

Post Blast Tympanic Perforations, Clinical and Paraclinical Study at Six Yaounde Hospitals

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How to cite this paper: Christian, A.N.Y., Pierrette, L., Christian, M.B.R., Prudence, M., David, M.E., Francois, D., Richard, N. and Alexis, N. (2024) Post Blast Tympanic Perforations, Clinical and Paraclinical Study at Six Yaounde Hospitals. *International Journal of Otolaryngology and Head & Neck Surgery*, 13, 126-134.

<https://doi.org/10.4236/ijohns.2024.132012>

Received: December 2, 2023

Accepted: March 16, 2024

Published: March 19, 2024

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Abstract

Introduction: Post-blast tympanic perforations represent an entity of traumatic perforations; various mechanisms are at the origin of the latter, and the increase in conflicts and acts of violence are increasing the studies on this subject, but few data are available in our context. **Objective:** This paper aims to study post-blast tympanic perforations in Yaounde, specifically the epidemiological, clinical, and paraclinical aspects. **Methodology:** We conducted a descriptive cross-sectional study with retrospective and prospective data collection in six Yaounde hospitals over 63 months from January 1, 2018, to March 31, 2023. All patients with at least one post-blast tympanic perforation were included. Socio-demographic, clinical and paraclinical data were collected on a questionnaire and analysed using SPSS 28 software. **Results:** We included 124 patients. The prevalence of post-blast tympanic perforations was 0.1% of the consultations in the departments. 71 The average age was 28.6 ± 9.1 years, with extremes ranging from 7 to 49 years. The median consultation time was five days. The most frequent injury circumstances were physical aggression (81.45%) and armed conflict (10.5%). The injury mechanisms were slaps (75%), punches (21.74%) and grenades (4.8%). The main symptoms on admission were hearing loss (63.7%), tinnitus (58.1%) and otalgia (57.3%). The tympanic perforations were unilateral in all cases, the anterior-inferior location was more characteristic, and the deafness was conductive in 58.3% of cases, followed by mixed deafness in 23.3% of cases. **Conclusion:** Post-blast tympanic perforations are rare in consultation. The population is primarily male and from the second decade of life. The main circumstance is aggression.

Keywords

Tympanic Perforation, Blast, Yaounde

1. Introduction

The tympanic membrane is a fibrous, transparent membrane that separates the external ear canal from the middle ear. It can be prone to many injuries, such as infections and trauma that can cause it to puncture. Many mechanisms are at the origin of traumatic perforations, including the blast. The blast or auricular blast effect refers to injuries due to overpressure in the external acoustic meatus, regardless of origin. Post-blast tympanic perforations, long considered a wartime pathology, are becoming more and more common in both military and civilian settings. Many authors have conducted studies on general tympanic perforations, focusing on post-blast tympanic perforations.

In Belgium, van Haesendonck *et al.* (2018) found a prevalence of 5.3% of post-blast perforation [1]. In Africa, a study carried out in Tunisia by Sethom and collaborators on ear blasts found a prevalence of perforation of 89.5%.

In Cameroon, very little data are available on post-blast perforations.

This is why we conducted this study, and the main objective was to investigate the epidemiological, clinical, and paraclinical aspects of post-blast tympanic perforations in our environment.

2. Patients and Methods

This was a descriptive, cross-sectional study with a retrospective and a prospective component. The analysis was carried out in six hospitals in the city of Yaounde: Yaounde University Hospital (YUH), Yaounde General Hospital (YGH), Yaounde Central Hospital (YCH), Essos Hospital Center (EHC), Yaounde Military Hospital (YMH), Yaounde Gynecological, Obstetric and Pediatric Hospital (YGOPH) over 63 months from January 1, 2018 to March 31, 2023.

In this study, we included all patients with at least one post-blast tympanic perforation. For the retrospective component, the patient was selected after the consultation medical files. Those who have the diagnosis of post blast tympanic perforations were selected in our study. For the prospective component we consulted the patient after medical examination those who has the post blast perforation was included. Socio-demographic (age, sex, marital status, occupation, consultation period), clinical (injury circumstances, source of blast, symptoms at admission, physical signs in admission), and paraclinical data (hearing loss) were collected using a pre-established questionnaire and analysed using the CPro7.7 IBM SPSS Statistics 28 software. We used the Chi Carre test where the Theoretical numbers was ≥ 5 and Fisher test when < 5 , the significance threshold was set at 5%. The degree of significance depended on the p-value found:

- For p between 0.01 and 0.05: the test is considered significant;

- For p between 0.001 and 0.01: the test is said to be highly significant;
- For p ≤ 0.001: the test is said to be highly significant.

3. Results

In the end of this study, we included 124 patients. The overall prevalence of post-blast tympanic perforations in our hospitals is 0.1% (**Table 1**).

Table 2 indicates that the mean age of patients was 28.6 ± 9.1 years, with extremes of 7 and 49 years. Men accounted for 57.3%, a sex ratio of 1.34. Most were single and accounted for 68.75%, and were college students with 30.6%.

Table 1. Hospitaler prevalence of post-blast tympanic.

Number of perforations in Consultation	Consultation staffing	(%)
YUH 34	18,916	0.17
YCH 18	11,551	0.15
EHC 6	15,386	0.04
YGH 15	14,678	0.1
YMH 48	15,835	0.3
YGOPH 3	24,684	0.01

Table 2. Distribution of the population by socio-demographic characteristics.

Terms	Number of patient (N = 124)	Frequency (%)
Age Groups (years)		
<20	20	16.1
[20 - 30[51	41.1
[30 - 40[39	31.5
[40 - 50[14	11.3
Sex		
Female	53	42.7
Male	71	57.3
Marital status		
single	88	68.75
Married	35	28.2
widower	1	0.8
Occupation		
pupil/student	38	30.6
Civilian in the informal sector	26	21.0
Civil in the public and private sector	30	23.43
Law Enforcement Personnel	17	13.7
Unemployed	13	10.5

The median time to consultation was 5 (2-8) days, with extremes of 1 and 120 days. The majority came to consultation 3 to 7 days after the responsible injury, *i.e.* 46.0% (**Figure 1**).

Fighting was the most common injury (81.45 per cent), followed by armed conflict (10.5 per cent) (**Table 3**).

Figure 2 indicates that the primary source of the blast was slapping (75%), followed by punches (21.74%).

The main symptoms on admission were hearing loss (63.7%), tinnitus (58.1%) and otalgia (57.3%) (**Figure 3**).

Post-blast perforation was unilateral in all cases (100.0%), and the left side was affected in 66.1% or 66.1% of cases. As for the type of perforation, it was unique in most cases (95.2%) and anterior inferior site (62.1%). Regarding the shape of the perforation, we found mainly oval (37.1%) and punctiform (33.1%) shapes (**Table 4**).

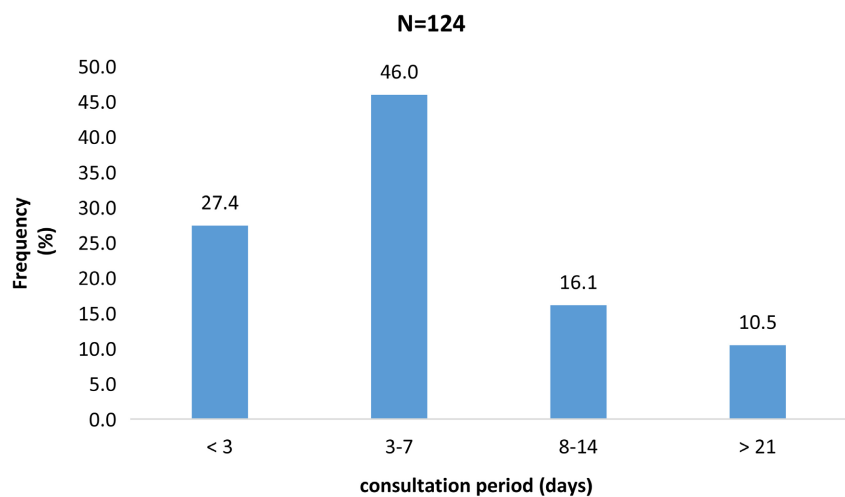


Figure 1. Distribution of the population according to the consultation period.

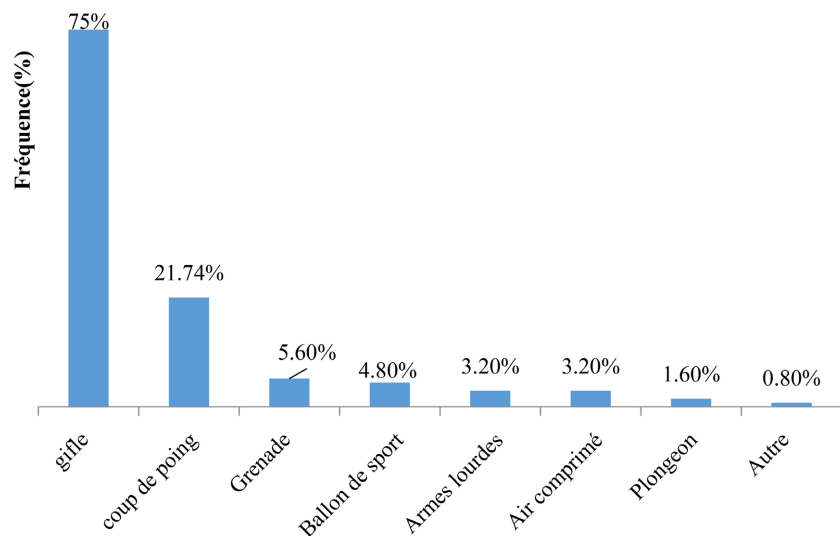


Figure 2. Population distribution from the source of the blast.

Table 3. Distribution of the population according to injury circumstances.

Circonstance de survenue	Number of patient (N = 124)	Frequency (%)
Physical Assault	101	81.45
Armed Conflict	13	10.5
Game	6	4.8
Dive	2	1.6
Industrial accident	1	0.8

Table 4. Population distribution based on physical signs of perforations.

Terms	Number of patient (N = 124)	Frequency (%)
Laterality of the lesion		
Left unilateral	82	66.1
Rigth unilateral	42	33.9
Type of perforation		
Unique	118	95.2
Multiple	4	3.2
Sub totale	1	8
Total	2	1.6
Perforation Seat		
Anterior inferior	77	62.1
Posterior inferior	57	46.0
Anterior superior	34	27.4
Posterior superior	24	19.4
Shape of the perforation		
Punctiform	41	33.1
Oval	46	37.1
Linear	13	10.5
Circular	10	8.1
triangular	7	5.6
Others	13	10.5

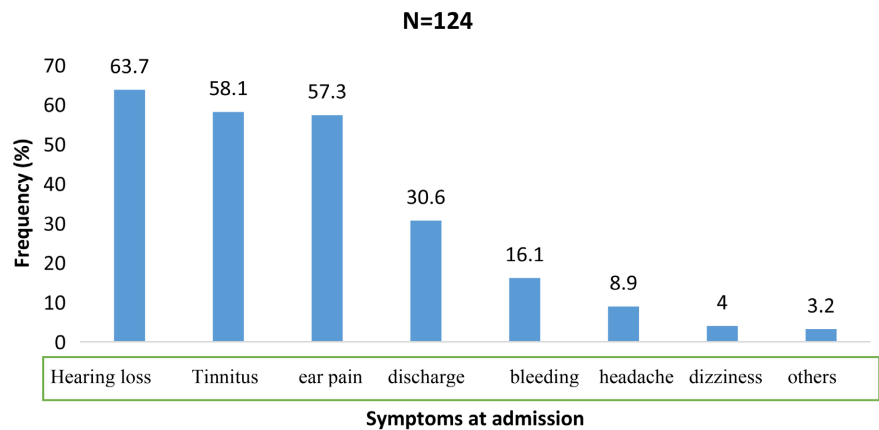


Figure 3. Population distribution by symptoms at admission.

4. Discussion

The prevalence of postblast tympanic perforations in our study was 0.1%, in contrast to the study by Van Haesendonck *et al.* In 2016, in Belgium, there was a 5.3% prevalence of post-blast tympanic perforation [1]. The prevalence found in our study includes all patients admitted to ENT departments, unlike the study mentioned above, which only considers blast patients.

This study, 124 cases were included with a male preponderance (57.3%) with a sex ratio of 1.34. This is consistent with the analysis by Wahid FI *et al.* Performed in Pakistan, which included 114 male-dominated patients (71%) with a sex ratio of 2.5 [2]. The mean age of the patients in our study was 28.6 years, close to the study done in Germany in 2015 by Kraus *et al.* on traumatic tympanic perforations, which had an average age of 28.7 years [3]. These findings are also corroborated by another study conducted by Qureshi *et al.*, who found that the average age was less than 30 years old [4]. In these studies, the majority were at the end of the third decade because people are more active and more exposed to violence.

In our study, the consultation time varied from 2 to 8 days; 46% came for consultation between 3 and 7 days—a study done in Tunis by A Sethom *et al.* On-ear, blasts found that the consultation time varied from 3 to 10 days, and 44% had consulted within less than a week [5], which is close to our study.

We found that tympanic perforations by slapping accounted for (75%), results similar to those of one of the studies mentioned above by Wahid FI *et al.* In Pakistan in 2021, 72.9% of post-blast tympanic perforations were caused by slapping [2]. These findings are also reinforced by a study done in Bangladesh in 2015 by Rabbani SG *et al.* on traumatic tympanic perforations, which reported that 88.5% of cases were caused by slapping [6]. The one made by Roshan *et al.* in Nepal in 2023 on traumatic tympanic perforations on 60 patients who found beating as the aetiology of perforation in 30% of cases [7]. This could be explained by the fact that most physical assaults occurred in the context of an argument.

Hearing loss (63.7%), tinnitus (58.1%) and otalgia (57.3%) were the main functional signs on admission. These results can be superimposed on the studies done by Van Haesendonck *et al.*, which found 80.3% tinnitus and 57.1% hearing loss [1]. As for Cave *et al.*'s analysis, they found 49.2% tinnitus and 25.6% hearing loss [8]. Hussain *et al.* found tinnitus in 78.7% of cases [9]. These symptoms can be explained by the auditory glare experienced by patients after the blast on the one hand and by the presence of tympanic perforations on the other.

Post-blast tympanic perforations are predominant in the left ear (66.1%). The literature shares this observation, Rabbani *et al.*, which found an 85% predominance of perforations on the left ear [6] and Xie *et al.* [10]. The preference for the left ear can be explained on the one hand by the fact that slapping was a primary etiological factor in these series. On the other hand, most of the world's population is right-handed, so a right-handed person will tend to slap on the left ear.

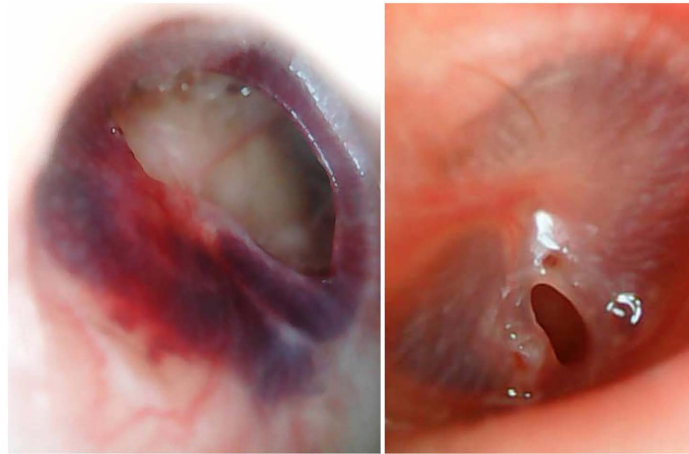


Figure 4. Post blast tympanic perforation appearance.

Our study found an anterior puncture site in 89.5% of cases (**Figure 4**). Like the literature, Sogebi *et al.* found perforations that predominated on the anterior site in 46.9% of cases in Ghana [11]. Also, Aslier *et al.* in Turkey in 2019 regained the previous seat in 45.4% of cases [12]. The predominance of perforation on the anterior-inferior site is explained by the physiological inclination of the eardrum downwards. In contrast, the lower part of the eardrum is more exposed to the outside.

During our study, 48.4% of patients underwent audiometry, which allowed us to characterise the type and degree of deafness.

Regarding the type of deafness, 58.3% of patients had conductive hearing loss. It was mild in 50% of cases and moderate in 28.3%. These results can be superimposed on the literature. In Bangladesh, Rabbani *et al.* found conductive hearing loss in 97.14% of cases and mild hearing loss in 70% [6]. Similar to those of Wahid *et al.* in 2021 in Pakistan, they found conductive hearing loss in 79.9% of cases, and mild hearing loss in 50% of cases [2]. Mild conductive hearing loss is often found in post-blast perforations and other traumatic perforations. Bali-vet *et al.* found results in France in 2017 that were contrary to ours. In their study, mixed hearing loss accounted for 55% of cases, and conductive hearing loss accounted for 29% [13]. This could be explained by including other blast lesions and the pathophysiology of mixed hearing loss, which results from a partial damping of energy by the middle ear and its partial transmission to the inner ear [14].

The limitations of the study the retrospective component (lack of some data), all the patient did not realise audiometry, for the hearing loss the follow up was not easy.

5. Conclusion

At the end of this study, we can conclude that post-blast tympanic perforations are rare in consultation. The population is predominantly male and of the second decade. The main circumstance of occurrence is aggression.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Van Haesendonck, G., Van Rompaey, V., Gilles, A., Topsakal, V. and Van de Heyning, P. (2018) Otologic Outcomes after Blast Injury: The Brussels Bombing Experience. *Otology & Neurotology*, **39**, 1250-1255. <https://doi.org/10.1097/MAO.0000000000002012>
- [2] Wahid, F.I., Saleem, M., Muhammad, R. and Khan, M.R. (2021) Aftermath of Traumatic Tympanic Membrane Perforation: Our Findings at a Tertiary Care Hospital in Pakistan. *Pakistan Journal of Medical Sciences*, **37**, 874-878. <https://doi.org/10.12669/pjms.37.3.3923>
- [3] Kraus, F. and Hagen, R. (2015) Ätiologie und Therapie der traumatischen Trommelfell perforation. *Laryngo-Rhino-Otologie*, **94**, 596-600. <https://doi.org/10.1055/s-0034-1395522>
- [4] Qureshi, T.A., Awan, M.S., Hassan, N.H., Aftab, A.H. and Ali, S.A. (2017) Effects of Bomb Blast Injury on the Ears: The Aga Khan University Hospital Experience. *Journal of the Pakistan Medical Association*, **67**, 1313-1317.
- [5] Sethom, A., Akkari, K., Dridi, I., Tmimi, S., Ben Garbia, D., Benzarti, S., *et al.* (2008) Le blast auriculaire. *Journal Tunisien d'ORL et de Chirurgie Cervico-Faciale*, **17**, 5-8. <https://doi.org/10.4314/jtdorl.v17i1.42066>
- [6] Rabbani, S.G., Rashid, M.A., Mahmud, K., Chowdhury, M.A. and Razzak, M.A. (2015) Traumatic Rupture of Tympanic Membrane: A Study of 70 Cases. *Bangladesh Journal of Otorhinolaryngology*, **21**, 38-42. <https://doi.org/10.3329/bjo.v21i1.24295>
- [7] Acharya, R., Tulachan, B., Acharya, A. and Devkota, A. (2023) Traumatic Perforation—Etiology, Outcome and Factors Affecting the Outcome. *Journal of Universal College of Medical Sciences*, **11**, 14-17. <https://doi.org/10.3126/jucms.v11i01.54471>
- [8] Cave, K.M., Cornish, E.M. and Chandler, D.W. (2007) Blast Injury of the Ear: Clinical Update from the Global War on Terror. *Military Medicine*, **172**, 726-730. <https://doi.org/10.7205/MILMED.172.7.726>
- [9] Hussain, S.M., Saeed, H.K. and Ali, A.H. (2022) Tinnitus after Blast Injury; a Prospective Study in Basrah, Iraq. *The International Tinnitus Journal*, **26**, 122-126. <https://doi.org/10.5935/0946-5448.20220019>
- [10] Xie, P., Peng, Y., Hu, J., Peng, A. and Yi, S. (2020) Assessment of Hearing Loss Induced by Tympanic Membrane Perforations under Blast Environment. *European Archives of Oto-Rhino-Laryngology*, **277**, 453-461. <https://doi.org/10.1007/s00405-019-05710-3>
- [11] Sogebi, O.A., Oyewole, E.A. and Mabifah, T.O. (2018) Traumatic Tympanic Membrane Perforations: Characteristics and Factors Affecting Outcome. *Ghana Medical Journal*, **52**, 34. <https://doi.org/10.4314/gmj.v52i1.7>
- [12] Asher, M., Özay, H., Gürkan, S., Kırkım, G. and Güneri, E.A. (2019) The Effect of Tympanic Membrane Perforation Site, Size and Middle Ear Volume on Hearing Loss. *Turkish Archives of Otorhinolaryngology*, **57**, 86-90. <https://doi.org/10.5152/tao.2019.4015>
- [13] De Régloix, S.B., Crambert, A., Maurin, O., Lisan, Q., Marty, S. and Pons, Y. (2017)

Blast Injury of the Ear by Massive Explosion: A Review of 41 Cases. *Journal of the Royal Army Medical Corps*, **163**, 333-338.

<https://doi.org/10.1136/jramc-2016-000733>

- [14] Pessey, J.-J., Deguine, O. and Wanna, G. (2004) Pathologies oto-rhino-laryngologiques au cours des explosions. *EMC - Oto-rhino-laryngologie*, **1**, 225-231.

<https://doi.org/10.1016/j.emcorl.2004.03.001>