



Original Article

**Ototoxicity monitoring in general medical practice: Exploring perceptions and practices of general practitioners about drug-induced auditory symptoms**

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**Abstract**

**Background:** The general practitioner is predominantly responsible for offering comprehensive health care to every individual seeking medical care, and ototoxicity being a consequence of major life threatening treatments falls within this scope of practice. This research study aimed to determine the perceptions of general practitioners in the Gauteng region, regarding ototoxicity monitoring and its management in general medical practice. **Method:** A total of 28 general practitioners participated in this study. Participants were recruited from private practices and state hospitals in Gauteng, South Africa. The researchers employed a cross sectional survey design utilising paper-based self-administered questionnaires with the use of a qualitative and quantitative analysis paradigm, utilising content analysis and descriptive statistics. **Results:** General practitioners are aware of the cardinal ototoxicity symptoms as a consequence of ototoxicity medication. The majority of general practitioners have easy access to audiological services, however not all utilise these services. General practitioners in this study were aware of ototoxicity monitoring strategies however they do not carry them out diligently, as they feel that patients' medical diagnosis takes priority over the ototoxicity risk factors and they feel it is not feasible to monitor every patient on ototoxicity treatment. **Conclusion:** The findings from this study indicated that even though general practitioners are aware of their role in ototoxicity monitoring, they do not appear to carry out monitoring strategies for various reasons and hence there is a need for increased emphasis on the importance of their role in ototoxicity monitoring, and a clear need for audiologists to work closely with the general practitioners. Protocols and ototoxicity monitoring programs need to be established and implemented to contribute toward efficacious patient care.

**Keywords:** Ototoxicity, General Practitioners, Sensorineural Hearing Loss, Ototoxicity Monitoring, Tinnitus.

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## 1. Introduction

Ototoxicity can be understood as the side effect of medicines which results in auditory and/or vestibular system dysfunction with a consequence of hearing loss and disequilibrium [1]. Ototoxicity occurs due to toxic agents destroying the outer hair cells in the basal turn of the cochlea, this thereafter results in a high frequency sensorineural hearing loss [2]. Ototoxic medications are likely to cause tinnitus, hearing loss and/or instability such as dizziness and vertigo [3].

According to World Health Organisation (WHO), reports suggest a large percentage of hearing impairment attributable to ototoxic medication resulted from inappropriate use of ototoxic drugs by health care providers of various categories, which is often the result of a lack of awareness on the part of the prescriber [4]. Iqbal, Murthy, Banerjee and Vishvanathan's study suggests that it is primarily important for a physician prescribing ototoxic drugs to be aware of the early symptoms of impending hearing loss; therefore necessary investigations can be carried out to confirm the suspicion and thereafter treatment is implemented at the earliest stage [5].

Symptoms which present themselves as a result of ototoxic changes can be revealed days or even months after the consumption of the ototoxic drug [6]. Due to these symptoms being poorly correlated with dosage, peak serum levels, and other toxicities, the only way ototoxicity can be detected is by directly assessing the auditory and vestibular function. The detection of ototoxic damage varies greatly [7,8]. Significant hearing loss can follow intake of a single dose in one patient, in comparison to another, where they may not experience

symptoms for weeks or even months after treatment [9]. Patients may not be able to identify an ototoxic hearing loss until a communication problem becomes apparent. This signifies that hearing loss within the frequency range which is important for understanding speech, has already occurred. Comparably by the time the patient complains about dizziness, permanent vestibular damage probably has already arisen [10]. Tinnitus, hearing loss and vertigo are cardinal symptoms of ototoxicity [11].

The term 'ototoxicity monitoring' is generally taken to express the principle of early identification, yet the concept also embraces the principle of early intervention [12]. American Speech Language Hearing Association (ASHA) proposed an effective ototoxicity monitoring programme which included the following elements:

- (a) Specific criteria for identification of toxicity,
- (b) Timely identification of at-risk patients,
- (c) Pre-treatment counselling regarding potential cochleotoxic effects,
- (d) Valid baseline measures (pre-treatment or early in treatment),
- (e) Monitoring evaluations at sufficient intervals to document progression of hearing loss or fluctuation in sensitivity, and
- (f) Follow-up evaluations to determine post-treatment affects [13].

It is widely recognised that there is a need for audiometric testing in order to identify early changes in hearing thresholds which result from drug therapy [14]. There is evidence of basic protocols that have been considered, however resources on sensorineural hearing loss do not propose a comprehensive guideline for preventing and

monitoring ototoxicity [2,15]. There are many physicians who prescribe ototoxic drugs and are reported to be uninformed of the important role that the otolaryngologist and audiologist play in the pre-treatment of counselling and follow-up assessments, which are essential for the evaluation of their patient's auditory function [2].

Physicians gain optimal information when an ototoxic hearing loss is detected early and thus provided with the opportunity necessary to decrease further damage, and in some cases prevent hearing loss from progressing to the stage which requires aural rehabilitation [10]. A patient is often left with vocational, social and interpersonal consequences, when undetected ototoxic damage progresses or when alternative treatment regimens are not considered. There is an evident need for successful ototoxic monitoring programmes to be established in order to enable physicians, medical personnel, and patients to make an informed decision regarding ototoxic medications and their effects. Audiologists are seen as essential in this process [10]. If an ototoxic hearing change is identified, the physician may consider following potential treatment options, such as; changing the drug to one which has a reduced risk for ototoxicity, discontinuing treatment or altering the dosage of the drug [2,10]. On the contrary if there is no detection of change in the hearing status, the physician may opt to treat the patient more aggressively. The early identification of ototoxicity may prevent or reduce hearing damage that could have an overwhelming effect on communication and post-treatment quality of life [10].

As the general practitioner is predominantly responsible for offering comprehensive health care to every individual seeking

medical care and ototoxicity being a consequence of major life threatening treatments, this research study aims to establish the perceptions and practice of general practitioners on ototoxic monitoring and its management.

## **2. Methodology:**

Ethical clearance was obtained from the Human Research Ethics Committee prior to the data being collected.

Main aim:

To determine the perceptions of general practitioners regarding ototoxicity monitoring and its management

Objectives:

- To determine general practitioners' perceptions about ototoxicity in their general practice;
- To explore their perceptions about ototoxicity monitoring while establishing the types of ototoxicity monitoring protocols followed;
- To explore the nature of ototoxicity preventative measures in general practice.

### **Participants:**

Participants were sampled from private practices and state hospitals in Gauteng, South Africa. A total of 28 general practitioners with work experience ranging from three years to 37 years participated in this study. They were requested to complete a questionnaire regarding ototoxicity and its management in general medical practice. The work experience distribution was as follows:

- 3 - 10 years: 17 participants
- 11 - 20 years: 5 participants
- 21 - 30 years: 5 participants
- > 30 years: 2 participants

Regarding participants' place of practice, 13 general practitioners were based in private

practice, followed by participants practising in state hospitals and a minority of the participants practiced at state hospitals and private practices simultaneously.

A convenient sampling strategy was used to select participants. Participants were required to meet the following inclusion criteria in order to be included in the proposed study:

- To be practicing as a general practitioner for a minimum of 3 years (to control for level of experience and exposure as a confounding variable).
- To be fluent in English; as the questionnaire is formulated in English.
- To be practicing in the Gauteng region.

#### **Research design:**

The research was a cross sectional survey design utilising paper-based self-administered questionnaires. Self-administered questionnaires were completed by participants in the absence of the investigator, and these were completed anonymously.

#### **Measurement tools:**

The tool used in this study was a designed questionnaire adapted from that by de Andrade, Khoza-Shangase and Hajat [16]. The questionnaire was divided into six sections. The first covered the socio-demographic data and job characteristics of the physician; for example level of experience, highest medical qualification and years of experience. Furthermore, general practitioners' perceptions of the audiologist's role and the services provided by them were also attained in this section. The second section contained questions about ototoxicity and its management. Information on whether ototoxic medications were prescribed; and whether

auditory symptoms were identified and/or monitored was explored here. For auditory function, symptoms of ototoxicity vary in both scope and magnitude. These include tinnitus, vestibular disturbances such as vertigo, or hearing loss ranging from temporary threshold shifts to profound bilateral deafness [17]. The third section contained questions to assess the monitoring of ototoxicity. Information obtained included; nature of ototoxicity monitoring protocols, as well as management. The rest of the sections covered counselling, audiological services and the preventative measures in place at the general practices. These latter sections aimed at exploring management options around ototoxicity. This included counselling services; access to audiological services; as well as preventative measures which the general practitioners believed could be/are implemented to prevent ototoxicity

#### **Data analysis:**

Data were analyzed through descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations for quantitative variables. Qualitatively, content analysis was employed. The researcher analysed the data received in response to the open ended questions from the questionnaires, and highlighted significant themes and trends.

### **3. Results and discussion**

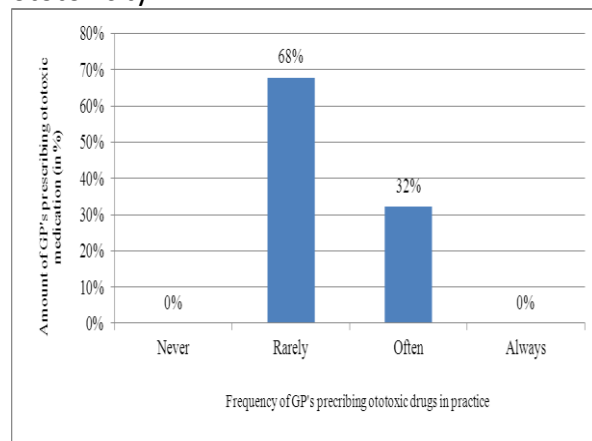
Results are presented in accordance with the specific objectives:

- To determine general practitioners' perceptions about ototoxicity in their general practice.

- To determine general practitioners' perceptions about ototoxicity monitoring and the types of ototoxicity monitoring protocols followed.
- The nature of ototoxic preventative measures in general practice

**General practitioners perceptions about ototoxicity in their general practice:**

Results displayed in Figure 1, reveal that a greater percentage (68%) of the general practitioners reported that they 'rarely' prescribed ototoxic medication; this in comparison to the 32% who reported prescribing them more 'often'. It is evident that all general practitioners prescribed ototoxic medications at some point in their practice life. The majority (68%) of the participants, who reported that they 'rarely' prescribed ototoxic medications, explained their responses by stating that they were not presented with patients who required ototoxic medication. The minority (32%) of the general practitioners who reported that they 'often' prescribed ototoxic medications to their patients in practice, supported their responses by stating that when presented with such patients, their diagnosis was often of greater concern in comparison to the risks of ototoxicity, and therefore the patient's life was given priority over the risk of ototoxicity.

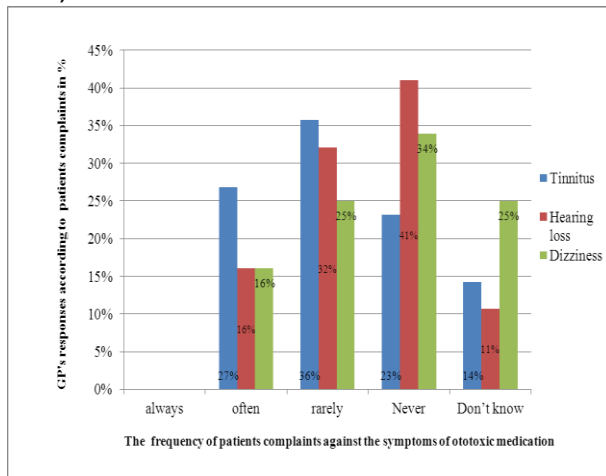


**Fig 1:** Frequency of prescribing ototoxic medications by general practitioners in practice (in percentage %).

The minority (32%) of the participants' responses in terms of their explanation as to why they were not reluctant to prescribe ototoxic medication and thus prescribed it often, remained in agreement with the research study that was reported by Vasquez and Mattucci, who proposed that there should be no reluctance in terms of prescribing ototoxic medicines, as in some cases the treating physician is placed in a situation where the severity and intensity of the patient's illness is of greater concern, and thus the ototoxic consequences no longer become a priority in the patient's life [2]. This further implies that current medical diagnosis of life threatening ailments have focused mainly on the treatment due to the severity and nature of the ailment and lesser importance had been given to the risks of ototoxicity that accompany the consumption of ototoxic medication. In the current study potentially ototoxic medications prescribed included the following:

- Anti-inflammatory agents (nonsteroidal anti-inflammatories -NSAIDs, salicylates): aspirin; ibuprofen; fenoprofen; ketoprofen
- Antineoplastic agents: bleomycin; cisplatin; nitrogen mustard; vinblastine; vincristine
- Cardiovascular agents: enalapril; captopril; digitalis; metoprolol; quinidine
- Anti-infectives: aminoglycosides (amikacin, gentamicin, tobramycin, etc.); amphotericin B; ampicillin; antihelminthics (praziquantel, thiabendazole); Chloroquine; Griseofulvin (antifungal); Macrolides (azithromycin, erythromycin); Metronidazole; Vancomycin

- Tricyclic antidepressants: amitriptyline; amoxapine; desipramine; doxepin; imipramine.
- Diuretics: Acetazolamide; ethacrynic acid; furosemide.



**Figure 2:** General practitioners' perceptions about the frequency of complaints by patients regarding tinnitus, hearing loss and dizziness when on ototoxic medication. (in percentage %).

Figure 2 represents general practitioner's perceptions on the frequency of patients' complaints with regards to specific symptoms that are associated with ototoxicity. This was graded on a frequency of 'always' to 'never' and 'don't know' results. This revealed that the general practitioners in this study were aware and had the knowledge that tinnitus, hearing loss and dizziness are cardinal symptoms of ototoxic hearing loss and thus their responses reveal that a proportion of their patients on ototoxic medication presented with the above mentioned symptoms. This further revealed that none of the participants reported that their patients always complained about these symptoms, thus indicating that not all patients on ototoxic medication always display symptoms of tinnitus, hearing loss and dizziness; a fact that is well supported in the

literature. This finding could of course also be attributed to the sometimes late onset of ototoxic symptoms; which can present days or even months after the consumption of the ototoxic drug [6]; supporting the evidence that indicates that not all patients may present with the symptoms at the same time and with the same degree following ototoxic drug use. These findings are contrary to WHO's reports from a hospital study which assert that patients on ototoxic medication always present with at least one of these symptoms when on ototoxic treatment [4].

An interesting finding from Figure 2 of practitioners not being aware of presentation of ototoxicity symptoms due to these never forming part of the case history probe raises important implications about monitoring strategies. If general practitioners fail to enquire about adverse effects, it limits chances of successful implementation of ototoxicity screening programmes where fully established diagnostic programmes cannot be established due to resource constraints. This would obviously mean that such symptoms are only identified when they are severe, and have become irreversible [2].

**General practitioners' perceptions about ototoxicity monitoring and the types of ototoxicity monitoring protocols followed in their practice:**

As indicated in Table I (a), only 25% of general practitioners' sought audiological assessments for their patients when placed on ototoxic medication and the rest did not. Reasons provided for lack of referral for audiological monitoring included the belief that due to the increased amount of ototoxic drugs on the market, it was not feasible to send every patient on ototoxic treatment for

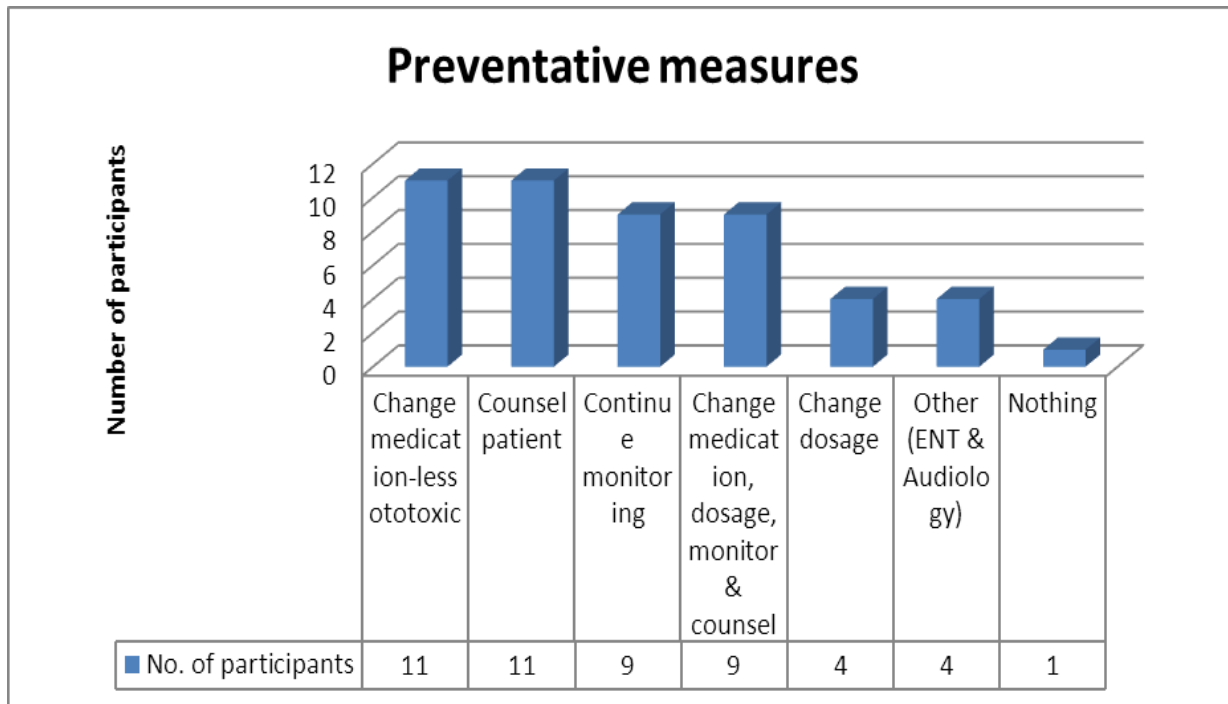
a hearing assessment. Some general practitioners expressed the view that should ototoxicity be expected to form standard management protocol, so should neurological assessments for peripheral neuropathy which can also be one of the adverse effects. Furthermore some general practitioners in the current study reported that they did not have easy access to audiological services as these are not readily available in every state and/or private healthcare facility in South Africa. These views are not supported by Dutta, Venkatesh and Kashyap [17], who assert that audiological monitoring is crucial and should take place prior to and during administration of ototoxic treatment; although this recommendation might be over-ambitious and less practical for this context.

**Table 1:** Representation of the percentage of general practitioners responses

Question	Yes	No
(a) General practitioners' responses to patients on ototoxic medication who are referred for audiological assessments (%)	25%	75%
(b) General practitioners' responses to easy access to audiological services (%)	71.4%	28.6%
(c) General practitioners' responses in terms of whether they believe preventative measures are required with ototoxic treatment.	86%	14%

Table I (b), reveals that majority of the participants in the current study (71.4%) believed they had easy access to audiological services within or close to their practice; with a third reporting having no access. Nuanced analysis of access to audiology services revealed better access in state

hospitals than in private practice; a finding that the current authors believe could be influenced by financial constraints associated with private healthcare; where patients in private are expected to pay separately for each kind of service received which is not the standard practice in public/state hospitals. In state hospitals, multidisciplinary care is often a packaged standard of care. Although a large majority of general practitioners (71.4%) claimed to have easy access to audiological services, this was not correlated well with use and/or referral to these services, as 75% of the general practitioners did not send their patients on ototoxic medication for audiological assessments. Rationale for this lack of referral for audiological management could include, firstly, the explanation provided by some of the practitioners which speaks to them adopting the protocol that dictates treatment of symptoms as they arise. This symptomatic management protocol might completely miss ototoxicity symptoms as these could sometimes be subclinical in nature; with microcochlea symptoms only presenting on sensitive ototoxicity monitoring measures such as otoacoustic emissions even before they can be depicted on the standard audiogram. Moreover, this protocol of symptomatic management also means that patient symptoms will only be managed once they've become evident to the patient; often indicating that the changes to the auditory system have become severe; a reality which the American Speech and Hearing Association [13] recommends needs to be prevented through implementation of ototoxic monitoring protocols. Secondly, time and financial resource limitations on patients' side might be an influencing factor



as often the patients would have to make a separate visit to the audiologist—an added financial burden. Figure 3: Frequency of participants’ responses regarding ototoxicity preventative measures that could be implemented

financial and time burden to the already vulnerable patient. It would therefore be wise and practical to have audiologists partnering with general practitioners where the use of ototoxic medications is most prevalent.

**The nature of ototoxic preventative measures in general practice:**

Figure 3 represents the different ototoxicity preventative measures which the current sample believed could be implemented during treatment with ototoxic medications. The range of measures reported are consistent with current evidence base with regards preventative measures; and indicate that implementation of proper protocols would most likely succeed with positive results for patients. The two most common preventative strategies recommended were

altering the type of medication to one that is less toxic and counseling the patient; with only one participant believing there’s nothing one can do to prevent ototoxicity. Although awareness of the various preventative strategies was positive, application of these strategies remained a concern, as a large majority (68%) reported not consistently and diligently applying these in general practice.

**The nature of preventative measures in general practice:**

Table I (c) reveals that majority of general practitioners (86%) believed that ototoxicity preventative measures are necessary in patients on ototoxic medications. The small number that believed otherwise justified their belief by reporting that patients who have been prescribed ototoxic medication have usually been screened for better



alternatives, and thus ototoxic effects of the chosen treatment is not a priority. These findings contradict the research findings by Fausti et al [10], who stress that even though patients may be faced with a life-threatening sickness which warrants treatment with ototoxic drugs, preservation of the patients' remaining quality of life should remain the primary treatment goal [10]. This highlights the importance of implementing preventative measures as these could reduce symptoms and additional problems that might negatively influence quality of life indicators. Various therapeutic otoprotective strategies have been proposed for the various classes of ototoxic drugs; and these should be tested within the South African context. Over and above prescription of otoprotective agents along ototoxic drugs; appropriate schedules of therapy; ototoxicity monitoring with the aim of changing drug, dosage, method of administration; and so on; are some of the strategies that general practitioners can adopt.

### **Conclusion**

Findings of the current study indicate that even though general practitioners are aware of ototoxicity as well as their potential role in ototoxic monitoring, they; for various reasons, do not appear to be actively engaging in monitoring strategies and hence, there is a need for increased emphasis on the importance of their role in ototoxicity monitoring. It is within their scope of practice to alternate drugs, reduce the dosages or alter the treatment regimens as well as methods of administration; and refer for ototoxicity monitoring during the treatment period, which in turn ensures early identification of hearing impairment and consequently serves as preventative measures for ototoxicity, as damage to the

auditory system may be prevented or reduced before the ototoxic effects become irreversible. Current findings also highlight the need for strategic and systematic implementation of ototoxicity monitoring programs in practices where ototoxic medication is prescribed. This is particularly important as counselling about adverse effects of drugs has been documented to have a positive effect on adherence to treatment, which can ultimately improve patients' response to medical management.

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