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Predictor Factors that Influence the Results of Sudden Deafness Therapy

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ABSTRACT

Sudden deafness is an emergency case in otorhinolaryngology (ORL). Standard therapy did not result in the same hearing improvement between cases. There are some factors that may influence the therapeutic result therefore, it is necessary to identify predictive factors that may effect on prognosis. Methods: Prognostic test study was done to 52 sudden deafness patients (58 ears) that were treated in ORL-HN department at Moh. Hoesin General Hospital from December 2015 until May 2016. From 52 participants, we found some predictive factors that may influence the therapeutic results, including the suffered side of ear (p=0.011), pattern of audiometry results (p=0.047), and degree of hearing impairment (p=0.038). From the logistic regression we found those factors, including suffered side of ear (OR adj=4), onset of therapy (OR adj=3.8), and degree of hearing impairment (OR adj=2.3). There was significant corellation between suffered side of ear, pattern of audiometry results, and degree of hearing impairment with therapeutic results. There was some predictive factors that mostly influenced the therapeutic results, including suffered side of ear, onset of therapy, and degree of hearing impairment.

Keywords: Sudden Deafness, Predictive Factors, Therapeutic Result

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INTRODUCTION

Sudden Deafness is one of the emergency obstetric cases in otolaryngology. Sudden deafness is defined as sensorineural hearing loss greater than 30 dB at three frequencies respectively at the beginning of less than three days. Sudden deafness is a rare case in otolaryngology. Sudden deafness occurs only 1% of all sensorineural deafness. Prevalence varies among countries. This sudden onset of deafness tends to increase every year. There is no difference in sudden deafness rates between men and women, and can occur at any age with the highest incidence at 50-60 years of age. Unilateral sudden deafness is more common than bilateral. At Mohammad Hoesin General Hospital, there are 44 cases during October 2012 to November 2015[1-5].

The exact cause of sudden deafness is unknown. It is suspected that several factors and comorbid diseases are at risk of causing sudden deafness with main mechanics with microangiopathy pathway and inner ear organ damage. Several sistemic disease for example diabetic mellitus, hypertension, dyslipidemia, autoimmune disease and hematologic disorder can become the sudden deafness etiology. The sudden deafness management can be more focus if we know the etiologic of its. Starting period of management may influence the improvement. Therefore, it is urgent to diagnosis and chose correct treatment [3, 6-9].

The same management does not always provide the same hearing improvement. There are several factors that influence the outcome of therapy on sudden deafness. These factors include age, the onset of treatment, the presence of vascular comorbidities, the presence of vestibular symptoms such as vertigo and tinnitus, the degree of hearing loss, the frequency of hearing loss, as

well as the audiometric picture at the time of diagnosis. The delay in starting treatment will provide a poor prognosis for hearing improvement. It is therefore important to recognize and detect these hearing losses early and identify factors that may affect the prognosis, so as to support the recovery of hearing function and patient's quality of life [1, 5].

The purpose of this study is to determine what factors can be predictors of prognosis determinants and look for factors that have the highest predictor value. In addition, this study is also expected to be consideration for early intervention of some potentially modifiable prognostic factors such as for risk factors for vascular disorders and duration of starting therapy and expected to be a source of knowledge and foundation for further research.

MATERIALS AND METHODS

This research uses prognostic test design (prognostic study). This research was conducted in Installation of Inpatient Ear Nose and Throat (ENT) Mohammad Hoesin General Hospital. Research data was collected from December 2015 until the sample size was met. Samples taken in the study were sudden deafness patients treated at Mohammad Hoesin General Hospital for at least 1 week, had complete medical records and were willing to follow the study. Sudden deafness patients who are unwilling to attend research and incomplete patient medical records are excluded from the study. The minimum sample size is 29 samples.

Samples were taken by consecutive sampling, in which every patient who came to ENT outpatient, emergency room, or consult from other departement of Mohammad Hoesin General Hospital Palembang and fulfilled the inclusion criteria of the study in order to be sampled until the required amount was reached. The patient then performed an audiometric examination and then identified the factors that influenced the prognosis and recorded. During the development of the study subjects followed, re-audiometry was performed after 1 week of care and assessment of whether the success of therapy and treatment is continued for up to 2 weeks. After 2 weeks evaluation of therapy results, the data are recorded in a form which is then processed and analyzed statistically using SPSS.

RESULTS

The number of study subjects was 52 people consisting of 33 men (63.5%) and 19 women (36.5%). Age was divided into two groups with subject distribution more than 50 years as many as 27 (51.9%) and less than 50 years as many as 25 (48.1%). the affected ear side was 46 (88.5%) unilateral and 6 (11.5%) bilateral, with the most distributions being on the right ear of 24 (46.2%), followed by the left ear 22 (42.3%), and left right ear 6 (11.5%).

Based on the criteria of the onset of therapy, 39 (75%) were started on therapy less than 7 days and 13 (25%) more than 7 days. Symptoms of vestibular accompanying were obtained vertigo as much as 23 (44.2%) and tinnitus of 40 (76.9%). From 52 subjects with hypertension disease were 23 (44.2%), diabetes mellitus 10 (19.2%), dyslipidemia 18 (34.6%), and hypercoagulation 16 (30.8%).

Table 1: Baseline characteristics

Variable	N (52)	%
Gender		
Man	33	63.5
Women	19	36.5
Age		
< 50 years	25	48.1
> 50 years	27	51.9
The ear is exposed		
Unilateral	46	88.5
Right	24	46.2
Left	22	42.3
Bilateral	6	11.5
Long start therapy		
<7 days	39	75
> 7 days	13	25
Vertigo		
Yes	23	44.2
No	29	55.8
Tinitus		
Yes	40	76.9
No	12	3.1
Hypertension		
Yes	23	44.2
No	29	55.8
Diabetes mellitus		
Yes	10	19.2
No	42	80.8
Dyslipidemia		
Yes	18	34.6
No	34	65.4
Hypercoagulation		
Yes	16	30.8
No	36	69.2

In the analysis of prognostic factors with therapeutic outcomes, there was a significant relationship between the affected ear side factor, the audiometric picture pattern and the audiometric degree with the outcome of the therapy. While other factors such as hypertension, DM, hypercoagulation, dyslipidemia, age, tinnitus, long start therapy and vertigo was not found a significant relationship to the outcome of therapy.

In the analysis between ear side factors affected by therapeutic results, 6 subjects experienced bilateral deafness, where the results of the improvement therapy were obtained in 1 person and not 5 people. A total of 46 subjects experienced unilateral deafness and improvement was found in 34 people. Fisher test showed significant correlation between therapy result with ear side exposed (p = 0,011). From the test subjects affected by bilateral deafness had a 14.2-time risk (OR = 14.2) for no improvement.

Table 2: The Ear Defect Affected by Therapeutic Results

	Result of Theraphy		Total n (%)
	No Improvment n (%)	Improvment n (%)	
Bilateral Defect of Ear	5 (83.3%)	1 (16.7%)	6 (100%)
Unilateral Defect of Ear	12 (26.1%)	34 (73.9%)	46 (100%)
Total	17	35	52

Fisher test, p=0.011 OR =14.2 95%CI= 1.5-133.82

Table 3: Relationship of audiometric views with therapeutic results

		Result of Theraphy		Total n (%)
		No Improvment n (%)	Improvment n (%)	
Audiometric Views	Upsloping	3 (20%)	12 (80%)	15 (100)
	Flat	5 (62.5%)	3 (37.5%)	8 (100)
	Downslopin g	7 (29.2%)	17(70.8%)	24 (100)
	Profound	7 (63.6%)	4 (36.4%)	11 (100)
Total		22	36	58

In relation to audiometric pattern with therapeutic result, the most audiometric pattern is obtained down sloping as much as 24 with 70.8% improvement therapy results and no improvement of 29.2% of people. The second most audiometric pattern is up sloping 15 with 80% improvement therapy and no 20% improvement. Followed by profound audiometry picture pattern of 11 with less therapeutic improvement result (36.4%) than unfixed (63.6%), while the least audiometric pattern is flat as much as 8 with result of improvement therapy which is also less (37.5%) than that not improvement (62.5%). Chi-square test showed a significant correlation between therapeutic results with audiometric picture pattern (p = 0.047).

In the degree of audiometric relationship with therapeutic results, the highest degree of audiometry was severe 16 with no improvement (62.5%) of the treatment than the improvement (37.5%). The second largest was profound as much as 14 with result of therapy improvement more (57.1%) than not improvement (42.9%). A moderate severe degree was found to be 13 with improved therapeutic results (84.6%) than no improvement (15.4%). The mean degree was found to be 10 with improved therapeutic results (60%) than no improvement (40%). While the least obtained is a mild degree of 5 with the results of 100% repair therapy. Chi-square test obtained a significant relationship between the therapy with audiometric degree (p = 0.038).

Table 4: Relationship of audiometric degree with therapy results

		Result of Theraphy		Total n (%)
		No Improvment n (%)	Improvment n (%)	
Audiometric Degree	Mild	0	5 (100%)	5 (100)
	Moderate	4 (40%)	6 (60%)	10 (100)
	Moderate-Severe	2 (15.4%)	11(84.6%)	13 (100)
	Severe	6 (42.9%)	8 (57.1%)	14 (100)
	Very Severe	10 (62.5%)	6 (37.5%)	16 (100)
Total		22	36	58

In this study the probability of no improvement can be seen from the existence of predictor factors that most influence on the results of therapy obtained from logistic regression test that is affected ear, duration of therapy and audiometric degree. The higher the predictor factors the possibility of no greater improvement. For example, if the patient has bilateral ear predictors, length of therapy more than 7 days, and the

audiometric degree is very severe then using the formula is unlikely to improve after therapy is 40%. Whereas if the patient had left unilateral ear predictor factor, duration of therapy less than 7 days, and mild audiometric degree then chances of no improvement after therapy were 27%.

DISCUSSION

This study is a prognostic test (prognostic study) which aims to determine the influence of predictor factors associated with the results of sudden deafness therapy. In this study, there was more sudden deafness in men (63.5%) than women (36.5%) with less significant differences between age groupmore than 50 years (51.9%) and less than 50 years (48.1%). This finding is similar to Akdag *et al.,* study in Turkey (2014) against 112 sudden deaf patients where 55.4% occurred in males and 44.6% in females. Subjects were found in the 17-70 year age range with a higher incidence rate at <50 years of age [10].

Based on the side of the ears affected by unilateral sudden deafness were found more than bilaterally, with 88.5% unilateral and bilateral 11.5%. On the unilateral side there was no significant difference between right and left ear events. This is consistent with the literature of incidents unilateral sudden deafness more than bilateral. In the Xiao-tong et al in China 2010 study found unilateral deafness incidence of as much as 89.7% and bilateral 10.3%, with no significant difference in the number of occurrences of right ear and left ear in unilateral cases [2].

In this study, based on the length of treatment, more patients who started therapy less than 7 days compared with more than 7 days with a ratio of 3: 1. This is in accordance with Lee et al's study in 2014 in Korea where the ratio of cases that started treatment less than 7 days compared with more than 7 days was 5: 1[23]. The symptoms of vestibular accompanying tinnitus were encountered more than the symptoms of vertigo. Tinnitus was obtained in 76.9% of cases while vertigo was obtained in 44.2% of cases. This is consistent with Zhang et al's study of tinnitus occurring in 88.3% of cases and vertigo in 27% of cases [2].

Complications of vascular hypertension (44.2%) were more common than those of dyslipidemia (34.6%), hypercoagulation (30.8%), and diabetes mellitus (19.2%). This result is not much different from the research of Lionello *et al.,* in 2015 in Italy where there was a case of sudden deafness with comorbid hypertension (29%), dyslipidemia (15%) and diabetes mellitus (9%).[5] The audiometric densities more common in deafness in this study were very severe (27.6%), followed by weight (24.1%), moderate weight 22.4%), medium (17.2%), and light (8.6%). This is in accordance with previous research, Edizer *et al.,* also found that most degrees were very severe (29.8%), followed by degree of level (25.9%), moderate level (18.5%), moderate (16.1%), and profound level (9.8%) [11]. In this study the most audiometric picture pattern is downsloping (41.4%) followed by upsloping (25.9%), profound (19%), and flat (13.8%). This is slightly different from the results of Lee et al's research that found the pattern of picture audiometry found the most is flat (52.2%), followed downsloping (19.7%), upsloping (19.4%), and profound (8.7%)[12].

The specific purpose of this study was to determine predictor factors related to the results of sudden deafness therapy and to see the odds ratios of factors related to the results of sudden deafness therapy by using bivariate analysis and to determine which predictor factors were the most effect on the result of sudden deafness therapy obtained from multivariate analysis.

In this study, each predictor factor was associated with therapeutic results using bivariate analysis. There was a significant correlation between ear side exposed and therapeutic result using Fisher test (p = 0,011). Fisher test was performed because it did not meet the requirements of Chi-square test. From the test subjects affected by bilateral deafness had a 14.2-time risk (OR = 14.2) for no improvement. Then the affected ear is categorized again into the right and left ear and then performed bivariate analysis using Chi-square test. From the test, there was no significant relationship between ear side exposed category and therapeutic result (p = 0,737).

In this study also found a significant relationship between the audiometric picture pattern and the therapeutic results of the Chi-square test (p = 0.047). According to Mattox and Simmons hearing improvement is influenced by audiometric features in which upsloping images have a better prognosis than other audiometric patterns of

viewing [13] This is supported by Lee *et al.,* study which has a significant association between audiometric pattern and therapeutic results (p = 0.003) [16] this is not found in other studies as in Lionello *et al.*, where there is no significant relationship between audiometric pattern and therapeutic results (p = 0.31) [5].

The degree of initial hearing is also known to affect the prognosis of improvement after the therapy where in this study also found a significant relationship between audiometric degrees with therapeutic results of Chi-square test (p = 0.038). Then to find the risk (OR) the result of therapy is not improvement then the degree of audiometry is categorized again to more than 70 db (degree of mild, moderate, and moderate weight) and more than 70 db (degree of weight and very heavy). Chi-square test showed significant correlation between therapy result and category audiometric degree (p = 0,021). From the test, the degree of audiometric more than 70 db has 3.7 times (OR = 3.7) to not improve. Based on Ustun et al's research which found that the more severe the degrees of hearing loss the prognosis was also worse.[13] From the research Wang et al also reported a degree of hearing loss more than 70 db was associated with a poor prognosis [14].
To find the most influencing predictor factors on the outcomes of the therapy was a multivariate analysis with logistic regression. From the analysis, there are three predictor factors that influence the outcome of therapy in example the affected ear (OR adj = 4), length of therapy (OR adj = 3.8) and audiometric degree (OR adj = 2.3). Based on the results of research Harada *et al* who also conducted multivariate analysis of several predictor factors on the outcome of therapy found the most influential factor is the long start therapy, hearing degrees, vertigo and age. This study concluded that these factors simultaneously provide a poor prognosis for the outcomes of therapy is the duration of treatment for more than 7 days, the degree of hearing is very severe, the presence of symptoms of vertigo accompanying deaf people suddenly old age [15].

In previous studies, long-standing therapy was associated with therapeutic outcomes. When starting treatment early is associated with a good prognosis for hearing function recovery. Lee *et al*,. found that hearing improvement was significantly higher in patients receiving treatment before 7 days compared with more than 7 days [16]. This result was also reinforced by Bullo *et al*., study that the best time limit for starting therapy for hearing improvement was 7 days. This is linked to the increasing extent of hair cells which is damaged by inflammation if treatment delay is prolonged. Shaia and Sheehy found improvements in 75% of sudden deafness patients who started vasodilator therapy within 7 days after symptom onset was found and percentage decreased to 53% in cases where treatment began more than 7 days [13].

Then a probability calculation of the most influential predictors was predicted on the outcome of the treatment based on the previous logistic regression test results to predict the probability that the prognosis did not improve after therapy. From these calculations, patients who had predictors long duration of therapy more than 7 days, bilateral ears and very heavy hearing levels have a 40% chance of not improving. As for patients with predictors of long duration of therapy less than 7 days, left unilateral left ear, and mild audiometric degree had 27% chance of no improvement.

CONCLUSION

There was significant corellation between suffered side of ear, pattern of audiometry results, and degree of hearing impairment with therapeutic results. There were some predictive factors that mostly influenced the therapeutic results, including suffered side of ear, onset of therapy, and degree of hearing impairment.

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