



# Differences Pre-Operative Bone Gap Water Value Between Intact and Destructive Ossicular Chains In Patients With Chronic Suppurative Otitis Media Without Cholesteatoma

<sup>1</sup>Fira Sofia, <sup>2</sup>Sofia Tiarini

<sup>1,2</sup> Department of Otorhinolaryngology-Head and Neck Surgery, Faculty of Medicine, Universitas Airlangga - Dr. Soetomo Academic Medical Center, Surabaya, Indonesia

**Abstract:** Chronic suppurative otitis media (CSOM), is defined as chronic inflammation of the middle ear and mastoid cavity, which is characterized by recurrent ear discharge or otorrhoea through perforation of the tympanic membrane. The purpose of this study was to prove that there was a difference in ABG values between intact and destroyed ossicular chains in CSOM patients without cholesteatoma. The type of research used is analytic observational with a cross sectional research design. Data obtained from secondary data in the form of medical records at URJ ENT-KL Otology division of RSUD Dr. Soetomo. The ABG value was obtained through a pure tone audiometry examination carried out at the URJ ENT-KL neuro-otology division by competent personnel. Pathology of the tympanic cavity was found in the form of granulation tissue in 60 patients (73.2%) without granulation in 22 patients (26.8%). Based on the type of perforation, central perforation was found in 26 patients (31.7%), sub-total perforation in 34 patients (41.5%) and total perforation in 22 patients (26.8%). Intact ossicular chains were found in 62 patients (75.6%) while destruction in 20 patients (24.4%). Based on the results of the independent t test, the value of  $p = 0.002$  was obtained. There is a significant difference in the value of the air bone gap between intact ossicular chains and destruction in CSOM patients without cholesteatoma at a frequency of 500, 1000 and 4000 Hz but there is no difference at a frequency of 1000 Hz.

**Keywords:** Bone Gap Water, Destructive ossicular, Suppurative otitis media

**Index Terms - Component, formatting, style, styling, insert.**

## I. INTRODUCTION

Chronic suppurative otitis media (CSOM), is defined as chronic inflammation of the middle ear and mastoid cavity, which is characterized by recurrent ear discharge or otorrhoea through perforation of the tympanic membrane. The prevalence of CSOM is reported to vary widely. Data from the World Health Organization (WHO) reports that globally CSOM involves 65–330 million people and 60% of them experience significant hearing loss [1].

Hearing loss in CSOM is generally mild to moderate conductive hearing loss. This hearing loss is associated with tympanic membrane perforation, pathology of the tympanic cavity and destruction of the ossicular chain. Ossicular chain destruction is a common complication of CSOM. Ossicular chain destruction can be found in both CSOM without cholesteatoma and CSOM with cholesteatoma. The incidence of ossicular chain destruction in CSOM is reported in about one third of all CSOM cases [1].

Pure tone audiometry examination can help predict preoperative ossicular chain status through air conduction hearing threshold values and air bone gap (ABG). Several studies concluded that an increase in ABG at a specific frequency can predict ossicular chain destruction in CSOM. The relationship between ABG and ossicular chain status is influenced, among others, by the size and type of tympanic membrane perforation and the pathology of the tympanic cavity[2].

The purpose of this study was to prove that there was a difference in ABG values between intact and destroyed ossicular chains in CSOM patients without cholesteatoma.

## II. Research Method

### Population and Sample

The type of research used is analytic observational with a cross sectional research design. Data obtained from secondary data in the form of medical records at URJ ENT-KL Otology division of RSUD Dr. Soetomo. The study population was CSOM patients who were treated at URJ ENT-KL Otology division of RSUD Dr. Soetomo. The research sample was patients who met the inclusion and exclusion criteria. The inclusion criteria of this study were CSOM patients without cholesteatoma who underwent Canal Wall Up (CWU) tympanoplasty surgery during the period January 2018 to December 2019. Exclusion criteria were CSOM patients without cholesteatoma who underwent revision surgery and incomplete medical record data.

### Data and Sources of Data

The ABG value was obtained through a pure tone audiometry examination carried out at the URJ ENT-KL neuro-otology division by competent personnel. The ABG value is calculated based on the difference in the hearing threshold between air conduction and bone conduction at the frequencies of 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz. The status of the ossicular chain was obtained from the intraoperative findings. The ossicular chain is said to be intact if all three ossicles, namely the malleus, incus and stapes, are found intact. Ossicular chain destruction when there is bone destruction in at least one of the three ossicles. The basic data are presented in the form of distribution and frequency tables. ABG differences between intact and destroyed ossicular chains were analyzed using the independent sample t test.

## III. RESULTS AND DISCUSSION

### 3.1 Result in this study

The study sample size that met the inclusion and exclusion criteria was 82 patients. Based on gender, there were 42 women (51.2%) while 40 men (48.8%). The youngest age is 12 years old, the oldest is 72 years old, the mean age is 30.93 years with a standard deviation of 13,142. From the intraoperative findings, the pathology of the tympanic cavity was found in the form of granulation tissue in 60 patients (73.2%), without granulation in 22 patients (26.8%). Based on the type of perforation, central perforation was found in 26 patients (31.7%), sub-total perforation in 34 patients (41.5%) and total perforation in 22 patients (26.8%). Intact ossicular chains were found in 62 patients (75.6%) while destruction in 20 patients (24.4%).

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The average ABG at a frequency of 1000 Hz for the intact ossicular chain group was 39.44 with an SD value of 19,961 and the destroyed ossicular chain group was 56.25 with an SD value of 20,893. Based on the results of the independent t test, the value of  $p = 0.002$  was obtained. This indicates that there is a significant difference in mean ABG at a frequency of 1000 Hz between intact and destroyed ossicular chains ( $p < 0.05$ ).

Table 1. The difference in mean air bone gap between intact and destroyed ossicular chains at each frequency

Frekuensi	Rantai Osikula		<i>t value</i>	<i>p value</i>
	Utuh	Destruksi		
500 Hz	45,97±22,284	62,00±16,654	2,957	0,004
1000 Hz	39,44±19,961	56,25±20,893	3,329	0,002
2000 Hz	26,85±15,020	31,50±18,503	1,135	0,26
4000 Hz	31,13±17,116	42,75±21,913	2,460	0,016

\*p value – independent t test p value <0.05 is significantly different

The average ABG at a frequency of 2000 Hz for the intact ossicular chain group was 26.85 with an SD value of 15,020 and the destroyed ossicular chain group was 31.50 with an SD value of 18,503. Based on the results of the independent t test, the  $p$  value = 0.26. This shows that there is no significant difference in the average ABG frequency of 2000 Hz between intact and destroyed ossicular chains ( $p > 0.05$ ).

The average ABG at 4000 Hz frequency for the intact ossicular chain group was 31.13 with an SD value of 17.116 and the destroyed ossicular chain group was 42.75 with an SD value of 21.913. Based on the results of the independent t test, the  $p$  value = 0.016. This indicates that there is a significant difference in the mean ABG frequency 4000 Hz between intact and destroyed ossicular chains ( $p < 0.05$ ).

### 3.2 Discussion

The results showed that the youngest age of CSOM patients without cholesteatoma was 12 years old, while the oldest age was 72 years old with an average age of 30.93 years. The distribution of CSOM patients without cholesteatoma by gender in this study was mostly female, namely 51.2%. Based on the pathology of the tympanic cavity, granulation tissue was found in most of the patients (73.2%), the rest did not have granulation tissue (26.8%). The most common type of tympanic membrane perforation in this study was the sub total type (41.5%), followed by the central type (31.7%), and the total type (26.8%).

Ossicular destruction is damage to the malleus, incus and stapes due to increased bone resorption, erosion and necrosis. Ossicular destruction can be found in both safe and dangerous types of CSOM, but it is more often found in the dangerous type due to the presence of cholesteatoma and granulation tissue [3,4]. In this study, 75.6% of intact ossicular chains were found and destruction of 24.4%. Other similar studies include Rout et al., who stated the incidence of ossicular chain defects in 26.67% of cases of safe type CSOM and a

study by Saboo & Modwal who found ossicular destruction of 37% of 200 patients [5,6]. The results of this study different from the research by Rusmantika which found the incidence of ossicular destruction was 63.1% [7].

The air bone gap in CSOM patients is believed to be related to the status of the ossicular chain. A decrease in ABG indicates ossicular integrity while an increase in ABG can predict ossicular destruction. Granulation tissue and cholesteatoma can be independent predictors of ossicular status because they can interfere with the process of direct sound transmission.

The largest ABG average in this study was obtained at a frequency of 500 Hz, while the smallest was at a frequency of 2000 Hz. This result is similar to Rusmantika's study which got the largest average ABG at a frequency of 500 Hz and the smallest at 2000 Hz. 7 Other studies that reported similar results, namely the highest ABG value at a frequency of 500 and 1000 Hz was more than 40 db while at a frequency of 2000 and 1000 Hz 4000 Hz less than 40 db [8].

The results of this study showed that there was a significant difference in mean ABG between intact and destroyed ossicular chains at frequencies of 500, 1000 and 400 Hz. There was no difference in mean ABG between intact ossicular chains and destruction at a frequency of 2000 Hz. This finding is similar to a study in India which concluded that there was a significant difference in mean ABG between intact and destroyed ossicles at frequencies of 500, 1000, 2000 and 4000 Hz [9]. Ossicles at frequencies of 500, 1000, 2000 and 4000 Hz. Ossicular status is a risk factor that has the strongest relationship with the incidence of ABG in CSOM

Different results were obtained from research by Rusmantika which stated that there was no relationship between ABG and ossicular status at a frequency of 5000, 2000 and 4000 Hz except at a frequency of 1000 Hz which showed a significant relationship[7]. Research by Albera, et al., stated that the AC and BC values increased. according to the degree of ossicular destruction but the ABG value was obtained relatively stable. Pure tone audiometry and ABG values are considered not to reflect the ossicular status.10

There is a significant difference in the value of the air bone gap between intact ossicular chains and destruction in CSOM patients without cholesteatoma at a frequency of 500, 1000 and 4000 Hz but there is no difference at a frequency of 1000 Hz.

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