Study on Relation of Kidney-Deficiency with Hearing Damage and Serum Trace Elements in Patients with Chronic Nephropathy

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ABSTRACT  Objective: To find some objective criteria for Syndrome Differentiation of Kidney Deficiency by analysing the relationship between Kidney and hearing as well as serum trace elements. Methods: The hearing and serum trace element of 73 cases of chronic nephropathy were measured. Results: The incidence of hearing damage in high frequency was 68.5% with a mean hypoacusis of 35.1 ± 6.1 dB, while in the 55 patients of Kidney deficiency type, the incidence of hearing damage in high frequency was 83.6 %, which was significantly higher than that in patients without Kidney Deficiency. The serum levels of trace elements (iron and zinc) in patients with Kidney Deficiency were lower than the normal level and that in patients without Kidney Deficiency, and the decrease of serum iron was directly proportional to the degree of hearing damage. Conclusion: There was close relationship between Kidney Deficiency and hearing damage as well as the serum levels of iron and zinc.

KEY WORDS  chronic nephropathy, hearing damage, serum trace elements, Kidney Deficiency

The Kidney is considered to be closely related with the ear in traditional Chinese medicine (TCM), and the phenomenon that both the kidney and the ear were involved in a disease simultaneously often occurred in clinical practice. In order to explore the essence of the relationship between Kidney Deficiency and ear the authors determined the hearing and serum trace elements in 73 patients of chronic nephropathy, expecting to find some general rule.

METHODS

Clinical Materials

Seventeen cases of the 73 patients suffered from type I nephrotic syndrome (nephrosis), 24 from type II, and 32 from chronic renal failure. All conformed with the revised standard of diagnosis and typing worked out by the Second Secession of the National Conference on Nephropathy, 1985(1). Forty nine of them were males and 24 females, aged 19 - 46 years, 37.4 ± 7.1 years in average, with course of disease ranging from 6 months to 13 years, averaging 3.3 ± 2.4 years. Thirty healthy persons were enrolled in the control group, 21 males and 9 females, aged 20 - 45 years, 31.3 ± 4.1 years in average. No disease of nose or ear had been found in them, neither had they received any drugs of ototoxicity within half a year before the hearing examination.

Among the 73 cases of chronic nephropathy, 58 cases manifested aching in the back and waist; 36 tinnitus or deafness, 40 soreness and weakness on legs and knees, 25 alopecia or loosening of teeth, 19 post-urination dripping and 20 attenuation of sexual function. The Syndrome Differentiation of patients was done on the basis of the reference standard of TCM Syndrome Differentiation on Deficiency Syndromes formulated by the National Specialized Committee of Integrated Traditional Chinese and Western Medicine Research on Deficiency and Geriatric Diseases, Zhengzhou, May 1986, 55 cases were typed as Kidney Deficiency, including 23 cases of nephropathy and 32 of renal failure, the other 18 cases were not Kidney Deficiency.

Method of Hearing Examination

The pure tone audiometer (international hearing standard zero grade) was used to mea-
Sure the pure tone in routine at indoor noise < 25 dB. The standard for evaluation was that the hearing was recognized as normal when mean hearing damage \leq 15 \text{ dB}, otherwise, as dysacusis\(^3\). There were three types of dysacusis: (1) Low frequency dysacusis with the mean hearing damage \geq 15 \text{ dB at 125, 250 and 500 Hz in frequency.} \) (2) Flat dysacusis with the mean hearing damage \geq 15 \text{ dB at 500, 1000 and 2000 Hz.} \) (3) High frequency dysacusis with the hearing curve at 2000 Hz frequency reduced to 8000 Hz or with the V-shaped notches of hearing curve presented at 2000, 4000 and 8000 Hz and the mean hearing damage \geq 15 \text{ dB.} \) Severity of hearing damage was divided into mild deafness (mean hearing damage \leq 40 \text{ dB}) and severe deafness (mean hearing damage \geq 40 \text{ dB}).

**Serum Trace Elements Determination**

The serum trace elements were measured by the atomic absorption method with the atomic absorption spectrophotometer AA646 type made in Japan. Two milliliter of venous blood were drawn at 6:00 ~ 7:00 AM for measurement.

**RESULTS**

**Results of Hearing Examination**

1. The relation of different diseases with hearing damage

Fifty of the 73 patients suffered from high frequency dysacusis, the incidence being 68.5\%, and the mean hearing damage of 2000, 4000 and 8000 Hz frequency was 35.1 ± 6.1 dB. Among them, 21 suffered from severe deafness, 29 mild, and the remaining 23 from no deafness. The incidence of high frequency dysacusis in renal failure patients was 87.5\% (28 in 32 cases), their mean hearing damage was 39.0 ± 5.6 dB, while in nephrotic syndrome patients the incidence was 53.7\% (22 in 41) and the mean hearing damage 30.1 ± 6.7 dB. The renal failure patients showed higher incidence and higher degree of hearing damage than the nephrosis patients statistically (\(P < 0.01\)).

2. Relation of Kidney Deficiency Syndrome with hearing damage

Forty six cases in the 55 patients of Kidney Deficiency revealed high frequency dysacusis in different degrees, the incidence being 83.6\%, while in the 18 patients without Kidney Deficiency, there were merely 4 cases who suffered from high frequency dysacusis, the incidence being 22.2\%. When treating it statistically with \(\chi^2\) test, it was found that the incidence of hearing damage in Kidney Deficiency patients was markedly higher than that in patients without Kidney Deficiency, \(P < 0.01\). However, when the hearing damage incidence of Kidney Deficiency with nephrosis (78.3\%, 18/23) was compared with that of renal failure, the difference was insignificant, \(P > 0.05\).

**Results of Serum Trace Elements Measurement**

1. Relation of serum trace elements with different diseases

The serum trace elements level in either nephrosis or renal failure was lower than that in healthy persons. Patients of renal failure had their serum zinc level lower than that in the healthy subjects, but the difference of serum copper and magnesium among patients with nephrosis, renal failure and the healthy subjects were insignificant. The serum iron and zinc in renal failure were also not much different from those in nephrosis (see table 1).

| Table 1. Comparison of Serum Trace Elements of Different Diseases (μmol/L, \(\bar{x} \pm s\)) |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|
| Group             | n   | Zinc          | Copper          | Iron            | Magnesium       |
| Renal Failure     | 32  | 16.41 ± 1.86* | 17.86 ± 2.99    | 16.05 ± 3.92**  | -               |
| Nephrosis         | 41  | 17.06 ± 2.08  | 17.67 ± 2.38    | 17.55 ± 4.38*   | 0.99 ± 0.16     |
| Control           | 30  | 17.68 ± 1.99  | 17.48 ± 2.88    | 19.97 ± 4.06    | 1.05 ± 0.17     |

Notes: * \(P < 0.05\), ** \(P < 0.01\), compared with the control group.