



Complications Of Suppurative Otitis Media Still Occur In The 21st Century.

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ABSTRACT

Chronic suppurative otitis media is chronic inflammation affected the middle ear and divided in 2 types benign and malignant type, Where the complication most aggressive with the malignant type. This study is aretrospective chart review for files of patients with suppurative otitis media complicated with one or more of the cranial and or intra-cranial complications of CSOM and attended to Assiut University Hospital (AUH) for management of their diseases during the 10 years from 1- 1-2005 to 31-12-2014. The patients were grouped into 3 groups: Group I: - with Cranial complications. Group II: - with Intra-cranial complications. Group III: - with mixed complications. The aim of study was to Identification of cases with different cranial and intra-cranial complications of suppurative otitis media that presented to AUH from 1-1-2005 to 31-12-2014, analyzing the factors surrounding these patients with complications, and Identification of the ways of management done

1.0 Inroduction

childhood infectious disease worldwide and is the most common cause of hearing impairment in the developing world, although it is infrequently seen in the developed world (Thorne MC *et al*, 2009).

The chronic form is characterized by drainage from the middle ear for at least two weeks and is associated with a tympanic membrane (TM) perforation that is usually painless (Penido NO *et al*, 2005).

The tympanic membrane is perforated in chronic suppurative otitis media (CSOM). If this is a tubo-tympanic perforation, it is usually 'safe', whilst attico-antral perforation is often 'unsafe'. Safe or unsafe depends on the presence of cholesteatoma. Safe CSOM is that type without cholesteatoma. It can be subdivided into active or inactive depending on whether or not active infection is present. Unsafe CSOM involves cholesteatoma. Cholesteatoma is a non-malignant but destructive lesion of the skull base (Acuin J, 2007).

The incidence rate of CSOM is 4.76% from 31 million cases, where 50% of CSOM patients suffer from hearing impairment. Worldwide, there are between 65-330 million people affected, of whom 60% receive significant hearing loss. This burden falls disproportionately on children in developing countries (Aziz N, 2012). Initial management includes aural toilet and topic ntibiotics or antiseptics.

Intravenous antibiotics are typically reserved for treatment failures. Surgical management is indicated for patients with concomitant cholesteatoma (Dubey SP *et al*, 2007).

Topical treatment is more effective at clearing aural discharge than systemic therapy, probably due to the higher local concentrations of antibiotic achieved where the antibiotics should have activity against gram- negative organisms, particularly pseudomonas and gram-positive organisms, especially Staphylococcus aureus (Gerami H *et al*, 2009).

Spread of infection from the ear and temporal bone causes intracranial complications of otitis media. Spread of infection occurs through 3 routes, namely, direct extension, thrombophlebitis, and hematogenous dissemination. Cranial complications are usually direct sequelae of localized acute or chronic inflammation (WHO- 2004).

Antibiotics have produced an overall decline in the frequency of complications of otitis media relative to the pre antibiotic era. However, severe complications still occur and may be associated with high mortality (Verhoeff M *et al*, 2006)

2.0 Materials and Methods

This study is a retrospective chart review for files of patients with suppurative otitis media complicated with one or more of the cranial and or intra-cranial complications of CSOM and attended to Assiut University Hospital (AUH) for management of their diseases during the 10 years from 1- 1-2005 to 31-12-2014.

- The patients were grouped into 3 groups:
- 1- Group I:- with Cranial complications.
- 2- Group II:- with Intra-cranial complications.
- 3- Group III:- with mixed complications.

2.1 Statitlcal analysis of cases

- 1- Demographic details: information about patient population (sex-age), type and time of occurrence of the complication and the surgical history of the affected ear, previous surgery or trauma.
- 2- Indications for surgery.
- 3- Incidence of complication of CSOM in relation to all surgeries at the same period
- 4- Comparison the result of the study with that in

2.2 Ethical consideration

2.2.1 Confidentiality:

The confidentiality of all participants admitted to this study will be protected to the fullest extent possible. The study participants will not be identified by name in any report or publication resulting from data collected in this study.

2.2.2 Research statement

Ethical aspects whether substantial or procedural will be implicated in this study. **Statistical analysis was performed using the SPSS v21 Statistical software package. **Specially prepared sheet was used to collect the data of each patient

3.0 Results

This study include 207 cases of complication of CSOM within period of 10 years (1-1-2005 to 31-12-2014): Table 1: Number of ear patients, ear surgeries and ear complications

Year	Total of examined ear cases/year	Ear operations/year		CSOM complications/year	
		No.	%	No.	%
2005	5331	270	5.1	9	0.2
2006	4988	451	9.0	27	0.5
2007	7592	363	4.8	38	0.5
2008	6030	602	10.0	26	0.4
2009	2423	210	8.7	18	0.7
2010	6312	451	7.1	28	0.4
2011	3014	255	8.5	14	0.5
2012	6909	289	4.2	5	0.1
2013	7480	413	5.5	25	0.3
2014	5817	348	6.0	17	0.3
Total	55896	3652	6.53%	207	0.37%

Table 2: Descriptive data

Group	No.	%
Cranial	179	86.5
intra cranial	24	11.6
Mixed	4	1.9
Age		
Range	3 - 78	
Mean±SD	24.4±15.4	
Children (up to 12 years)	41	19.8
Adolescent (13-18 years)	50	24.2
Young adult (19-40 years)	85	41.1
Adults (above 41 years)	31	15.0
SEX		
Male	131	63.3
Female	76	36.7
SIDE		
Rt.	83	40.1
Lt.	124	59.9
Past surgical H/O		
Denovo	131	63.3
Recurrent 1 st time	67	32.4
Recurrent 2 nd time	5	2.4
Recurrent 3 rd time	4	1.9
CO-MORBIDITY		
FREE	203	98.0
ADENOIDS	1	0.5
D.M	1	0.5
ETHEMODITIS	2	1.0

- Cranial cases 179, intracranial cases 24 and mixed 4 cases.
- Children 41, adolescent 50, young adult 85, adult 31 case.
- The males were affected more than the females 131 case to 76 case. -The left ear was affected more than the right 124 to 83 case.
- 131 case where free ear surgical history, 67 with once time same ear surgery, twice same ear surgery find with 5 cases and three times find with 4 cases.
- Most of the cases was free morbidity but there’s two cases complain of ethemoditis, 1 diabetic case and 1 with adenoids

Table 3: Complications and surgical procedures:

The Complications	NO	%
MASTOID ABSCESS	112	54.1
MASTODITIS	28	13.5
FASCIAL PALSY	19	9.2
BRAIN ABSCESS	10	4.8
LATERAL SEMICIRCULAR CANAL FISTULA (circumscribed labyrinthitiss)	10	4.8
SUBDURAL ABSCESS	9	4.3
ZYGOMATIC ABSCESS	4	1.9
LATERAL SINUS THROMBOPHELIPITIS	3	1.4
LATERAL SINUS THROMBOPHELIBITIS + MASTOID ABSCESS	2	1.0
MASTODITIS+ZYGOMATIC ABSCESS	2	1.0
MENINGITIS	2	1.0
BEZOLDS ABSCESS	1	0.5
FASCIAL PALSY+ZYGOMATIMC ABSCESS	1	0.5
MASTODITIS + FASCIAL PALSY	1	0.5
MASTOID ABSCESS+BEZOLDS ABSCESS	1	0.5
MENINGITIS + FASCIAL PALSY	1	0.5
MENINGITIS + MASTODITIS	1	0.5
PROCEDURE		
COMPINED APPROACH TYMPANO-MASTEDICTOMY	78	37.7
MODIFIED RADICAL MASTEDICTOMY	15	7.2
RADICAL MASTEDICTOMY	114	55.1

-The individual complications with the surgical procedure was discussed in details in the pages 70 & 71.

Table 4: Distribution of various complications relative to age groups

	Cranial (n=179)		intra (n=24)		cranial		Mixed (n=4)	
	No.	%	No.	%	No.	%	No.	%
Age, mean+SD	24.3+15.9		24.0+9.4		28.0+22.2			
Children	38	21.2	2	8.3	1	25.0	1	25.0
Adolesent	44	24.6	5	20.8	1	25.0	1	25.0
young Adults	68	38.0	16	66.7	1	25.0	1	25.0
Adults	29	16.2	1	4.2	1	25.0	1	25.0
SEX								
Male	108	60.3	21	87.5	2	50.0	2	50.0
Female	71	39.7	3	12.5	2	50.0	2	50.0

In the children age group: 38 case complain from cranial complications, 2 with intracranial and 1 with mixed complications.

-Adolescent age group: 44 case with cranial, 5 with intracranial and 1 mixed.

-Young adult: 68 cranial, 16 intracranial and 1 mixed.

-The males are more than the females in the cranial group 108 to 71, within intracranial group 21 to 3 cases and in the mixed group is equal 2 to 2 cases.

Table 5: Complications relative to ear sides

Side	Cranial (n=179)		intra cranial (n=24)		Mixed (n=4)	
	No.	%	No.	%	No.	%
Rt.	72	40.2	10	41.7	1	25.0
Lt.	107	59.8	14	58.3	3	75.0

- The cranial complication are affected the left side more than the right side 107 to 72.
- The intracranial complications affected the left side within 14 case and right side within 10 cases.
- The mixed group affected 3 left and 1 right.

Table 6: Complications relative to otologic surgical history

Past surgical H/O	Cranial (n=179)		intra cranial (n=24)		Mixed (n=4)	
	No.	%	No.	%	No.	%
Denovo	106	59.2	21	87.5	4	100.0
Recurrent 1 st time	64	35.8	3	12.5	0	0.0
Recurrent 2 nd time (5 mastoid abscess)	5	2.8	0	0.0	0	0.0
Recurrent 3 rd time (3 mastoid abscess, 1 mastoditis)	4	2.2	0	0.0	0	0.0

- The cranial group: 106 case denovo, 64 case once time surgery, 5 cases twice and 4 cases three times same ear surgery.
- The intracranial group: 21 case denovo and 3 case once time same ear surgery.
- The mixed group: all the 4 cases was free surgical history before.

Table 7: Complications relative to co-morbidity

CO-MORBIDITY	Cranial (n=179)		intra cranial (n=24)		Mixed (n=4)	
	No.	%	No.	%	No.	%
FREE	175	97.8	24	100.0	4	100.0
ETHEMODITIS	2	1.1	0	0.0	0	0.0
ADENOIDS	1	0.6	0	0.0	0	0.0
D.M	1	0.6	0	0.0	0	0.0

- The morbidity was just shown in the cranial group where was found 2 cases complain of ethemoditis (1 mastoid abscess & 1 mastoditis with facial palsy), one diabetic case (lateral semicircular canal fistula) and one case with adenoids (mastoid abscess), except that all of other cases was free.

Table 8: Surgical procedure done relative to each group of complications

PROCEDURE	Cranial (n=179)		intra cranial (n=24)		Mixed (n=4)	
	No.	%	No.	%	No.	%
RADICAL MASTEDICTOMY	96	53.6	14	58.3	4	100.0
COMBINED APPROACH TYMPANO-MASTEDICTOMY	69	38.6	9	37.5	0	0.0
MODIFIED RADICAL MASTEDICTOMY	14	7.8	1	4.2	0	0.0

- Cranial group: 96 case done for him radical mastectomy, 69 done combined approach tympano-mastectomy and 14 cases done for him modified radical.
- Intracranial group: 14 cases with radical, 9 cases with combined approach tympano mastectomy and one with modified radical mastectomy
- Mixed group: all the four cases done for him radical mastectomy

Table 9: Surgical procedure done for each individual complication

THE COMPLICATIONS	PROCEDURE					
	combined approach tympanum ASTEDICTomy		RADICAL MASTEDICTOMY		MODIFIED RADICAL MASTEDICTOMY	
	No.	%	No.	%	No.	%
MASTOID ABSCESS	45	57.7	61	53.5	6	40.0
MASTODITIS	6	7.7	16	14.0	6	40.0
FASCIAL PALSY	12	15.4	7	6.1	0	0.0
BRAIN ABSCESS	4	5.1	5	4.4	1	6.7
LATERAL SEMICIRCULAR CANAL FISTULA	1	1.3	8	7.0	1	6.7
SUBDURAL ABSCESS	4	5.1	5	4.4	0	0.0
ZYGOMATIC ABSCESS	3	3.8	1	0.9	0	0.0
LATERAL SINUS THROMBOPHELIPITIS	1	1.3	2	1.8	0	0.0
LATERAL SINUS THROMBOPHELIBITIS + MASTOID ABSCESS	0	0.0	2	1.8	0	0.0
MASTODITID+ZYGOMATIC ABSCESS	1	1.3	0	0.0	1	6.7
MENINGITIS	0	0.0	2	1.8	0	0.0
BEZOLDS ABSCESS	0	0.0	1	0.9	0	0.0
FASCIAL PALSY+ZYGOMATIMC ABSCESS	0	0.0	1	0.9	0	0.0
MASTODITIS + FASCIAL PALSY	1	1.3	0	0.0	0	0.0
MASTOID ABSCESS+BEZOLDS ABSCESS	0	0.0	1	0.9	0	0.0
MENINGITIS + FASCIAL PALSY	0	0.0	1	0.9	0	0.0
MENINGITIS + MASTODITIS	0	0.0	1	0.9	0	0.0

4.0 Discussion

Chronic otitis media (COM) is defined as persistent infection or inflammation of the middle ear. As far as the infection is confined to the middle ear, it is still uncomplicated (COM). When the infection extends beyond this chamber a complication or more arises. Although these complications were more common in the past, they are still encountered and when they happen – they carry a high potential for morbidity and sometimes even mortality. Early recognition of the complications is critical for an early and effective treatment. Complications of chronic suppurative otitis media (COM) are generally classified into extra-cranial, cranial and intra-cranial complications the extra-cranial complications are in-largely-external ear infection which is generally a trivial condition that resolves with short-time treatment with antibiotics (Smith J *et al*, 2006).

The overall incidence of all complications of otitis media has decreased since the advent of effective antimicrobial treatment. For example, in the pre-antibiotic era the incidence of mastoiditis requiring surgical treatment was 25-50%, but in the 1980s, the incidence decreased to approximately 0.02%. We have revised our cases of complications in Assiut University Hospital in the decade starting from January 2005 – December 2014. During this period of time the ENT team of our hospital has examined 55896 otologic cases, out of these cases, 3652 ear surgeries were done with a percentage of 6.53%. There were 207 ear surgeries for cranial &/or intracranial complication with an overall incidence of 0.37%. Different incidence rates for cranial complications of COM have been reported to this date, Kangsanarak found cranial complications in 0.45% of the COM cases (Kangsanarak J *et al*, 1993). Osma has reported that the prevalence of cranial complications was 1.35% (Osma U *et al*, 2000). In their study, which included 91 patients with complications of CSOM with cholesteatoma (Mustafa A *et al*, reported 52 patients with cranial complications (about 57.1%) (Mustafa A *et al*, 2008). The incidence of surgery for complications in these 10 years varied from 0.1% in 2012 to 0.7% in 2009. In our series the cranial complications were present in 179 patients (86.5%), the intracranial ones were in 24 (11.6%) and the mixed ones (both cranial and intracranial) were only in 4 (1.9%). In our cases, all complications were secondary to Chronic type of suppurative otitis media CSOM. In fact, complications do occur 2ry to acute type of suppurative otitis media ASOM especially the cranial ones mastoiditis, labyrinthitis and facial paresis, but many cases were sure treated and improved as out-patients cases without being accessed to the surgical records. The same thing might happen with meningitis which may complicate ASOM and receive treatment –especially in young children and infants- without even knowing that they have ASOM. In 1995, Kangsanarak conducted a review of 24,321 patients with otitis media that revealed an intracranial complication rate of 0.36%. (Yorgancilar E *et al*, 2013). In a similar study in 2013 reported 121 complications in a decade of ear surgery in their center 47.1 % of which were extracranial complications, 30.6% intracranial ones and 22.3% mixed type of complications. The age of the patients

with complications ranged from 3 to 78 years in our series which means that no age is immune against complications so, whenever cholesteatoma is diagnosed, very much attempt should be done to surgically treat this potentially dangerous disease. Children and adolescents constituted less than half of our patients while those above 18 years were a bit-over half. More or less similar age distribution was reported by (Ceylan A *et al*, 2009). Although their study was focusing on the extracranial complications. Males in our series were slightly less than double the females. The higher male incidence was also reported in similar studies (Ceylan A *et al*, 2009), (Kuczkowski J *et al*, 2001), (Hyden D *et al*, 2006), (Miura MS *et al*, 2005), (Yorgancilar *et al*, 2013) etc. We could not find explanation for this high male to female ratio which is almost fixed in all relevant studies.

The right side is affected less than the left side (40 % Vs 60%). Two thirds of our patients with complications were operated upon for the first time because of the complication, however about one third was operated upon for cholesteatoma once before the complication occurred. Surgery was done twice before in 2.4% and 3 times before in 1.9%. All the 9 cases with more than one surgery before had mastoid abscess with the exception of one case.

Proper cleaning of all accessible air cells is so mandatory in all mastoidectomies especially in revision surgery and whenever there is doubt about such a point (in the presence of much granulations or active infection which jeopardizes visibility and sense of safe surgery) open procedure should be a priority and the logic choice. This also means that follow up after cholesteatoma surgery is mandatory especially after intact canal-wall surgery and we feel comfortable to assure that the second look advocated by the old experts is actually reflecting their correct vision of safety comes first. We have searched for co-morbidity in these patients with complications whether local ENT ones or general ones, our results showed that the vast majority of these patients (98%) were free of such co-morbidity and only in 4 cases (2%) diabetes, large adenoids and radiologic evidence of ethmoiditis were present which minimizes any suspected roles for the general or local co-morbidity. It has to be mentioned that a 3 –year old female with mastoiditis was excluded from the study as she was under treatment of acute leukemia and was referred from the oncology department to treat her resistant mastoiditis. Incision of here post-aural area for drainage revealed very minimal pus and what's came out was much blood and leukemic infiltrate. In our study the cranial complications dominated the overall results. They occurred 7 times more than the intracranial ones. Mastoid abscess and mastoiditis together constituted 2/3rd the whole complications.

In most studies mastoid abscess was found as the most common cranial complication (Osma U *et al*, 2000). In Rupa study the mastoid abscess was seen in more than half of the patients with complications, Mastoid abscess with or without superosteal abscess was observed in 11 (15.5%) patients in their study, mastoid fistula was seen in 7 (7.2%) patients (Rupa V *et al*, 1991). Facial paralysis and paresis occurred in 22 cases (10%). It occurred alone in 19 cases

and with other complications in 3 cases. Savic has reported facial palsy incidence as 5.1% (Savic DL *et al*, 1989), but Altuntas reported 1.7% patients in their cases of complications with facial palsy (Altuntas A *et al*, 1998). In a recently published study 14% of the patients among 70 CSOM complications had facial palsy (Dubey SP *et al*, 2007). Facial nerve palsy as a complication of COM is often associated with dehiscence in the bone covering the facial nerve this dehiscence may be a congenital one or as consequence of bony erosion of the bony facial canal through osteitis or cholesteatoma. Direct inflammation of the nerve by bacteria or by neurotoxic substances, which may be secreted from the cholesteatoma matrix, may also be the etiologic factors for the facial palsy secondary to CSOM (Harker L *et al*, 1992). Circumscribed labyrinthitis (through fistula in the lateral semicircular canal) was found in 10 cases (about 5%). Osma et al have reported 5 cases of labyrinthitis among 39 cranial complications (osma U *et al*, 2000). Dubey and Larawin have reported 2 patients (3%) serous labyrinthitis among 70 patients (Dubey *et al*, 2007). Cholesteatomacan causing labyrinthine fistula with serous labyrinthitis was also the most common complication in Nissen study in 1996 (Nissen AJ *et al*, 1996). The zygomatic variant of mastoid abscess occurred in 7 cases 4 of them were alone and 3 were with other complications. The rarely seen Bezold's abscess was seen twice (less than 1%). Most studies relevant to the topic found- more or less- close results to ours, although (Cyelan A *et al*, 2009). Found labyrinthitis to be more than double the mastoid abscess and fistula. We believe that labyrinthitis is generally under estimated in our society and it is not uncommon to discover it accidentally during routine audiologic evaluation through the course of CSOM. The most common intracranial complication encountered to us was brain abscess where 10 cases were found 6 of them were in the temporal lobe and 4 were in the cerebellum. Subdural abscess was less in number by one (9 cases). Lateral sinus thrombosis occurred in 5 cases, and meningitis in 4 cases. As we have mentioned before the incidence of meningitis should be more but because it is to a far extent a medical problem, it is sometimes treated in fever hospitals or fever departments in our hospital and the patient –especially young children- may miss the chance of having their source of infection identified and handled well. Most studies found meningitis the leader complication in terms of frequency and the gate that opens the way for other intracranial complications (Kuczkowski J *et al*, 2001), (Miura MS *et al*, 2005), (Yorgancilar *et al*, 2013). As to most common forms of presentation of ICC, there are some differences in the literature. Penny backer reported 200 cases of ICC where they found 85 cases of temporal lobe and cerebellum abscess, 28 cases of otitic hydrocephalus, 13 cases of meningitis, and 8 cases of lateral sinus thrombosis (Pennybacker J *et al*, 1961). There's study was done in otorhinolaryngology department of assiut university hospital at 1988 about intracranial complications of otitis media done on 39 case complain from complications of chronic otitis media and was fined

21 case with brain abscess, 11 case with extradural abscess, 9 cases with meningitis, 8 cases with lateral sinus thrombosis and two cases with otitis hydrocephalus (Abdelmoneim M *et al*, 1988).

At Otorhinolaryngology department of Complexo Hospitalar Santa Casa (CHSC), Porto Alegre for a period of 2 years from (April 2000 to May 2002) the hospital received 6 cases of chronic otitis media with intracranial complications (ICC). In all patients the intracranial complications were multiple and one of them followed by cranial complications (Bezold's abscess).

The most frequent ICC was meningitis, which was detected in all patients. Five of them had abscesses, three in the temporal region and two in the cerebellar region. Three cases manifested as hydrocephalus and the Lateral sinus thrombosis occurred in 2 patients.

Abscesses were the second most frequent type of complication. There were 4 cases (66.7%), three with temporal location and one with cerebellar location which progressed to death. Management of patients with complications was done- in general- through 3 ways of management. Classic radical mastoidectomy was the choice in more than 55% of complications (In 100% of mixed complications, about 60% of intracranial complications, and 54% of cranial complications). Combined approach tympano-mastoidectomy (ICW), was chosen in 37.7% (38.5% of cranial and% 37.5% of intracranial complications), while modified radical mastoidectomy was the procedure in about 7% of cases (7.8% of cranial and 4.2% of intracranial complications). The choice of these surgical lines was actually based upon so many factors. Some of these factors were, the individual complication itself, the status of the middle ear itself in terms of its hearing status, the intactness of the meatal wall, the bony boundaries of the ear and mastoid, the age of the patient, the condition of the other ear, the previous surgery if present and the preference of the surgeon himself.

Conclusion:

The complications of chronic suppurative otitis media still occur in the 21st century but by fewer incidences than the past time. Development, widespread use of antibiotics and health care instructions have all lead to decrease the incidence of the chronic suppurative otitis media complications. In many developing countries, prioritizing health-care need is a difficult task. As long as health-care delivery fails to target high-risk groups in developing countries, complications CSOM will persist. Complications of CSOM were seen among children so educating parents and guardians on possible risk factors of the disease may be a preventive strategy that might reduce disease occurrences. The cranial complications still occur more than the intracranial complication and the mastoid abscess is the most cranial complication while the brain abscess is the most intracranial complication in our study

References

- Abdelmoneim M. (1988): The study intracranial complications of otitis media, thesis. Assiut University Hospital. P 48.
- Acuin J. (2007): Chronic suppurative otitis media. Clin Evid (Online).
- Aziz N. (2006): Inflammatory Diseases of the Middle Ear, Medscape, 2012 Verhoeff M, van der Veen EL, Rovers MM.
- Ceylan A. Bayazit Y. Yilmaz M. Celenk F. Bayramoglu I. Uygur K. Goksu N (2009): Extracranial complications of chronic otitis media. *Int.ad.otol.5:(1)* 51-55
- Dubey SP, Larawin V. (2007): Complications of chronic suppurative otitis media and their management. *Laryngoscope.*
- Gerami H, Naghavi E, Wahabi-Moghadam M. (2009): Comparison of preoperative computerized tomography scan imaging of temporal bone with the intra-operative findings in patients undergoing mastoidectomy. *Saudi Med J*
- Harker LA, Pignatari SS. (1992): Facial nerve paralysis secondary to chronic otitis media without cholesteatoma. *Am J Otol. 13:372-4.*
- Hyden D. Akerlind B. Peebo M. (2006): inner ear and facial nerve complications of acute otitis media with focus on bacteriology and virology. *Acta oto-laryngologica 126: 460-466.*
- Kangsanarak J, Fooanant S, Ruckphaopunt K, Navacharoen N, Teotrakul S. (1993): Extracranial and intracranial complications of suppurative otitis media. Report of 102 cases. *J Laryngol Otol. 107:999-1004.*
- Kuczkowski J. Mikaszewski B. (2001): intracranial complications of acute and chronic mastoiditis: report of two cases in children. *Int. j of ped otol 227- 237.*
- Mauricio S. Rita C. Krumennauer F. Lubicana N. (2005): intracranial complications of chronic suppurative otitis media in children. *V71, n5, 639- 43*
- Mustafa A, Heta A, Kastrati B, Dreshaj S. (2008): Complications of chronic otitis media with cholesteatoma during a 10-year period in Kosovo. *Eur Arch Otorhinolaryngol. 265:1477-82.*
- Nissen AJ, Bui H. (1996): Complications of chronic otitis media. *Ear Nose Throat J. 75:284-92.*
- Pennybacker J. (1961): Discussion on intracranial complications of otogenic origin. *Proc R Soc Otol; 54: 309-20.*
- Rupa V, Raman R. (1991): Chronic suppurative otitis media: complicated versus uncomplicated disease. *Acta Otolaryngol. 111:530-5* .Penido NO, Borin A, Iha LC. (2005): Intracranial complications of otitis media: 15 years of experience in 33 patients. *Otolaryngol Head Neck Surg* .Osma U, Cureoglu S, Hosoglu S. (2000): The complications of chronic otitis media: report of 93 cases. *J Laryngol Otol. 114:97-100.*
- Savic DL, Djeriç DR. (1989): Facial paralysis in chronic suppurative otitis media. *Clin Otolaryngol Allied Sci. 14:515-7.*
- Smith JA, Danner CJ. (2006): Complications of chronic otitis media and cholesteatoma. *Otolaryngol Clin North Am. 39:1237-55.*
- Thorne MC, Chewaproug L, Elden LM. (2009): Suppurative complications of acute otitis media: changes in frequency over time. *Arch Otolaryngol Head Neck Surg.*
- Yorgancilar E. Yildirum M. Gun R. Bakir S. Tekin R. Gocmez C. Meric F. Topcu I. (2013): complications of chronic suppurative otitis media: a retrospective review. *Eur Arch otol 270:69-76 WHO-2004.*