International Journal of Pediatric Otorhinolaryngology 101 (2017) 7–10

Contents lists available at ScienceDirect

International Journal of Pediatric Otorhinolaryngology

journal homepage: http://www.ijporlonline.com/

The risk ratio for development of hereditary sensorineural hearing loss in consanguineous marriage offspring

Hossam Sanyelbhaa [a, *], Abdelmagied Kabel [a], Heba Abd El-Rehem Abo El-Naga [b], Ahmed Sanyelbhaa [c], Hatem Salem [d]

[a] Audiology Unit, ENT Dept., Menoufia University, Egypt
[b] ENT Dept., Menoufia University, Egypt
[c] Internal Medicine Dept., Suize Canal University, Egypt
[d] Ministry of Health, Kingdome of Saudi Arabia, Saudi Arabia

ARTICLE INFO

Article history:
Received 7 April 2017
Received in revised form
15 July 2017
Accepted 17 July 2017
Available online 19 July 2017

Keywords:
Genetic hearing loss
Non syndromic hearing loss
Etiology of hearing loss

ABSTRACT

Objectives: This study aims to define the relative risk of development of hearing loss in offspring of consanguineous marriages.
Materials and methods: This is a retrospective case-control study conducted in a tertiary referral center in Jeddah, KSA. The study group included 1600 probands (848 males, 752 females), with age range 0.5–12 years (6.6 ± 3.6). The study group comprised of two equal, age and sex matched subgroups; *Hearing Loss (HL) group and Normal Hearing (NH) group*. The children included in the HL group should have idiopathic or non syndromic genetic sensorineural hearing loss.
Results: The HL Group comprised 800 children with variable degrees of sensorineural hearing loss. Profound and severe degrees of hearing loss were the most prevalent degrees ($P < 0.05\%$). The prevalence of consanguineous marriage offspring in the NH group was 42.5%, while in the HL group it was 68.9% ($P < 0.05$). The differences between both study subgroups regarding the distribution of different degrees of parental consanguinity (first, second, double first, and first once removed cousins) were insignificant ($P > 0.05$). The relative risk and 95% confidence interval (RR, 95% CI) for development of hearing loss in offspring of consanguineous marriage was 1.76 (95% CI 1.57–1.97, $P < 0.001$).
Conclusions: There was 76% increased risk for consanguineous marriage progeny to develop SNHL when compared to non consanguineous progeny.

1. Introduction & rationale

Clinical genetics defines consanguineous marriage (CM) as the union between related couples as second cousins or closer, leading to a coefficient of inbreeding (F) in their progeny ≥ 0.0156 [1]. The prevalence of CM around the world discloses significant variability; in Europe it is less than 0.5%, while in the Middle East countries it may reach up to 67.6%. The prevalence of CM among married women in Riyadh, Kingdome of Saudi Arabia (KSA) is 37.9% [2,3].

CM leads to increased expression of autosomal recessive disorders including sensorineural hearing loss [4]. About two-thirds of the cases of sensorineural hearing loss (SNHL) in children are either genetic non syndromic SNHL or idiopathic SNHL. Recently, most of the cases previously described as “idiopathic” were also attributed to genetic factors [5]. The prevalence of SNHL among children in KSA is 14 per 1000. This is much higher than the prevalence of hearing loss in children of developed countries, which have less incidence of consanguinity, whereas the prevalence of SNHL is 3–4 per 1000 [6,7].

It is important that health care providers in highly consanguineous communities would have clear evidence-based guidelines in counseling consanguineous couples to minimize the risks for having affected offspring [4]. This study aims to define the relative risk of development of hearing loss in CMs offspring.

2. Material and methods

2.1. Subjects

This is a case-control study conducted in a tertiary referral center, between Dec. 2010 and Oct. 2016 in Soliman-Fakeeh

* Corresponding author.
E-mail address: Sanyelbhaa@yahoo.com (H. Sanyelbhaa).

http://dx.doi.org/10.1016/j.ijporl.2017.07.020
0165-5876/

hospital, Jeddah, KSA. The study group included 1600 children belonging to 1600 different families (848 males, 752 females), their age range was 0.5–12 years (6.6 ± 3.6). The study composed of two, age and sex matched, subgroups; *Hearing Loss (HL) group and Normal Hearing (NH) group*. **HL group:** included 800 children with variable degrees of SNHL. They were attending the audiology clinic for hearing assessment. The inclusion criteria in this subgroup were: 1) Absence of any conductive element in the hearing loss; 2) The SNHL is either idiopathic or non-syndomic; children with syndromic hearing loss or hearing loss due to prenatal, perinatal or postnatal causes were not included in the present study. **NH group:** included 800 children with normal hearing sensitivity, they were relatives of the attendants of the audiology clinics and infants subjected for routine audiological assessment. The children were free from any medical general disorder. The study was approved by the Ethics Committee at Soliman-Fakeeh hospital, and consents of approval to participate in the study was obtained from the guardian of the children.

2.2. Methods

The entire study group was subjected to the following:

1) Detailed history to inquire about any condition that would cause hearing loss e.g. neonatal sepsis, head trauma, ototoxicity etc.
2) General and neurological examination to exclude the presence of syndromic features
3) Middle ear function testing using Zodiac 901 immittancemeter to confirm absence of middle ear pathology
4) Hearing threshold assessment using interacoustics AC440 audiometer or ICS Charger EP200 Otometrics system. Auditory brainstem evoked response (ABR) was assessed using two tone bursts (500 and 2000 Hz). Normal ABR threshold was considered when wave V could be traced down to 40 and 30 dB nHL for 500 and 2000 Hz respectively [8]. Pure tone threshold was considered normal when the thresholds for the frequencies 250–8000 Hz ≤ 15 dB [9]. To determine the degree of hearing loss, pure tone average of the frequencies 500, 1000 and 2000 Hz was calculated and classified according to Clark [10].
5) Detailed study of the parental consanguinity for the children in both study subgroups.

3. Results

3.1. Demographic distribution

Table 1 shows the demographic distribution of the study subgroups, there were no statistical significant difference as regards age or gender distribution between both study subgroups ($p > 0.05$).

3.2. Consanguineous marriages

Table 1 discloses that the prevalence of CM among the parents of the children included in the current study was 55.7% (891 children). The possibility of having a sibling with hearing loss in the family was significantly higher in the HL group, especially if there were CM ($P < 0.05$).

Fig. 1 discloses the different degrees of the CM encountered in the current study, first degree cousins was the most prevalent degree ($P < 0.05$), the differences between both study subgroups (NH and HL groups) regarding the distribution of different degrees of consanguinity (first, second, double first, and first once removed cousins) were insignificant ($P > 0.05$).

The **relative risk** and 95% confidence interval (RR, 95% CI) for development of hearing loss in offspring of CM was 1.76 (1.57–1.97) ($P < 0.001$). In other words, there was 76% increased risk for development of hearing loss in the offspring of CM.

Table 1
Demographic distribution and prevalence of consanguineous marriages and affected siblings in the study subgroups.

	HL group	NH group
Age (years) Mean ± SD	6.9 ± 3.2	6.7 ± 3.1
Females (%)	366 (45.8%)	386 (48.3%)
Males (%)	434 (54.2%)	414 (51.7%)
Consanguineous parents	511 (68.9%)	340 (42.5%)
No Consanguinity	289 (31.1%)	460 (57.5%)
Number of siblings with hearing loss:		
Consanguineous parents	86 (16.8%)	11 (3.2%)
No Consanguinity	32 (11.1%)	12 (2.6%)

HL group: children with hearing loss, NH group: children with normal hearing.
Student t-test and Chi square test revealed non significant differences between both groups regarding age and sex distribution ($P > 0.05$). The difference between both groups regarding the prevalence of consanguinity was statistically significant ($P < 0.001$).

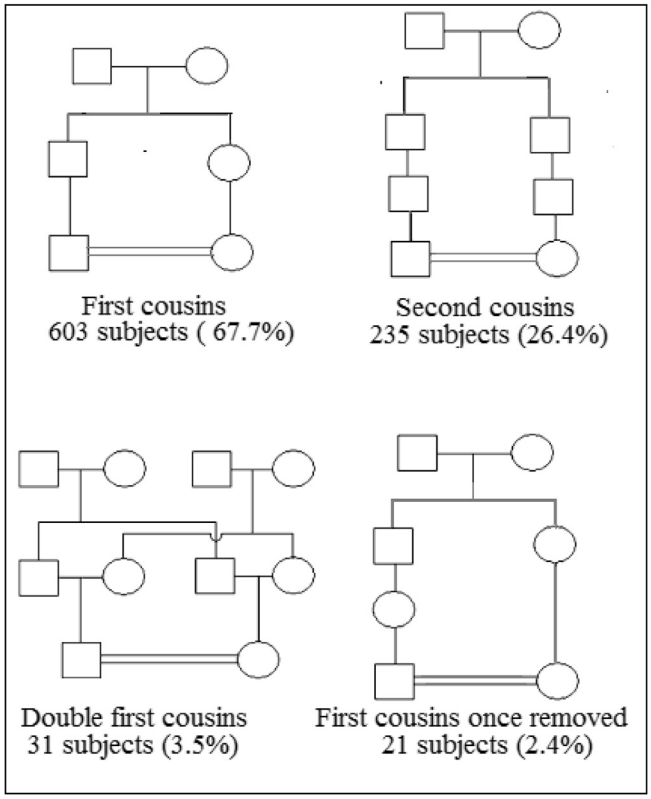

Fig. 1. The prevalence of different degrees of consanguineous marriage in the study. The total number of consanguineous marriages was 891 subjects (100%).
One sample *t*-test between percentages revealed that the first cousins were significantly higher in prevalence, followed by second cousins.

3.3. Hearing sensitivity

According to the inclusion criteria of the present study, the entire study group had normal middle ear functions. The **HL Group** comprised 800 children with variable degrees of sensorineural hearing loss. Table 2 discloses the different degrees of the hearing loss in **HL group**. Profound and severe degrees of hearing loss were the most prevalent degrees ($P < 0.05\%$). Fig. 2 compares the pure-