CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

Available online at: http://www.iajps.com Research Article

ANALYSIS OF HEARING IMPAIRMENT IN CHILDREN WITH CHRONIC RENAL FAILURE

[1]Dr. Syed Muhammad Ali Raza, [2]Dr. Gohar Ali, [3]Dr. Umar Mahmood

[1]Medical Officer at Children Hospital Complex & ICH, Multan

[2]Demonstrator in Sahara Medical College, Narowal

[3]Medical Officer at THQ Hospital Gujar khan, Rawalpindi

Abstract:

Introduction: *The cochlea and kidney have similar physiological mechanisms, namely the active transport of fluid and electrolytes performed by the stria vascularis and the glomerulus, respectively. They may also have common antigenicity.* ***Objectives of the study:*** *The basic aim of the study is to analyze the hearing impairment in children with chronic renal failure.* ***Material and methods:*** *This study was conducted at Children Hospital Complex & ICH, Multan during Jan 2018 to April 2018. This prospective study carried out 50 patients of both genders and age range 10 years to 15 years. Renal failure was diagnosed by elevated level of blood urea and serum creatinine and associated oliguria. Haemodialysis was done in 14 patients.* ***Results:*** *Ten out of the 14 cases (71.42%) had undergone for haemodialysis; at least once (1 case), twice (2 cases), thrice (6 cases) and 4 times (1 case). Thus, 4 out of these 10 cases (40%) had a hearing loss of over 75 db and had undergone for HDs 3–4 times. In contrast only 4 out of 36 cases without SNHL had undergone for haemodialysis; once (1 case), twice (1 case) or thrice (2 cases). Thus, the degree of hearing loss correlated with the number of haemodialysis (HDs) as seen.* ***Conclusion:*** *It is concluded that there is a possible link between kidney function and hearing loss, as suggested by our study, potentially could modify the usual care of people with CKD.*

Corresponding author:

Dr. Syed Muhammad Ali Raza,

Medical Officer at Children Hospital Complex & ICH, Multan

QR code

Please cite this article in press Syed Muhammad Ali Raza et al., ***Analysis of Hearing Impairment in Children with Chronic Renal Failure.,*** *Indo Am. J. P. Sci, 2018; 05(12).*

INTRODUCTION:

The cochlea and kidney have similar physiological mechanisms, namely the active transport of fluid and electrolytes performed by the stria vascularis and the glomerulus, respectively. They may also have common antigenicity. Although the gross anatomy of the kidney and cochlea differs considerably, there are many similarities at the ultrastructural level. Both contain epithelial structures in close contact with their vascular supply. Basement membrane is found closely apposed to capillary endothelium in both Bowman's capsule and the proximal renal tubules of the kidney and also around the capillaries of the stria vascularis [1]. In addition, basement membrane lined intercellular channels exist in both the glomerulus and the stria vascularis. Moreover, the epithelial cells in both the cochlea and the kidney show features known to be associated with active transport of fluid and electrolytes, namely, microvilli containing numerous mitochondria. Both organs are involved in body fluid homeostasis, and therefore have epithelium containing a sodium–potassium ion pump using ATPase. Carbonic anhydrase is also present in both the stria vascularis and the nephron [2]. They are also affected similarly by some medications (i.e. nephrotoxic and ototoxic effects of aminoglycosides) and immunological factors on the two organs. Both inner ear and kidney development are influenced by similar genetic factors in hereditary conditions such as Alport's syndrome and branchio-oto-renal syndrome [3]. Presence of hearing loss and estimation of type and degree constitute one of the most common method used to investigate the effects of renal disease on the auditory system. The incidence of sensorineural hearing loss (SNHL) among patients with CRF is considerably higher than general population and varies from mild hearing disturbance found in 77% cases to moderately severe hearing loss in 46% of the tested patients. Most of hearing loss is in high frequency range with a notch at 6 kHz [4]. The degree of hearing loss may give an indication of the extent of damage to auditory function whereas the type of hearing loss may distinguish between lesion in outer and middle ear (conductive hearing loss) or cochlea and the neural pathways (SNHL) [5].

Objectives of the study

The basic aim of the study is to analyze the hearing impairment in children with chronic renal failure.

MATERIAL AND METHODS:

This study was conducted at Children Hospital Complex & ICH, Multan during Jan 2018 to April 2018. This prospective study carried out 50 patients of both genders and age range 10 years to 15 years. Renal failure was diagnosed by elevated level of blood urea and serum creatinine and associated oliguria. Haemodialysis was done in 14 patients. An informed consent was taken from all the patients. A thorough clinical examination and a complete ENT checkup was done. Other investigations like serum electrolytes (Na^+, K^+, Cl^-) and urine for protein (albumin) were also carried out. USG abdomen (for kidney size) was advised for every patient. Audiological examinations includes Tuning fork tests, Pure tone audiometery, Tympanometry and BERA and were done in all cases to describe the (type and extent) hearing loss.

Statistical analysis

Student's t-test was performed to evaluate the differences in roughness between groups. Two-way ANOVA was performed to study the contributions. A chi-square test was used to examine the difference in the distribution of the fracture modes (SPSS 19.0 for Windows, SPSS Inc., USA).

RESULTS:

Ten out of the 14 cases (71.42%) had undergone for haemodialysis; at least once (1 case), twice (2 cases), thrice (6 cases) and 4 times (1 case). Thus, 4 out of these 10 cases (40%) had a hearing loss of over 75 db and had undergone for HDs 3–4 times. In contrast only 4 out of 36 cases without SNHL had undergone for haemodialysis; once (1 case), twice (1 case) or thrice (2 cases). Thus, the degree of hearing loss correlated with the number of haemodialysis (HDs) as seen.

Table 01: Relationship between duration of CRF and degree of SNHL

Duration of CRF (years)	Number with SNHL					Number without SNHL	
	Degree of SNHL (db)				Number according to HDs		Number according to HDs
	50–60	>60–70	>70–80	>80–90			
1–2	–	–	–	–	–	9	2
2–3	2	–	–	–	–	11	1
3–4	–	2	–	1	4	8	–
4–5	–	1	3	2	4	7	1
5–6	–	1	1	1	2	1	–

There was no difference in the level of serum electrolytes between the groups of patients with SNHL of 50–70 db and those without hearing loss. However, Patients with SNHL over 70 db had significantly low sodium and higher potassium and chloride values. This signifies the role of electrolyte disarray in causing hearing loss.

Table 02: Serum electrolytes in patients with CRF with and without hearing impairment

Electrolyte (mEq/l)	With SNHL (Mean ± SD)		Without SNHL (Mean ± SD)
	50–70 db	71–90 db	
Sodium	133.5 ± 2.6	127.7 ± 5.6*	133.1 ± 7.8
Potassium	5.2 ± 0.9	6.8 ± 0.7*	5.4 ± 0.9
Chloride	102.3 ± 1.9	107.1 ± 4.1*	104.9 ± 3.8

$P < 0.05$ significant versus (50–70 dbs)

DISCUSSION:

Hemodialysis is a safe and effective treatment for children with acute and CRF. Although there were early problems with application of a complex extracorporeal technique in children and small infants, the availability of sophisticated equipment (particularly ultrafiltration control devices) together with skilled nursing staff make the technique applicable to even the smallest or the sickest children. The two most common complications of chronic uremia are encephalopathy and peripheral neuropathy. The clinical course of encephalopathy was reversed by hemodialysis whereas peripheral neuropathy was not reversed [6]. HL among patients with CRF has been reported as a common finding in studies investigating the effects of renal failure on auditory function. However, there is a debate on the relationship between renal insufficiency and HL 16. Hemodialysis applied in the terminal phase of CRF causes considerable metabolic and electrolyte disturbances within a few hours in humans. There is also ongoing debate on the effect of regular hemodialysis on hearing acuity [7].

Early and more recent reports present conflicting findings concerning possible contributions of hemodialysis treatment to hearing loss in renal failure. Methodology of these investigations includes reports on the effects of a single session on hearing function and comparisons of patient groups with varying duration on the treatment. Ozen *et al*. reported an improvement of 20 dB in the hearing of patients following hemodialysis. They suggested that changes in serum osmolality, BUN, and fluid retention may reverse the hearing impairment post dialysis. However, as changes in the dialysis method alleviated wide fluctuations of these parameters, the hearing may not be as affected from hemodialysis today as it was at that time [8]. There are several more recent reports in the literature contradicting the "hearing improvement" finding. Visenscio and Gerber reported that pure tone thresholds did not change significantly after hemodialysis. However, there was no correlation between weight and hearing changes after hemodialysis.

CONCLUSION:

It is concluded that there is a possible link between kidney function and hearing loss, as suggested by our study, potentially could modify the usual care of people with CKD.

REFERENCES:

1. Alder D, Fiehn W, Ritz E. Inhibition of Na^+, K^+ stimulated ATPase in the cochlea of guinea pig. A potential cause of disturbed inner ear functions in terminal renal failure. Acta Otolaryngol. 1980;90:55–60.
2. Gartland D, Tucker B, Chalstrey S, Keene M, Baker L. Hearing loss in chronic renal failure–hearing threshold changes following hemodialysis. J Roy Soc Med. 1991;84:587–589.
3. Yassin A, Badry A, Fatthi A. The relationship between electrolyte balance and cochlear disturbances in cases of renal failure. J Laryngol Otol. 1970;84:833–843.
4. Hutchson J, Klodd D. Electrophysiological analysis of auditory, vestibular, and brainstem function in chronic renal failure. Laryngoscope. 1982;92:833–843.
5. Quic CA, Fish A, Brown C. The relationship between cochlea and kidney. Laryngoscope. 1973;83:1469–1482.
6. Arnold W. Experimental studies in the pathogenesis of inner ear disturbances in renal diseases. Arch Otorhinolaryngol. 1975;211:217.
7. Ozturan O, Lam S. The effect of hemodialysis on hearing using pure tone audiometery and distortion product otoacoustic emission. ORLJ of Oto Rhino lary. 1998;60:306–313.
8. Bazzi C, Venturini C, Arrigo GD, Amico G. Hearing loss in short and long term haemodialyzed patients. Nephrol Dial Transpl. 1995;10:1865–1868.