Received: 14 January 2020 | Accepted: 17 February 2020

DOI: 10.1002/lio2.372

ORIGINAL RESEARCH

Laryngoscope Investigative Otolaryngology

Auricular avulsion injuries and reattachment techniques: A systematic review

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Abstract

Objective(s): Multiple surgical techniques exist in the acute management of auricular avulsion injuries, including reattachment of the tissue as a composite graft, reconstruction using local skin flaps, the pocket principle, the Baudet method, and microvascular repair. This review aimed to compare the success rates of reattachment methods in auricular avulsion injuries.

Methods: A PubMed search systematically identified cases in which (a) an auricular avulsion injury occurred and (b) reattachment was attempted. Search results were combined with an extensive review of references from published studies. In total, 148 cases were identified. Three reviewers independently graded the final aesthetic result of each case using a 5-point scale. The average grade of each repair was compared to the reattachment method to identify successful techniques.

Results: Microvascular repair was associated with a statistically significant higher success rate compared to all other reattachment methods. Composite graft reattachment also tended to generate better final aesthetic outcomes, but this difference was not statistically significant.

Conclusion: Microvascular repair of the avulsed segment consistently demonstrated higher success rates. Composite graft reattachment should also be considered under the right circumstances. Overall, microvascular repair and composite graft reattachment should be considered the best options in cases of auricular avulsion repair. The authors share a major concern that other methods that rely on the use of periauricular skin will compromise any future attempts for secondary reconstruction, such as staged procedures using costal cartilage grafts. Manipulation of these tissues and in particular burying of the avulsed ear cartilage is discouraged.

Level of Evidence: 4

Previously presented at The Triological Society 121st Annual Meeting at COSM, at National Harbor, MD, USA on April 21, 2018.

KEYWORDS
auricular avulsion, auricular avulsion injury, Baudet method, ear avulsion, microsurgical repair, microvascular repair, periauricular skin, platysma myocutaneous flap, pocket principle, temporoparietal fascia flap

1 | INTRODUCTION

Traumatic amputation of the ear is a serious injury and can result in a wide variety of disfiguring deformities.[1] Most cases of ear amputation are caused by avulsion of the auricle, a traumatic separation of all or part of the ear which damages the small vessels of the ear and makes replantation very difficult.[2] Auricular avulsion injuries most often result from motor vehicle accidents, bites, falls, and incidents of assault.[3,4] Although these injuries are relatively uncommon, the intricate vasculature, delicate skin, and elaborate cartilaginous contours of the external ear complicate the management of these injuries.[5] The unique position of the auricle on the side of the head, combined with its outward projection, increases its vulnerability to injury. This positioning also makes the post-traumatic deformity highly visible, which can cause the patient significant psychological distress.[4]

Numerous techniques for repair of auricular avulsion injuries have been utilized with varying success rates. However, a definitive method for repair has been difficult to determine due to the low frequency, high variability, and complexity involved in the management of these injuries.[2,6] A failed ear reattachment complicates subsequent reconstruction with autogenous rib cartilage,[6] emphasizing the importance of maximizing successful reattachment rates in the acute care of these injuries, while ensuring maximal preservation of tissue critical to any salvage repair.

A comprehensive literature search was performed to assess the relationship between different reattachment techniques and overall aesthetic outcomes in published series and case reports of traumatic auricular avulsion injuries. One goal of the study was to critically compare the advantages and disadvantages of each technique and dispel many of the myths associated with the management of these injuries. Based on this information, guidance is offered on how to best care for these injuries in the acute setting.

2 | MATERIALS AND METHODS

A PubMed search was conducted to systematically identify cases in which (a) an auricular avulsion injury occurred and (b) reattachment was attempted. A health sciences librarian, with expertise in advanced database searching, was consulted to develop the search strategy. The search was performed in June 2017. The search terms used in this primary search included: (ear [mesh] AND ear [ti] OR auricul*

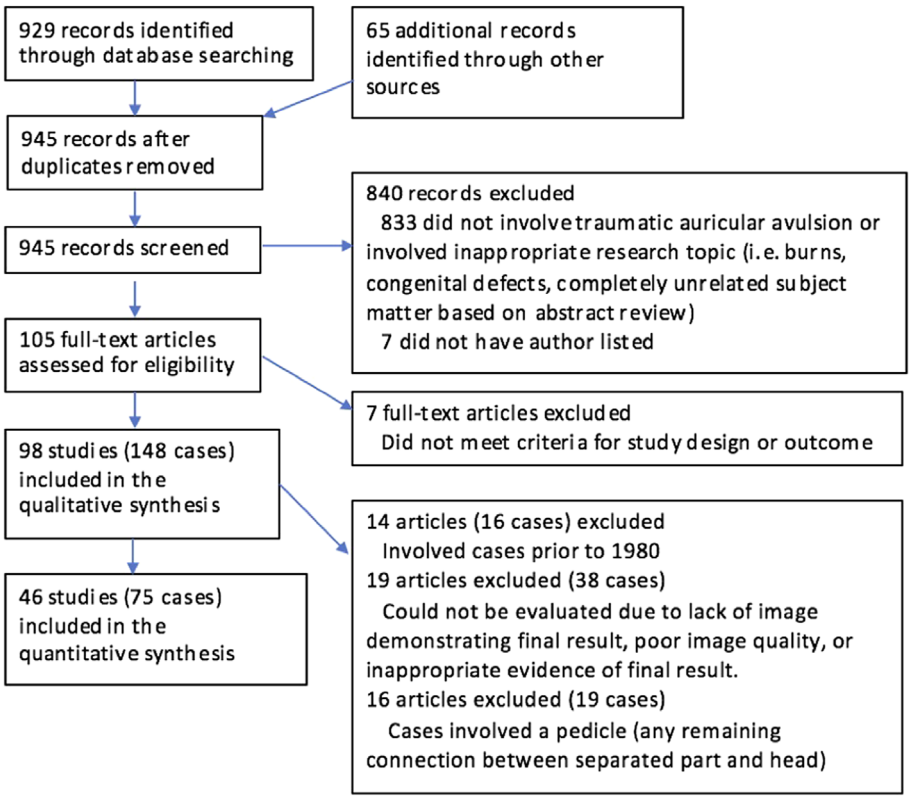

FIGURE 1 PRISMA diagram demonstrating the screening and inclusion/exclusion processes

[ti] OR auricle [ti]) AND (Amputation, Traumatic/surgery [mesh] OR reattach* [tiab] OR avul* [tiab] OR reattach* [tiab] OR avul* [tiab] OR trauma [mesh]) AND english [lang] AND humans [mesh]. This database search produced 929 records. The primary search was supplemented by an extensive review of references from published studies and a search of Scopus database (ear avulsion) which together generated 65 additional records. Duplicate articles were removed, resulting in 945 total records. The initial screening process removed articles which did not involve auricular avulsion injuries and articles focusing on topics unrelated to acute management of auricular avulsion injuries. Details of the screening process can be seen in Figure 1. Auricular avulsion injuries were defined as cases involving the complete or partial separation of a segment of the auricle due to mechanical trauma. For example, cases involving burns, congenital defects, or other processes resulting in an ear deformity were excluded. If an article involved a case where it was not immediately clear whether an auricular avulsion occurred, then the article was evaluated and discussed by three reviewers to decide if it should be included. Seven additional articles were removed in this process.

In total, 148 cases were included in the qualitative analysis. Of these cases, 14 additional articles (16 cases) were excluded because they occurred prior to 1980. This year was selected for two reasons. First, Pennington et al transformed the field of auricular avulsion repair in 1980 with the use of microvascular techniques to repair an avulsed auricle.[7] Second, selecting the year 1980 allowed this project to limit cases to more modern medical practice as well as allow comparison between this project and Steffen et al's review of auricular avulsion repair techniques in 2006.[6] Twenty-five cases included segments with a pedicle, which was defined as any attachment remaining between the avulsed segment and the base of the auricle or head, and were also excluded from the final analysis. In total, 46 studies with 75 total avulsion cases were included in the quantitative analysis. Relevant information for each case was recorded including: gender, cause of injury, mechanism of injury, degree of injury, and whether a pedicle remained. Degree of injury was designated into one of three categories: first-degree—one-third or less of the auricle avulsed, second-degree—more than one-third, but less than two-thirds of the auricle avulsed, or third-degree—greater than two-thirds of the auricle avulsed.

TABLE 1 Criteria used for grading the outcomes of each case

Grade	Criteria
5	Normal or near-normal in appearance: normal shape and size, normal skin color, subtle scar.
4	Subtle abnormality: slight reduction in height of ear, tiny notch at reattachment site, mild scarring of the involved skin.
3	Definite abnormality: obvious contracture of reattached segment, diminished vertical height, moderate scarring of involved skin.
2	Severe abnormality: significant deformation of the ear, severe contraction, significant loss of height, very poor skin quality, significant scarring.
1	Complete failure with loss of the avulsed tissue.
CNE—Cannot evaluate	No pictures of the final outcome are provided, timing of the photos is inappropriate, or the picture quality is too poor to appropriately assess outcome.

TABLE 2 Characteristics of cases

	No.	Percent
Age category		
<20	26	20
20-40	63	48
40-60	31	23
60+	8	6
Not specified	4	3
Gender		
Male	92	70
Female	30	23
Not specified	10	8
Injury cause		
Animal bite	19	14
Assault	10	8
Fall	5	4
Human bite	27	20
Industrial	1	1
Motor vehicle accident	45	34
Not specified	23	17
Suicide attempt	2	2
Injury type		
Avulsion	96	73
Avulsion with crush	7	5
Avulsion with laceration	23	17
Not specified	6	5
Degree of injury		
<1/3	22	17
1/3-2/3	24	18
>2/3	86	65
Pedicle present		
Total avulsion	108	82
Pedicle intact	24	18
Repair category		
Baudet	6	5
Microsurgical; arterial only	27	20
Microsurgical; with vein	34	26
Platysma flap	6	5
Pocket	12	9
Local flap	10	8
Reattachment	25	19
TPF flap	12	9

Abbreviation: TPF, temporoparietal fascia.

Three reviewers (A.D.G., J.M.C., W.W.S.) independently graded the final aesthetic result of each case in a blinded fashion using a 5-point scale (Table 1). The final grade for each case represented the mean of the three grades. The average grade of each repair was used to compare success rates of the reattachment method using Student's *t* tests. A multivariate regression model was also created to examine the impact of repair technique independently of age, gender, pedicle status, degree of injury, and injury type. STATA 15 (StataCorp, College Station, Texas) was used for analyses.

3 | RESULTS

In total, 148 cases were identified, with 16 cases excluded because they occurred prior to 1980. Of the remaining 132 cases, males represented the majority of cases (n = 92) with only 30 cases involving females and 10 cases that did not specify sex (Table 2). The most common cause of injury was motor vehicle accident (n = 45), followed by human bites (n = 27) and animal bites (n = 19) (Figure 2). All 132 cases involved an avulsion of the auricle with 96 cases describing the injury either by using "avulsion" specifically or through a narrative description of how the injury occurred, which was then classified as an avulsion. There were seven cases which described an avulsion along with a component of crush injury to the avulsed segment.

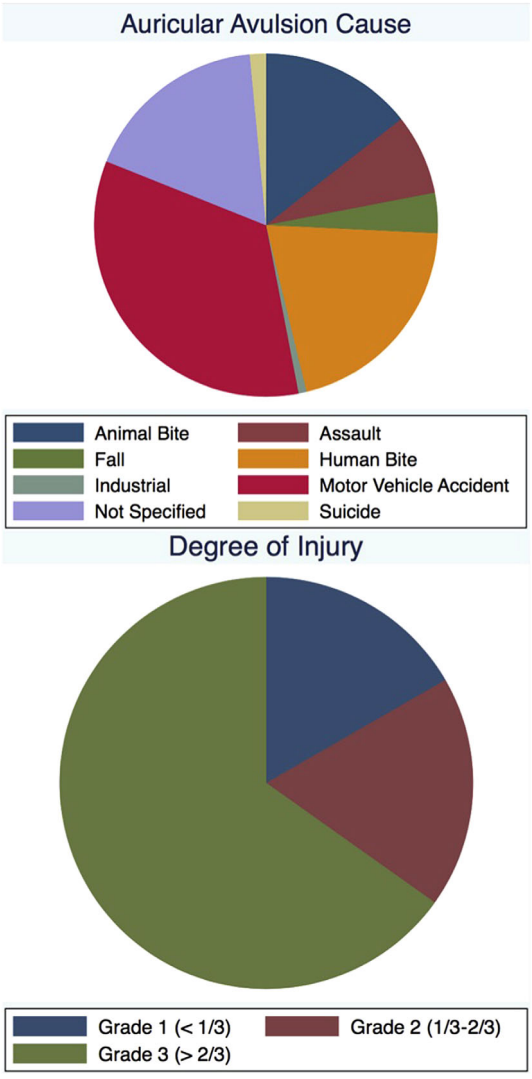

FIGURE 2 Frequency of auricular avulsion injuries by cause (top) and by degree of injury (bottom)

TABLE 3 Average final grade by injury type, repair category, and repair technique

Repair category	Mean grade	SD	*P* value
Injury category			
Pedicle (n = 19)	3.74	0.78	.05
Total avulsion (n = 75)	3.24	0.99	
Repair type (among total avulsion patients)			
Microsurgical (n = 44)	3.50	1.30	.01[a]
Microsurgical with artery alone (n = 21)	3.29	1.28	.25[b]
Microsurgical with artery and vein (n = 23)	3.67	0.87	
Other techniques (n = 31)			
Reattachment (n = 6)	3.39	1.14	.07[c]
Local flap (n = 4)	3.08	0.88	
Pocket (n = 7)	2.95	0.56	
TPF flap (n = 7)	2.67	0.54	
Platysma (n = 2)	2.67		
Baudet (n = 5)	2.53	0.38	

Abbreviation: TPF, temporoparietal fascia.
[a]*P* value for microsurgical vs all others.
[b]*P* value for microsurgical with artery alone vs microsurgical with artery and vein.
[c]*P* value for reattachment vs all others except microsurgical.

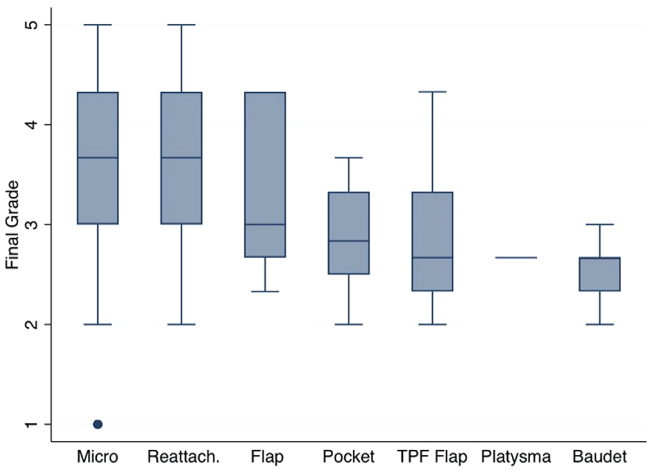

FIGURE 3 Final average grade and repair technique employed. TPF flap, temporoparietal fascia flap

Twenty-three cases indicated an avulsion injury with a component of a laceration, or injuries involving a sharp object.

Nearly two-thirds of the cases involved a third-degree avulsion (n = 86) (Figure 2). There was a nearly equal number of first-degree and second-degree avulsions with 22 and 24 cases, respectively.

After the qualitative review of the data, cases graded as CNE—could not evaluate, were excluded before quantitative analysis. This exclusion resulted in 94 cases. A preliminary review of the data identified a significant difference (P = .04) between cases with a pedicle (n = 19), and cases without a pedicle (n = 75). Cases with a pedicle had an average final grade of 3.74 while cases without any remaining connection had an average final grade of 3.24 (Table 3). To limit bias in the final quantitative analysis, cases with a pedicle were excluded.

When individually comparing each repair technique to all other techniques, the use of microvascular repair yielded a significantly higher average grade than other techniques (average grades of 3.5 vs 2.9; P = .01) (Figure 3). There was also a trend toward a higher average grade using reattachment when compared to other reattachment techniques aside from microvascular (3.4 vs 2.8; P = .07). No other techniques were associated with a significant difference in average grade.

In a multivariate model incorporating demographics, pedicle status, injury degree, and injury type, microvascular repair was significantly associated with a higher average grade when compared to other techniques (average grade increase of 0.7; P = .01). The use of a pedicle was the only other variable significantly associated with a higher average grade (average increase of 0.8; P = .01).

Of the 44 cases repaired by microsurgical techniques, 21 cases involved arterial anastomosis only with an average grade of 3.29. Twenty-three cases repaired by microsurgical techniques involved both arterial and venous anastomoses with an average grade of 3.67 (Table 3). Although injuries repaired by both arterial and venous anastomoses demonstrated a higher average final grade compared to repairs with arterial anastomosis only, this difference was not statistically significant (P = .25).

4 | DISSCUSSION

4.1 | General background

Auricular avulsion injuries are uncommon traumatic injuries which represent a unique challenge to the practicing otolaryngologist or reconstructive surgeon. By their nature, patients with these injuries are seen on an emergent basis. A single surgeon has little or no experience with these injuries. In addition, there are no widely accepted guidelines to assist in the proper management of these injuries.

Although there are a multitude of repair methods available for reattaching an avulsed segment, there remains significant controversy on how to best manage these cases in the acute setting. Currently, the most common reattachment methods include: reattachment as a composite graft, reconstruction using local flaps, pocket principle, Baudet method, and microvascular repair. Steffen et al reviewed the success rates and individual benefits of each technique in 2006, concluding that the pocket principle and use of periauricular skin or fascia flaps should be abandoned.[6] Despite these recommendations, many surgeons continue using these methods with varying degrees of success.[8-17]

4.2 | Composite graft (simple reattachment)

The first record of a successful ear reattachment was reported by Brown in 1898.[18] He used eight sutures to reattach the avulsed segment and included a preoperative sketch of the injury as well as a follow-up photo. Despite this early report, literature presenting successful ear replantation was exceptionally sparse, with only one case reported that included a photograph by 1967.[19]

In 2006, Steffen et al reviewed the literature spanning 1980 to 2004 and reported their findings based on 74 cases. They concluded that simple reattachment is only indicated when the injury results in the preservation of a skin pedicle.[6] In Steffen et al's review, only a single case demonstrated a successful application of simple reattachment in which more than one-third of the auricle was avulsed and no pedicle existed. The remainder of the successful cases repaired by simple reattachment either contained a skin pedicle or consisted of an avulsion involving one third or less of the auricle.[20-24]

Nine cases, published in 2008 or later, employed the use of simple reattachment methods in which avulsed auricles with narrow skin pedicles present were identified.[25-29] Erdmann et al further investigated the anatomical basis for the success in these cases and defined the helical arcade.[29] Based on these findings, the authors concluded that as long as attachment via the helical root is maintained, a near total auricular amputation can survive with simple reattachment and proper care of venous congestion until neovascularization occurs.

There have only been six cases published since 2008 where authors employed simple reattachment methods despite no skin pedicle being present. Bear in mind that those with good results are more likely to report their findings.

4.3 | Local flap reconstruction

Many variations on the use of local skin flaps in auricular reattachment and reconstruction have been devised.[30-32] Elsahy discussed some of these techniques, including the use of flaps from preauricular, retro-auricular, mastoid, and cervical regions, as well as skin from the medial and lateral surfaces of the ear.[2] The type and combination of skin flaps used is dependent on the site and extent of the amputated area and the condition of the skin around the injury.

4.4 | Temporoparietal fascia flaps

One historically popular method involved the use of the temporoparietal fascia (TPF) flap for reconstruction.[33-35] Brent et al originally demonstrated the TPF flap as an ample, thin, vascular cover in the repair of

congenital ear deformities.[36] Turpin et al[33] and Anous and Hallock[34] adapted this technique to provide vascular support for the repair of traumatically avulsed auricles. Although many variations of this technique have been presented,[15-17,33-35,37] the general concept involves degloving the skin of the amputated ear, suturing the amputated part into its original position, applying a TPF flap, and covering the area with a full-thickness skin graft.

Steffen et al did not identify any complete losses in replantation methods using local skin flaps or TPF; however, they concluded that the TPF flap is an "appropriate 'life boat' after failed microsurgical repair."[6] This conclusion was largely based on two cases presented by Cavadas and Chun et al in which they successfully applied the TPF flap technique as a salvage procedure after failed microvascular repair.[38,39] Steffen et al noted late cartilage resorption and distortion, as well as the need for secondary reconstruction, when using either local skin flaps or the TPF flap technique, making these less than ideal methods for initial reconstruction.

4.5 | Pocket principle

The pocket principle was introduced by Mladick et al in 1971. This technique involves minimal debridement of the skin edges with dermabrasion of the skin of the avulsed segment. A subcutaneous postauricular pocket is created, the ear is reattached, and the reattached portion of the ear is inserted into the pocket.[40] The ear is removed from the pocket after 28 days. In 1973, Mladick et al improved upon the original technique with the introduction of the modified pocket principle. Major changes included the addition of traction sutures along the helical rim to stretch out the buried component, as well as removal of the ear from the pocket after only 14 days.[41] Both methods are based on the theory that enlarging the area of vascular contact will improve the viability of large composite grafts after replantation.

In 2006, Steffen et al reviewed 14 cases in which the pocket principle was employed and concluded that all variations of the pocket principle should be abandoned.[6] This recommendation was largely based on the successful repair of partial avulsion injuries. In this case, "partial avulsion injuries" referred to cases in which only part of the auricle was avulsed and no pedicle remained. For instance, in this definition of a partial avulsion, 50% of an auricle may be traumatically avulsed while 50% of the ear remains intact, without any connection between the two parts. Pribaz et al reported a six-case series using the pocket method in 1996. Half of the injuries involved one-third or less of the auricle (first-degree as previously defined) and either healed satisfactorily or with slight atrophy.[42] Unfortunately, more severe injuries involving more than one third of the auricle all demonstrated some form of atrophy, and one case demonstrated complete loss of the auricle. Other authors, including Clayton and Friedland[43] and Lehman and Cervino[44] have also demonstrated successful use of the pocket principle in cases involving one-third or less of the auricle.

Employment of the pocket principle results in extensive undermining of the postauricular skin. This dissection and subsequent scarring limits the availability of secondary options should the primary reattachment attempt fail or result in significant deformity. Steffen et al described "loss of cartilage complexity and stability,"[6] even in cases where the pocket principle was successfully employed. Despite Steffen et al's review and recommendations, the pocket principle is still employed.[12-14,44]

4.6 | Platysma myocutaneous flap

The use of a plastyma myocutaneous flap was originally described by Ariyan et al in 1986.[45] In this technique, the auricular cartilage of an avulsed ear segment is inserted under the thin plastyma muscle using a "sandwich" technique. This method was considered advantageous because it allows the cartilage to be vascularized from both the anterior and posterior surfaces. After 3 weeks, the interpolated flap was divided and inset. This case required two revisions, one using costal cartilage to accentuate the helix, and the other to augment the lobule and apply a split-thickness skin graft to highlight the convolutions of the antihelix. In 1999, de Mello Filho et al published a case series of five cases of auricular avulsion repaired using a platysma myocutaneous flap.[46] Four of these cases were reported to be successful, while one resulted in a complete loss of the ear due to necrosis of the entire flap.

4.7 | Baudet method

In 1972, Baudet et al proposed a two-stage reattachment technique for avulsion injuries. The Baudet method involves excising the posterior skin from the severed part, creating a postauricular flap, and perforating the cartilage of the amputated ear to create large fenestrations.[47] These perforations allow better contact between the graft and underlying vascular bed and improve tissue survival.[48] The first stage of the reattachment is completed by suturing the amputated part to the anterior stump of the ear and the postauricular flap.[10] The second stage involves elevation of the ear with application of a full-thickness skin graft to the postauricular area and is performed after 3 to 4 months.[10,11,47]

Although some authors advocate that the Baudet method is a simple, reliable alternative when microsurgical repair is not possible,[9,11] our review indicates that this technique often results in a loss of contour and nearly always leads to a reduction in auricle size.[8,10,11,47,49,50] Horta et al proposed that the increased vascular contact offered with the Baudet method may be an acceptable alternative in cases with a high risk for infection, such as human or animal bites.[11] This assertion is difficult to assess, given the relative scarcity of published cases where reattachment failure occurred due to infection. In our review, there were only two infections out of 148 cases reviewed.

4.8 | Microvascular repair

In 1980, Pennington et al reported the first successful microvascular repair of a totally amputated auricle.[7] In addition to demonstrating the

TABLE 4 Technical points contributing to successful microvascular repair asdescribed by Pennington et al in 1980[7]

Thorough exploration of the amputated ear while it is still cooled on the bench (hand surgery table), with tagging of all suitable vessels
Use of vein grafts to simplify microsurgical access, to allow generous resection of damaged vessels and prevent anastomotic tension
Performance of the most critical anastomosis (between the suitable artery in the ear and its feeding vein graft) on the bench, where conditions for very small vessel anastomosis (0.5 mm) at high magnification are ideal
Completion of arterial revascularization first, which helps to identify small veins and ensures they are not confused with arteries

feasibility of replanting a human ear microsurgically, Pennington et al also outlined key technical considerations for applying this technique (Table 4). First, bench microdissection was used to identify and tag suitable arteries. Vein grafts allowed for damaged vessels to be resected and helped to prevent the tension typically associated with anastomosing vessels. Last, anastomoses of vein grafts to the avulsed segment were completed at the bench under ideal conditions. After this preparation, the ear segment was reattached and arterial anastomoses were completed first, which facilitated the identification of small veins.

Since Pennington's initial description of the application of microvascular repair to auricular avulsion injuries, many technical advancements have been proposed.[51-57] Venous congestion is the major complication associated with microvascular repair of the auricle, and several authors have reported cases where venous congestion led to late failure of reattachment and complete loss of the replanted segment.[58-62] The most common methods for managing venous congestion are leech therapy or surgical perforation of the reattached segment. Sadove asserted that intravascular thrombosis was inevitable and advocated prophylactic initiation of medicinal leeches four times daily for the first several days.[62] Katsaros et al partially attributed their failed case to a delay in the start of leech therapy.[59] A full discussion of leech therapy is beyond the scope of this article.

In Steffen et al's review, microvascular repair was reported to offer superior cosmetic results, when compared to all other repair methods.[6] Although offering the best aesthetic outcomes, microsurgical repair has some inherent disadvantages. Kind et al reviewed 25 cases of microsurgically repaired ears and noted an average operative time of approximately 6 hours, an average hospital stay of 11.4 days, and a high likelihood of blood transfusion.[57] The average number of transfusions reported by Kind et al was 5.94 units, while the highest transfusion rate was 13 units for a single procedure, reported by de Chalain and Jones.[63] The need for blood transfusions, increased operative times, and prolonged hospital stays are important considerations and should be taken into account before attempting microvascular repair.

To optimize the possibility of microvascular repair, Garcia-Murray and Talbi support storing the separated part in moist gauze and refrigerating it (4°C), while Talbi et al added antibiotics to the compress.[64,65]

4.9 | Burying avulsed auricular cartilage

The senior author has seen several patients in whom the avulsed ear segment was denuded of skin and the remaining cartilage was placed under the postauricular skin "for later use." We strongly discourage this practice. In spite of our best efforts and looking over 105 articles, we are unable to account for where this practice originated. Even though banked ear cartilage will likely survive, it is unusable and cannot withstand the forces of contraction that take place following secondary reconstruction. In our opinion, dissection of the postauricular skin in the acute setting is to be avoided at all costs.

4.10 | Study limitations

Although our results appear to support microvascular and simple reattachment techniques, it is clear that the vast majority of the publications studied attempted to show good results with their respective techniques. For this reason, we cannot estimate the failure rate of these techniques when broadly applied. Almost certainly many of those reading this article will relate to their own experiences of ischemic necrosis following attempted reattachment of a significant auricular segment. It is very unlikely that there will be a published series looking at unselected cases in which reattachment was attempted, reporting both successes and failures.

While microvascular repair reliably demonstrated the highest final aesthetic grades, composite graft reattachment and local flap reconstruction also generated good results. The lack of disparity between these techniques is most likely due to the low number of nonpedicled cases repaired by reattachment and local flap reconstruction, 6 and 4, respectively. Furthermore, authors have a tendency to only publish their best results. Bernstein and Nelson reported nine cases of reattachment but only provide photographic results in two cases and report the remaining seven cases as simply "most gratifying."[21] Hyckel et al discuss five cases in which he employed Mladick's pocket principle in 1999, but only provides details on a single case.[66] The omission of important case details complicates the process of identifying which techniques consistently outperform other repair methods and skews the assessment of failure rates.

Although our results indicate that simple reattachment can generate good aesthetic results, we have significant concerns about simple reattachment of segments larger than one-third of the auricle, based on the observations of Steffen et al.[6]

4.11 | Observations/cautions

In our analysis, both microvascular repair and simple reattachment are to be better alternatives than other techniques, as measured by final aesthetic outcome (grade). This is not to imply that local flaps, the pocket principle, or the Baudet method result in extensive tissue loss. In fact, each of these is associated with a satisfactory success rate, with respect to viability. However, in general each is also associated with a poor result and associated lifelong deformity. These findings

are supported by Bai and Tollefson stating that techniques using periauricular flaps such as pocket technqiues and TPF flaps tend to result in distortion and shrinkage of the auricle from cartilage resorption and fibrosis.[67] Likewise covering the cartilage segment with a TPF flap and skin grafts would likely result in a viable reconstructed auricle. However, the TPF flap is such a unique reconstructive option that we feel it is best used in a delayed fashion by surgeons with significant experience with ear reconstruction using costal cartilage grafts or synthetic auricular implants (eg, MEDPOR). As noted earlier, in order for the patient to be a good candidate for costal cartilage reconstruction, the postauricular skin must be unaltered.

4.12 | Recommendations for surgeons

Management of auricular avulsion injuries remains a significant therapeutic dilemma. Based on our systematic review, two things appear to be clear: (a) avulsion injuries in which a soft tissue pedicle exists offer a greater chance for success (viability and a good aesthetic result) following reattachment and (b) microvascular repairs are associated with the best outcomes. Clinical judgment will dictate which technique is most appropriate. Under ideal circumstances, microvascular repair appears to be the best option for major defects. However, in the vast majority of patients, this may not be appropriate or available. Counseling about the use of leeches and the need for blood transfusions also plays a major role in the decision-making process.

Reattachment of the segment as a composite graft can be considered. Although not proven by our data, it is likely that reattachment of smaller segments has a greater chance for survival. Larger segments are more likely to fail, leading to necrosis and resulting in a large residual defect. In Steffen et al's study, segments larger than one-third of the ear had a poor outcome.[6] Although other methods such as local flap and fascial flap reconstruction can be accomplished, these techniques not only "burn bridges" but also are less likely to be associated with a good aesthetic result.

The authors recommend against the use of postauricular skin or temporoparietal fascial flaps in the acute setting, reserving these tissues for secondary reconstruction (usually months later). This also allows for referral to a reconstructive surgeon who has significant experience in auricular reconstruction (eg, microtia repair) under whose care an optimal result is more likely.

5 | CONCLUSION

When comparing repair techniques in the acute management of an auricular avulsion, microvascular repair demonstrates the best aesthetic outcomes. Composite graft reattachment methods also demonstrated better aesthetic outcomes compared to other methods and should be considered under the right circumstances. Our results reaffirm Steffen et al's findings and support the abandonment of repair techniques such as the Baudet method, the pocket principle, and techniques involving periauricular skin flaps and TPF flaps in the acute management of auricular avulsion injuries. These techniques are associated with less than ideal results and jeopardize future procedures used for secondary reconstruction.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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How to cite this article: Gailey AD, Farquhar D, Clark JM, Shockley WW. Auricular avulsion injuries and reattachment techniques: A systematic review. *Laryngoscope Investigative Otolaryngology*. 2020;5:381–389. https://doi.org/10.1002/lio2.372