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Assessment of cost and health-related quality of life following three different methods of microtia reconstruction in 30 patients

1 | INTRODUCTION

Microtia patients usually have both a functional and an aesthetic deficit. Physicians should address both of these issues in consultation with a microtia patient. The aesthetic component of microtia can be treated with one of three methods of auricular reconstruction. The most common procedure utilises an autologous costal cartilage framework placed under the adjacent mastoid skin. Since its initial introduction in 1959, this method has been refined into a two-staged surgery.¹ The use of an alloplastic framework covered by a thin fascia flap and skin grafts is a more recent method of reconstruction. It allows for single-stage surgery at younger age than the rib cartilage method.² Removable silicone prosthetic ears usually attached using osseointegrated bone implants are an alternative to both previously mentioned reconstruction options.

Advantages and disadvantages of each reconstructive technique have been reported.³ In today's healthcare environment, cost-benefit outcomes are increasingly important. To the best of our knowledge, there are no studies describing both cost and quality of life (QoL) for the three available methods of external auricular reconstruction.

The goal of this study was to evaluate the cost burden and QoL benefit, for patients having either alloplastic, autologous or prosthetic ear reconstruction.

2 | MATERIAL AND METHODS

Consecutive Dutch microtia patients who underwent auricular reconstruction between January 2011 and April 2018 either in Los Angeles or Nijmegen were recruited for retrospective chart review. Since alloplastic ear reconstruction is not performed in Nijmegen, we recruited Dutch patients who travelled to Los Angeles for microtia surgery in order to minimise bias as much as possible by studying culturally similar patients. Patients who had aural atresia repair combined with auricular reconstruction were excluded.

We divided study patients into three different groups based on the reconstructive technique: (i) alloplastic ear reconstruction, (ii) autologous ear reconstruction and (iii) prosthetic ear reconstruction. Alloplastic patients had surgery in Los Angeles, United States. Autologous and prosthetic patients had surgery in Nijmegen, the Netherlands.

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Patients' medical records were reviewed, and age, gender, laterality, previous surgery, clinical course and follow-up times were recorded. Since healthcare systems, reimbursement structures and currency valuation differ between United States and the Netherlands, we analysed only objective and comparable variables. These variables included hospital admission, number of pre- and postoperative outpatient visits, diagnostic tests, number of surgeries, total surgery time, total anaesthesia time and specific materials required for the particular operative technique.

Benefit outcome of the reconstruction was measured using the Glasgow Benefit Inventory (GBI), or Glasgow Children's Benefit Inventory (GCBI) for younger children.^{4,5} Each patient or parent received the questionnaire by email. Patients younger than 12 years received the GCBI, and patients of 12 years of age or older received the GBI. Minimum follow-up time after surgery was six months.

All data were analysed using descriptive statistics in IBM SPSS statistics.

3 | RESULTS

Thirty patients with 34 ear reconstructions were included in this study. Patient demographics and generic outcomes are shown in Table 1. Cost variables are shown in Table 2. GBI and GCBI results are shown in Table 3.

3.1 | Alloplastic

Within this group, one patient had previous autologous ear reconstruction surgery and was dissatisfied with the result. All nine patients had one-stage surgery as described by Reinisch et al using porous polyethylene implant framework.² All patients were discharged after surgery without hospitalisation. Prior to surgery, CT scan was performed to assess the patients' candidacy for aural atresia repair and to rule out the presence of a congenital cholesteatoma. Beside one small scalp seroma, which was drained in the clinic, no complications occurred postoperatively. Five patients had minor cosmetic refinements in the outpatient clinic, either to adjust the size of the lobule or tragus, or to further elevate the reconstructed auricle. Eight of nine families

(89%) completed the questionnaire. One patient received the GBI. The remaining families received the GCBI because their child's age was less than 12 years. All patients reported a positive score.

3.2 | Autologous

All patients underwent two-stage surgery as described by Siegert and Magritz.¹ The patients were admitted to the hospital postoperatively following the harvest of costal cartilage. Preoperative CT scan was performed the Radboudumc unless previously performed elsewhere. Postoperative complications included an ear hematoma and a slight skin defect with cartilage exposure. Both cases required revision surgery. Antibiotic treatment was given to one patient due to mild wound infection near the lobule. Two patients had minor refinements under general anaesthesia. Eleven of 13 patients (84.6%) completed the GBI, all reporting a positive QoL score.

3.3 | Prosthetic

Five of eight patients in this group had previous autologous auricular reconstruction elsewhere and opted for prosthesis due to an unsatisfactory result. Each patient had preoperative CT scan to determine

Key Points

- Both cosmetic and functional items should be addressed in patients with microtia.
- Three surgical techniques for auricular reconstruction are available.
- The choice for a technique is individual for each patient and requires complete and thorough counselling (shared decision making).
- Factors assessed in this study, such as hospital admission, outpatient visits, number of surgeries and total surgery time, could guide the patient and their caretakers when choosing one of the three available surgical techniques.
- All patients having ear reconstruction showed a benefit in quality of life, as defined by the GBI or GCBI surveys.

the optimal location of bone anchoring implants. 3D laboratory-fabricated surgical template was used to ensure accurate placement of the implants.⁶ All patients underwent one-stage surgery to insert the implants to retain the auricular prosthesis. One patient

TABLE 1 Patient demographics

	Alloplastic N = 9	Autologous N = 13	Prosthetic N = 8	Total population N = 30
Sex				
Male	7	8	5	20
Female	2	5	3	10
Laterality				
Right	7	8	4	19
Left	1	4	2	7
Bilateral	1	1	2	4
Mean age at surgery, in years (Range)	8.3 (3-18)	20.5 (9-57)	26.8 (13-50)	18.5 (3-57)
Mean follow-up time, in years (Range)	3.4 (0.8-5.7)	5.1 (2.1-7.9)	4.9 (1.5-7.8)	4.5 (0.8-7.9)

TABLE 2 Surgical variables

Surgical variables	Alloplastic N = 9			Autologous N = 13			Prosthetic N = 8		
	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Hospital admission, in days	0	-	-	5.4	1.1	3-7	0.1	0.4	0-1
Outpatient visits	4.6	1.2	3-7	11.5	3.5	5-17	7.3	2.6	5-11
Diagnostic tests	1	-	-	0.5	0.5	0-1	1	-	-
No. of surgeries	1	-	-	2.1	0.3	2-3	1.1	0.4	1-2
Total surgery time, in minutes	481	57	387-588	656	136	289-828	196	83	70-332
Total anaesthesia time, in minutes	528	56	434-627	792	140	416-968	242	98	119-407
Materials used	PPI			WS			BI + P + ST		

Abbreviations: BI, Bone Implants; P, Prosthesis; PPI, Porous polyethylene Implant; ST, Surgical Template; WS, Wire Sutures.

TABLE 3 Health-related Quality of Life data of the patients that filled out the GBI or GCBI questionnaire

GBI and GCBI scores	Alloplastic N = 8			Autologous N = 11			Prosthetic N = 7		
	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Total score									
Total score GBI	44.4 ^a	-	-	30.0	10.8	11.1-50	33.3	11.1	16.7-52.8
Total score GCBI	24.4	20.4	2.1-54.2						
GBI subscore									
General	66.6 ^a	-	-	42.9	16.3	16.7-77.3	49.2	17.4	27.5-79.2
Social	0 ^a	-	-	9.1	17.3	0-50	0	-	-
Physical	0 ^a	-	-	1.5	5.0	0-16.7	-2.4	6.3	0--16.7
GCBI subscore									
Emotion	27.9	25.4	0-70.8						
Learning	14.3	20.2	-14.3-35.7						
Physical	36.3	25.0	4.1-75						
Vitality	20.7	22.4	0-55						
Time interval since surgery, in years	2.9	1.5	0.5-5.4	2.4	2.1	0.5-7.2	2.3	2.3	0.5-5.5

Abbreviation: SD, standard deviation.

^aNo standard deviation and range are displayed because the GBI in this group was completed by only one patient.

had removal of the previously reconstructed auricle under general anaesthesia (including one day hospital admission) with subsequent outpatient surgery under local anaesthesia for placement of the implants. The remaining patients were operated as outpatients without hospitalisation. Seven of eight patients (87.5%) completed the GBI and reported a positive QoL score. However, one patient reported a statistically insignificant deterioration in the physical domain of the GBI.

4 | DISCUSSION

4.1 | Main findings

This study assesses clinical variables relating to cost and determines benefit outcome for Dutch patients that had ear reconstruction. No absolute costs could be calculated because of differences in health-care systems in the Netherlands and United States. However, some notable differences were seen in cost variables between groups.

Alloplastic reconstruction has shorter total surgery and anaesthesia time compared with autologous reconstruction. This is attributed to one-stage surgery of the alloplastic method compared to two-stage autologous method. Similar to alloplastic reconstruction, prosthetic reconstruction was done without hospitalisation. Placement of implants for retaining the prosthesis can be performed under local anaesthetics, provided no microtic remnant or previous ear reconstruction has to be removed. The need to replace the prosthesis every few years, along with requiring annual outpatient clinic visits, contributes to ongoing future costs following prosthetic reconstruction. There were patients in both prosthetic group (five patients) and alloplastic group (one patient) that had prior autologous reconstruction at another centre. These patients were dissatisfied

with the postoperative result of their reconstruction and opted for removal of the cartilage framework and replacement with a prosthesis or alloplastic reconstruction. This dissatisfaction may be a reflection of a surgeon's inexperience and lack of aesthetic competence more than the choice of surgical technique.

Postoperative benefit in health-related QoL was comparable between the alloplastic, autologous and prosthetic reconstruction. Outcomes show that all patients benefitted in QoL (total mean follow-up: 4.5 years) regardless type of reconstruction.

4.2 | Comparison with other studies

To our knowledge, this is the first study that compares cost variables and health-related QoL outcomes for three different methods of ear reconstruction. There have been few papers analysing either cost or QoL using a single reconstructive method.⁷⁻¹⁰

Kolodzynski et al analysed costs of autologous ear reconstruction in ten Dutch microtia patients.⁷ Compared to our study, they reporting longer hospital admission time (9.5 days) and more surgeries (3.4), but fewer visits to the outpatient clinic (10.2) and shorter total surgery time (457.5 minutes). Results reported by previous studies using the GBI and GCBI are in accordance with the present study, showing that ear reconstruction results in benefit in QoL.⁸⁻¹⁰ One study reported a higher GBI outcome after autologous auricular reconstruction (48.1).¹⁰

4.3 | Limitations

Drawbacks of this study include its retrospective design and relatively small sample size of groups. In order to assess costs and QoL

more accurately, bigger sample sizes are preferable. Furthermore, no long-term follow-up was included in this study. Longer follow-up period might demonstrate additional costs for treatment of late complications. Auricular reconstruction is not obligatory for microtia patients. Ideally, QoL of patients declining reconstruction would have been included in this study. Another limitation is difference between groups in terms of age at surgery, sex and time interval between surgery and administration of the questionnaire. The GCBI used for patients under 12 years is completed by the patient's parent. Although this is a validated instrument, caretakers' expectations might deviate from patient's experience, making valid comparison to the GBI difficult. Besides factors analysed in this study, additional factors play an important role in the patients' choice for a reconstructive technique and should be taken into consideration when counselling a microtia patient.

5 | CONCLUSION

While the quality of life improvement following each type of reconstruction was similarly positive, the cost of each reconstructive method varied. Autologous ear reconstruction was associated with a longer hospital admission, longer surgery time, and more outpatient visits compared to alloplastic and prosthetic ear reconstruction. Knowledge of the differences in care costs should be of interest to physicians who counsel microtia patients as well as administrators and policy makers concerned with the total care expense for different treatment options. Besides the clinical variables contributing to the care costs, this study shows also additional factors influencing patients' choice for a reconstructive technique and all aspects should be taken into consideration when counselling a microtia patient.

CONFLICT OF INTEREST


None to declare.

ETHICAL CONSIDERATIONS

All patients or caretakers provided consent for the use of their data. The study was performed in accordance with the Declaration of Helsinki. The study protocol was approved by the ethics committee of the Radboudumc, Nijmegen.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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