ORIGINAL ARTICLE

Factors Associated with Postpiercing Auricular Cartilage Keloids

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ABSTRACT

Objective: To determine the factors responsible for postpiercing auricular cartilage keloids.
Study Design: Observational study.
Place and Duration of Study: Department of Plastic Surgery, King Edward Medical University (KEMU), Lahore, from March 2007 to July 2010.
Methodology: Fifty patients of post-earpiercing keloids affecting the cartilaginous portion were included in the study. Patients with keloids at any other site, positive family history of keloids and recurrent keloids were excluded. Information regarding age at piercing, site of piercing, use of gun or home sewing needle for piercing, use of jewellery other than gold postpiercing, itching or redness with use of jewellery, tight fitting of jewellery in the piercing hole and postpiercing infection was collected. Fisher exact and Wilcoxon rank sum tests were used to analyse the data.
Results: All the patients had low lobule piercing at a mean age of 4.52 $\pm$ 1.15 years and cartilage piercing at an average age of 22.32 $\pm$ 3.74 years ($p < 0.001$). Eleven patients (22%) had also simultaneous high piercing in the lobule. Only cartilage piercing sites developed the keloids. Postpiercing infection was present in all the 50 patients of cartilage piercing whereas only 3 out of 11 high lobule piercing sites got infected ($p < 0.001$).
Conclusion: Cartilage bearing portion of the ear is more likely to form keloids due to its piercing in or after adolescence and prolonged wound healing caused by infection.

Key words: *Keloid. Ear-piercing. Cartilage.*

INTRODUCTION

Ear piercing is common and multiple piercing of the ear has gained popularity. This involves "high" piercing through the cartilage of the upper third of the pinna.[1] Keloid formation is a recognized complication of ear piercing and patients commonly present to plastic surgeons.[2] An interesting observation is that these patients have keloids developing in their ear cartilage piercing sites, whereas the common sites for keloid formation like ear lobule, chest, back and shoulders are spared in these cases.[3]

Mustoe *et al.* classified clinical scars into normal mature scar, immature scar, linear hypertrophic scar (HS), widespread HS, minor keloid and major keloid.[4] The use of terms 'hypertrophic response' for less severe forms and 'keloid diathesis or disease' for severe keloids has been recommended.[5] Keloid disease (KD) is a clinical entity characterized by formation of severe keloids in response to minor trauma like scratching, acne, lobule piercing and injection etc. (Figure 1). The important risk factors for keloid disease (KD) are genetic predisposition and ethnicity and typical sites are ear lobule, chest, back and shoulders.[6] Whereas healing by secondary intention is the major risk factor for hypertrophic scars and keloids. Thus, wounds subjected to a prolonged inflammation due to repeated trauma, infection or foreign body, are at risk of minor keloids.[7,8]

Cartilage of the ear has no direct blood supply and is a tough structure as compared to the lobule. Piercing guns with very blunt studs are commonly used by the quacks for cartilage piercing. Jewellery fits too tightly and it becomes difficult for the patient to periodically rotate the jewellery to stretch these piercing holes.[1] There is more risk of infection with high ear piercing owing to sparse blood supply. Moreover, guns are not properly sterilized and the resulting perichondritis is difficult to treat and leads to healing by secondary intention.[1,9] Normal healing time for ear cartilage piercing is 2 months to 1 year as compared to 4-6 weeks healing time for lobule piercing.[10] Other factors responsible for delay in healing may be metal sensitivity and wearing tight fitting jewellery.[3,11] Age is also an important risk factor in the development of keloids. People aged 10-30 years develop keloids more frequently.[12]

Much of the clinical and scientific research in the field of keloid scaring is flawed because investigators have failed to define their research material as mild keloid or severe/ massive keloid and all the fibro proliferative disorders of the skin that grow beyond the boundaries of original wound or have an unrecognized origin are falsely classified as 'keloid'.[13] The interventions for all the keloids without stratification lead to confusion not clarity. The variable response to treatment reflects the heterogeneity of morphological features, risk factors, extra cellular matrix and vascular architecture within each of the keloid. Studies have to identify cohorts of

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keloid according to anatomical location, morphological features and cellular markers.[14]

The objective of this study was to determine the risk factors for postpiercing auricular cartilage site keloids like age of piercing; use of gun or home sewing needle for piercing; postpiercing use of jewellery other than gold; itching or redness with the use of jewellery; tight fitting of jewellery in the piercing hole and postpiercing infection.

METHODOLOGY

It was an observational study done at the Department of Plastic and Reconstructive Surgery, Mayo Hospital, Lahore, from March 2007 to July 2010. The ethical issues were considered and study protocol was approved by the institutional review board. Keloids were defined as fibro proliferative disorders of the skin that grew beyond the boundaries of original wound or had an unrecognized origin.[15] Fifty patients having postpiercing keloids affecting the auricular cartilage were studied. All the ear lesions were excised and confirmed as keloids on histopathology. Patients with keloids at any other site, positive family history of keloids and recurrent keloids were excluded for possible keloid diathesis.

All the patients included in the study completed a survey and gave information about age of lobule and cartilage piercing; use of gun or home sewing needle for piercing; postpiercing use of jewellery other than gold; itching or redness with the use of jewellery; tight fitting of jewellery in the piercing hole; postpiercing infection. The tight fitting of jewellery in the piercing hole was defined as ability to rotate the jewellery in the piercing hole with difficulty.[1] The postpiercing infection was defined as presence of pain, redness, swelling, heat and discharge.[9]

All the data were shifted to preformed proforma. The Wilcoxon rank sum test was used to compare mean age of cartilage and lobule piercing. The Fisher exact test was used for comparison of proportions of cases of cartilage piercing (n=50,100%) and high lobule piercing (n=11,100%). Proportions compared were use of gun or home sewing needle for piercing, postpiercing use of jewellery other than gold; itching or redness with use of jewellery; tight fitting of jewellery in the piercing hole and postpiercing infection. SPSS version 16 was used to analyze the data. All tests were two sided. A value of p less than 0.05 was considered significant. Table was used to present the data.

RESULTS

All included patients (n=50, 100%) were females. All the patients had low lobule piercing in childhood at an average age of 4.52 years $\pm$ 1.15 years (age range between 3 years to 7 years) and cartilage piercing in or after adolescence at an average age of 22.32 years $\pm$ 3.74 (age range between 16 - 30 years) with only cartilage piercing sites developing the keloids. Comparing the average ages by Wilcoxon rank sum test gave a value of $p < 0.001$.

Eleven patients (22%) had also additional high piercing in the lobule along with cartilage piercing. Interestingly, in these patients only cartilage piercing site developed the keloids (Figure 2). Proportions and percentages of other risk factors for cartilage piercing cases and similar information for high lobule piercing site are shown in Table I. Total keloids studied were 101. Forty five patients had bilateral keloids with four having multiple keloids. Five of the remaining patients had keloids affecting only one ear.

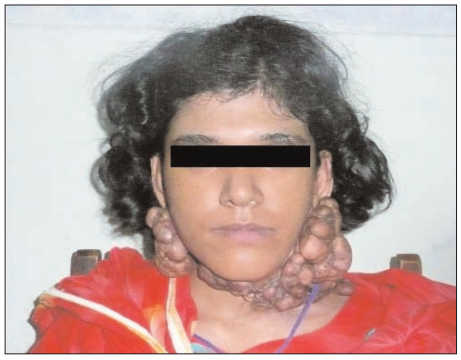

Figure 1: A case of severe keloids.

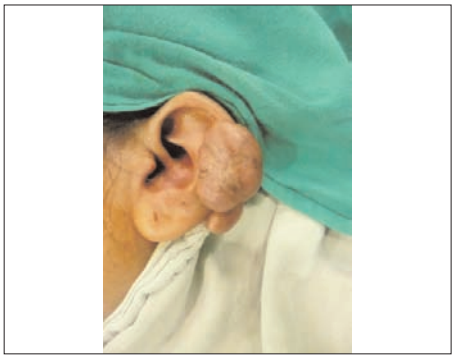

Figure 2: A case of cartilage and high lobule piercing with only cartilage piercing sites developing keloids.

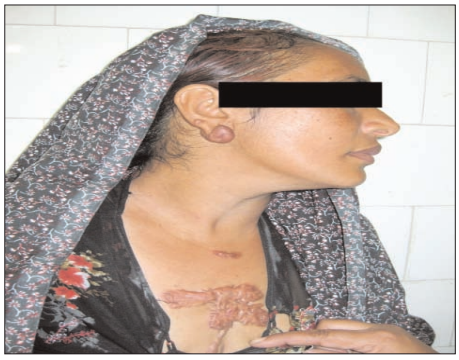

Figure 3: A case of multiple keloids at chest, lobule and cartilage piercing sites.

Table I: Risk factors other than age for cartilage.

S. No.	Risk factors for cartilage and lobule piercing	Total number of cases of cartilage piercing (n50)	Percentage	Total number of cases of high lobule piercing (n11)	Percentage	P-value
1	Use of gun or sewing needle for piercing	42	84%	8	72%	0.400
2	Postpiercing infection	50	100%	3	27%	< 0.001
3	Use of jewellery other than gold postpiercing	30	60%	5	45%	0.50
4	Itching/ redness with the use of jewellery	11	22%	2	18%	1.00
5	Tight fitting of jewellery into piercing hole	8	16%	0	0%	0.33

Analysis of single Table I, S. No. 1.

Use of gun or sewing needle for piercing	Cartilage piercing (n 50)	High lobule piercing (n 11)
Yes	42	8
No	8	3

Chi-square .78 Fisher exact two tailed p-vlaue 0.400

Analysis of single Table I, S. No. 2.

Postpiercing infection	Cartilage piercing (n 50)	High lobule piercing (n 11)
Yes	50	3
No	0	8

Chi-square 47.44 Fisher exact two tailed p-vlaue 0.0001

Analysis of single Table I, S. No. 3.

Use of jewellery other than gold	Cartilage piercing (n 50)	High lobule piercing (n 11)
Yes	30	5
No	20	6

Chi-square .78 Fisher exact two tailed p-vlaue 0.504

Analysis of single Table I, S. No. 4.

Itching/redness with the use of jewellery	Cartilage piercing (n 50)	High lobule piercing (n 11)
Yes	11	2
No	39	9

Chi-square .08 Fisher exact two tailed p-vlaue 1.000

Analysis of single Table I, S. No.5.

Tight fitting of jewllery in the piercing hole	Cartilage piercing (n 50)	High lobule piercing (n 11)
Yes	8	0
No	42	11

Chi-square 2.03 Fisher exact two tailed p-vlaue 0.33

DISCUSSION

Despite the physical and psychological trauma caused by the keloids, exact cause and pathogenesis of their development remain unclear. It has been said that the less is known about a disease, the more therapeutic modalities seem to be available. This universal medical truth certainly applies to keloids.[16] The term keloid is not a homogenous biological entity. Recognition of different morphological phenotypes is necessary in understanding genotypic pre-disposition and aiding diagnosis, treatment and prognosis of keloid scars. At present, it is still difficult to know the effectiveness of various therapeutic options used for the keloids without first classifying it on the basis of race affected, genetic susceptibility, and age of occurrence, nature of trauma, anatomical site, aggressiveness (mild or severe keloid) and above all, course of wound healing.[17]

Age has been considered a significant risk factor for the development of keloids because of the observation that they tend to develop more readily during and after puberty. This has been associated with endocrine factors and increased pituitary activity in puberty as pituitary hyperactivity results in increased pigmentation due to greater melonocyte stimulating hormone (MSH) release and keloid formation mainly occurs in parts of the body with high concentrations of melanocytes, and it is rare on the soles and palms.[18] These observations should hold true for the cartilage bearing portion of the ear. In the current study all the patients had their cartilage piercing at an average age of 22.74 years and low lobule piercing at an average of 4.7 years. Only cartilage piercing site developed keloids justifying age as the risk factor for these keloids. Joshua *et al*. also studied age as a risk factor for post-ear piercing keloids and found that 75% of patients developing the keloids had their first piercing performed at $\geq$ 11 years of age. Among those whose first piercing was done before age 11 and did not result in a keloid, 92.3% had a keloid after their second piercing at $\geq$ 11 years of age. Based on these observations ear piercing in childhood has been recommended.[11] However, in the current study, rest of the 11 patients had additional second high lobule piercing at an average age of 20.24 years and they did not develop keloids. This refutes age as the sole risk factor for these keloids. The study by Joshua *et al*. had a major limitation in declaring age as the sole risk factor for these keloids because the site of the keloid formation (lobule or cartilage) was not mentioned for the cases developing the keloid after their first piercing at $\geq$ 11 years of age. Moreover, cases developing keloids after second piercing had their piercing sites involving auricular cartilage (potentially an additional risk factor for keloid formation), a factor that could not be examined in the study.[11] However, the fact that high lobule piercing in and after adolescence did not lead to keloid formation needs to be explored.

It has been suggested that keloid scarring is caused by an inability to stop the wound healing process. The events occurring during the wound healing process can be classified into three distinct, yet temporal overlapping phases: the inflammatory, proliferative, and scar maturation phase.[19] Keloid formation is often considered to be the result of a prolonged proliferative and a delayed remodelling phase. In addition, there has been a theory that keloid formation is due to an abnormal response to inflammation by fibroblasts.[20,21] Infection produces an inflammatory response, one that is necessary for normal wound healing. But as the inflammatory phase of wound healing is prolonged, macrophages secrete numerous growth factors and cytokines that act on fibroblast, endothelial cells (EC), and keratinocytes, including: platelet-derived growth factor (PDGF), transforming growth factor (TGF)-α, TGF-β, FGF-2, VEGF, and IGF-I. In addition to their involvements in the inflammatory phase, some of these growth factors and cytokines are also involved in the proliferative phase and have also been implicated to be abnormal in keloids.[22] TGF-β is the most widely studied cytokine involved in keloid pathogens as it stimulates fibroblast multiplication, motility and myofibroblast

transformation; extracellular matrix synthesis and remodelling and decreased collagen degradation. Hence, with a greater stimulus for inflammation, more amount of collagen will be secreted by fibroblasts. Therefore, scar formation is directly dependent on the amount of inflammatory response.[23]

In the current study, all the patients developing keloids in cartilage bearing portion of ear had infection of the piercing site. Thus, infection appears to be an important risk factor for development of these keloids. Owing to the sparse blood supply of the cartilage, it is prone to infection and more importantly infection of cartilage piercing site is difficult to combat by the host defences and antibiotics again due to deficient blood supply. This prolongs healing time by secondary intention leading to formation of these mild keloids. Moreover, there is reason to believe that consequent to sparse blood supply of cartilage, hypoxic environment adds directly to an increased collagen production and decreased collagen degradation leading to increased collagen deposition in the cartilage bearing portion of the ear and formation of these different keloids.[24]

On the other hand, 3 out of the 11 lobule piercing sites got infected with none developing keloids. Explanation to these observations can be better combating of infection due to better blood supply. Thus, lobule piercing site can develop keloids with mildest stimulus when one has genetic pre-disposition to the process and these are severe form of keloids, difficult to treat with very high recurrence rate (Figure 3). Whereas cartilage piercing sites develop mild keloids as a part of hypertrophic response whenever healing is prolonged mainly due to infection and scant blood supply, even when one has no genetic predisposition to keloids Thus, these ear cartilage postpiercing mild keloids should have better response to the treatment and in fact these keloids, in contrast to intra lesional excision, are treated with extra lesion excision with very low recurrence rate.[17]

A majority of the patients in the study (n = 42) had use of gun or home sewing needle for piercing and this contributed to the infection at piercing sites.[25] Other risk factors like use of jewellery other than gold postpiercing, itching or redness with the use of jewellery and tight fitting of jewellery into piercing hole are not independent risk factors and appear to contribute to prolong healing time.

CONCLUSION

Piercing in or after adolescence and prolonged wound healing caused by infection and deficient blood supply make the auricular cartilage a more frequent site for the keloid formation as compared to the lobule when one is not genetically predisposed to keloid formation. Public should be made aware of the fact that strict sterilization should be maintained during the procedure and antiseptics should be used, if needed, while the piercing is in the process of healing.

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