ORIGINAL ARTICLE

Frequency of Malignant Otitis Externa using CT-scan in uncontrolled Diabetic and Positive aural culture for pseudomonas aeruginosa

ALI HUSNAIN SHEIKH[1], ATIQ U REHMAN[2], NASIR RIAZ[3], *NAVEED ASLAM[4], SANA KUNDI[5], IRSHAD MALIK[6]*

ABSTRACT

Background: Diagnosis of malignant otitis externa has always been a challenge for an otorhinolaryngologist. Various imaging studies can detect the disease, but these are expensive and are not routinely used. Out of these, the role of CT scan which is cheaper and easily available, has been studied and found successful by many authors. However, the results need validation. In this study, we describe our experience of analyzing CT scan findings to establish the radiological diagnosis of malignant otits externa.
Aim: To determine the frequency of malignant otits externa using CT scan in uncontrolled diabetics with positive aural culture for pseudomonas aerogenosa.
Study design: Cross sectional survey.
Setting: ENT department of Akhtar Saeed Trust teaching Hospital.
Duration with dates: Six months, starting from 30-05-2017 to 30-11-2017.
Methods: Fifty patients with uncontrolled diabetes mellitus and positive pseudomonas culture were enrolled. CT scans were done in all patients. CT findings suggestive of malignant otitis externa that included bony erosion, soft tissues, intracranial and extracranial involvement were noted. Diagnosis of malignant otitis externa was established based on CT findings. Data was collected on a specially designed Proforma.
Results: A total of 50 patients had CT scan. Diagnosis of malignant otits externa was established in 36 (72%) patients based on CT scan findings. Bony erosion was noticed in all (100%) the patients in whom diagnosis of malignant otitis externa was established.
Conclusion: CT scan can be used for establishing diagnosis of malignant otitis externa. It is also an excellent modality in detecting bony erosions associated with malignant otitis externa.
Key words: Malignant otitis externa, CT scan, Bony erosion.

INTRODUCTION

Although each ear can function independently, however, in a normal human being, it is a pair of ears that performs the function of hearing. Besides this, they also add to the beauty of the facial framework. The ears function by converting physical vibrations into a nervous impulse like a biological microphone. It is the external ear that amplifies and modifies the spectrum of the sound wave, the middle ear makes the most significant contribution to this process[1,2].

Sometimes the external ear loses its customary environment due to some problems like inflammatory conditions of the external auditory canal, with or without infection that leads to symptoms, which include, ear discomfort, itching, discharge and impaired hearing. 3 Most of the times, the conditions are treated successfully with symptomatic topical treatment but sometimes, the infections are invasive leading to bony and soft tissue destruction[3,4].

Necrotizing external otitis, or malignant external otitis represents a form of complicated ear pathology that was initially described by Chandler[5]. This condition is termed as malignant because of its propensity to cause complications due to bony erosions and soft tissue destruction. Hence the term malignant must not be confused in a histological sense. Malignant otits externa is a life-threatening Pseudomonas infection of the external auditory canal and skull base, which occurs most commonly in elderly patients with uncontrolled diabetes mellitus and immunocompromized patients (HIV, steroids etc)[6].

The pathophysiology of the disease is still incompletely understood and it is believed that it originates from aural water exposure which is considered a potential iatrogenic factor. 7 Cerumen of ear, poor host defense and microvascular angiopathies due to diabetes are blamed for this debilitating process to start[8].

The typical patient presents with classical feature of otalgia and otorrhea which is common in 97.8% and 91.3%, respectively[9]. Facial paralysis was present in 19.6% of cases[10,11]. The classical feature of malignant otitis externa include, unrelenting deep otalgia, purulent otorrhea, and polypoidal granulations of the external auditory canal at the osseocartilagenous junction. If left untreated, many complications may arise, which include, cranial nerve neuropathies (the most common of which is the 7th nerve), meningitis, sigmoid sinus thrombosis and brain abscess that can develop due to subtemporal extension of the infection[12,13].

A high degree of suspicion should be kept in mind and a definitive diagnosis of malignant otitis externa is based on a combination of clinical findings, which include severe otalgia that worsens at night, otorrhea, increased erythrocyte sedimentation rate, proven presence of pseudomonas aerogenosa, histological exclusion of malignancy and evidence of soft tissue involvement with or

[1,2]Assistant Professor ENT, Akhtar Saeed Medical College, Lahore
[3]Senior Registrar ENT, Shaikh Zayed hospital Lahore
[4]Professor of ENT Department, Sh Zayed hospital Lahore.
[5]Consultant Radiologist, Pakistan Kidney and Liver Institute and Research Centre, Lahore
[6]Associate Professor ENT, Jinnah Hospital Lahore
Correspondence to Dr. Ali Husnain Sheikh, Email: sheikhali.1@gmail.com, Cell: 03454760457

without bone erosion in the external auditory canal and infratemporal fossa with the help of imaging modalities[6,14].

The diagnosis of malignant otitis externa is difficult and various imaging modalities are available, every one of which has its own uses and indications. These include Technetium Tc 99 methylene diphosphonate bone scanning, Gallium citrate Ga 67 scan, Indium In 111–labeled leukocyte scan, computed tomographic (CT) scan and magnetic resonance imaging (MRI)[15,16].

However, anatomic imaging modalities such as CT and magnetic resonance imaging are more useful than nuclear medicine studies in the assessment of malignant otitis externa. Anatomic imaging allows for both disease localization and an assessment of disease progression or resolution. CT scans are ideal for assessing bone erosions.17 Serial CT scans are required in patients suffering from malignant otitis externa at the time of diagnosis, and particularly after conclusion of antibiotic therapy. It is likely that patients would demonstrate abnormalities of external auditory canal, with or without bone erosion. Fluid in the middle ear, mastoid pathologies and involvement of the parapharyngeal space (both pre and poststyloid) are seen in greater than 50% of the cases. By delineating the extra and intracranial extent of the disease, serial CT scans enable one to make the diagnosis, determine the extent of infection, document recurrence, exclude progression and confirm resolution of malignant external otitis.18 Many studies have analyzed the role of CT scan in diagnosis of malignant otitis externa. In a study by Sudhoff H, et al, it was concluded that CT scan is superior to conventional radiography and polytomography in evaluating the progression of bone and soft tissue changes in malignant otitis externa, as 70% of affected individuals, demonstrate evidence of bone erosion on CT scan.19 CT scans can be used to delineate inflammatory changes in soft tissues of middle ear and mastoid, the infratemporal fossa, the parapharyngeal space, and in the area of stylomastoid foramen where involvement of facial nerve usually occurs.20 CT scanning also helps to clearly demonstrate the progression of bone erosion once significant demineralization has occurred [21].

This study helps to analyze the CT scans of patients in an attempt to identify diagnostic features of the disease and to establish the radiological features of both the detection, as well as its persistence or recurrence.

The objective of this study was to determine the frequency of malignant otitis externa using CT scan in uncontrolled diabetics with positive culture.

OPERATIONAL DEFINITION

Malignant otitis externa using CT scan: Computerized tomography scanning is a well recognized tool for the diagnosis of malignant otits externa, as it is effective in localizing subtle bone erosions, thus resulting in earlier recognition of these bony changes and in addition, it provides a clear detection of the early invasion of the soft tissue planes by an inflammatory process. Lastly, CT provides additional advantage of detecting any intracranial and extracranial disease.

Uncontrolled diabetes: HbA1C levels of more than 7 % in diabetes type I and II respectively.

Positive aural culture: Positive culture for pseudomonas aeruginosa.

MATERIAL AND METHODS

This cross sectional survey was carried out in ENT department of Akhtar Saeed Trust teaching Hospital, Lahore from 30-05-2017 to 30-11-2017.. The calculated sample size was 50 cases, with a 13% margin of error, 95% confidence level, taking expected percentage of malignant otitis externa on CT scan, which is 70% in uncontrolled diabetes. Non-probability purposive sampling technique was used.

Inclusion criteria

1. Uncontrolled diabetics (as mentioned in operational definition), age range of 39 – 87.
2. Patients with positive culture of Pseudomonas from ear discharge were included in my study.

Exclusion criteria

1. Malignancy, which was confirmed by histopathologic examination of granulation tissue from infection site.
2. Otomycosis complicating otitis externa, as shown by the physical findings.
3. Patients already on treatment for malignant otits externa.

Data collection procedure: Data was collected in six months after the approval of study on a structured questionnaire. The subjects presenting to ENT outpatient department, who fulfilled the inclusion criteria were recruited for study. Selected patients were explained in detail about the nature of the investigation. Institution review boards of Akhtar Saeed Hospital were informed about the study. The patients were subjected to computed tomography at the time of admission and related information regarding malignant otitis externa by tomographic scan in terms of bony erosions and soft tissue involvement of external auditory canal and infratemporal fossa were entered in the questionnaire.

Data analysis procedure: The data was entered in the SPSS version 10 and analyzed. The results were presented in the frequency table and proportions. The diagnosis of malignant otitis externa, age of the patient, computed tomographic finding were variable of interest. The outcome was measured in response to clinical and radiological findings like condition of the external auditory canal, bone remineralization after treatment, and soft tissue conditions in middle ear were variable of the interest and all were presented by frequency and percentage.

RESULTS

There were a total of 50 patients included in this prospective case series. The mean age of the patient was 61.10 ±10.95 (range 40–80 years). There was only 1(2%) patient whose age was under 40 years. There were 8 (16%) patients of age range of 41 – 50 years, 18 (36%) patients of age range of 51 – 60 years, 12 (24%) patients of age range of 61 – 70 years, 9 (18%) patients of age range of 71 – 80 years and 2 (4%) patients of age more than 80 years. (Table 3)

Out of the total 50 patients in the study, there were 28 (56%) female patients and 22 (44%) male patients. The male to female ratio was 1:1.38. The mean blood sugar level of the patients was 256.06 ± 29.45 in the range of 188 – 312 mg/dl. There were 4 (8%) patients in whom the blood sugar level was in the range of 181 – 200 mg/ dl, 16 (32%)

patients with the blood sugar level in the range of 201-250 mg/dl, 27 (54%) patients with the blood sugar level in the range of more than 251 – 300 mg/ dl and 3(6%) patients with blood sugar level more than 300 mg/dl. The patients were also assessed for their glycosylated hemoglobin (HbA1C) levels. The mean HbA1C level of patients was 10.20 ±1.53 with the range of 6 – 13. There were 5 (10%) patients in whom the HbA1C level was in the range of 6 – 8 and 22 (44%) patients with HbA¬1C level, in the range of 11–12. HbA1C level of 2 (4%) patients was more than 12. Based on the CT scan findings, malignant otitis externa was detected among 36 (72%) patients and among 14 (28%) patients, malignant otits externa could not be detected.

The patients were also distributed according to details of the CT scan findings. Of the 36 (72%) CT scans of the patients which confirmed the diagnosis of malignant otitis externa, it was observed that bony erosion was detected in all the scans (100%), soft tissue involvement was seen in 33 (91%) patients, extracranial manifestations were seen in 23 (64 %) scans. Intracranial involvement was seen in the scan of 1 (3%) patients. (Figure 18)

Table 1: Distribution of patients by age (n=50)

Age (Years)	No.	%age
< 40	1	2
41-50	8	16
51-60	18	36
61-70	12	24
70-80	9	18
< 81	2	4
Mean±SD	61.10 ±10.95	
Range	40 – 88	

Table 2: Distribution of patients by random blood sugar levels (n=50)

Random blood sugar level (mg/dl)	No.	%age
181 – 200	4	8
201 – 250	16	32
251 – 300	27	54
> 300	3	6
Mean±SD	256.06 ± 29.45	
Range	188 – 312	

Table 3: Distribution of patients by HbA1C level(n=50)

HbA1C level	No.	%age
(%)	5	10
6 – 8	22	44
9 – 10	21	42
11 – 12	2	4
> 12		
Mean±SD	10.20 ± 1.53	
Range	6 – 13	

DISCUSSION

This prospective study was carried out to evaluate the frequency of malignant otitis externa detected on CT scan findings among the patients with uncontrolled diabetes with positive aural culture reports. This is probably one of the largest study (including 50 patients) which evaluated the CT scan findings among patients with otitis externa.

Before that, Sudhoff H et al[19], performed a study describing the usefulness of CT scan for detection of malignant otitis externa among 23 patients. The sample size in our study was almost double than this study. Similarly, Soudry E, et al[13], evaluated the role of CT scan in 48 patients. So, the results of our study are comparable to other studies in the world as we used a bigger sample size. Moreover, in this study, prospective data was analyzed, while both of the other studies were based on retrospectives data. This study was similar to these studies in matter of case selection. Cases in all the two studies and in ours were selected on almost the same criteria. Further, the outcome variable, i.e., CT scan findings were almost the same.

In this study, the mean age of the patients was 61 years in the range of 40 – 80 years. When compared to the other studies in the world, the average age of patients included in our study was less than the other studies. It was 71years as described by Soudry E, et al[13], 73 years as reported by Franco-Vidal, et al, 9 71years in a study by Sudhoff H, et al. 19 However, the age range of the patients as described by Sudhoff H, et al was similar to our study i.e. 40 – 80 years. However, the average age of the patients described by Stewart L, et al[16], was close to that of our results, i.e. 65 years.

A higher frequency of female patients (56%) was observed in our study. The same observation was seen in a study by Soudry E, et al[13], the female population affected by the disease were 65 %, and rest 35% were male. However, Aziz AA reported that all the patients presented and diagnosed with malignant otitis externa were male. However, it was a very small case series, which included only 6 patients. On the basis of above results, it can be observed that malignant otitis externa is more common in females as compared to males.

In our study, the CT scan findings revealed diagnosis of malignant otitis externa in 72% patients. The results of our study are quite comparable to the study by Sudhoff H, et al[19], who claimed those to be in 70% patients. However, the study by Glynn F, et al, and study by Aziz AA, et al showed the CT scan confirmed the diagnosis of malignant otitis externa in 100 % patients. However, these were case series and reported only few patients (9 patients by Aziz AA, and 6 patients by Glyn F)[11,17].

In this study the bony erosion was seen in all the CT scans (100%) of the patients, in whom the diagnosis was confirmed by CT scans. This finding was confirmed by other authors like Glynn F and Aziz AA 19 in their studies i.e. the frequency of bony erosion was 100%. However, Sudhoff H described that bony erosion was seen in 70% of the CT scans of the patients with malignant otitis externa. Soft tissue involvement was seen in 91% of patients in our study which can be justified by the fact that CT scan is not considered ideal for the soft tissue findings.

Extracranial manifestations were seen in 64% of the patients with CT scan findings of malignant otitis externa. When compared to that of Sudhoff, 19 it was seen in 16(70%) patients out of 23 patients with CT findings of malignant otitis externa.

Intracranial involvement was also seen in only 1 patient in our study. But, none of the above study has mentioned any case. This may be due to the fact that most

of the people in Pakistan present very late in the course of the disease.

Diagnosis of malignant otitis externa is largely based on strong suspicion, history of DM, resistant symptoms of otitis externa and positive culture. Radiological studies may also help in confirming the diagnosis and are also helpful in follow up or response of therapy. The radiological studies that can help in establishing diagnosis of malignant otitis externa include: Technetium Tc 99 methylene diphosphonate bone scanning, Gallium citrate Ga 67 scan, Indium In 111–labeled leukocyte scan, CT scan and MRI. Routine X-rays and polytomography have no role. These investigations are helpful but most of them are expensive and out of reach of the patients that belong to rural and poor population. So, their role is limited due to cost effectiveness. In this background, it is CT scan which can be helpful in establishing the diagnosis, though its role has already been defined for detecting response of treatment.

The above discussion suggests that overall frequency of detection of malignant otitis externa on CT scan is between 70 to 100%. This is quite a good range. So, this investigation can be helpful in establishing the diagnosis of malignant otits externa in our setup where majority of people are poor and government lacks funds for patients.
This study has some limitations. This was not a double blind study.

CONCLUSION

CT scan can be used for establishing radiological diagnosis of malignant otitis externa. It is also excellent in detection of bony erosion in patients with malignant otitis externa. However, multi-center trials for a longer period are required to better estimate the role of this technique.

REFERENCES

1. Hoffman M, Opstal VJ. Binaural weighting of pinna cues in human sound localization. Exp Brain Res 2003;148:458-70.
2. Cheng T, Dai C, Gan RZ. Viscoelastic properties of human tympanic membrane. Ann Biomed Eng 2007;35:305-14.
3. Kaushik V, Malik T, Saeed SR. Interventions for acute otitis externa. Cochrane Database Syst Rev. 2010;20:CD004740.
4. Beers SL, Abramo TJ. Otitis externa review. PediatrEmerg Care 2004;20:250-6
5. Kraus DH, Rehm SJ, Kinney SE. The evolving treatment of necrotizing external otitis. The Laryngoscope 2009;98:934 – 9.
6. Carfrae MJ, Kesser BW. Malignant otitis externa. OtolaryngolClin North Am. 2008;41:537-49.
7. Nussenbaum B, Roland PS, Shohet JA. External ear, malignant external otitis. Laryngoscope 2005;108:463-6.
8. Eleftheriadoul A, Ferekidis E, Korres S, Chalastras T, Yiotakis I, Soupidou P, Soulantinas K, Kandiloros D. Necrotizing otitis externa: an often unsettling disease in rural and remote Greek areas. The crucial role of family physicians in prevention and treatment Rural and Remote Health 7: 629. (Online), 2007.
9. Franco-Vidal V, Blanchet H, Bebear C, Dutronc H, Darrouzet V. Necrotizing external otitis: a report of 46 cases. OtolNeurotol. 2007; 28:771-3.
10. Ismail H, Hellier WP, Batty V. Use of magnetic resonance imaging as the primary imaging modality in the diagnosis and follow up of malignant external otitis. J LaryngolOtol 2004;118:576-9.
11. Aziz AA, Yasser MA. Management of Malignant Otitis Externa Bahrain Medical Bulletin 2003;25.
12. Sreepada, GangadharS.Skull base osteomyelitis secondary to malignant otitis externa. Current Opinion in Otolaryngology & Head & Neck Surgery 2003:11:316-323.
13. Soudry E, Joshua BZ, Sulkes J, Nageris BI. Characteristics and Prognosis of Malignant External Otitis With Facial Paralysis Arch Otolaryngol Head Neck Surg. 2007;133:1002-4.
14. Narozny W, Kuczkowski J, Stankiewicz C, Kot J, Mikaszewski B, Przewozny T. Value of hyperbaric oxygen in bacterial and fungal malignant external otitis treatment European Archives of Oto-Rhino-Laryngology 2006;263:680-684
15. Ruby C, Dana M, William E, Philip E, David B, Case Report: CT negative Malignant Otitis Externa Diagnosed with Tc-99m Fanolesomab (NeutroSpec(R)) WBC Scan & Gallium-67 Imaging Clinical Nuclear Medicine 2006;31:245.
16. Stewart L, Robin H, Andrew F, Alla T, Vincent C, Reza N. Otogenic Cranial Base Osteomyelitis: A Proposed Prognosis-Based System for Disease Classification Otology &Neurotology 2008;29:666-72.
17. Glynn F, Walsh RM. Necrotizing otitis externa: a new trend? Report of 6 atypical cases 2009;88:1261-3.
18. Rubin J, Curtin HD, Yu VL, Kamerer. Malignant oexternal otitis: utility of CT in diagnosis and follow-up. Am J Radiol 2002;174:391-4.
19. Sudhoff H, Rajagopal S, Mani N, Moumoulidis I, Axon PR, Moffat D. Usefulness of CT scans in malignant external otitis: effective tool for the diagnosis, but of limited value in predicting outcome. 2008;265: 1434-4726.
20. Karantanas AH, Darantzas G, Katsiva V, Proikas K, Dandris V. CT and MRI in malignant external otitis; a report of four cases. Comput Med Imaging Graph 2003; 27:27-34.
21. Chang PC, Fischbein NJ, Holiday RA. Central skull base osteomyelitis in patients without otitis externa: imaging findings. AJNR 2003;24:1310-6.