

Risk Factors Associated with Post-Ear-Piercing Keloid Formation in Thai Population

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Background: Keloid is abnormal wound response after skin trauma of which the exact etiology is unknown. Ear piercing is one of the most popular body ornamentation that could somehow lead to keloid formation.

Objective: To identify any risk factors that may relate to post-ear piercing keloid formation.

Materials and Methods: This case control study was conducted in Thai people at Department of Plastic and Maxillofacial Surgery at Ramathibodi Hospital between August 2015 and August 2016. It consisted of post-ear piercing subjects with and without keloid formation as case (43 subjects) and control (44 subjects) groups respectively. Information regarding age at piercing, history of keloid formed, age of keloid formation, site of piercing, method for piercing, jewelry use after piercing, complications, development of keloid at other location of the body, family history of keloid, and skin color was collected.

Results: According to the study, complications from piercing such as infection or allergic reaction were significantly related to post-ear piercing keloid formation ($p < 0.001$). Piercing through cartilage was also proven to be one of the major risk factors ($p < 0.001$). There was no difference between cases and controls in terms of age at piercing, method for piercing, use of jewelry, keloid at other location of the body, family history of keloid, and skin color.

Conclusion: Two major contributing factors of post-ear piercing keloid formation that were identified from the present study are development of post-piercing complications and cartilage piercing.

Keywords: Keloid, Ear piecing, Risk factors, Skin color, Cartilagenous part

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Keloids are abnormal wound responses resulting benign dermal fibro proliferative growths unique to humans that occur in predisposed individuals after skin trauma⁽¹⁾. They can be difficult to differentiate from hypertrophic scars, since both can be raised, firm, pruritic, and painful lesions. However, keloids typically extend beyond the borders of the inciting wounds taking months to years to develop and do not regress over time^(2,3). The exact etiology is unknown but factors contributing to its formation include genetic predisposition, some forms of skin trauma, ethnicity, and age. Darker skin tone increases the risk to 15 times that of white individuals⁽⁴⁾. According to Fitzpatrick skin phototype model, the higher the phototype, the higher the chance of keloid formation⁽⁵⁾. Keloids can develop at any age, but they show a peak incidence during and

after puberty between 15 to 24 years of age, which could relate to growth and hormonal status as contributing factors⁽⁶⁻⁸⁾. They also have a predilection for a specific area of the body, according to a 20-year retrospective study that highlighted the two highest risk areas, the trunk (chest and abdomen), and the face⁽⁸⁾. Though, several effective treatment options are available to treat this abnormal wound healing, recurrence rates are still as high as 15%⁽⁹⁻¹¹⁾. Quality of life in patients with keloids is affected both physically and psychologically. There is correlation of physical impairment in symptomatic keloids such as pruritus, pain, and movement restriction, with the latter two factors associated with psychological effect as well^(12,13).

Ear piercing is a popular method of body ornamentation especially in females, and it is also a form of skin trauma that has somehow lead to keloid formation. The incidence of keloid formation in ear piercing is roughly less than 2.5%, however, due to the prevalence of ear piercing, a number of patients have suffered from this disease⁽¹⁴⁾. Moreover, ear piercing differs from other forms of skin trauma because of its

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cartilaginous portion, sterility, and method of piercing, and introduction of foreign body such as jewelry. Piercing through the cartilaginous part of the ear may increase both minor and major complications such as infection including perichondritis, and keloid. Surgical excision is apt for disfiguring keloid at ear, since it will return the wound into its initial state. However, excision alone is plagued with high recurrence rates of 50% to 100% and secondary deformities, therefore, multimodal therapy is requisite for successful treatment^(15,16). Prevention seems to be the best strategy to counter this hard-to-treat abnormal wound healing. However, to do so, exact etiology must be outlined and studied. The aim of this study is to identify any risk factors that may relate to post-ear piercing keloid formation.

Materials and Methods

This is a prospective case-control study conducted in Thai population between August 2015 and August 2016 at the Division of Plastic and Maxillofacial Surgery in Ramathibodi Hospital. The study consisted of post-ear-piercing patients with and without keloid formation as case and control groups respectively. Diagnosis of keloid was made by attending plastic surgeons. Ear keloid originating from other causes except ear piercing was excluded from the study. Information regarding age at piercing, age of keloid formation, site of piercing, method for piercing, use of jewelry after piercing, infection and other complications, development of keloid at other location of the body, family history of keloid, and skin color was collected. Site of ear piercing was mapped on an ear diagram dividing mainly between cartilaginous (Figure 1) and non-cartilaginous (lobule) portion (Figure 2). If there were more than one piercing site on each ear, detailed information regarding each site was collected. Skin color was measured at inner upper arm via a hand-held colorimeter (DSM II ColorMeter, Cortex technology, Denmark) using the CIE L*a*b* color system (only the L* value was used, L* = 0 yields black and L* = 100 indicates white) and melanin index. Fitzpatrick skin phototypes were also used to categorize skin typology into I-VI. The results were statistically analyzed with SPSS 24.0. Pearson Chi-square test was used for nominal variable calculation, and Fisher's exact test was applied for two nominal variable data. A t-test was used for ordinal variables. Statistical significance was determined by *p*-value of less than 0.05.

Results

There were 43 and 44 subjects in the case and



Figure 1. Keloid at the cartilaginous part of ear pinna.



Figure 2. Keloid at the non-cartilaginous (lobule) part of ear pinna.

control groups respectively. All controls were females, while only five patients (11.6%) in the case subjects were males. Regarding the site of keloid formation, 14 patients (32.6%) had keloid at ear lobule, 25 patients (58.1%) had keloid at cartilaginous portion, and

four patients (9.3%) developed keloid at both non-cartilaginous and cartilaginous sites.

Complications from piercing were found more prevalent in keloid group (53.5%) than control (15.9%) significantly ($p < 0.001$). There was no difference between cases and controls regarding development of keloid at other location ($p = 0.368$), family history of keloid ($p = 0.506$). For skin color, CIE L* value was slightly lower in cases than controls (36.97 vs. 39.86, $p = 0.005$), but no difference in melanin index (34.80 vs. 33.18, $p = 0.110$). Age of piercing at ear lobule was younger in controls than cases (11.8 years vs. 18.3 years, $p = 0.014$), but was not different at cartilaginous site (18.3 years vs. 17.9 years, $p = 0.887$) (Table 1). Latency of keloid formation at ear lobule was 1.5 years using median value in cases, and at cartilaginous site was one year. Regarding method of piercing and type of jewelry at the ear lobule, no difference was found between both groups (Table 2). The silver material was significantly related with keloid formation of the cartilaginous part (Table 3). There was significant predilection of ear keloid formation at cartilaginous site of piercing more than ear lobule piercing ($p < 0.001$) (Table 4).

Discussion

This is the first study in Thai population in keloid formation after ear piecing. We used case-control study because of the low incidence of keloid and limitation of time and budget. We could get some evidence of risk factor in keloid formation after ear piecing. The recall bias was unavoidable in the present study design and the cohort study is recommended to get better reliable conclusion.

Keloid is an abnormal wound response that occurs after some forms of skin trauma including body piercing⁽¹⁾. The ear is the most common site for piercing in both genders, though much more prevalent in females throughout the world. The practice seems easy, but the complication rates are as high as 30%. They include complications such as minor infection, allergic reaction, traumatic tear, and keloid⁽¹⁷⁾. The formation of keloid occurs in about 2.5% of ear-piercing. While the incidence is quite low, it is combining with high prevalence of piercing, therefore, it results in a high number of patients suffering from this abnormal wound response⁽¹⁴⁾. From the present study results, one of the strong risk factors for ear keloid formation is having complications including infection and allergic reaction after piercing. There were several reports of serious infection such as perichondritis requiring oral or intravenous antibiotic, but none occurred from our

Table 1. Analysis of risk factors between case and control groups

	Case n = 43	Control n = 44	p-value
BMI (kg/m ²)	22.73	22.39	0.743 ^a
Complications	23 (53.5)	7 (15.9)	<0.001 ^b
Keloid at other location	9 (20.9)	6 (13.6)	0.368 ^b
Family history of keloid	7 (16.3)	5 (11.4)	0.506 ^b
L* value, mean	36.97	39.86	0.005 ^a
Melanin index, mean	34.80	33.18	0.110 ^a
Age at ear lobule piercing (year)	18.39	11.83	0.014 ^a
Age at cartilaginous piercing (year)	17.93	18.25	0.887 ^a

BMI = body mass index

^a t-test, ^b Pearson Chi-square test

Data presented as mean or n (%)

Table 2. Analysis of piercing method and type of jewelry use after piercing at non-cartilaginous (lobule) site

	Keloid at lobule	No keloid at lobule	p-value
Piercing method, n (%)			0.751 ^c
Gun	3 (16.7)	15 (22.7)	
Needle	15 (83.3)	51 (77.3)	
Total	18 (100)	66 (100)	
Jewelry use after piercing, n (%)			0.144 ^c
Gold	6 (33.3)	24 (36.4)	
Silver	2 (11.1)	14 (21.2)	
Steel	6 (33.3)	18 (27.3)	
Plastic	2 (11.1)	1 (1.5)	
Thread	0 (0.0)	3 (4.5)	
Wood	2 (11.1)	6 (9.1)	
Total	18 (100)	66 (100)	

^c Fisher's exact test

Table 3. Analysis of piercing method and type of jewelry use after piercing at cartilaginous site

	Keloid at cartilage	No keloid at cartilage	p-value
Piercing method, n (%)			1.000 ^c
Gun	4 (13.8)	1 (12.5)	
Needle	25 (86.2)	7 (87.5)	
Total	29 (100)	8 (100)	
Jewelry use after piercing, n (%)			0.047 ^c
Gold	0 (0.0)	1 (12.5)	
Silver	14 (48.3)	2 (25.0)	
Steel	15 (51.7)	4 (50.0)	
Wood	0 (0.0)	1 (12.5)	
Total	29 (100)	8 (100)	

^c Fisher's exact test

Table 4. Correlation between keloid formation and site of piercing

	Case n = 43	Control n = 44	p-value
Site of piercing, n (%)			<0.001 ^c
Non-cartilaginous	14 (32.6)	36 (81.8)	
Cartilaginous	29 (67.4)	8 (18.2)	

^c Fisher's exact test

review^(18,19). Sterility and maintenance of foreign body at piercing site can account for high complication rates. This leads to prolonged inflammation and could somehow trigger abnormal wound response causing formation of keloid.

Several piercing methods are available, all of them have been shown to cause the same extent of damage to both cartilage and perichondrium histologically⁽²⁰⁾. Furthermore, in histological examination of keloid recurrence, foreign body reactions were not found to be an associated factor⁽²¹⁾. In accordance with our results, method of piercing and type of jewelry were not associated with ear keloid formation. Sterility of the wound during and after piercing could be the contributing factor, but due to the retrospective nature of our study with recall bias, conclusion cannot be drawn.

From our study, the development of keloid at other location and family history of keloid were not risk factors. Even though ear is a prone area for keloid formation, surprisingly ear-piercing in predisposed individuals does not increase the chance of keloid formation⁽²²⁾. This suggests that ear keloid may have a different etiology such as chronic inflammation from infection or allergic reaction as mentioned above.

Ethnicity and dark skin tone may be contributing factors in keloid formation⁽⁴⁾. Measurement of skin color between cases and controls was only statistically different in CIE L* value, but not in melanin index. However, the difference was minute, which may not have any clinical significance. This suggests that varying skin tone in the same ethnicity does not contribute to ear keloid formation. Ethnicity may still be a risk factor of keloid especially in darker-skinned race⁽²³⁾.

Age at piercing was observed to be a risk factor. Piercing at age younger than 11 years old is less likely to have ear keloid⁽²⁴⁾. From our study, there was a difference of age at piercing with controls being younger than cases but only in ear lobule piercing but not in transcartilaginous piercing. Keloid development is higher during 10 to 30 years of age, but the chance is known to diminish in the extremes of life⁽²⁴⁾. This finding of protective effect in younger age is still controversial, since there was a report of keloid formation as early as nine months old⁽²⁵⁾.

Transcartilaginous ear piercing has more complications than its lobule counterpart. Infectious complications can occur such as bacterial perichondritis requiring oral or intravenous antibiotic^(18,19). *Pseudomonas aeruginosa* is responsible for more than

80% of infection, followed by *Staphylococcus aureus*. Moreover, this leads to secondary deformity, which is more common at the scapha than the helix⁽¹⁹⁾. The relationship between location of piercing and keloid formation was proven true in the present study. Cartilage piercing has been shown to be more prone to keloid development than lobule piercing. This may be due to localized infection in the form of perichondritis insinuating prolonged wound inflammation.

Our study found that people with keloid at cartilaginous part used higher proportion of silver earrings after ear piecing, however, this is not enough scientific evidence to support the relationship of silver material and keloid formation.

We would suggest that ear piecing be done under sterile technique and only in the lobular area to reduce the risk of keloid formation.

Conclusion

Two major contributing factors of post-ear piercing keloid formation that were identified from this study are development of post-piercing complications and cartilage piercing.

What is already known on this topic?

From the previous knowledge, People with dark skin color was known to have higher risk for keloid formation after skin injury.

What this study adds?

Our study found that piecing the ear through the cartilaginous part had higher risk of keloid than ear lobule.

Silver material using for maintaining the ear piecing fistular tract had higher keloid formation which may cause by more wound reaction.

The infection after ear piecing related to keloid formation and we suggested that ear piecing under sterile technique and used ear ring with low tissue reaction material to reduce the occurrence of the keloid.

Potential conflicts of interest

None.

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ปัจจัยเสี่ยงของการเกิดคีลอยด์หลังการเจาะหูของคนไทย

จิตติ ตันติธรรม, คชินท์ วัฒนวงษ์

วัตถุประสงค์: แผลเป็นนูนคีลอยด์เป็นความผิดปกติของการหายของบาดแผลที่ผิวหนังโดยไม่ทราบสาเหตุที่แน่ชัด การเจาะหูเพื่อใส่เครื่องประดับเป็นสิ่งที่นิยมกระทำในคนทั่วไป และมักพบว่าอาจนำไปสู่แผลเป็นนูนคีลอยด์ได้

วัตถุประสงค์: ศึกษาเพื่อหาปัจจัยเสี่ยงของการเกิดคีลอยด์หลังการเจาะหู

วัสดุและวิธีการ: วิธีการศึกษาแบบมีกลุ่มควบคุม ศึกษาในคนไทยที่สาขาวิชาศัลยศาสตร์ตกแต่ง โรงพยาบาลรามารินทร์ ระหว่างเดือนสิงหาคม พ.ศ. 2558 ถึง สิงหาคม พ.ศ. 2559 โดยประกอบไปด้วยกลุ่มคนใช้คีลอยด์หลังการเจาะหู 43 ราย และกลุ่มควบคุมที่ไม่เกิดคีลอยด์หลังการเจาะหู 44 ราย โดยการเก็บข้อมูล อายุ ขณะเจาะหู อายุ ขณะเกิดคีลอยด์ ตำแหน่งที่เจาะ วิธีการเจาะ ชนิดของต่างหู ข้อแทรกซ้อนหลังเจาะ การมีคีลอยด์ในส่วนอื่นของร่างกาย ประวัติครอบครัว และสีผิว

ผลการศึกษา: การเกิดข้อแทรกซ้อนหลังเจาะหู เช่น ติดเชื้อ หรือ เกิดการแพ้ต่อวัสดุ มีส่วนเกี่ยวข้องกับการเกิดคีลอยด์อย่างมีนัยสำคัญ ($p < 0.001$) และรวมถึงการเจาะหูผ่านกระดูกอ่อน ($p < 0.001$) ส่วนปัจจัยอื่นๆ เช่น อายุที่เจาะ วิธีการเจาะ ชนิดของต่างหู การมีคีลอยด์ในส่วนอื่นของร่างกาย ประวัติครอบครัว และสีผิว ไม่พบความแตกต่างจากกลุ่มควบคุมอย่างมีนัยสำคัญ

สรุป: การเจาะหูผ่านกระดูกอ่อนของหูและการเกิดปัญหาแทรกซ้อนหลังเจาะหูเป็นปัจจัยเสี่ยงของการเกิดคีลอยด์หูหลังการเจาะหูของคนไทย
