Pseudomonas aeruginosa Necrotizing Chondritis Complicating High Helical Ear Piercing Case Report

Clinical and Public Health Perspectives

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ABSTRACT

Background: Auricular or high helical ear piercing is an increasingly widespread fashion trend that is associated with an increased risk of potentially serious post-piercing complications such as auricular perichondritis.

Case report: An 11-year-old girl developed severe auricular perichondritis following piercing of the upper helical cartilage of her ear at a hairdressing salon. Four days post piercing, she returned to the same salon for a haircut during which the pierced site was manipulated. She presented to her family physician and was treated unsuccessfully with oral cephalexin. She was then referred to an infectious diseases consultant and received antipseudomonal intravenous antibiotics with subsequent resolution. She also required debridement and removal of necrotic cartilage. Public health investigation evaluated potential sources of infection including the piercing gun, disinfectant solutions, and hair cutting spray water bottles. Final culture results of the ear helical aspirate grew *Pseudomonas aeruginosa*. *Pseudomonas aeruginosa* was also cultured from one of the water bottles used to wet her hair during the haircut.

Discussion: Although the pseudomonal strains from the water bottle were different than the infecting one, this contamination presents a potential source of wound infection. Damage to the helical cartilage caused by the piercing gun may also have contributed to this infection. Initial empiric antibiotic therapy for these kinds of infection must include anti-pseudomonal coverage. Auricular or high helical ear piercing using a piercing gun is not recommended.

MeSH terms: Ear piercing; ear cartilages; pseudomonas infections

La traduction du résumé se trouve à la fin de l'article.

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Auricular or high helical ear piercing has become an increasingly widespread fashion trend in recent years and is commonly available at most piercing salons. Unlike piercings through soft tissues, cartilaginous piercings are theoretically at higher risk of serious infective complications due to the avascular nature of cartilage.¹⁻⁴ Healing is further hindered by the presence of an indwelling foreign body. Auricular perichondritis, despite increasing knowledge and awareness, is still a major post-piercing complication of high ear piercing, with reported rates doubling in England between the early and late 1990s.⁵ Rates of infection are reported to be higher during the summer months due to perspiration triggered by warm weather events and water activities.³ Piercing guns are believed to increase the risk of complication because they apply a shearing force to the perichondrium causing the perichondrium to slip off of the cartilage.^{1,6,7} As a result, the avascular cartilage is less likely to survive. However, there are reports of auricular perichondritis occurring secondary to needle piercing and acupuncture as well.^{8,9} Poor antiseptic technique and the use of benzalkonium chloride (vs. 70% alcohol solutions or iodine) as the pre-piercing cleaning agent also increase the risk of infection.¹

The present case demonstrates a recognized and potentially disfiguring complication of high ear piercing, and suggests personal and public health measures that could be taken to prevent its occurrence.

METHODS

Case report

An eleven-year-old girl presented to the Children's Hospital Emergency Department in Winnipeg with a painful and swollen left ear following piercing of the left helix. She had had a "high ear" piercing of the left helical cartilage with a piercing gun at a local hairdressing salon 11 days prior to presentation. Three days following the piercing, redness and tenderness at the piercing site had been noted. On the fourth day after the piercing, she returned to the salon for a haircut, during which the piercing site was pulled and manipulated by the hairdresser's comb. The following day, the redness and tenderness worsened, and the girl went to her family physician, who removed the earring

TABLE I

Biochemical Profiles and Antibigrams of Clinical and Environmental Isolates of *Pseudomonas aeruginosa*

Test	Clinical Isolate (left ear)	Environmental Isolate (water bottle – large colony)	Environmental Isolate (water bottle – small colony)
Vitek GNB card Identification code	LyPrPyGIGg	PrGg	PrGIGg
	Vitek MIC mcg/mL susceptibility testing		
Gentamicin	2	4	4
Trimethoprim-sulfamethoxazole	160	80	80
Piperacillin	<4	8	8
Tobramycin	<1	<1	<1
Ciprofloxacin	<0.25	<0.25	<0.25
Ceftazidime	2	4	4
Cefepime	<1	2	2
Imipenem	<0.5	<0.5	<0.5
Piperacillin/ Tazobactam	<4	8	8

and started antibiotic treatment with oral cephalexin (50 mg/kg/day). Over the next six days, erythema, swelling and tenderness over the left helix continued to worsen. She was referred for assessment by an infectious diseases consultant on her seventh day of cephalexin therapy.

There was no history of contact with pets. The girl had attended a pool-side function at her neighbour's pool but indicated that she had not gone swimming. She had covered her ear with a plastic "baggie" during showers. There was no associated fever or hearing loss, and the subject was otherwise healthy with no relevant past medical history.

Initial physical examination revealed an afebrile young girl with normal vital signs. The helix of her left ear was erythematous, warm and tender to touch. There was marked swelling over the posterior helix and fluctuant pustules were noted on the posterior aspect of the upper auricle. Tympanic membranes and auditory meati were normal. The oropharynx was clear and there was no cervical lymphadenopathy. The remainder of the physical examination was within normal limits.

Initial white blood cell count was $10.5 \times 10^9/L$ with $7.8 \times 10^9/L$ neutrophils and the subject's erythrocyte sedimentation rate was mildly elevated at 18 mm/hr. She was seen by an otolaryngologist who did an initial incision and drainage in the Emergency Department with the removal of 1.5 cc of pus and blood by needle aspiration. This specimen was sent for gram stain and culture. She was then admitted to hospital and started on treatment with intravenous cloxacillin (100 mg/kg/day), clindamycin (30 mg/kg/day) and ceftazidime (150 mg/kg/day). The following day, she was taken to the operating room for debridement of the infected tissues.

Necrotic cartilage was removed from the upper helix and tissue sample was sent for culture and sensitivity and pathology. Final culture results of the initial helical aspirate showed moderately heavy growth of *Pseudomonas aeruginosa* sensitive to ceftazidime. No other pathogens were isolated. Similarly, surgically-collected tissue grew *Pseudomonas aeruginosa* only. The final pathology report revealed the presence of a fibropurulent exudate with no recognizable tissue structures seen. There was gradual clinical improvement over the next four days. A peripherally-inserted central catheter line was placed and the patient was discharged home on ceftazidime (150 mg/kg/day). At last follow-up visit, there was good cosmetic improvement with a small fibrotic area in the upper left helix remaining following six weeks of intravenous ceftazidime.

Public health investigation

Though not a reportable communicable disease, on Day 10 of the subject's intravenous antibiotic treatment, this incident was brought to the attention of public health officials to review ear-piercing procedures and practices at the hairdressing salon where the piercing had been performed. Although ear piercings are not regulated by the provincial Public Health Act or by municipal bylaws, a public health inspector was sent to inspect the salon. The salon had been performing ear-piercing procedures for eight years and was deemed to follow appropriate policies and procedures. The piercing gun used to perform the high ear piercing on this child was in good working condition. Isopropyl alcohol was used as a topical and instrument disinfectant after and prior to each use of the piercing gun. Only sterile pre-packaged studs were used to perform ear

piercings. A review of procedures revealed that all staff were adequately trained and competent in performing cleaning and disinfecting of equipment and workspace.

Several environmental bacteriology samples were collected, including water specimens from four spray water bottles used for wetting hair during haircuts, swabs from each of the water bottle nozzles, and disinfectant samples from two Barbicide disinfectant containers. The actual bottle used to wet this child's hair during her haircut could not be determined. All environmental samples were collected 19 days after the haircut. Unfortunately, no samples were collected from the piercing gun.

RESULTS

No growth was detected from the water bottle nozzle swabs or from Barbicide samples. Heterotrophic plate counts on the water specimens ranged from 220 to >3000 CFU/mL. *Pseudomonas aeruginosa* was cultured from one of the water bottles (10 CFU/100 mL). Two colony morphologies were isolated and respective cultures of each type (labelled as a small colony and a large colony type) were further analyzed. These isolates differed significantly from the clinical isolate obtained from the ear specimen as determined by biochemical profile, antibiogram, and pulsed-field gel electrophoresis (see table and figure).

DISCUSSION

This is the first case in the reported literature in which water bottle contamination at a hairdressing salon was explored as a potential source of bacterial infection in a post-piercing auricular perichondritis. In August 2000, an outbreak of *Pseudomonas*

Dice (Opt:1.00%) (Tol 1.0%-1.0%) (H>0.0% S>0.0%) [0.0%-100.0%]
XbaI

Figure 1. PFGE results from clinical and environmental isolates of *P. aeruginosa*. The dendrogram was constructed using Bionumerics software (Applied Maths, Kortrijk, Belgium). Lanes labelled "solution isolate" are the isolates cultured from the water bottle, "ear isolate" is the culture from the patient, and "control isolate" are two non-epidemiologically linked clinical isolates. PFGE was performed using a modified procedure for methicillin-resistant *Staphylococcus aureus*¹⁷ (modifications were the substitution of lysozyme for lysostaphin for cell lysis and *XbaI* for *SmaI* for digestion of DNA).¹⁷

aeruginosa infections in high helical ear piercings was identified in Oregon. The patient isolates identified in the outbreak matched those from a disinfectant bottle at the jewelry kiosk.¹⁰ In our experience, although the pseudomonal strains cultured from a water bottle were different than the infecting one, it is clearly demonstrated that water bottle contamination in a hair-dressing salon presents a very real potential source of pseudomonal wound infection. *Pseudomonas* species are known to be common water-borne organisms. The water used to spray hair in the salon was simply tap water that was changed on a daily basis; but there was no regular schedule for washing the water bottles. Although tap water was a plausible source of the pseudomonas isolated from the water bottle, neither the tap nor tap water was directly sampled for confirmation.

It has been well documented that adherence to strict antiseptic technique during the piercing procedure is essential to minimizing the risk of infection. In this instance, the public health inspector determined that good aseptic technique and use of an appropriate alcohol-based disinfectant had been used. In addition, however, all aquatic sources of contact with the newly pierced cartilage provide the potential for infection and must be avoided until wound healing has occurred. In this case, all reasonable measures were taken to avoid post-piercing exposure to water, with the only exception being the haircut that occurred a few days after the piercing while the wound was still healing. In fact, the

piercing site was accidentally traumatized during the haircut, increasing the probability of contamination with a water-borne organism from the spray water bottle used to wet the subject's hair.

Use of piercing guns to perform high helical piercings have been associated with increased risks of complications, allegedly because they apply a shearing force to the perichondrium causing it to slip off of the cartilage.^{1,6,7} As a result, the avascular cartilage is less likely to survive an infectious complication. Therefore, the use of a piercing gun in this case may have contributed to the post-piercing infection. As the gun was not sampled, we could not support or refute its role as a potential source of the pseudomonal organism.

Post-piercing high auricular perichondritis usually occurs 3-4 weeks following the piercing.³ Initial presentation involving erythema and tenderness of the auricle may resemble cellulitis. There is often marked swelling of the auricular helix and pustules may develop over the affected area. There is also marked tenderness due to involvement of the perichondrium, which helps distinguish perichondritis from superficial infections involving only the skin.⁴ Infection can then progress to abscess formation and necrosis of the involved cartilage. Bacterial cultures commonly reveal *Pseudomonas aeruginosa* or staphylococcal species,^{11,12} but *Streptococcus*, *Proteus* and *Lactobacillus* species have also been identified as causes of auricular perichondritis.¹³ In addition, post-piercing auricular perichondritis has been associated with a com-

monly used disinfectant, benzalkonium chloride, which is active against many Gram-positive and Gram-negative bacteria but is ineffective against *Pseudomonas* species.¹ Therefore, alcohol-based disinfectants are preferred, as was the practice in this hair salon.

Because *Pseudomonas* is a common cause, physicians must be aware that these infections cannot be treated with oral anti-staphylococcal antibiotics alone, as initially prescribed in this case. Early treatment must also include anti-pseudomonal antibiotic coverage. Auricular perichondritis has been successfully treated with oral ciprofloxacin in adults, but its use is limited in children due to the potential for damage to developing cartilage.¹⁴ Thus, in children, initial treatment with intravenous antibiotics is necessary. Surgical debridement and drainage may also be required. If left untreated, auricular perichondritis may progress to necrosis of the underlying cartilage, necessitating surgical removal of the affected tissues. This may lead to cosmetic disfigurement and development of "cauliflower ear". Surgical reconstruction is necessary to attempt cosmetic repair.¹⁵

CONCLUSION

Appropriate training of piercing personnel, adherence to strict antiseptic technique, and the use of piercing tools for which sterilization can be ensured are all measures which can be taken to minimize the risk of post-piercing auricular perichondritis.^{1,16} Aftercare cleaning instructions, infective risks and early warning signs of infection should be taught to all individuals who undergo high ear piercings. The best chance of reducing infection rates is by intervening at the pre-piercing and piercing stages, since adolescents and children may be less likely to comply with strict aftercare instructions.¹ It may be prudent to include avoidance of haircuts until the wound is completely healed as part of aftercare instructions.

In the case presented here, the use of a piercing gun and further trauma to the helix during a subsequent haircut are factors that likely contributed to the development of perichondritis. Furthermore, the spray water bottle used to wet the hair during the subsequent haircut presented a potentially significant source of wound

contamination with *Pseudomonas* species. Finally, failure to recognize the need for anti-pseudomonal antibiotic coverage also delayed appropriate treatment. Auricular or high helical ear piercing using a piercing gun is not recommended.¹⁶

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RÉSUMÉ

Contexte : Le perçage du haut de l'oreille, une mode qui s'étend de plus en plus, est associé à un risque accru de complications post-perçage potentiellement graves, comme la périchondrite de l'oreille.

Exposé de cas : Une fillette de 11 ans a contracté une périchondrite grave de l'oreille après le perçage du cartilage du tiers supérieur du pavillon de son oreille dans un salon de coiffure. Quatre jours après l'intervention, elle est retournée au même salon pour une coupe de cheveux durant laquelle le site percé a été manipulé. Elle s'est présentée chez son médecin de famille, qui lui a administré sans succès un traitement oral à la céphalexine. Elle a ensuite été dirigée vers un consultant en maladies infectieuses, où elle a reçu des antibiotiques antipseudomonas par voie intraveineuse qui ont guéri l'infection. Il a aussi fallu exciser et retirer le cartilage nécrosé. Les enquêteurs de la santé publique ont analysé les sources d'infection possibles, dont le pistolet de perçage, les solutions désinfectantes et les flacons du salon de coiffure servant à pulvériser l'eau. Les derniers résultats de culture de l'aspirat du pavillon de l'oreille ont développé des bactéries *Pseudomonas aeruginosa*. Ces bactéries se sont également développées dans les cultures provenant d'un des flacons utilisés pour mouiller les cheveux de la fillette pendant sa coupe de cheveux.

Discussion : Bien que les souches pseudomonales du flacon aient été différentes de celle ayant infecté la fillette, cette forme de contamination pourrait avoir été une source d'infection de la plaie. La lésion du cartilage auriculaire causée par le pistolet de perçage pourrait aussi avoir joué un rôle dans l'infection. L'antibiothérapie empirique que l'on utilise initialement pour traiter ce genre d'infection doit inclure un agent antipseudomonal. Le perçage du haut de l'oreille à l'aide d'un pistolet n'est pas recommandé.

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