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Association of Demographic Profiles and Clinical Characteristics of Patients with Aural Foreign Bodies at the Emergency Room of the East Avenue Medical Center with Clinical Outcomes: A Cross-Sectional Study

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ABSTRACT

Objective: To determine the association of demographic profiles and clinical characteristics of patients with aural foreign bodies seen at the Emergency Room (ER) of the East Avenue Medical Center with clinical outcomes.

Methods:

Design: Cross-Sectional Study

Setting: Tertiary Government Training Hospital

Participants: A total of 143 aural foreign body cases seen at the ER from January to December 2022 under the Department of Otorhinolaryngology – Head and Neck Surgery (ORL-HNS) of East Avenue Medical Center were included in the study.

Results: Of the 143 patients, majority (84; 58.74%) were males. Mean age was 21.92 years old with two peak incidences noted at ages 1-12 years old and 18-65 years old. Most of the patients were right-handed (134; 93.71%). Majority of the foreign bodies were animate (76; 53.15%) and were frequently found to be lodged on the right ear (86; 60.14%) with duration from lodgment to extraction commonly within less than 24 hours (119; 83.22%). One hundred forty two (99.30%) patients had successful foreign body extraction, 60 (41.96%) had complications, specifically involving the external auditory canal (51; 35.66%) and tympanic membrane (6; 4.20%). Significant associations were found between age and type of foreign body [χ^2 (3, N =143) = 31.24, $p < .01$] with a higher proportion of animate foreign bodies in adults and inanimate foreign bodies in children; sex and presence of complications [$\chi^2(1, N = 143) = 5.41, p < .05$] with males experiencing more complications than females; type and duration of foreign body [, $\chi^2(2, N = 143) = 16.33, p < .01$] with animate foreign bodies generally having a shorter duration of less than 24 hours compared to inanimate foreign bodies; and the duration of foreign body and presence of TM complications [$\chi^2(4, N = 143) = 14.21, p < .01$] with shorter durations (less than 24 hours) showing fewer TM complications. Males had higher odds of developing complications compared to females (OR = 2.315, 95% CI [1.105, 4.851]).

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Conclusion: Our study revealed that children and adults are both at higher risk for foreign body lodgment, although causes differ between groups. There was a higher proportion of animate foreign bodies in adults and inanimate foreign bodies in children. Animate foreign bodies were reported and managed within less than 24 hours compared to inanimate foreign bodies. Complications were more frequent in male patients, particularly those with external auditory canal involvement. These clinical characteristics should be considered when managing patients with aural foreign bodies - particularly age, sex, and foreign body type to reduce the risk of complications.

Keywords: *external ear canal; aural foreign body, animate; inanimate; extraction; emergency room, complications; association; demographic profile; clinical outcome*

Foreign body in the external auditory canal is one of the most frequent ER consults in Otorhinolaryngology.[1] As these foreign bodies come in different shapes, sizes and composition, their removal requires good anatomical knowledge along with certain skills and techniques. If not properly done, they have a high potential for morbidity/mortality, and are costly to manage. Their complications include tympanic membrane perforation, ear canal lacerations, bleeding, infection, stenosis, hearing loss and others.[2]

In the developed world, there are already established and continually evolving protocols for aural foreign body management.[1,2,3] However, in resource poor regions, such protocols are in the process, if at all, of being developed.[4] Unfortunately, there is no current available local literature that documents epidemiology, treatment options and outcomes of aural foreign body among Filipinos. To the best of our knowledge, based on a search of Google Scholar, MEDLINE (PubMed), PubMed Central (PMC), Directory of Open Access Journals (DOAJ), Western Pacific Region Index Medicus (WPRIM) and the Health Research Development Information Network PLUS (HERDIN Plus) using the search terms " aural foreign body," "guidelines," " protocol," and " management algorithm," there are no local current consensus statements or clinical practice guidelines concerning its management.

The aim of this study is to determine the association of demographic profiles and clinical characteristics (presenting symptom, patient handedness, type, laterality and duration of foreign body and the method of extraction) of patients with aural foreign bodies seen at the ER of the East Avenue Medical Center with clinical outcomes (successful extraction and presence/absence of complications).

METHODS

With East Avenue Medical Center Institutional Ethics Review Board approval (EAMC IERB 2023-54), a chart review was conducted on all cases of aural foreign bodies seen at the ER of the East Avenue Medical Center under the Department of ORL-HNS from January to December 2022.

Considered for inclusion were all records of all patients who had aural foreign body and underwent foreign body extraction at the ER from January to December 2022. Records of those who had no, missing, or incompletely filled up charts were excluded.

Total enumeration of records of patients meeting the inclusion and exclusion criteria was made. The following data were collected patient demographics: age, sex, clinical symptoms, handedness, type of foreign body (animate or inanimate), laterality and duration of foreign body lodgment, method of extraction and outcomes (successful extraction, presence and type of complication).

All data were encoded using Microsoft Excel version 16.65 (Microsoft Corp., Redmond, WA, USA) and analyzed using STATA version 16.1 for Windows (StataCorp. LLC, College Station, TX, USA). Categorical data were described using frequencies and percentages, while continuous data were described using means and standard deviations. The logistic regression analysis was used to generate the odds ratios for the successful removal of foreign bodies and presence of complications given the patients' demographic and clinical profiles. A 5% significance level was used as the threshold for the statistical analyses.

RESULTS

Records of a total of 220 patients diagnosed with aural foreign body who sought consult at the ER at the East Avenue Medical Center during the 1-year study period were identified. Of these, records of 77 patients were excluded because of incomplete records and documentation leaving a total of 143 patient records for analysis.

Of the 143 patients, 84 (58.74%) were males and 59 (41.26%) were females. The mean age was 21.92 with a standard deviation of 19.03 years. Two peak incidences of aural foreign bodies were noted in the following age groups: among children (1-12 years old) and among adults (18-65 years old). Sixty-seven (46.85%) were children aged 1-12 years, seven (4.90%) were adolescents aged 13-17, 66 (46.15%) were adults aged 18-65, and three (2.10%) were older adults aged > 65 . Foreign body sensation or the patient felt something went inside the ear (83; 58.04%) was the most common reason for consult, followed by patient disclosure that he/she inserted an object inside the ear (39; 2.27%), local pain and swelling (30; 20.98%). Majority of patients were

right- handed (134; 93.71%) and majority of aural foreign bodies were also lodged on the right ear (86; 60.14%). Duration from insertion to extraction was commonly recorded to be within less than 24 hours (119; 83.22%). Animate foreign bodies were noted to be the most predominant type (76; 53.15%) with cockroach as the most commonly reported (46; 32.16%). Among the inanimate aural foreign bodies, the most frequently identified were cotton (11; 7.69%), earrings (10;6.99%) and beads (9; 6.29%). Other less common aural foreign bodies are summarized in *Table 1*.

Table 1. Type of foreign bodies

Aural Foreign Bodies	Frequency (n=143)	Percentage %
Animate	76	53.15
cockroach	46	32.16
ticks	6	4.19
flea	4	2.79
ant	3	2.09
beetle	3	2.09
dog lice	3	2.09
fly	3	2.09
termite	2	1.39
insect(unidentified)	2	1.39
moth	2	1.39
centipede	1	0.69
spider	1	0.69
Inanimate	67	46.85
cotton	11	7.69
earing	10	6.99
bead	9	6.29
toy part	6	4.19
paper	5	3.49
pellet	4	2.79
rice grain	3	2.09
seeds	3	2.09
clay	3	2.09
crayon	2	1.39
sticker	2	1.39
ginger	1	0.69
green peas	1	0.69
candy	1	0.69
styrofoam	1	0.69
match stick	1	0.69

One hundred forty-two (99.30%) had a successful extraction and only one (0.70%) had unsuccessful extraction. A slightly greater proportion of these patients did not have any complications 83 (58.04%) while 60 (41.96%) had complications. Among those with complications, 51 (35.66%) had external auditory canal (EAC) complication, 6 (4.20%) had tympanic membrane (TM) complication, and 3 (2.10%) had both complications. Specific EAC and TM complications are summarized in *Table 2*. The most commonly used instruments in foreign body extraction in this study were alligator forceps 89 (62.24%), aural flushing

Table 2. Complications

	Frequency (n=143)	Percentage %
EAC	51	35.66
Abrasion	27	18.88
Laceration	1	0.70
Erythema/Swelling	32	22.38
TM	6	4.20
Perforated (< 5%)	1	0.70
Perforated (5-10%)	1	0.70
Perforated (> 10%)	4	2.80
Both	3	2.10

through the use of a syringe 41 (28.67%), Jobson-Horne Ear probe 10 (6.99%) and suction 7 (4.90%).

Pearson's chi-squared test of independence was conducted to examine the association between age and duration of foreign body, type of foreign body, success in extraction, presence of complication, presence of EAC complication, and presence of TM complication. The results indicated that there was a statistically significant association between age and type of foreign body, χ^2 (3, N =143) = 31.24, $p < .01$. The data shows a higher proportion of animate foreign bodies in adults and higher proportion of inanimate foreign bodies in children. On the other hand, there were no statistically significant association between age and duration of foreign body, χ^2 (6, N =143) = 3.99, $p = .68$, age and success in extraction, χ^2 (3, N =143) = 1.14, $p = .77$, age and presence of complication, χ^2 (3, N =143) = 3.44, $p = .33$, age and presence of EAC complication, χ^2 (3, N =143) = 2.93, $p = .40$, and age and presence of TM complication, χ^2 (6, N =143) = 2.37, $p = .88$.

The test also evaluated the relationship between sex and the same factors. A significant association was found between sex and the presence of complications, $\chi^2(1, N = 143) = 5.41$, $p < .05$, with males experiencing more complications than females. However, no significant associations were observed between sex and the duration of the foreign body, $\chi^2(2, N = 143) = 0.89$, $p = .64$; type of foreign body, $\chi^2(1, N = 143) = 0.31$, $p = .58$; success in extraction, $\chi^2(1, N = 143) = 1.43$, $p = .23$; presence of EAC complications, $\chi^2(1, N = 143) = 1.50$, $p = .22$; or presence of TM complications, $\chi^2(2, N = 143) = 0.88$, $p = .64$. Additionally, no significant association was found between handedness and the laterality of the foreign body, $\chi^2(2, N = 143) = 0.32$, $p = .85$.

Furthermore, the analysis showed a significant association between the type of foreign body and its duration, $\chi^2(2, N = 143) = 16.33$, $p < .01$, with animate foreign bodies generally having a shorter

duration of less than 24 hours compared to inanimate foreign bodies. However, no significant relationships were found between the type of foreign body and success in extraction, $\chi^2(1, N = 143) = 1.14$, $p = .29$; presence of complications, $\chi^2(1, N = 143) = 1.95$, $p = .16$; presence of EAC complications, $\chi^2(1, N = 143) = 1.16$, $p = .28$; or presence of TM complications, $\chi^2(2, N = 143) = 4.18$, $p = .12$.

Finally, a significant association was found between the duration of the foreign body and the presence of TM complications. However, no significant associations were observed between the duration of the foreign body and success in extraction, $\chi^2(2, N = 143) = 0.20$, $p = .90$; presence of complications, $\chi^2(2, N = 143) = 0.18$, $p = .91$; or presence of EAC complications, $\chi^2(2, N = 143) = 0.29$, $p = .86$.

Given that there was only one patient who experienced unsuccessful removal, no logistic regression analyses can be made on successful extraction as a clinical outcome. *Table 3* presents the results of the univariate logistic regression analysis of the presence of complications given the patients' demographic and clinical profiles. We found that males had higher odds of developing complications compared to females (OR = 2.315, 95% CI [1.105, 4.851]).

No significant differences were found in the odds of complications between children and adolescents (OR = 0.719, 95% CI [0.103, 4.996]) compared to children and adults (OR = 1.086, 95% CI [0.456, 2.587]). Similarly, no significant differences in the odds of complications were observed between left-handed and right-handed patients (OR = 0.853, 95% CI [0.201, 3.612]). Moreover, the odds of complications did not differ significantly between patients with animate versus inanimate foreign bodies (OR = 0.436, 95% CI [0.179, 1.063]). The analysis also revealed no significant differences in the odds of complications between patients with foreign bodies located on the left side versus both sides (OR = 1.957, 95% CI [0.144, 2.664]) or left versus right sides (OR = 1.412, 95% CI [0.663, 3.006]). Furthermore, no significant differences in the odds of complications were observed between patients whose foreign body duration was less than 24 hours compared to 24 to 48 hours (OR = 1.806, 95% CI [0.495, 6.589]) or less than 24 hours compared to more than 48 hours (OR = 1.552, 95% CI [0.398, 6.059]). Additionally, there were no statistically significant differences in the odds of complications when comparing the use of alligator forceps to other methods of foreign body removal, including aural flushing (OR = 0.870, 95% CI [0.377, 2.008]), aural speculum (OR = 0.933, 95% CI [0.350, 6.853]), Jobson-Horne Ear probe (OR = 1.548, 95% CI [0.256, 1.932]), endoscope (OR = 0.558, 95% CI [0.262, 0.702]), headlight (OR = 0.376, 95% CI [0.229, 0.403]), normal otoscope (OR = 0.753, 95% CI [0.340, 1.453]), suction (OR = 1.108, 95% CI [0.500, 1.370]), and video otoscopy (OR = 1.329, 95% CI [0.426, 1.448]).

Table 3. Factors associated with complications

Variables	Odds Ratios	95% CI	p-values[1,2]
Sex (Baseline: Females)	2.315	1.105, 4.851	< .05*
Age (Baseline: Children)			
Adolescents	0.719	0.103, 4.996	.738
Adults	1.086	0.456, 2.587	.853
Older adults	-	-	-
Patient handedness (Baseline: Left)	0.853	0.201, 3.612	.829
Type of foreign body (Baseline: Animate)	0.436	0.179, 1.063	.068
Laterality of foreign body (Baseline: Left)			
Both	1.957	0.144, 2.664	.614
Right	1.412	0.663, 3.006	.371
Duration of foreign body (Baseline: Less than 24 hours)			
24 to 48 hours	1.806	0.495, 6.589	.370
More than 48 hours	1.552	0.398, 6.059	.527
Methodology of extraction (Baseline: Alligator forceps)			
Aural flushing	0.870	0.377, 2.008	.744
Aural speculum	0.933	0.350, 6.853	.888
Jobson-Horne Ear probe	1.548	0.256, 1.932	.565
Endoscope	0.558	0.262, 0.702	.516
Headlight	0.376	0.229, 0.403	.346
Normal otoscope	0.753	0.340, 1.453	.519
Suction	1.108	0.500, 1.370	.826
Video otoscopy	1.329	0.426, 1.448	.519

[1] Variables with groups that have no variation in the data are dropped from the analyses.
[2] ** signifies that the p-value is statistically significant at the 1% level, while * signifies that the p-value is statistically significant at the 5% level.

DISCUSSION

The objective of this study was to determine the association of clinicodemographic profiles and clinical outcomes in the management of aural foreign bodies at the ER of the East Avenue Medical Center from January to December 2022.

A bimodal distribution with peaks at 1-12 years and 18-65 years old was noted in this study, which was not observed in the previous studies[2-11] which showed peak incidences predominantly among 0-5 age groups. The study of Nakao *et al.*[10] is the only literature reviewed that had contrasting results and showed a peak incidence among older adults (75-79 years old). The bimodal peak reflects the behavioral influences of the two age groups identified that would predispose to

aural foreign body lodgment. Curiosity to explore orifices, imitation, boredom, playing, along with the availability of the objects and absence of watchful caregivers predispose a child for manipulations of the various orifices including the ear canal.[12] Adults, on the other hand, are predisposed due to faulty ear-cleaning practices, presence of otological infection and increased exposure to outdoor activities.

Male predominance, right ear laterality involvement, patient handedness and foreign body sensation as a reason for consult were consistent with the findings of the previous studies.[7,8,11,13] There was a predilection for foreign bodies to be lodged in the right side probably because most patients were also right-handed. Animate foreign bodies were the most commonly reported type, specifically cockroaches which are ubiquitous in Filipino houses. Cockroaches generally enter the external auditory canal from the ground, particularly in people who habitually (or for lack of choice) sleep on the floor.[4] Among the inanimate aural foreign bodies, the most frequently identified were cotton, earrings and beads, which are congruent with the reviewed literature.[1,6,11-14] Cotton fragments reflect popular cleaning habits and methods for relieving otological pruritus or imitation by pediatric patients of the unhealthy habits of ear picking by adults[4,6] while earrings and beads are part of female accessories and toy parts. The time span between insertion and removal was commonly recorded to be less than 24 hours. This can be explained by the fact that majority of the reported foreign bodies were animate in nature which can be irritating and painful once lodged or trapped in the external auditory canal prompting the patients to consequently seek immediate ER consultation.

The complication rate in this study is congruent with the findings of the previous studies ranging from 12% to 77%.[1,2,4,6,8,9,16] Among the cases with complications, majority involved the external auditory canal. This can be attributed to the unique anatomical structure of the canal, which is sigmoid in shape, with the cartilaginous portion angling posteriorly and superiorly. The canal also features two natural narrowing points: one at the bony-cartilaginous junction and another just lateral to the tympanic membrane. These characteristics contribute to the canal's heightened sensitivity, where even minor manipulation can cause significant pain and trauma. As a result, the extraction process becomes particularly challenging and prone to complications.[7,8] The occurrence of complications is also influenced by several factors, including the nature of the foreign body, its duration, the instrumentation used, and the extraction technique. In our practice, animate foreign bodies are typically neutralized with oil instillation before aural flushing, while inanimate foreign bodies are removed using alligator forceps or irrigation. In this study, most cases were managed through direct visualization and patient immobilization. Only two pediatric patients required intravenous sedation due to uncooperativeness, both resulting in tympanic membrane perforations. In these cases, improper handling and impetuous manipulation in the presence of a struggling patient led to the displacement of the foreign body beyond the isthmus, causing perforation of the tympanic membrane.[9]

The relationship between the identified patient clinicodemographic profiles was analyzed using the Pearson's chi-squared test of independence and Fisher's exact test. A statistically significant association was observed between age and the type of foreign body. Adults were more likely to have animate foreign bodies while children had a higher proportion of inanimate foreign bodies. This can be explained by several factors. As individuals age and mature, the lodging of aural foreign bodies is no longer driven solely by curiosity or the pleasure of manipulating orifices but also can be influenced by poor ear-cleaning habits, methods of relieving otological pruritus and infection, sleeping positions[7] and the use of scents and fragrances that attract insects.[11,12] Additionally, adults often participate in outdoor activities such as farming or industrial work, which increases their exposure to animate foreign bodies.[11] Moreover, their wider ear canals compared to children facilitate greater accessibility for insects. Our study also revealed that animate foreign bodies had a shorter duration of less than 24 hours compared to inanimate foreign bodies, likely due to the acute pain and discomfort caused by the animate foreign body once it becomes lodged in the ear canal. Regarding complications, the data indicated a higher incidence of complications in males compared to females. This finding contradicts previous findings[6] that reported no association between sex and complications. Moreover, there was a higher proportion of cases without TM complications when the foreign body had been present for less than 24 hours. Prolonged presence of foreign bodies in the ear can provoke a local inflammatory response, sensitizing the EAC or TM, leading to edema, necrosis and perforation, thus complicating removal.[15]

Univariate logistic regression analyses were performed on the patients' demographic and clinical profiles to assess successful extraction and complications. Due to a single case of unsuccessful extraction, no logistic regression could be conducted on this outcome. However, for complications, males were found to have significantly higher odds of developing complications than females (OR = 2.315). No statistically significant relationship was found between the presence of complications and factors such as age, handedness, type of foreign body, laterality, duration of foreign body, or extraction methodology.

This finding contrasts with previous studies[6,7,15] that identified significant associations between complications and factors such as age, type, location and duration of the foreign body. One possible explanation for this discrepancy is the variation in sample sizes, as these studies included 698[15] and 1,356 [7] cases whereas our study had a smaller sample size. Larger sample sizes in previous studies may have provided more statistical power to detect these relationships.

Although our study provides valuable insights, it is not without limitations. The use of secondary data from patient records may not fully capture the patients' actual history or physical examination findings. Moreover, variations in how data was recorded and interpreted by different individuals may lead to inconsistencies. The study's focus on emergency room patients also means that those who sought treatment in outpatient settings were not included, narrowing the scope of the findings. Additionally, the research was conducted at a single institution, which may limit the broader applicability of the results. Future studies could build on these findings by including a larger sample through multicenter collaborations, extending the duration of the research, and incorporating additional variables such as the number of extraction attempts and a more detailed classification of foreign bodies.

In conclusion, the management of aural foreign bodies, though commonly encountered, can be challenging and frustrating. Our study revealed several important associations between demographic factors and clinical outcomes in the management of aural foreign bodies. The bimodal age distribution suggests that children and adults are both at higher risk for foreign body lodgment, although causes differ between groups. There was a higher proportion of animate foreign bodies in adults and inanimate foreign bodies in children. Animate foreign bodies were reported and managed within less than 24 hours compared to inanimate foreign bodies. Complications were also more frequent in male patients particularly those with external auditory canal involvement. These findings suggest that clinical characteristics should be considered when managing patients with aural foreign bodies, particularly age, sex, and foreign body type to reduce the risk of complications.

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