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Comparison between Cartilage Cutting and Cartilage Sparing In Correction of Prominent Ear

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Abstract: ***Background:*** Protruding ears are the most common congenital ear deformity, with a frequency of 13.5% and a well-known hereditary component. Such a deformity can lead to serious psychosocial disturbances from childhood onward. ***Aim of the Study:*** To compare the success rates of cartilage cutting and cartilage sparing technique of otoplasty as regard outcomes, complications and recurrence rates through a systematic review study. ***Patients and Methods:*** Our study included all the studies of cartilage cutting technique and cartilage sparing technique for correction of prominent ear published in PubMed and MEDLINE with using terms (cartilage cutting, cartilage sparing, prominent ear). Our study included (25) studies, (14) studies about cartilage cutting techniques with total number of patients (n=2034) and (11) studies about cartilage sparing techniques with total number of patients (n=933) with only two studies comparing the two techniques at the same time. ***Results:*** There is no significant difference between cartilage cutting techniques and cartilage sparing techniques in term of recurrence (8% and 7%, respectively), bleeding (3% and 4%, respectively) and infection (2% and 1%, respectively). Cartilage cutting techniques have higher percent of hematoma (3%) while cartilage sparing techniques have higher percent of suture extrusion (7%). ***Conclusion:*** *No difference between cartilage cutting and sparing in term of recurrence, infection and bleeding. however,* Cartilage cutting techniques have higher percent of hematoma while cartilage sparing techniques have higher percent of suture extrusion.

[Samia Ahmed fawaz, Mohamed Saad Hassaballah, Ossama Mostafa Mady and Mahmoud Mohamed Morshed. **Comparison between Cartilage Cutting and Cartilage Sparing In Correction of Prominent Ear.** *Nat Sci* 2019;17(11):164-172]. ISSN 1545-0740 (print); ISSN 2375-7167 (online). http://www.sciencepub.net/nature. 20. doi:10.7537/marsnsj171119.20.

Keywords: Cartilage Cutting - Cartilage Sparing - Prominent Ear-complication.

1. Introduction

Operative correction of prominent ear is encouraged even before the child is school-age because 85% of the auricular growth is complete by the age of 3 years and the cartilaginous portions of the ears have nearly reached their permanent dimensions by the time the child is 6 to 7 years' old [(1)].

Hundreds of techniques have been described for correction of prominent ears. They can be classified into 2 broad categories i.e. cartilage-cutting and cartilage-sparing operations. Cartilage-cutting techniques include incisions, excisions, scoring, and/or abrasion of cartilage. The major advantage of cutting techniques is long-term stability of results, while its Disadvantages include disruption of cartilaginous support, creation of contour irregularities and higher possibility of infection. Cartilage-sparing methods were developed to decrease the incidence of contour irregularities and infection and to maintain the structural support of the cartilage; however, longevity of results may be decreased when compared to cutting techniques [(2)].

Modern otoplasty favours a graduated approach by combining suture techniques, and, when appropriate, adding cartilage-cutting methods in a stepwise fashion until the desired correction is achieved [(3)].

Aim of the Study

To compare the success rates of cartilage cutting and cartilage sparing technique of otoplasty as regard outcomes, complications and recurrence rates through a systematic review study.

2. Materials and Methods

This study was done in the following steps:

- Determination of the target subject.
- Identification and Location of articles.
- Screening and evaluation of the articles.
- Data collection.
- Data analysis.
- Reporting and interpretation (of the results).
- Discussion and conclusion.

I) Target subject Studies on Patients who were

diagnosed with prominent ears according to specific measurements and operated upon either by cartilage cutting or sparing technique.

II) Identification and location of articles: We revised and sort Published medical studies about cartilage cutting and cartilage sparing techniques in the PubMed, Medline database and Cochrane library in English language then choose suitable ones according to relevant criteria.

Using a combination of the following key words:

1. Prominent auricle.
2. Otoplasty.
3. Cartilage cutting.
4. Cartilage sparing otoplasty.
5. Outcome.

III) Screening and evaluation of articles: The screening form of articles was used to screen the articles, which were yielded by the Medline search after blinding the author name and journal name.

The inclusion criteria included articles:

- Published in English language.
- Conducted on human subjects.
- Patients with a diagnosis of prominent ear only.
- Patients underwent cartilage cutting techniques.
- Patients underwent cartilage sparing techniques.

Excluded articles:

Articles which miss one or more of the above mentioned inclusion criteria, like articles not concerned in outcome evaluation; articles not in English; articles conducted in animals and articles used moulding techniques for correction.

IV) Data collection:

Information was gathered for each individual study about complication and recurrence of each technique and then data extraction was done.

Statistical methods:

Statistical considerations

Evaluation and sorting of outcome results from the included articles were combined by using the Review Manager Software, statistical bias was considered and evaluated, collective statistical analysis was done in a single arm statistical results.

Testing for heterogeneity

Studies included in statistical analysis were tested for heterogeneity of the estimates using the following tests:

1. Cochran Q chi square test: A statistically significant test (p-value <0.1) denoted heterogeneity among the studies.
2. I-square (I^2) index which is interpreted as follows;
   - I^2 = 0% to 40%: unimportant heterogeneity
   - I^2 = 30% to 60%: moderate heterogeneity
   - I^2 = 50% to 90%: substantial heterogeneity
   - I^2 = 75% to 100%: considerable heterogeneity

Examination of publication bias

Publication bias was assessed by examination of the funnel of the effect size measures. The funnel plot is a plot of the estimated effect size on the horizontal axis versus a measure of study size (standard error for the effect size) on the vertical axis. In the presence of bias, the plots are asymmetrical. Assessment of asymmetry is subjective and in general, funnel plots are thought to be unreliable methods of investigating publication bias, particularly if the number of studies is small (less than 10).

3. Results

Table (1): Cartilage Cutting Technique Recurrence

Study	*Sample size*	*Percentage (%)*	*95% CI*	*Weight (%)*	
				Fixed	*Random*
Chongchet (1962) [4]	21	9.524	1.175 - 30.377	1.07	5.15
Tan (1986) [5]	101	13.861	7.790 - 22.162	4.98	7.72
Calder and Naasan (1994) [6]	562	8.007	5.900 - 10.568	27.49	8.70
Jeffery (1999) [7]	118	11.864	6.641 - 19.105	5.81	7.87
Caouette Laberge et al (2000) [8]	500	4.400	2.778 - 6.586	24.46	8.67
Peker et al. (2002) [9]	178	0.000	0.000 - 2.051	8.74	8.20
Bulstrode et al. (2003) [10]	114	6.140	2.504 - 12.243	5.62	7.84
Di Mascio et al. (2003) [11]	40	5.000	0.611 - 16.920	2.00	6.41
Panettier et al. (2004) [12]	33	3.030	0.0767 - 15.759	1.66	6.06
Kompatscher et al (2004) [13]	50	50.000	35.527 - 64.473	2.49	6.79
Rubino et al. (2005) [14]	10	0.000	0.000 - 30.850	0.54	3.61
Mandal et al. (2006) [15]	68	10.294	4.240 - 20.067	3.37	7.24
Salgarello et al. (2007) [16]	135	2.963	0.813 - 7.413	6.64	7.99
Olivier et al. (2009) [17]	104	11.538	6.106 - 19.288	5.13	7.75
Total (fixed effects)	2034	6.769	5.719 - 7.944	100.00	100.00
Total (random effects)	2034	8.409	4.903 - 12.992	100.00	100.00

Test for heterogeneity

Q	118.6928
DF	13
Significance level	P < 0.0001
I^2 (inconsistency)	89.05%
95% CI for I^2	83.39 to 92.78

1. Recurrence in cartilage cutting technique: as regard recurrence we found 14 studies of cartilage cutting technique with total number (n=2034), incidence of events was presented as percentage with their 95% confidence limit were pooled using Dersimonian-larid random effect method (REM) and mantel-haenszel fixed effect method (FEM). pooling with (REM) and we found percent about 8% as shown in table (1).

2. Infection in cartilage cutting technique: as regard infection following cartilage cutting technique, we found it is reported in 5 studies with total number (n=1383), incidence of events was presented as percertage with their 95% confidence limit were pooled using Dersimonian-larid random effect method (REM) and mantel-haenszel fixed effect method (FEM). pooling with (REM) shows percent about 2% as shown in table (2).

Table (2): Cartilage Cutting Technique Infection

Study	Sample size	Percentage (%)	95% CI	Weight (%)	
				Fixed	Random
Calder and Naasan (1994) [6]	562	5.160	3.483 - 7.327	40.56	21.77
Jeffery (1999) [7]	118	3.390	0.931 - 8.452	8.57	19.33
CaouetteLaberge et al (2000) [8]	500	0.000	0.000 - 0.735	36.10	21.68
Mandal et al. (2006) [15]	68	1.471	0.0372 - 7.923	4.97	17.53
Salgarello et al. (2007) [16]	135	0.000	0.000 - 2.696	9.80	19.68
Total (fixed effects)	1383	1.679	1.071 - 2.503	100.00	100.00
Total (random effects)	1383	1.602	0.0485 - 5.279	100.00	100.00

Test for heterogeneity

Q	52.4038
DF	4
Significance level	P < 0.0001
I^2 (inconsistency)	92.37%
95% CI for I^2	85.17 to 96.07

3. Bleeding in cartilage cutting technique: as regard bleeding in cartilage cutting technique, we found it is mentioned in 9 studies with total number (n=1772), incidence of events was presented as percentage with their 95% confidence limit were pooled using Dersimonian-larid random effect method (REM) and mantel-haenszel fixed effect method (FEM). pooling with (REM) shows percent about 3% as shown in table (3).

Table (3): Cartilage Cutting Technique Bleeding

Study	Sample size	Percentage (%)	95% CI	Weight (%)	
				Fixed	Random
Tan (1986) [5]	101	7.921	3.482 - 15.012	5.73	10.23
Calder and Naasan (1994) [6]	562	1.957	0.981 - 3.475	31.61	16.96
CaouetteLaberge et al (2000) [8]	500	2.000	0.963 - 3.647	28.13	16.66
Peker et al. (2002) [9]	178	5.618	2.727 - 10.089	10.05	12.93
Bulstrode et al. (2003) [10]	114	0.877	0.0222 - 4.791	6.46	10.83
Rubino et al. (2005) [14]	10	10.000	0.253 - 44.502	0.62	2.04
Mandal et al. (2006) [15]	68	1.471	0.0372 - 7.923	3.87	8.31
Salgarello et al. (2007) [16]	135	6.667	3.094 - 12.278	7.64	11.65
Olivier et al. (2009) [17]	104	0.962	0.0243 - 5.241	5.90	10.38
Total (fixed effects)	1772	2.867	2.143 - 3.752	100.00	100.00
Total (random effects)	1772	3.401	1.971 - 5.201	100.00	100.00

Test for heterogeneity

Q	22.7255
DF	8
Significance level	P = 0.0037
I^2 (inconsistency)	64.80%
95% CI for I^2	28.16 to 82.75

4. Hematoma in cartilage cutting technique: as regard hematoma in cartilage cutting technique, we found it is mentioned in 8 studies with total number (n=1075), incidence of events was presented as percentage with their 95% confidence limit were pooled using Dersimonian-larid random effect method (REM) and mantel-haenszel fixed effect method (FEM). pooling with (REM) shows percent about 2% as shown in table (4).

Table (4): Cartilage Cutting Technique Hematoma

Study	Sample size	Percentage (%)	95% CI	Weight (%)	
				Fixed	Random
Chongchet (1962) [4]	21	4.762	0.120 - 23.816	2.03	6.44
Jeffery (1999) [7]	118	3.390	0.931 - 8.452	10.99	14.68
CaouetteLaberge et al (2000) [8]	500	0.400	0.0485 - 1.437	46.26	18.85
Peker et al. (2002) [9]	178	2.247	0.616 - 5.653	16.53	16.26
Di Mascio et al. (2003) [11]	40	7.500	1.574 - 20.386	3.79	9.46
Panettier et al. (2004) [12]	33	0.000	0.000 - 10.576	3.14	8.51
Kompatscher et al (2004) [13]	50	6.000	1.255 - 16.548	4.71	10.58
Salgarello et al. (2007) [16]	135	0.000	0.000 - 2.696	12.56	15.23
Total (fixed effects)	1075	1.370	0.766 - 2.256	100.00	100.00
Total (random effects)	1075	2.365	0.817 - 4.689	100.00	100.00

Test for heterogeneity

Q	23.1542
DF	7
Significance level	P = 0.0016
I^2 (inconsistency)	69.77%
95% CI for I^2	37.09 to 85.47

5. Suture extrusion in cartilage cutting technique: as regard suture extrusion in cartilage cutting technique, we found it is mentioned in 7 studies with total number (n=1022), incidence of events was presented as percentage with their 95% confidence limit were pooled using Dersimonian-larid random effect method (REM) and mantel-haenszel fixed effect method (FEM). pooling with (REM) shows percent about 1% as shown in table (5).

Table (5): Cartilage Cutting Technique Suture Extrusion

Study	Sample size	Percentage (%)	95% CI	Weight (%)	
				Fixed	Random
Chongchet (1962) [4]	21	0.000	0.000 - 16.110	2.14	7.07
Calder and Naasan (1994) [6]	562	0.000	0.000 - 0.654	54.71	24.49
Peker et al. (2002) [9]	178	0.000	0.000 - 2.051	17.40	20.16
Bulstrode et al. (2003) [10]	114	0.000	0.000 - 3.184	11.18	17.61
Panettier et al. (2004) [12]	33	0.000	0.000 - 10.576	3.30	9.57
Rubino et al. (2005) [14]	10	0.000	0.000 - 30.850	1.07	4.06
Olivier et al. (2009) [17]	104	4.808	1.579 - 10.864	10.20	17.04
Total (fixed effects)	1022	0.287	0.0581 - 0.843	100.00	100.00
Total (random effects)	1022	0.676	0.0314 - 2.141	100.00	100.00

Test for heterogeneity

Q	16.5976
DF	6
Significance level	P = 0.0109
I^2 (inconsistency)	63.85%
95% CI for I^2	18.27 to 84.01

6. Recurrence in cartilage sparing technique: as regard recurrence we found 11 studies of cartilage sparing technique with total number (n=933), incidence of events was presented as percentage with their 95% confidence limit were pooled using Dersimonian-larid random effect method (REM) and mantel-haenszel fixed effect method (FEM). pooling with (REM) shows percent about 7% as shown in table (6).

Table (6): Cartilage Sparing Technique Recurrence

Study	Sample size	Percentage (%)	95% CI	Weight (%)	
				Fixed	Random
Rigg (1979) [18]	101	1.980	0.241 - 6.971	10.81	10.15
Minderjahn et al. (1980) [19]	135	11.852	6.928 - 18.532	14.41	10.78
Attwood and Evans (1985) [20]	52	0.000	0.000 - 6.848	5.61	8.36
Tan (1986) [5]	45	24.444	12.882 - 39.537	4.87	7.92
Adamson et al. (1991) [21]	55	7.273	2.017 - 17.587	5.93	8.53
Foda (1999) [22]	39	5.128	0.627 - 17.324	4.24	7.47
Horlock et al. (2001) [23]	51	11.765	4.442 - 23.868	5.51	8.30
Mandal et al. (2006) [15]	94	4.255	1.171 - 10.538	10.06	9.98
Beaudoin Olivier et al. (2009) [24]	104	6.731	2.749 - 13.377	11.12	10.22
Schaverien et al. (2010) [25]	30	3.333	0.0844 - 17.217	3.28	6.63
sinha (2012) [26]	227	3.524	1.534 - 6.826	24.15	11.65
Total (fixed effects)	933	6.184	4.733 - 7.915	100.00	100.00
Total (random effects)	933	6.675	3.835 - 10.229	100.00	100.00

Test for heterogeneity

Q	36.7390
DF	10
Significance level	P = 0.0001
I^2 (inconsistency)	72.78%
95% CI for I^2	50.14 to 85.14

7. Infection in cartilage sparing technique: as regard infection following cartilage sparing technique, we found it is mentioned in 2 studies with total number (n=321), incidence of events was presented as percentage with their 95% confidence limit were pooled using Dersimonian-larid random effect method (REM) and mantel-haenszel fixed effect method (FEM). pooling with (REM) shows percent about 1% as shown in table (7).

Table (7): Cartilage Sparing Technique Infection

Study	Sample size	Percentage (%)	95% CI	Weight (%)	
				Fixed	Random
Mandal et al. (2006) [15]	94	1.064	0.0269 - 5.785	29.41	29.41
sinha (2012) [26]	227	0.441	0.0112 - 2.430	70.59	70.59
Total (fixed effects)	321	0.863	0.164 - 2.592	100.00	100.00
Total (random effects)	321	0.863	0.148 - 2.161	100.00	100.00

Test for heterogeneity

Q	0.5230
DF	1
Significance level	P = 0.4695
I^2 (inconsistency)	0.00%
95% CI for I^2	0.00 to 0.00

8. Bleeding in cartilage sparing technique: as regard bleeding in cartilage sparing technique, we found it is mentioned in 8 studies with total number (n=470), incidence of events was presented as percentage with their 95% confidence limit were pooled using Dersimonian-larid random effect method (REM) and mantel-haenszel fixed effect method (FEM). pooling with (REM) shows percent about 4% as shown in table (8).

Table (8): Cartilage Sparing Technique Bleeding

Study	Sample size	Percentage (%)	95% CI	Weight (%)	
				Fixed	Random
Attwood and Evans (1985) [20]	52	1.923	0.0487 - 10.255	11.09	12.51
Tan (1986) [5]	45	33.333	20.001 - 48.950	9.62	12.18
Adamson et al. (1991) [21]	55	0.000	0.000 - 6.487	11.72	12.63
Foda (1999) [22]	39	0.000	0.000 - 9.025	8.37	11.82
Horlock et al. (2001) [23]	51	1.961	0.0496 - 10.447	10.88	12.47
Mandal et al. (2006) [15]	94	5.319	1.749 - 11.978	19.87	13.57
Beaudoin Olivier et al. (2009) [24]	104	0.962	0.0243 - 5.241	21.97	13.71
Schaverien et al. (2010) [25]	30	3.333	0.0844 - 17.217	6.49	11.11
Total (fixed effects)	470	3.918	2.365 - 6.069	100.00	100.00
Total (random effects)	470	4.286	0.911 - 9.982	100.00	100.00

Test for heterogeneity

Q	42.6335
DF	7
Significance level	P < 0.0001
I^2 (inconsistency)	83.58%
95% CI for I^2	69.20 to 91.25

9. Suture extrusion in cartilage sparing technique: as regard suture extrusion in cartilage sparing technique, we found it is mentioned in 10 studies with total number (n=798), incidence of events was presented as percentage with their 95% confidence limit were pooled using Dersimonian-larid random effect method (REM) and mantel-haenszel fixed effect method (FEM). pooling with (REM) shows percent about 7% as shown in table (9).

Table (9): Cartilage Sparing Technique Suture Extrusion

Study	Sample size	Percentage (%)	95% CI	Weight (%)	
				Fixed	Random
Rigg (1979) [18]	101	10.891	5.564 - 18.652	12.62	11.56
Attwood and Evans (1985) [20]	52	3.846	0.469 - 13.213	6.56	9.25
Tan (1986) [5]	45	15.556	6.491 - 29.455	5.69	8.70
Adamson et al. (1991) [21]	55	9.091	3.018 - 19.954	6.93	9.46
Foda (1999) [22]	39	12.821	4.297 - 27.430	4.95	8.15
Horlock et al. (2001) [23]	51	0.000	0.000 - 6.978	6.44	9.18
Mandal et al. (2006) [15]	94	3.191	0.663 - 9.045	11.76	11.33
Beaudoin Olivier et al. (2009) [24]	104	4.808	1.579 - 10.864	13.00	11.65
Schaverien et al. (2010) [25]	30	10.000	2.112 - 26.529	3.84	7.14
sinha (2012) [26]	227	2.643	0.976 - 5.664	28.22	13.58
Total (fixed effects)	798	5.654	4.164 - 7.477	100.00	100.00
Total (random effects)	798	6.582	3.791 - 10.072	100.00	100.00

Test for heterogeneity

Q	27.2823
DF	9
Significance level	P = 0.0013
I^2 (inconsistency)	67.01%
95% CI for I^2	35.79 to 83.05

10. Comparison between those separate studies: On comparing the statistical analysis of the studies of the two techniques: cartilage cutting and sparing, we found that no statistical significant difference as regard recurrence (8% and 7%, respectively), bleeding (3% and 4%, respectively) and infection (2% and 1%, respectively). Cartilage cutting techniques have higher percent of hematoma (3%) while cartilage sparing techniques have higher percent of suture extrusion (7%) as shown in table (10).

Table (10): Comparison between the results of statistical analysis of separate studies:

Parameter	Cartilage cutting technique			Cartilage sparing technique		
	sample size	Proportion (%)	95% CI	Sample size	Proportion (%)	95% CI
Recurrence	2034	8.409	4.90 - 12.99	933	6.675	3.835 - 10.229
Infection	1383	1.602	0.0485 - 5.279	321	0.863	0.164 - 2.592
Bleeding	1772	3.401	1.971 - 5.201	470	4.286	0.911 - 9.982
Hematoma	1075	2.365	0.817 - 4.689	-	-	-
Suture extrusion	1022	0.676	0.0314 - 2.141	798	6.582	3.791 - 10.07

11. Comparison between cartilage cutting and sparing in term of recurrence: as regard randomized control clinical trials comparing recurrence in the two techniques we found 2 studies with total number (n=308), incidence of events was presented as relative risk with their 95% confidence limit were pooled using Dersimonian-larid random effect method (REM) and mantel-haenszel fixed effect method (FEM). pooling with (REM) shows relative risk about 1 which means there is no difference in recurrence between the two techniques, P-value=0.0381 as shown in table (11).

Table (11): Comparative studies Recurrence: Relative Risk

Study	CCT	CST	Relative risk	95% CI	z	P	Weight (%)	
							Fixed	Random
Tan (1986) [5]	14/101	11/45	0.567	0.280 - 1.150			73.84	55.54
Mandal et al. (2006) [15]	7/68	4/94	2.419	0.737 - 7.938			26.16	44.46
Total (fixed effects)	21/169	15/139	0.902	0.506 - 1.609	0.350	0.726	100.00	100.00
Total (random effects)	21/169	15/139	1.081	0.260 - 4.495	0.107	0.915	100.00	100.00

Test for heterogeneity

Q	4.3024
DF	1
Significance level	P = 0.0381
I^2 (inconsistency)	76.76%
95% CI for I^2	0.00 to 94.71

12. Comparison between cartilage cutting and sparing in term of suture extrusion: as regard randomized control clinical trials comparing suture extrusion in the two techniques we found 2 studies with total number (n=308), incidence of events was presented as relative risk with their 95% confidence limit were pooled using Dersimonian-larid random effect method (REM) and mantel-haenszel fixed effect method (FEM). pooling with (REM) shows relative risk less than 1 which means that cartilage sparing have higher risk of suture extrusion, P-value=0.3656 as in table (12).

Table (12): Comparative studies Relative risk Suture Extrusion

Study	CCT	CST	Relative risk	95% CI	z	P	Weight (%)	
							Fixed	Random
Tan (1986) [5]	0/101	7/45	0.0301	0.00175 - 0.515			51.82	51.82
Mandal et al. (2006) [15]	0/68	3/94	0.197	0.0103 - 3.747			48.18	48.18
Total (fixed effects)	0/169	10/139	0.0670	0.0105 - 0.429	-2.853	0.004	100.00	100.00
Total (random effects)	0/169	10/139	0.0743	0.00961 - 0.575	-2.491	0.013	100.00	100.00

Test for heterogeneity

Q	0.8185
DF	1
Significance level	P = 0.3656
I^2 (inconsistency)	0.00%
95% CI for I^2	0.00 - 0.00

4. Discussion

Protruding ears are the most common congenital ear deformity, with a frequency of 13.5% and a well-known hereditary component. Such a deformity can lead to serious psychosocial disturbances from childhood onward [28].

The practical aspects of undergoing surgery must be considered including the child's ability to cooperate with the aftercare. Unfortunately, very young children are often unable to comply with the postoperative care required, particularly prolonged head bandaging as required by some techniques. Thus, a young or unmotivated child will find the postoperative course stressful and unpleasant [29].

The huge number of different techniques for correcting protruding ears can be grouped into three basic concepts: the cutting technique described by Converse, the scoring technique according to Stenström, and the pure suture techniques introduced by Mustardé. Compared to all cutting or scoring techniques, the risk of undesired edges, defects, or deformities difficult to correct is lower with cartilage sparing, suture techniques. Therefore, otoplasty using suture technique is especially recommendable when focusing on patient benefit [30].

Cartilage-cutting techniques involve scoring, incising, or excising cartilage to create the desired shape, while cartilage-shaping techniques involve suturing to bend cartilage into the desired shape. Cartilage-cutting techniques can result in unsightly irregularities, while cartilage shaping techniques are at risk for suture failure and the ear springing back to its original position [31].

Our study is a collective analysis of retrospective and prospective cohort studies done separately on the two broad categories of correction of prominent ear.

The data analysed and results showed no great difference in cartilage cutting and cartilage sparing techniques as regard recurrence (8% and 7%, respectively) taking in consideration difference is sample size in the two different categories.

Also, no great difference in incidence of infection (2%) in cartilage cutting and (1%) in cartilage sparing despite difference in sample size and surrounding environmental conditions predisposing to infection in both techniques.

No difference in occurrence of bleeding (4 %) in both techniques despite difference in sample size and heterogeneity of study group.

However, hematoma occurred in 4% in cartilage cutting group compared to non-significant percent in cartilage sparing group as cartilage cutting is injurious to cartilage and its covering perichondrium.

Also, suture extrusion whether it is early or late occurred (7%) in cartilage sparing group compared to (1%) in cartilage cutting group as cartilage sparing depend mostly on sutures.

Limitation of study

1. Paucity of comparative randomized control clinical trials.
2. Most of included studies were retrospective or prospective cohort studies.
3. No definite age group was detected in most of those studies.
4. No randomization in study sample.
5. Diversity of sample size between the two techniques.
6. Each category either cartilage cutting or cartilage sparing contain different sub techniques and modification done by the author.
7. Absence of similarity in experimental conditions among those techniques.
8. The recurrence was due to either overcorrection or under correction or presence of operable cartilage irregularity.

Conclusion

There is no significant difference between cartilage cutting techniques and cartilage sparing techniques as regard recurrence, bleeding and infection.

However, cartilage cutting techniques have higher percent of hematoma while cartilage sparing techniques have higher percent of suture extrusion.

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9/3/2019