



Prevalence of Presbycusis in Casablanca

Loudghiri Myriam ^{a*}, Iarhrabli Ibtissam ^{a*},
Oukessou Youssef ^a, Mahtar Mohamed ^a,
Redalah Larb. Abada ^a and Roubal Mohamed ^a

^a ENT Head and Neck Surgery Department, Faculty of Medicine and Pharmacy, Ibn Rochd University Hospital, Hassan II University, Casablanca, Morocco.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/98825>

Original Research Article

Received: 15/02/2023

Accepted: 18/04/2023

Published: 18/04/2023

ABSTRACT

Presbycusis or age-related hearing loss (ARHL) is characterized by high-frequency-dominated hearing loss, reduced speech understanding and impaired localization of sound source.

Presbycusis is correlated with decreased quality of life, retirement leading to depression. Furthermore, the association between hearing loss and cognitive function is widely accepted, it increases the risk of dementia and cognitive impairment.

In several countries, mass screening has been adopted to deal with early presbycusis and prevent its consequences, unlike in Morocco where presbycusis is still under-diagnosed. However, no prevalence study has been conducted so far in Morocco to assess the extent of this condition.

The aim of our study is to assess the prevalence of presbycusis during the year 2017 in Casablanca and to identify the influence of general factors on the prevalence of presbycusis.

We conducted a cross-sectional epidemiological study among people over 60 in 2017 at the level of 8 CDS randomly selected in Casablanca. A questionnaire was completed and the audiogram was conducted at 411 people who came to see health centers.

*Corresponding author: E-mail: m.loudghiri@hotmail.com, bettylar92@gmail.com;

The data from the study allowed us to highlight the relationship between presbycusis and other neurosensory deficits. Apart from age, no link could be established between presbycusis and demographic factors or health status. After the multivariate analysis, it was found that taking medication reduced the risk of developing presbycusis ($p < 0.001$, OR = 0.197 IC95 [0.093-0.415]), but could not determine exactly which drug was responsible for it.

Keywords: Presbycusis; prevalence; determining factors; neuro-sensory deficit.

1. INTRODUCTION

Presbycusis is a sensorineural deafness associated with age. It is a symmetrical and progressive bilateral sensorineural deafness predominant in high frequencies with difficulty in understanding speech (especially in a noisy environment) and a slowdown in the interpretation of sound information [1,2].

It is the most common age-related neurosensory deficit [3], and the third chronic disease of the elderly [4], affecting nearly 2/3 of people over 70 [5,6]. The date of onset of deafness, its evolution and its impact are characterized by significant interindividual variability [7,8]. Treatment depends on the type and severity of presbycusis [9]. The seriousness of this pathology lies in its consequences which can be severe and multiple: not only is it responsible for the isolation of the hearing impaired, leading to depression, but it also deteriorates their quality of life, affects their cognitive and motor functions, and increases the risk of dementia [10–12]. In the absence of treatment, the economic impact of hearing loss would amount to 213 billion euros per year in Europe, while the target device would reduce it by 40 % [13]. In several countries [14,15] mass screening has been adopted to treat presbycusis early and prevent its consequences, unfortunately, in Morocco, presbycusis remains under-diagnosed.

2. METHODS

It is a cross-sectional epidemiological study carried out in people over the age of 60 in 2017 at 8 randomly selected health centers in Casablanca. A questionnaire was completed and the audiogram was performed in 411 people who came to consult at the health centers. Presbycusis was retained according to the classification of the World Health Organization (hearing threshold greater than 25dB HL) and the International Bureau of Audio-Phonology (hearing threshold greater than 20dB HL).

Were excluded, Subjects suffering from congenital deafness, chronic otitis media, tympanic perforation, Meniere's syndrome, labyrinthitis, otological surgery, cranial surgery, use of ototoxic drugs. Subjects with earwax plugs were called back after washing.

For the procedure after ministerial agreement and ethical considerations, data collection was done through an operating sheet by an ENT doctor, which includes demographic data, current state of health, medical and otological histories and finally A Screening Questionnaire for Listening and Hearing Difficulties, Mini Mental State Examination, The Abbreviated Beck Depression Inventory and The Amsler Grid.

For this study, audiograms were performed by a trained physician using an AD229b Class 2 portable audiometer in a quiet room.

The intensity of the sound emitted is quantified in dB HL (hearing loss).

The hearing threshold was measured in the least deaf ear and then the most deaf ear.

3. RESULTS

In people aged between 60 and 65, the loss of hearing mainly affected the 4 and 8 kHz frequencies. Over time, the loss of hearing also reached the low frequencies. The prevalence of presbycusis (according to WHO) was 6.3%, 13.1%, 25.3% and 36.7% for 60-64 year olds, 65-69 year olds, 70-74 year olds and over 75 years respectively (details in Table 1).

The data from the study allowed us to highlight the relationship between presbycusis and other neurosensory deficits (as shown in Tables 2 and 3).

Apart from age, no link could be established between presbycusis, demographic factors and state of health (Table 4).

Table 1. Prevalence of presbycusis according to age groups defined by hearing threshold (N=408)

	Prevalence of presbycusis according to the BIAP			Prevalence of presbycusis according to WHO		
	not	%	CI 95%	not	%	CI 95%
60-64 years old (175)	33	19	13.4-24.9	11	6.3	3.2-10.1
65-69 years old (99)	30	31.3	32.6-40.7	13	13.1	6.3-20
70-74 years (76)	35	46.7	35.9-57.5	19	25.3	16.6-34.6
75 and over (61)	34	58.3	45.2-70.2	22	36.7	25-49.2
All (408)	132	32.8	27.9-37.5	65	15.9	12.3-19.9

Table 2. Influence of presbycusis (according to BIAP) on neuro-sensory deficits (N=408)

	Presbycusis BIAP			GOLD	CI 95%
	No presbycusis %	Presbycusis %	p		
Tinnitus (128)	28.1	38.9	0.028	1,631	1.05-2.5
AMD + screening (27)	5.9	8.5	0.329		
Cognitive disorders (117)	24.5	37.6	0.006	1,852	1.2-1.4
Depression (135)	28.8	44	0.54		

Table 3. Influence of presbycusis (according to WHO) on neuro-sensory deficits (N=408)

	Presbycusis WHO			GOLD	CI 95%
	No presbycusis %	Presbycusis %	p		
Tinnitus (128)	29.2	44.4	0.017	1,936	1.1-3.3
AMD + screening (27)	6.2	9.7	0.308		
Cognitive disorders (117)	25.7	45.3	0.002	2,392	1.4-4.1
Depression (135)	30.1	54.5	0.023	2.79	1.1-6.9

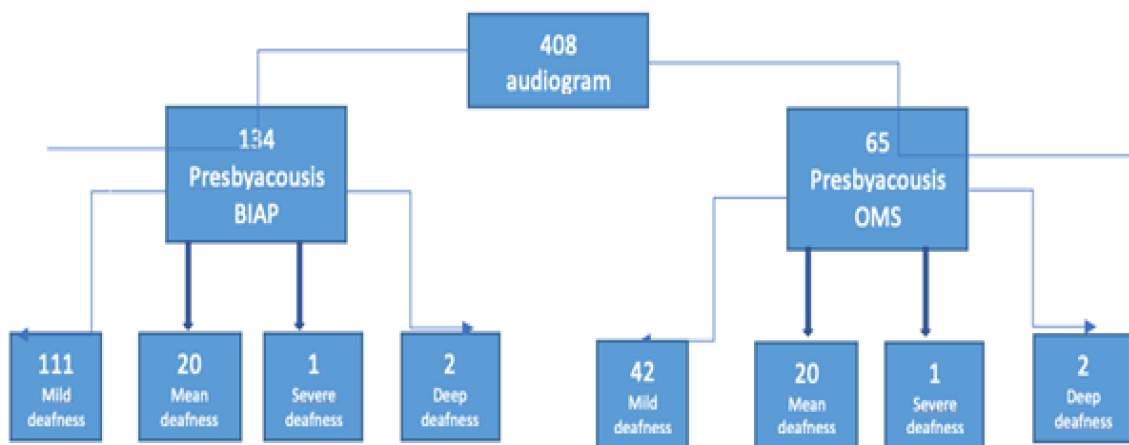


Fig. 1. Representative diagram of the overall results of our study

Table 4. Influence of demographic factors on the prevalence of presbycusis (N=408)

	Presbycusis BIAP			Presbycusis WHO		
	Not	%	P	Not	%	P
age range						
60-64 years old (174)	33	19		11	6.3	
65-69 years old (99)	31	1.3	<0.001	13	13.1	<0.001
70-74 years old (75)	35	46.7		19	25.3	
75 years + (60)	35	58.3		22	36.7	
Gender						
Male (140)	64	45.7	<0.001	31	22.1	0.013
Woman (268)	70	26.1		34	12.7	
Ethnic group						
White (383)	129	33.7	0.158	62	16.2	0.780
Black (25)	5	20		3	12	
Study level						
No schooling (240)	76	31.7		40	16.7	
Primary (58)	14	24.1	0.27	7	12.1	0.583
College (45)	12	26.7		5	11.1	
High School (11)	6	54.5		3	27.3	
Higher education (54)	26	48.1		10	18.5	
Previous professional status						
No work (200)	51	25.5		23	11.5	
Employee (81)	39	48.1	0.001	22	27.2	0.011
For own account (67)	19	28.4		9	13.4	
Informal (60)	25	41.7		11	18.3	
Socio-economic level						
Stockings (249)	76	30.5	0.414	39	15.7	0.813
Medium (121)	43	35.5		21	17.4	
High (38)	15	39.5		5	13.2	

Table 5. Influence of drugs on the prevalence of presbycusis

	Presbycusis BIAP			Presbycusis WHO		
	not	%	p	not	%	p
Medication Intake						
No (88)	41	46.6	0.002	24	27.3	0.001
Yes (320)	93	29.1		41	12.8	
Antihypertensives						
None (196)	71	36.2		34	17.3	
Monotherapy (171)	52	30.4	0.458	24	14	0.387
Bitherapy (36)	9	25		5	13.9	
Triple therapy (5)	2	40		2	40	
Insulin						
No (298)	103	34.6	0.223	9	18.8	0.009
Yes (110)	31	28.2		56	8.2	
Teen						
None (241)	90	37.3		44	18.3	
Monotherapy (140)	40	28.6	0.36	20	14.3	0.232
Bitherapy (25)	3	12		1	4	
Triple therapy (2)	1	50		0	0	
Aspirin						
No (367)	124	33.8	0.224	61	16.6	0.255
Yes (41)	10	24.4		4	9.8	
Sintrom						
No (389)	123	31.6	0.017	58	14.9	0.011

	Presbycusis BIAP			Presbycusis WHO		
	not	%	p	not	%	p
Yes (19)	11	57.9		7	36.8	
Hormones						
No (364)	125	34.3	0.64	61	16.8	0.189
Yes (44)	9	20.5		4	9.1	

Table 6. Comparison of study subjects to the target population (elderly people from Morocco and Casablanca)

	Morocco (HCP 2017)		Casablanca (HCP 2017)		Our study (2017)	
	In thousands	%	In thousands	%	n	%
60-64 years old	1247	51,5	137	50,4	175	28,6
Male	642	49,9	69	49,6	50	71,4
Women	605		68		125	
65-69 years old	895	50,4	77	46,7	99	32,3
Male	451	49,6	36	53,3	32	67,7
Women	444		41		67	
70-74years old	552	47,3	60	43,3	76	43,4
Male	261	52,7	26	56,7	33	56,6
Women	291		40		43	
75 years and +	851	46	83	43,4	61	41
Male	391	54	36	56,6	25	59
Women	460		47		36	
Schooling						
None		36,9		22,3		58,9
Primary		28		25,5		14,1
College secondary		14,2		17,5		11,2
Qualifying secondary		10		18,2		2,7
Superior		6,1		11,9		13,1
Previous occupation						
None		16,2		18,9		49
Employee		28,9		58,8		20
For his own account		48,4		20,8		16
Other		6,5		1,5		15

Table 7. Prevalence of presbycusis in different countries (age and hearing threshold mentioned)

Références	Studies	Prevalence of presbycusis (age and retained hearing threshold)
Our study	Morocco ; Prevalence of presbycusis in Casablanca. 2017	15,9%(≥60 ans, PAM≥26dB) 32,8%(≥60 ans, PAM≥20dB)
Lin et al. (2011)	USA; Hearing loss prevalence and risk factors among older adults in the united states. 2005-2006	63,1%(≥70 ans, PAM≥26dB)
Simonica de Sousa et al. (2009)	Brésil; Risk factors for presbycusis in a socio-economic middle-class sample. 2001-2005	36,6%(≥40 ans, PAM≥26dB)
Chang et al. (2007)	Taiwan ; Presbycusis among older Chinese	99% (≥65 ans, PAM≥26dB)

Références	Studies	Prevalence of presbycusis (age and retained hearing threshold)
	people in Taipei, Taiwan : A community-based study	
Gopinath et al. (2009) [5]	USA; Prevalence of age-related hearing loss in older adults: Blue Mountains study. 1992-1994	33% (≥50 ans, PAM≥26dB)
Liu et al. (2001)	Chine; Epidemiological studies on hearing impairment with reference to genetic factors in sichuan. 1986-1987	12,8%(≥60 ans, PAM≥20dB)
Borchgrevink et al. (2005)	Norvège ; Unscreened thresholds and prevalence of hearing impairment for adults >20 years. 1996-1998	14,2% (≥60 ans à 35dB)
Hietman et al. (2005) [16]	Danemark, suède, norvège; Hearing among 75-year-old people in three Nordic localities: a comparative study. 1989-1991	16,5%(≥75 ans, PAM≥40dB)

After the multivariate analysis, it turned out that taking medication reduced the risk of developing presbycusis ($p < 0.001$, $OR = 0.197$ IC95 [0.093-0.415]), without being able to determine which medication exactly was responsible (Table 5).

4. DISCUSSION

According to studies, 6.17% of patients with presbycusis would require a hearing aid [15] compared to 5.4% in our study.

While the rate of hearing aid use for people with presbycusis varies from 18.4% to 55% depending on the country [11,13,17], none of the participants in our study benefited from them.

The lack of hearing aids can easily be explained by the cost of hearing aids, which remains quite high for a cohort of which more than half are of low socio-economic level. In addition, some studies have shown the benefit of family support in the purchase and wearing of devices by 53%, while the demand by audiologists, ENT or family doctors has an influence of 20.18 and 12 % respectively [18].

There is still no universal recommendation for the treatment and management of presbycusis, primarily because of the many incriminated

factors, the different sites affected and especially because of the significant lack of information on the issue [19,20].

Individual psychological factors directly influence the impact of presbycusis and therefore justify management on a "case by case" basis [2,7].

Fitting both ears remains the usual treatment [11,18] with positive effects on cognition and other functional domains [21]. But first, vocal audiometry is necessary to explore the central auditory pathways and the difficulties of verbal discrimination [2]. Acoustic self-emission can also be proposed to study the viability of the inner and outer hair cells of the cochlea, supplemented by auditory evoked potentials to study the central auditory pathway [2].

The WHO offers auditory rehabilitation from a deafness threshold above 41dB, qualifying it as disabling [22], others state the indication as soon as the functional impairment is obvious and the average deficit in vocal audiometry exceeds 30dB with impairment of intelligibility related to speech audiometry of more than 50% [7]. However, some researchers recommend auditory rehabilitation at an earlier, so-called infra-clinical stage, through "audio-verbal" rehabilitation (prosthesis and auditory

rehabilitation) [16]. Hence the importance of just as early screening, which can even begin from the age of 50 [23].

Unfortunately, hearing aids show limited success [2,7], and in cases of profound deafness that cannot be corrected with a hearing aid, a cochlear implant may be offered. In the elderly, cochlear implants give very good results [2]. Indeed, the device remains focused on the peripheral auditory system, while presbycusis can have a central component, as mentioned above (damage to the inner hair cells, synapses, auditory nerve, and fronto-temporal cortex), that only the cochlear implant can correct [2,24,25].

5. CONCLUSION

Presbycusis is common in Morocco, its prevalence is estimated between 16% and 33% in Casablanca, it can be also associated with greater risk of cognitive disorders and depression and yet no screening measure was undertaken to take into account early charge this pathology.

CONSENT

As per international standard or university standard, patient (s) written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author (s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Mosnier I, Bouccara D. presbycusis. *Lett D'ORL Chir Cervico-Faciale*. 2010;(323): 21-5.
2. Roth TN. Aging of the auditory system. In: *Handbook of Clinical Neurology* [Internet]. Elsevier; 2015 [cité 12 nov 2017]. p. 357-73. Available:<http://linkinghub.elsevier.com/retrieve/pii/B9780444626301000202>
3. Martini A, Stephens D, Read AP. Genes, hearing, and deafness: from molecular biology to clinical practice. England; Boca Raton, FL: Informa Healthcare ; Distributed in North America by Taylor & Frances; 2007.
4. Lethbridge-Cejku M, Schiller JS, Bernadel L. Summary health statistics for U.S. adults: National Health Interview Survey, 2002. *Vital Health Stat* 10. juill 2004;(222):1-151.
5. Gopinath B, Rochtchina E, Wang JJ, Schneider J, Leeder SR, Mitchell P. Prevalence of age-related hearing loss in older adults: Blue Mountains Study. *Arch Intern Med*. 2009;169(4):415-6.
6. Zhan W, Cruickshanks KJ, Klein BEK, Klein R, Huang G-H, Pankow JS, et al. Generational Differences in the Prevalence of Hearing Impairment in Older Adults. *Am J Epidemiol*. 2010;171(2):260-6.
7. Bouccara D, Ferrary E, Mosnier I, BozorgGrayeli A, Sterkers O. Presbyacousie. *EMC - Oto- Rhino-Laryngol*. 2006;1(1):1-9.
8. Liu Z, Liu Z, Walters BJ, Owen T, Kopan R, Zuo J. In Vivo Visualization of Notch1 Proteolysis Reveals the Heterogeneity of Notch1 Signaling Activity in the Mouse Cochlea. *Riley B, éditeur. PLoS ONE*. 31 mai 2013;8(5):e64903.
9. Sprinzi GM, Riechelmann H. Current trends in treating hearing loss in elderly people: a review of the technology and treatment options - a mini-review. *Gerontology*. 2010;56(3):351-8.
10. Fortunato S, Forli F, Guglielmi V, De Corso E, Paludetti G, Berrettini S, et al. A review of new insights on the association between hearing loss and cognitive decline in ageing. *Acta Otorhinolaryngol Ital Organo Uff Della Soc Ital Otorinolaringol E Chir Cerv-facc*. juin 2016;36(3):155-66.
11. Gates GA, Mills JH. Presbycusis. *The Lancet*. sept 2005;366(9491): 1111-20.
12. Contrera KJ, Betz J, Genter DJ, Lin FR. Association of Hearing Impairment and Mortality in the National Health and Nutrition Examination Survey. *JAMA Otolaryngol-- Head Neck Surg*. oct 2015; 141(10):944-6.
13. De Kervasdoué J, Hartmann L. Impact économique du déficit auditif en France et dans les Pays développés [Internet]; 2016. Available:http://www.unsaf.org/doc/Impact_Economique_Deficit_Auditif_en_France.pdf

14. Kim G, Na W, Kim G, Han W, Kim J. The development and standardization of Self-assessment for Hearing Screening of the Elderly. *Clin Interv Aging*. 16 juin 2016;11:787-95.
15. Walling AD, Dickson GM. Hearing loss in older adults. *Am Fam Physician*. 15 juin 2012;85(12):1150-6.
16. Humes LE, Kidd GR, Lentz JJ. Auditory and cognitive factors underlying individual differences in aided speech-understanding among older adults. *Front Syst Neurosci* [Internet]. 1 oct 2013 [cité 1 févr 2018];7. Disponible sur: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3787592/>
17. Chang H-P, Chou P. Presbycusis among older Chinese people in Taipei, Taiwan: A community-based study. *Int J Audiol*. janv 2007;46(12):738-45.
18. MarkeTrak VIII: Key Factors in Hearing Aid Purchase Intent [Internet]. *Hearing Review*. [cité 4 févr 2018]. Available: <http://www.hearingreview.com/2012/03/marketrak-viii-the-key-influencing-factors-in-hearing-aid-purchase-intent/>
19. Roth TN, Hanebuth D, Probst R. Prevalence of age-related hearing loss in Europe: a review. *Eur Arch Otorhinolaryngol*. Août. 2011;268(8):1101-7.
20. Verschuur C, Agyemang-Prempeh A, Newman TA. Inflammation is associated with a worsening of presbycusis: Evidence from the MRC national study of hearing. *Int J Audiol*. Juill 2014;53(7):469-75.
21. Lin FR, Thorpe R, Gordon-Salant S, Ferrucci L. Hearing Loss Prevalence and Risk Factors Among Older Adults in the United States. *J Gerontol A Biol Sci Med Sci*. 1 mai 2011;66A(5):582-90.
22. OMS | Surdit  et d ficiency auditive [Internet]. WHO. Available: <http://www.who.int/mediacentre/factsheets/fs300/fr/>
23. OMS | Agir contre la perte auditive: un investissement judicieux [Internet]. WHO. [cité 31 janv 2018]. Disponible sur: <http://www.who.int/topics/deafness/action-for-hearing-loss/fr/>
24. Blamey P, Artieres F, Baskent D, Bergeron F, Beynon A, Burke E, et al. Factors Affecting Auditory Performance of Postlinguistically Deaf Adults Using Cochlear Implants: An Update with 2251 Patients. *Audiol Neurotol*. 2013;18(1):36-47.
25. Lenarz M, S nmez H, Joseph G, B chner A, Lenarz T. Cochlear implant performance in geriatric patients. *The Laryngoscope*. 2012;122(6):1361-5.

  2023 Myriam et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<https://www.sdiarticle5.com/review-history/98825>