Perichondritis of the Auricle: Analysis of 114 Cases

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ABSTRACT: **Background:** Perichondritis of the auricle is a serious disease that may lead to residual deformity.

Objectives: To assess our experience with perichondritis in a large group of patients hospitalized with this entity.

Methods: We retrospectively studied 114 patients who were admitted with perichondritis during 1987–2004, including their demographic details, medical history, current illness, etiology, pathogens and treatments.

Results: The patients' mean age was 41.8 ± 20.7 years. In more than half of the patients the etiology could not be determined. Forty-seven patients (41%) were treated prior to hospitalization for an average of 2.5 ± 1.9 days. Eight patients (7%) required surgical intervention. *Pseudomonas aeruginosa* was found to be the predominant organism (69% of available isolates) and was associated with a more advanced clinical presentation and longer hospitalization ($P = 0.008$).

Conclusions: Perichondritis develops in many cases after apparent minor trauma. Since *P. aeruginosa* is probably the predominant pathogen, initial treatment should include anti-pseudomonal antibiotics.

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KEY WORDS: perichondritis, auricle, trauma, *Pseudomonas aeruginosa*, fluoroquinolones

Perichondritis of the auricle is a frightening and perturbing complication of the traumatized ear that can lead to residual deformity [1]. Only a handful of relatively short articles have been published on this topic [1-4]. The recent large study from India by Prasad et al. [5] included a mixture of cases with malignant otitis externa [5].

Two major inflammatory conditions are known to involve the auricular cartilage: suppurative perichondritis and relapsing polychondritis. Relapsing polychondritis is a rare disease, with an autoimmune etiology, characterized by an episodic and progressive course that involves the cartilaginous tissue of the nose, ears and the laryngobronchial tree [6].

Traumatic ear injury with subsequent hematoma and secondary infection is the commonest cause of perichondritis. Penetrating injuries such as acupuncture and ear piercing, a growing trend in recent years, is causing increasing concern [2-4,7]. A common feature of auricular perichondritis is its insidious nature: in the early phase it presents as a dull pain that increases in severity, accompanied by redness, warmth and swelling. It usually starts in the helix and anti-helix but if not treated it may involve the entire cartilage; this is particularly true for the burned ear [1]. As the process progresses, abscess will develop, peeling the perichondrial layer off the cartilage, resulting in necrosis of cartilage and deformity known as "cauliflower ear" [4]. Suppurative perichondritis has also been described following surgery with inadequate aseptic techniques. In rare cases systemic infection has been described as a possible cause [8].

Although *Staphylococcus aureus* is the most common organism causing skin infections, *P. aeruginosa* is implicated as the major pathogen of perichondritis [1,4-5,9-14]. *P. aeruginosa* is often found in the external auditory canal, particularly under moist conditions. Traumatic injury might introduce this pathogen into the cartilaginous layer and the underlying soft tissue culminating in malignant external otitis [10].

The present study set out to answer the following questions: what is the current spectrum of etiologies of perichondritis, does outpatient antibiotic treatment play a role in the outcome of the disease, and has the recent trend of growing resistance among Gram-negative isolates affected the microbial epidemiology of perichondritis.

PATIENTS AND METHODS

We conducted a retrospective study of all patients admitted for perichondritis to the department of head and neck surgery at the Bnai Zion Medical Center in the years 1987–2004. Patients' files in the archives were located using the internal search program (2004 version) with one of the following diagnoses: chronic perichondritis of pinna, acute perichondritis of pinna, and perichondritis of pinna unspecified (ICD 9 codes: 380.02, 380.01 and 380.00, respectively). The files were summarized into a structured case report form. This form included demographic details, medical history (diabetes mellitus, autoimmune diseases, recurrent otitis), recent medical history related to current illness (any surgical intervention on the infected ear within one month of the current hospitalization and antibiotic treatment within one week of hospitalization), possible predisposing event (e.g., trauma, acupuncture), clinical data (body temperature above 38°C, and physical signs such as local red-

ness, swelling, secretions and pain), and hospitalization details (time from symptoms to hospitalization and treatment, length of hospital stay, surgical procedures, laboratory test results, isolated pathogens, and treatment).

The microbiology computer was searched for information regarding pathogens isolated from the peripheral blood and external ear of the patients.

The data were summarized using Windows Microsoft Excel software (version 2003). Statistical values were derived using GraphPad™ Instat software (version 3.05). Means were compared using the unpaired *t*-test and categorical values were compared using Fisher's exact test. Statistical significance was calculated by two-sided *P* value.

We used the following definitions:

- different hospitalizations of the same patient, at least one month apart, were considered as different events (cases)
- recurrent otitis – any patient who was hospitalized in the past or claimed to have had one or more former episodes of external or middle ear infection.
- fever – any temperature above 38°C
- polymicrobial infection – isolation of two or more pathogens from the same specimen.
- statistical significance – a P value < 0.05.

Patients were divided into two clinical groups depending on the physical findings on admission: group 1 – localized erythema, tenderness and swelling (milder presentation); and group 2 – localized erythema, tenderness, swelling, plus secretions from the auricle (more severe presentation).

We extracted the average time to treatment: i.e., the duration of time from the onset of symptoms until treatment initiation in the community, and the average time to hospitalization: i.e., the duration of time from the start of symptoms until admission.

RESULTS

Altogether, 114 patients fulfilled the selection criteria during the study period of 18 years. Their mean age was 41.8 ± 20.7 (median 43, range 2– 91 years), and 61 (53%) were males.

CO-MORBIDITIES

Fifteen patients (13%) had diabetes mellitus and 3 were suspected of having an autoimmune disease (2 of whom were on chronic steroid treatment, and 1 was hospitalized for relapsing polychondritis).

PREDISPOSING EVENTS

The most common etiological factor for perichondritis was trauma, present in 20 cases (17.5%). Of the latter, one case was due to ear scratching, three were caused by a hearing device, three were probably due to insect bites, and two by earrings. Other rare traumatic etiologies included a haircut, human bite and shaving. The full spectrum of etiologies is shown in Table 1.

Table 1. Apparent predisposing factors of perichondritis

Predisposing factors	Cases (n=114)	%
Post-traumatic*	20	17.5%
Allergic skin reaction	13	11.4%
Recent operation (≤ 1 month pre-admission)	7	6%
Herpes zoster**	6	5.3%
Suspected fungal infection§	3	2.6%
Unknown	65	57%

* Includes four cases of piercing

** Six patients received acyclovir

§ These patients had recurrent fungal infection in the community. Antifungals were not administered during hospitalization

PRE-HOSPITAL COURSE AND TREATMENT

The average time from symptoms to treatment was 3 ± 3.1 days (median 2, range 1–21 days); the average time from symptoms to hospitalization was 17.6 ± 5.8 days (median 3, range 1–180). Younger patients (< 60 years) had encountered significantly more episodes of otitis before admission (35.5% vs. 9.5% respectively, $P = 0.012$) than older ones (≥ 60 years). Forty-seven patients (41%) were treated for at least one week before hospitalization. These patients were treated for an average of 2.5 ± 1.9 days (range 1–7 days). Amoxycillin-clavulanate and amoxycillin were the most commonly prescribed antibiotics in the community. Patients treated with antibiotics in the community prior to their admission had been referred to hospitalization later than those who were not (5.7 ± 6 vs. 3 ± 2.8 days, respectively, $P = 0.004$). In addition, community treatment had reduced the occurrence of polymicrobial infections significantly (12.3% vs. none, $P = 0.02$).

HOSPITALIZATION AND MICROBIOLOGY

Seventy-one patients (62%) fell into the milder clinical group, while 42 (37%) could be categorized into the more advanced group. Fever (≥ 38°C) and lymphadenopathy were each found in 26 patients (23%). Although the white blood cell count and C-reactive protein levels in the second clinical group were higher, they were not significantly different (WBC 10.1 x 10^3 vs. 9.8x10^3 cell/mm^3 respectively; average CRP 46 and 32.7 mg/dl respectively). Older patients had significantly higher levels of CRP protein than younger ones (mean 57.8 ± 48.2 vs. 32 ± 31 mg/dl, $P = 0.024$).

Samples for bacterial culture were taken from 56 patients (49%). Thirty-six (64%) of these were positive. Twenty-eight patients grew a single pathogen (mostly *P. aeruginosa*), while

WBC = white blood cells
CRP = C-reactive protein

Table 2. Distribution of perichondritis pathogens (n=36)*

Pathogen	No. of isolates	%
P. aeruginosa	25	69%
Methicilin-sensitive *S. aureus* (MSSA)	6	17%
Streptococcus group A	4	11%
Streptococcus beta-hemolytic non-group A	3	8%
E. faecalis	2	5.5%
Streptococcus group G	1	3%
Methicillin resistant *S. aureus* (MRSA)	1	3%
Klepsiella pneumoniae	1	3%
Candida spp.	1	3%
Pseudomonas non-aeruginosa	1	3%
Polymicrobial infection	8	22%

* Some patients had more than one pathogen isolated

Table 3. Clinical features of perichondritis caused by *P. aeruginosa* vs. other organisms

	P. aeruginosa No. (n=25)	"Non-*Pseudomonas*" cases* (n=89)	*P* value
Diabetes mellitus (%)	8	14.6	NS
Operated within the last month (%)	12	4.5	NS
Recurrent otitis (%)	48	26	0.048
Started antibiotics in the community (%)	40	41.5	NS
Mean time to treatment (days)	3.0 ± 1.7	3.0 ± 3.4	NS
Mean time to hospitalization (days)	3.7 ± 2	4.3 ± 5.2	NS
Mean hospitalization length (days)	7.2 ± 2.7	5.7 ± 2.3	0.008
Clinical group 1 (%)	44	67.4	0.02
Clinical group 2 (%)	56	31.5	0.02
Fever (%)	8	27	0.058
WBC ($\times 10^3/mm^3$)	10.7 ± 2.5	9.8 ± 3	NS
Maximum CRP (mg/dl)	53.7 ± 46.7	32 ± 31	0.04
Maximum ESR (mm/h)	35.5 ± 20.7	44 ± 31.5	NS
Required surgery (%)	12	4.5	NS

* These 89 cases include 11 patients with other bacteria, 20 patients with negative cultures and 58 patients where no cultures were taken

CRP = C-reactive protein, ESR = erythrocyte sedimentation rate

in 8 of the cultures more than two pathogens were isolated. None of the patients had a positive blood culture.

P. aeruginosa was found to be the predominant organism (n= 25, 69% of isolates); methicillin-sensitive *Staphylococcus aureus* (MSSA) was the second most common (n=6, 17%). The distribution of causative pathogens is depicted in Table 2. Infections caused by *P. aeruginosa* were associated with a more advanced clinical presentation and involved a lengthier hospitalization [Table 3]. Fourteen isolates of *P. aeruginosa* showed resistance to at least one antibiotic (56%), while 6 were found to be resistant to three or more drugs. Interestingly, none of the isolates was resistant to quinolones, and 11 isolates were sensitive to all anti-pseudomonals tested (44%).

IN-HOSPITAL COURSE

Mean time to treatment was significantly longer in the second clinical group (4.0 vs. 2.4 days, $P = 0.016$). Eight patients (7%) needed surgical intervention, mostly (n=4) for incision and drainage. Two patients required debridement of soft tissue, one patient underwent revision mastoidectomy and another required excision of necrotic cartilage.

All patients in this cohort were treated with intravenous antibiotics, and 9 (8%) continued the same type of antibiotic orally. The mean length of hospitalization of the entire cohort was 6.1 ± 2.5 days (range 1–16 days). Patients with *Pseudomonas* infections demonstrated longer hospitalization time than those with non-*Pseudomonas* infections (mean 7.2 ± 2.7 vs. 5.7 ± 2.3 days respectively, $P = 0.008$). None of the patients died during hospitalization.

DISCUSSION

This work describes the largest group of patients hospitalized for perichondritis of the auricle published to date. In more than half of our cases a concrete etiology could not be established, indicating that an apparent negligible trauma may have initiated perichondritis.

Perichondritis has diverse etiologies and predisposing events. Previous studies focused on iatrogenic trauma to the auricle [1,5,11,14,15], burns [1,5,11,15,16], and piercing and acupuncture [2-4,7,9,16]. Our series includes less dramatic causes, such as scratches, shaving, insect stings, and the use of hearing devices. Six patients (5.3%) developed perichondritis subsequent to zoster infection of the auricle. Zoster infection could serve as a predisposing factor since vesicles may promote entry of bacteria. This entity was mentioned only vaguely elsewhere [5]. These findings suggest that direct damage to the cartilage is probably not mandatory for the initiation of perichondritis; the cartilage can become infected secondary to minimal trauma or any inflammatory reaction of the overlying skin.

Outpatient treatment seems to have a considerable impact on the course of the disease and on the spectrum of bacteria isolated on admission. We believe that previous antibiotic treatment (mostly amoxicillin-clavulanic acid) could have eliminated Gram-positive organisms from cultures taken on admission. The second impact of outpatient treatment was that time from diagnosis to hospitalization was significantly longer in previously treated patients. This finding could be intuitively explained by the primary physicians' unsuccessful attempt to treat them as outpatients, leading to a more advanced presentation upon admission. Longer time to in-hospital treatment was significantly higher in the second

clinical group (4 days vs. 2.4 days, $P = 0.016$). In addition, these previously treated patients had higher WBC levels on admission. This finding raises the question of whether patients with perichondritis should be treated as outpatients at all, treated differently as outpatients, or be promptly hospitalized for intravenous antibiotic treatment.

The most common pathogen isolated in this series (69%) was *P. aeruginosa*. Multiple factors may contribute to *P. aeruginosa* ear infections. *P. aeruginosa* is ubiquitous, especially in moist environments, such as the external ear canal, lakes or swimming pools, moisturized solid soap and contaminated disinfectants [10,17,18]. Infections caused by *P. aeruginosa* usually begin with superficial colonization of cutaneous or mucosal surfaces, and then progress to the underlying tissues by virtue of its high invasive capacity and virulence factors [10]. Furthermore, *P. aeruginosa* has a high affinity for damaged cartilage [5]. Previous antibiotic treatment lacking anti-pseudomonal activity could select for the growth of *Pseudomonas* species [1].

Patients with positive ear cultures for *P. aeruginosa* presented with a more severe disease, and were mostly included in the second clinical group. These patients had a longer hospital stay and had higher CRP levels. In light of these findings, we believe it is justifiable to recommend empiric treatment with anti-pseudomonal antimicrobials for outpatients as well as for hospitalized patients. A prospective study could answer the question whether initial treatment in the community with anti-pseudomonal antibiotics (e.g., fluoroquinolone) could minimize the number of hospitalizations and significantly raise the success rates of outpatient treatment of perichondritis. Unfortunately, over recent years we are being confronted with a global rise in bacterial resistance including resistance of *Pseudomonas* to fluoroquinolones [19]. Interestingly, all isolates cultured in the present series (1987–2004) were fluoroquinolone-sensitive, as compared to a sensitivity rate of only 75% among community and nosocomial isolates obtained during recent years (2005–2008) at our facility. This unfortunate development could hamper outpatient treatment, since fluoroquinolones are currently the only oral treatment available against *Pseudomonas*. Future studies should address this issue.

In conclusion, this work describes the largest known group of patients with perichondritis. Patients with perichondritis should be started as soon as possible on anti-pseudomonal medications.

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"It ought to be plain how little you gain by getting excited and vexed. You'll always be late for the previous train and always in time for the next"

Piet Hein (1905-1996), Danish scientist, mathematician, inventor, designer, author and poet, often writing under the Old Norse pseudonym "Kumbel" meaning "tombstone." His short poems, known as *gruks* or grooks (Danish: Gruk), first started to appear in the daily newspaper "*Politiken*" shortly after the Nazi Occupation in April 1940