Evidence-Based Case Report

Outcomes of Autologous Reconstruction in Comparison with Alloplastic in Microtia Patients

Dini W. Widodo,[1]* Irfan,[1] Eka D. Safitri,[2] Mirta H. Reksodiputro[1]

[1]Department of Otorhinolaryngology Head and Neck Surgery,
[2]Clinical Epidemiology and Evidence-Based Medicine Unit,
Faculty of Medicine Universitas Indonesia-dr. Cipto Mangunkusumo Hospital, Jakarta

*Corresponding author: dini_pancho@yahoo.com
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Abstract

Microtia is a congenital abnormality of the auricle and reconstruction is the important management. Reconstruction using an auricle framework from autologous material originating from the rib cartilages is the gold standard. However, some surgeons prefer alloplastic materials which are claimed to reduce morbidity and can be performed at a younger age. This paper report a case of a microtia patient underwent reconstruction followed by a literature search comparing the outcomes of autologous and alloplastic reconstruction. An 11-year-old with grade 3 unilateral microtia underwent autologous reconstruction surgery using materials from the rib cartilages. Later he complained of pain at the rib grafting site, more than at the surgical wound in the ear. A literature search based on the clinical question was done in PubMed, EBSCOhost, Cochrane Library, and by hand searching. Three relevant articles that fit the clinical question were included. Autologous reconstruction causes fewer complications, while alloplastic reconstruction is better aesthetically. Further research is needed regarding the quality-of-life. Auricular reconstruction using autologous material remains the superior material of choice, however alloplastic framework can be a choice with better aesthetic results but greater complication risk.
Keywords: *autologous, alloplastic, microtia, reconstruction, outcomes.*

Luaran Rekonstruksi Autologus Dibandingkan Aloplastik pada Pasien Mikrotia

Abstrak

Mikrotia adalah kelainan kongenital daun telinga. Manajemen komprehensif mikrotia adalah rekonstruksi daun telinga menggunakan framework aurikula yang dibentuk dari material autologus yang berasal dari kartilago iga (baku emas). Meskipun demikian, saat ini dokter bedah lebih memilih material aloplastik yang dikatakan dapat menurunkan morbiditas dan dapat dilakukan pada usia lebih muda. Tujuan EBCR ini adalah melaporkan kasus pasien mikrotia yang menjalani rekonstruksi autologus diikuti pencarian literatur untuk membandingkan luaran rekonstruksi autologus dan aloplastik. Seorang anak berusia 11 tahun dengan mikrotia derajat 3 unilateral menjalani operasi rekonstruksi autologus menggunakan material dari kartilago iga. Pasien mengeluh nyeri di area iga yang dirasa lebih berat daripada luka operasi di telinga. Dilakukan pencarian literatur berdasarkan pertanyaan klinis di PubMed, EBSCOhost, Cochrane Library, dan dengan pencarian manual. Diperoleh tiga artikel yang sesuai dengan pertanyaan klinis. Pada rekonstruksi autologus komplikasinya lebih ringan, namun rekonstruksi aloplastik lebih baik secara estetik. Diperlukan penelitian lebih lanjut mengenai kualitas hidup. Disimpulkan rekonstruksi daun telinga menggunakan rangka telinga autologus tetap menjadi pilihan. Rangka aloplastik dapat menjadi pilihan alternatif dengan luaran estetik daun telinga yang lebih baik, meskipun lebih berisiko mengalami komplikasi.
Kata kunci: *autologus, aloplastik, mikrotia, rekonstruksi, hasil.*

Introduction

Microtia is a term describing a congenital defect in auricula, ranging from smaller-sized ears with normal form, to smaller-sized ears with abnormal form, all the way through the absence of auricula.[1] The incidence of microtia varies between 0.8 and 4.53 per 10,000 births. Besides race and genetic vulnerabilities, there are some known risk factors concerning the mother's surroundings and circumstances, such as teratogens exposure, diabetes, and anemia. The management of microtia includes hearing aids at an early age and ear reconstruction starting from age 6 to 8.[2]

Ear reconstruction is a procedure involving the implantation of an auricular framework to create an auricle. It is usually done with a framework made from the patient's own tissues (autologous), harvested from the rib cartilage. However, an alloplastic framework made from porous polyethylene (PPE), known as MedPor®, has been used as an alternative. Every technique has its own set of complications. Autologous reconstruction can cause pneumothorax, infection, exposure, changes in the size of the framework, and lobule necrosis. Meanwhile, alloplastic reconstruction can cause hematoma, infection, exposure, and flap loss. Some surgeons prefer the latter because it has a shorter learning curve, does not pose a risk of pneumothorax, and can be done in a younger age. Nevertheless, autologous auricular reconstruction remains the gold standard.[2–5]

The superiority of either autologous or alloplastic materials in ear reconstruction has been studied with many factors to consider, such as cost, availability, aesthetic value, and risks. To evaluate the outcomes from the patients' perspectives, there are questioners that could be used, such as EuroQol-5D-Young (EQ5D-Y), EAR-Q, and Kristeansen-Q. The questions evaluate the aesthetic outcomes, functional outcomes, psychosocial outcomes, and clinic-related outcomes.[6,7] This paper aims to discover through literature whether autologous or alloplastic material is a better choice for auricular reconstruction.

Case Illustration

In November 2020, an 11-year-old male patient came to the ENT – facial-plastic reconstruction outpatient clinic, Cipto Mangunkusumo Hospital, Jakarta with a referral from Moewardi Hospital, Solo. The patient came with a defect in his right earlobe since birth (Figure 1). It was smaller than the other and had an abnormal form. The patient also had trouble hearing from his right ear.

Figure 1. Right Earlobe, Pre-Operative.

The patient was then diagnosed with grade 3 microtia of the right ear. A CT scan was done and ear canal reconstruction was not recommended based on the result. A hearing test revealed a severe conductive hearing loss in the left ear (hearing threshold 81.25 dB), and a normal hearing in the right ear. An ear reconstruction with autologous material was planned. In January 2021, the first stage of ear reconstruction was done by harvesting cartilages from the right costae. The patient was routinely monitored through the clinic. The patient complained of pain in the ribs where the cartilages had been harvested and felt it to be more painful than the surgery wounds in his ear. The patient's family wondered if there were any other surgical techniques that could result in less discomfort. In April 2021, the second stage of ear reconstruction was done. After the procedure, a loose suture was managed through the outpatient clinic. Figure 2 shows the post-operative pictures of stage II.

Figure 2. Right Earlobe, Post-Operative Stage II.

Formulation of the Research

Based on the patient's case and the patient's family's question, the writers formulated a clinical question: does the use of autologous material, compared to alloplastic material, in patients undergoing ear reconstruction result in better outcomes in aesthetic, quality of life, and complication? The writers then reconstructed the clinical question into the PICO (population, intervention, comparison, outcome) format, as follow. Patient: Patients with unilateral or bilateral microtia of all types; Intervention: Ear reconstruction with autologous material; Comparison: Ear reconstruction with alloplastic material; Outcome: Aesthetic value, complications, and quality of life

Evidence Research Strategy

We conducted literature search in 3 databases consist of PubMed, EBSCOhost, and Cochrane Library on 2021 December 15th. We used keywords "microtia", "autologous", "alloplastic", "ear reconstruction", "aesthetic", "complication", and "quality of life", along with synonyms for each term and arranged using the Boolean method "OR" and "AND" (Table 1). Literature search was also done by hand-searching method.

Article selection was done by using inclusion and exclusion criteria based on clinical question and PICO. Inclusion criteria consisted of microtia patients of all ages who underwent ear reconstruction procedures; autologous reconstruction surgery (rib cartilage grafting method) compared to alloplastic reconstruction surgery (eg. MedPor®); no publication date limitation; clinical outcomes assessed were aesthetic, functional, psychosocial, complication, and clinician/operator aspects measured by questionnaires such as EuroQol-5D-Young (EQ5D-Y) q, EAR-Q, and modified questionnaires that have been validated; research with systematic review or meta-analysis of RCT, RCT, cohorts, case-control design study, and case series. The exclusion criteria were articles that were not written in English or Indonesian language. Critical appraisal was conducted by using critical appraisal checklist instruments from Centre of the University of Oxford's Evidence-Based Medicine (CEBM).

Table 1. Search Terms Used in 3 Databases

Database	Search Terms	Articles Found	Articles Used
PubMed	((microtia) OR (auricular deformity)) AND ((autolog) OR (rib cartilage) OR (autogenous)) AND ((alloplastic) OR (polyethylene)) AND ((ear reconstruction) OR (auriculoplasty) OR (microtia surgery)) AND ((outcome) OR (esthetic) OR (aesthetic) OR (psychosocial) OR (quality of life) OR (complication))	40	2
EBSCOhost	((microtia) OR (auricular deformity)) AND ((autolog) OR (rib cartilage) OR (autogenous)) AND ((alloplastic) OR (polyethylene)) AND ((ear reconstruction) OR (auriculoplasty) OR (microtia surgery)) AND ((outcome) OR (esthetic) OR (aesthetic) OR (psychosocial) OR (quality of life) OR (complication))	21	2
Cochrane Library	#1 microtia	21	
	#2 auricular deformity	12	
	#3 #1 OR #2	33	
	#4 autologous	13313	
	#5 rib cartilage	40	
	#6 autogenous	1082	
	#7 #4 OR #5 OR #6	14245	
	#8 alloplastic	151	
	#9 polyethylene	5576	
	#10 #8 OR #9	5724	
	#11 ear reconstruction	145	0
	#12 auriculoplasty	0	
	#13 microtia surgery	11	
	#14 #12 OR #13 OR #14	152	
	#15 esthetic	4290	
	#16 quality of life	142442	
	#17 psychosocial	19062	
	#18 complication	76019	
	#19 outcome	570565	
	#20 #15 OR #16 OR #17 OR #18 OR #19	680491	
	#21 #3 AND #7 AND #10 AND #20	0	

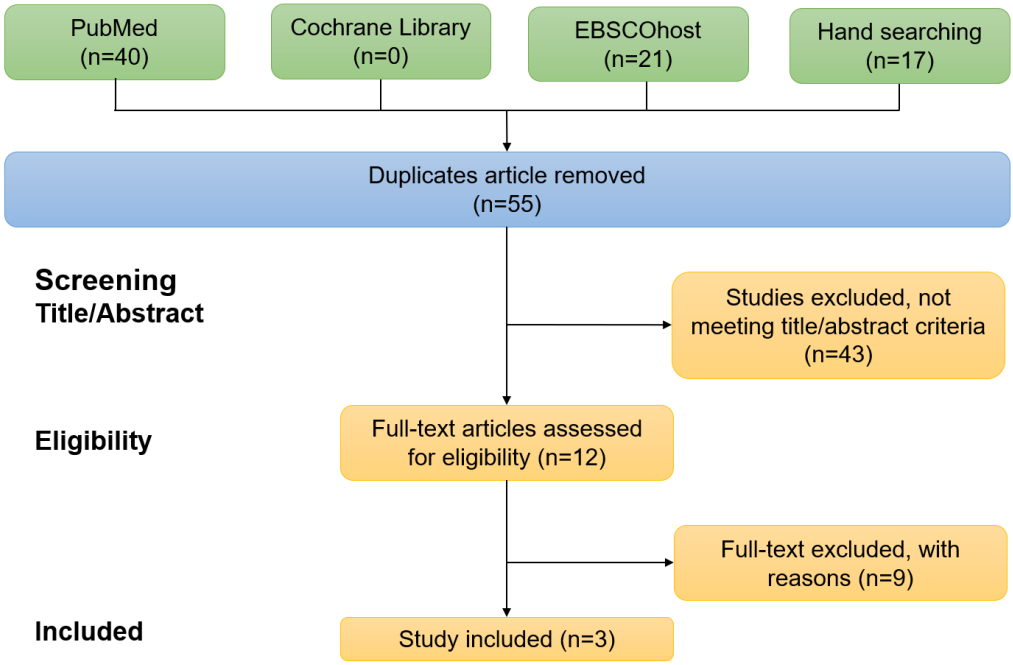

Figure 3. Literature Search Result

Results

From the literature search, there were 12 articles discovered that met the inclusion and exclusion criteria. We then conducted further full-text article selection that matched the clinical question, and 3 articles were obtained (Figure 3). Characteristics of the studies included are shown in Table 2. The studies were appraised using the Oxford's CEBM critical appraisal sheet for therapeutic studies, as shown in Table 3.

Table 2. Characteristics of Studies

Author (Year)	Study Design	n	Comparison	Primary Endpoint	LoE
Constantine et al[8]	Retrospective cohort	35	Autologous and alloplastic ear reconstruction	Complications (infection, extrusion, cartilage exposure, and pneumothorax) and aesthetic satisfactions (protrusion, definition, size, shape, colour match, and location)	2
Hamzavi[9]	Case-series	31	Autologous and alloplastic ear reconstructions	Complications, difficulties, flap use, duration, surgery age, inpatient care needs, dressing	4
Habiballah et al[10]	Case-series	22	Autologous rib cartilage and non-autologous rib cartilage (local flap, bovine cartilage, and alloplastic) ear reconstruction	Minor complications (exposure, infection, and revision), major complications (partial removal and total removal), and aesthetic outcome (morphology, symmetry, function)	4

LoE: Level of Evidence

Table 3. Critical Appraisal Result

Item	Constantine et al[8]	Hamzavi [9]	Habiballah et al[10]
Was the assignment of patients to treatments randomised?	No, the patients chose their preferred treatment.	No, the patients chose their preferred treatment.	Unclear, not explained how the decision of material used was chosen.
Were the groups similar at the start of the trial?	No, patient with different degree of microtia who underwent reconstruction procedure.	No, patient with different degree of microtia underwent reconstruction procedure.	No, patient with different degree of microtia who underwent reconstruction procedure.
Aside from the allocated treatment, were groups treated equally?	Yes	Yes	Yes
Were all patients who entered the trial accounted for? were they analysed in the groups to which they were randomized?	Yes	Yes	Yes
Were measure objective or were the patients and clinicians kept “blind” to which treatment was being received?	No, both the patients and the clinicians are aware of the treatment.	No, both the patients and the clinicians are aware of the treatment.	No, both the patients and the clinicians are aware of the treatment.
How large was the treatment effect?	Aesthetically, alloplastic usage is better with greater risk of complication compared to autologous.	Both autologous and alloplastic reconstruction have advantages and disadvantages and achieve great result in experienced hand.	Autologous reconstruction is better aesthetically with less risk of complication compared to alloplastic.
How precise was the estimate of the treatment effect?	Aesthetic assessment based on questionnaire with range of 1-5, RR/OR and NNT can’t be calculated. Complication assessment based on the case number that occurred.	Statistical analysis was not conducted in the case series; thus, it can’t be assessed. Complication assessment based on the case number that occurred.	Statistical analysis was not conducted; thus, it cannot be assessed. Aesthetic assessment based on pre and postoperative photo-graphs. Complication assessment based on the case number
Will the results help me in caring for my patient?	Yes	Yes	Yes

Out of the 3 studies appraised in this paper, none of them are randomized control trials. The first study is a retrospective cohort, while the last 2 are case series. All the studies compared autologous materials to alloplastic, although one of the studies compared them with other methods too. The outcomes observed in each study varies, ranging from complications and aesthetic outcome.

The first article is a retrospective cohort study that assessed aesthetic satisfaction and complications in microtia patients who had ear reconstruction surgery using autologous procedure compared to alloplastic procedure.[8] Protrusion and location were slightly better in the autologous group, however the difference between both groups was not significant (p=0.31 and p=0.75 respectively). Color match of reconstructed ear achieved better in autologous group with significant difference (p=0.05). While definition, shape, and size achieved better result in alloplastic group (p=0.05, p=0.08, and p=0.05 respectively). Case treated with alloplastic reconstruction had higher rates of infection and extrusion compared to autologous. In autologous group, one minor cartilage exposure was occurred and treated with superficial debridement without anesthesia and subsequent healing by secondary intent. No pneumothorax complication was found in this study.[8]

The second article is a case series describing 31 reconstructions, 8 of them using alloplastic materials.[9] The alloplastic group showed numerous complications, including 3 cases of skin necrosis with exposure, and 1 case of removal after 2 salvage surgeries, while the autologous group only showed 2 cases of flap dehiscence. In the case of infection, the implants need to be removed and replaced with new ones. Treating exposure is also easier in autologous reconstruction compared to

alloplastic reconstruction. The paper also discussed the difficulties in creating the framework out of autologous materials, the larger area of skin flap required for alloplastic reconstruction, the longer surgery duration of autologous reconstruction, the younger age requirement of alloplastic reconstruction, and the inpatient care needed in alloplastic reconstruction. The paper then concluded that both techniques can achieve similar desirable outcomes if carried out by experienced hands.[9]

The third article is a case series of ear reconstructions with autologous and non-autologous material. Based on the paper discussion, autologous reconstruction is better in satisfactory morphology, symmetry, and function compared to alloplastic. Alloplastic reconstruction had more complications compared to autologous. Out of 3 ear reconstructions with autologous material, only 1 minor complication occurred which was exposure of framework. Meanwhile out of 10 patients with alloplastic ear reconstruction, there were 9 complications. Minor complications in alloplastic group were one case of framework exposure and one case of infection. Major complications of alloplastic group consisted of 3 cases of partial removal and 4 cases of total removal.[10]

Discussion

The studies showed that both autologous and alloplastic reconstruction have their own advantages and disadvantages. In this section, we will discuss them, especially in terms of aesthetic outcome, complications, and patient's quality of life post-reconstruction. The first study (Constantine et al[8]) stated that alloplastic material is aesthetically better than autologous. On the contrary, the third study (Habiballah et al[10]) observed better aesthetic results in autologous reconstruction. However, the first study has a higher level of evidence and a larger number of subjects. Constantine et al[8] also conducted statistical analyses, whereas Habiballah's et al[10] study is an observational one, however the finding can be explained by the nature of autologous reconstruction which is dependent on the surgeon's expertise in crafting the auricular framework.[2,3] This mean that in experienced hands, autologous reconstruction can achieve very pleasing aesthetic results.

Regarding complications, alloplastic reconstruction consistently showed a higher risk of complications, especially exposures leading to implant removal. The management of infection and exposure is easier in autologous reconstruction,[3] which leads to fewer major complications. Autologous reconstruction does require the harvesting of rib cartilages which could incite pain and discomfort in the surgical site,[2,3] but the overall complication risk is still lower than alloplastic reconstruction.

In the literature search, no study comparing the quality of life between patients receiving autologous and alloplastic reconstruction. Some have studied the quality-of-life following ear reconstruction using a certain technique, such as Widodo et al[6] who found many patients have good health-related quality of life (HRQoL) after ear reconstruction using the Nagata technique (autologous) and Braun et al[11] who found that alloplastic reconstruction using MedPor® **significantly i**ncrease patient's HRQoL. These findings are supported by a systematic review stating that both autologous and alloplastic reconstruction has good outcomes in HRQoL. However, a study comparing the quality of life following autologous and alloplastic reconstruction still hasn't been done, so no conclusions on the superiority of either technique can currently be drawn. Ronde et al[12] observed the studies that have been done hadn't collected preoperative quality-of-life data. These showed a need for research to further study how either of the techniques might differently affect the lives of the patients. An analysis comparing preoperative and postoperative quality of life, as well as autologous and alloplastic reconstruction, can be very beneficial.

The limitations of this paper, microtia is a rare condition, so the studies available are also limited. This extends to the lack of level 1 evidence, which is also in part caused by the nature of the treatment in which a blind randomized controlled trial might not be possible. Furthermore, we recognize that there are numerous factors contributing to the success of surgery, so the data found may not be applicable to every center, all things considered.

Conclusion

Autologous reconstruction causes less complication, while alloplastic reconstruction is aesthetically superior. Further research is needed to compare the quality-of-life between autologous and alloplastic reconstruction. Both techniques have their own positive and negative attributes, but ultimately either can achieve great results in experienced hands. Autologous reconstruction remains the gold standard, but if available, alloplastic reconstruction can be an option if the risks are well-considered, and the surgeon is well-acquainted with the technique.

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