effect of Early Activation on Electrode Impedance	915 2021	Retrospective cohort study CI surgery patients unilaterally or bilaterally	Electrode impedance value	Saudi Arabia Egypt	EA: 1st day LA: 28th days
Chuan-Hung Sun et al. [16] Feasibility of early activation after cochlear implantation	40 M=11 & F=9 Mean: 11.09 2019	Case control study CI surgery patients	Electrode impedance Hearing and speech perception Complication	China	EA: 1st day LA: 28th day
S Roux-Vaillard et al. [17] Immediate activation after cochlear implantation: Preliminary Study	29 M=12 & F=17 mean=59 (EA) & 47 (LA) 2020	Retrospective study CI surgery patients with at least 6 months follow-up	Word recognition intelligibility thresholds	France	EA: 1st day LA: 2 weeks
Joshua Kuang-Chao Chen et al. [18] Safety and feasibility of initial frequency mapping within 24 hours after cochlear implantation	79 M=37 & F=42 Mean: 13.7 years 2015	Retrospective chart review CI surgery patients with profound hearing impairment underwent minimally invasive approach	Hearing perception Patient's satisfaction	China	EA: 1st day
Niño Torre LM et al. [22] Early activation of a late sequential cochlear implant systematic review	15 studies 2022	Systematic review	Electrode impedance Speech recognition Complication Safety	NA	EA LA