

World Journal of *Otorhinolaryngology*

World J Otorhinolaryngol 2014 May 28; 4(2): 6-11



Editorial Board

2011-2015

The *World Journal of Otorhinolaryngology* Editorial Board consists of 159 members, representing a team of worldwide experts in otorhinolaryngology. They are from 29 countries, including Australia (1), Austria (2), Belgium (5), Brazil (2), China (9), Colombia (1), Czech Republic (1), Denmark (1), Egypt (6), Germany (8), Greece (8), Hungary (1), India (12), Iran (4), Israel (6), Italy (14), Japan (7), New Zealand (1), Nigeria (1), Norway (1), Poland (1), Singapore (2), South Korea (4), Spain (3), Sweden (1), Switzerland (1), Turkey (15), United Kingdom (4), and United States (37).

EDITORS-IN-CHIEF

Tsutomu Nakashima, *Nagoya*
Steven J Wang, *San Francisco*

GUEST EDITORIAL BOARD MEMBERS

Mu-Kuan Chen, *Changhua*
Sheng Hwa Chen, *Taipei*
Tuan-Jen Fang, *Keelung*
Chao-Cheng Huang, *Kaohsiung*
Hsin-Ching Lin, *Kaohsiung*

MEMBERS OF THE EDITORIAL BOARD



Australia

Anne Elizabeth Vertigan, *Newcastle*



Austria

Christoph Arnoldner, *Vienna*
Dietmar Thurnher, *Vienna*



Belgium

Philippe Henri Dejonckere, *Brussels*
Joris Joris Dirckx, *Antwerp*
Amr Essam El-Shazly, *Liege*
Philippe Rombaux, *Brussels*
Robby Vanspauwen, *Antwerp*



Brazil

Maria Cristina Chammas, *São Paulo*
Etiene de Andrade Munhoz, *Porto Alegre*



China

Anna Chishan Kam, *Hong Kong*
Hua-Bin Li, *Guangzhou*
Jian-Chun Liao, *Shanghai*
Zheng Liu, *Wuhan*



Colombia

Luis M Ramirez Aristeguieta, *Medellin*



Czech Republic

Jan Vodicka, *Pardubice*



Denmark

Jesper Dammeyer, *Copenhagen*



Egypt

Tarek Abdelhameed Abulezz, *Sohag*
Omar A El-Banhawy, *El-Dakahlia*
Sherifa Ahmed Hamed, *Assiut*
Emad Ahmed Magdy, *Alexandria*
Badr Eldin Mostafa, *Cairo*
Sameh Ibrahim Sersar, *Mansoura*



Germany

Andreas Bahmer, *Frankfurt am Main*
Carsten Christof Boedeker, *Freiburg*

Raphael Richard Ciunan, *Gelsenkirchen*
Jessica Freiherr, *Aachen*
Haralampos Gouveris, *Mainz*
Markus Hambek, *Frankfurt*
Hamidreza Mojallal, *Hannover*
Leif Erik Walther, *Sulzbach*



Greece

Anna Eleftheriadou, *Rethymnon*
Tsakiropoulou Evangelia, *Thessaloniki*
G Michael-Minas Fragkiadakis, *Heraklion*
Vasiliki Vivian Iliadou, *Thessaloniki*
Alexander Dimitrios Karatzanis, *Heraklion*
George I Noussios, *Serres*
Theodossis S Papavramidis, *Thessaloniki*
Maria George Riga, *Alexandroupolis*



Hungary

László Robert Rovó, *Szeged*



India

Prakash Singh Bisen, *Jhansi*
Muthuswamy Dhiwakar, *Coimbatore*
Prahald Duggal, *Amritsar*
Bulbul Gupta, *Delhi*
Ajith Kumar U, *Mysore*
Satish Nair, *Delhi Cantt*
Vijaya Kumar Narne, *Mysore*
Ravi Chandran Nayar, *Bangalore*
Ashwani Sethi, *New Delhi*
Ashok Kumar Sinha, *Kolkata*
Alok Thakar, *New Delhi*
Jagdeep S Thakur, *Shimla*

**Iran**

Fatemeh Hassannia, *Tehran*
 Mohsen Naraghi, *Tehran*
 Mehrdad Nooranipour, *Tehran*
 Mohammad Sadeghi, *Tehran*

**Israel**

Itzhak Braverman, *Hadera*
 Haim Gavriel, *Zerifin*
 Menachem Gross, *Jerusalem*
 Avi Hefetz Khafif, *Ramat-Hasharon*
 Daniel M Kaplan Mha, *Omer*
 Michael Vaiman, *Bat Yam*

**Italy**

Marco Berlucchi, *Brescia*
 Giovanni Blandino, *Rome*
 Francesco Bussu, *Rome*
 Giuseppe Caruso, *Siena*
 Alessandro De Stefano, *Taranto*
 Alberto Deganello, *Florence*
 Francesco Dispenza, *Palermo*
 Alfio Ferlito, *Udine*
 Alessandro Franchi, *Florence*
 Paolo Gasparini, *Trieste*
 Dario Gregori, *Padova*
 Stavros D Hatzopoulos, *Ferrara*
 Gino Marioni, *Padova*
 Giacomo Pata, *Brescia*

**Japan**

Arata Horii, *Osaka*
 Sho Kanzaki, *Tokyo*
 Nejat Mahdieh, *Shizuoka*
 Nobuhiko Oridate, *Sapporo*
 Akihiro Shiotani, *Saitama*
 Keiji Tabuchi, *Tsukuba*

**New Zealand**

Srdjan Vlajkovic, *Auckland*

**Nigeria**

Bolajoko O Olusanya, *Lagos*

**Norway**

Vinay Swarnalatha Nagaraj, *Trondheim*

**Poland**

W Wiktor Jedrzejczak, *Warsaw*

**Singapore**

Gopalakrishna Iyer, *Singapore*
 De-Yun Wang, *Singapore*

**South Korea**

Yong Ju Jang, *Seoul*
 Han Su Kim, *Seoul*
 Sang Hag Lee, *Seoul*
 Raekil Park, *Iksan*

**Spain**

Mario A Hermsen, *Oviedo*
 Adolfo Toledano Muñoz, *Alcorcón*
 Enrique Zapater-Latorre, *Valencia*

**Sweden**

Zhe Jin, *Uppsala*

**Switzerland**

Thomas Nicola Roth, *Zurich*

**Turkey**

Atilla Arslanoglu, *Ankara*
 Murat Caloglu, *Edirne*
 Ali Coskun, *Izmir*
 Alper Nabi Erkan, *Adana*
 Muhammed Fatih Evcimik, *Istanbul*
 Mustafa Gul, *Kahramanmaras*
 Mehmet Gunduz, *Ankara*
 Samet Vasfi Kuvat, *Istanbul*
 Nuray Bayar Muluk, *Ankara*

Nesrin Bozdogan Ozyilkan, *Adana*
 Murat Songu, *Izmir*
 Rauf Tahamiler, *Istanbul*
 Murat Unal, *Mersin*
 Sidika Deniz Micozkadioglu Yalim, *Adana*
 Yavuz Selim Yildirim, *Istanbul*

**United Kingdom**

Ruth Epstein, *London*
 Ahmed Eweiss, *Gloucester*
 Jonathan Charles Hobson, *Manchester*
 Petros V Vlastarakos, *Stevenage*

**United States**

Ahmed Kamel Abdel Aal, *Birmingham*
 Thomas Jay Balkany, *Miami*
 Samuel S Becker, *Sewell*
 Annie W Chan, *Boston*
 Rakesh Kumar Chandra, *Chicago*
 Allen M Chen, *Sacramento*
 Nipun Chhabra, *Cleveland*
 Donald E Coling, *Buffalo*
 Didier A Depireux, *College Park*
 Dalian Ding, *New York*
 Richard L Doty, *Philadelphia*
 James Paul Dworkin, *Detroit*
 Ivan H El-Sayed, *San Francisco*
 Bharat Guthikonda, *Baton Rouge*
 Patrick Kyongmin Ha, *Baltimore*
 Jeffrey Allen Koempel, *Los Angeles*
 Kevin W Lollar, *Columbia*
 Lori Lombard, *Indiana*
 Ron B Mitchell, *St Louis*
 Larry Leonard Myers, *Dallas*
 Kevin K Ohlemiller, *Saint Louis*
 Fred A Pereira, *Houston*
 Sonja J Pyott, *Wilmington*
 Sophia Ran, *Springfield*
 Claus-Peter Richter, *Chicago*
 James M Ridgway, *Seattle*
 Richard Allen Roberts, *Foley*
 Peter S Roland, *Dallas*
 Soya Sisy Sam, *Saginaw*
 Chris A Sanford, *Pocatello*
 Ashok R Shaha, *New York*
 Abraham Shulman, *Brooklyn*
 Jeffrey Howard Spiegel, *Boston*
 Rohan R Walvekar, *New Orleans*
 Gregory Thomas Wolf, *Ann Arbor*
 Kathleen Yaremchuk, *Detroit*



World Journal of Otorhinolaryngology

Contents

Quarterly Volume 4 Number 2 May 28, 2014

FRONTIER

6 Vestibular evoked myogenic potential
Murofushi T

APPENDIX I-V Instructions to authors

ABOUT COVER Editorial Board Member of *World Journal of Otorhinolaryngology*, Hua-Bin Li, MD, PhD, Professor, Allergy Division, ENT Unit, 1st Affiliated Hospital, Sun Yat-sen University, Guangzhou 510080, Guangdong Province, China

AIM AND SCOPE *World Journal of Otorhinolaryngology* (*World J Otorhinolaryngol*, *WJO*, online ISSN 2218-6247, DOI: 10.5319) is a peer-reviewed open access academic journal that aims to guide clinical practice and improve diagnostic and therapeutic skills of clinicians.

WJO covers topics concerning endoscopy, rhinology, pharyngology, laryngology, tracheo-esophagology, otology, tracheology, cancer, nasal symptomatology, congenital nasal diseases, inflammatory diseases of the external nose, rhinitis, allergic rhinitis, nasal polyps, nasal septal diseases, nasal bleeding, nasal or sinus foreign bodies, sinusitis, rhinogenic complications, diagnostic imaging, evidence-based medicine, epidemiology and nursing. Priority publication will be given to articles concerning diagnosis and treatment of otorhinolaryngologic diseases. The following aspects are covered: Clinical diagnosis, laboratory diagnosis, differential diagnosis, imaging tests, pathological diagnosis, molecular biological diagnosis, immunological diagnosis, genetic diagnosis, functional diagnostics, and physical diagnosis; and comprehensive therapy, drug therapy, surgical therapy, interventional treatment, minimally invasive therapy, and robot-assisted therapy.

We encourage authors to submit their manuscripts to *WJO*. We will give priority to manuscripts that are supported by major national and international foundations and those that are of great basic and clinical significance.

INDEXING/ABSTRACTING *World Journal of Otorhinolaryngology* is now indexed in Digital Object Identifier.

FLYLEAF I-II Editorial Board

EDITORS FOR THIS ISSUE Responsible Assistant Editor: *Xiang Li* Responsible Science Editor: *Fang-Fang Ji*
Responsible Electronic Editor: *Huan-Liang Wu* Proofing Editorial Office Director: *Xiu-Xia Song*
Proofing Editor-in-Chief: *Lian-Sheng Ma*

NAME OF JOURNAL
World Journal of Otorhinolaryngology

ISSN
ISSN 2218-6247 (online)

LAUNCH DATE
December 28, 2011

FREQUENCY
Quarterly

EDITORS-IN-CHIEF
Tsutomu Nakashima, MD, PhD, Professor, Department of Otorhinolaryngology, Nagoya University Graduate School of Medicine, 65, Tsurumai-cho, Showa-ku, Nagoya 466-8550, Japan

Steven J Wang, MD, FACS, Associate Professor in Residence, Department of Otolaryngology-Head and Neck Surgery, University of California, San Francisco, 2233 Post St, 3rd Floor-Box 1225, San Francisco, CA 94115, United States

EDITORIAL OFFICE

Jin-Lei Wang, Director
Xiu-Xia Song, Vice Director
World Journal of Otorhinolaryngology
Room 903, Building D, Ocean International Center, No. 62 Dongsihuan Zhonglu, Chaoyang District, Beijing 100025, China
Telephone: +86-10-85381891
Fax: +86-10-85381893
E-mail: editorialoffice@wjnet.com
Help Desk: <http://www.wjnet.com/esps/helpdesk.aspx>
<http://www.wjnet.com>

PUBLISHER

Baishideng Publishing Group Inc
8226 Regency Drive,
Pleasanton, CA 94588, USA
Telephone: +1-925-223-8242
Fax: +1-925-223-8243
E-mail: bpgoffice@wjnet.com
Help Desk: <http://www.wjnet.com/esps/helpdesk.aspx>
<http://www.wjnet.com>

PUBLICATION DATE
May 28, 2014

COPYRIGHT

© 2014 Baishideng Publishing Group Inc. Articles published by this Open-Access journal are distributed under the terms of the Creative Commons Attribution Non-commercial License, which permits use, distribution, and reproduction in any medium, provided the original work is properly cited, the use is non commercial and is otherwise in compliance with the license.

SPECIAL STATEMENT

All articles published in journals owned by the Baishideng Publishing Group (BPG) represent the views and opinions of their authors, and not the views, opinions or policies of the BPG, except where otherwise explicitly indicated.

INSTRUCTIONS TO AUTHORS

Full instructions are available online at http://www.wjnet.com/2218-6247/g_info_20100722180338.htm

ONLINE SUBMISSION

<http://www.wjnet.com/esps/>

Vestibular evoked myogenic potential

Toshihisa Murofushi

Toshihisa Murofushi, Department of Otolaryngology, Teikyo University School of Medicine Mizonokuchi Hospital, Kawasaki 213-8507, Japan

Author contributions: Murofushi T contributed to the manuscript.

Correspondence to: Toshihisa Murofushi, Professor, Department of Otolaryngology, Teikyo University School of Medicine Mizonokuchi Hospital, 3-8-3 Mizonokuchi, Takatsu-ku, Kawasaki 213-8507, Japan. murofushi39@yahoo.co.jp

Telephone: +81-44-8443333 Fax: +81-44-8443333

Received: January 4, 2014 Revised: January 25, 2014

Accepted: April 17, 2014

Published online: May 28, 2014

Abstract

Vestibular evoked myogenic potential (VEMP), is an electromyographic response of vestibular origin evoked by sound, vibration or electrical stimulation. VEMP is widely used as a clinical test of the otolith organs. Nowadays, two kinds of VEMP, cervical VEMP (cVEMP) and ocular VEMP (oVEMP) are clinically used. cVEMP is a test of sacculo-colic reflex while oVEMP is a test of utricle-ocular reflex. Absence of responses, large interaural asymmetry of amplitudes, prolonged peak latencies, and abnormal thresholds of responses are regarded as abnormal responses. Clinical application to various diseases of the vestibular system was performed. Using VEMP, a new type of vestibular neuritis, inferior vestibular neuritis was established. A prominent feature of VEMP in Meniere's disease is a shift of a preferred frequency in cVEMP. The whole aspects of VEMP findings in patients with benign paroxysmal positional vertigo are not clarified yet. Sensitivity of cVEMP to vestibular schwannoma was 80.0%, while specificity was 52.7%. Concerning diagnosis of superior canal dehiscence syndrome (SCDS), oVEMP to air-conducted sound is the most helpful. Augmentation of oVEMP responses is a prominent feature in SCDS. I also presented "idiopathic otolithic vertigo", which I proposed as a new clinical entity based on VEMP findings. Some patients complained of lateral tilting sensation in the roll plane, or tilting or translational sensation in the pitch plane without rota-

tory vertigo. Majority of patients with these symptoms had absent or decreased responses of oVEMP and/or cVEMP. I proposed that these patients could be diagnosed as having "idiopathic otolithic vertigo".

© 2014 Baishideng Publishing Group Inc. All rights reserved.

Key words: Vestibular evoked myogenic potential; Otolith; Sacculae; Utricle; Otolithic vertigo

Core tip: This is a review of Vestibular evoked myogenic potential (VEMP). In this review I presented fundamentals concerning VEMP. Also I showed various types of clinical application of VEMP. Finally I introduced a new clinical entity, idiopathic otolithic vertigo which I proposed. Idiopathic otolithic vertigo cannot be diagnosed without application of VEMP.

Murofushi T. Vestibular evoked myogenic potential. *World J Otorhinolaryngol* 2014; 4(2): 6-11 Available from: URL: <http://www.wjgnet.com/2218-6247/full/v4/i2/6.htm> DOI: <http://dx.doi.org/10.5319/wjo.v4.i2.6>

INTRODUCTION

Vestibular evoked myogenic potential (VEMP) is an electromyographic response derived from the vestibular labyrinth evoked by sound, vibration, or electrical stimulation^[1]. VEMP is a clinical test of the otolith organs, sensors of linear acceleration. The otolith organs in human are consisted of the sacculae and the utricle. VEMP was first reported by Colebatch and Halmagyi in 1992^[2]. Since 1992 many papers concerning VEMP have been published all over the world. At first, VEMP, which was recorded on the sternocleidomastoid muscle (SCM), was performed as a test of otolith-colic reflex^[3]. Later, another method, recording around the eyes, has been also adopted as a test of otolith-ocular reflex^[4,5]. The former is called cVEMP (cervical VEMP), and the latter is called oVEMP (ocular VEMP). These tests provide different

information concerning the vestibular labyrinth from a caloric test and a head-impulse test (HIT)^[6], which are tests of the semicircular canals. In this review I will present fundamentals concerning VEMP.

RESPONSIBILITY TO SOUND OF THE MAMMALIAN VESTIBULAR LABYRINTH

For understanding VEMP, responsiveness to sound of the mammalian vestibular labyrinth must be addressed. In 1977 Young *et al*^[7] reported responses of the vestibular labyrinth to air-conducted sound (ACS) and bone-conducted vibration (BCV) using squirrel monkeys. They showed vestibular afferents could respond to ACS and BCV. Concerning ACS, saccular afferents showed lower thresholds than other end-organs. Didier *et al*^[8] showed that the inferior branch of the vestibular nerve (the inferior vestibular nerve) could respond to sound stimulation using guinea pigs which had destroyed cochlea but preserved vestibular labyrinth by amikacin injection. In 1990s, McCue *et al*^[9,10] using cats and Murofushi *et al*^[11-13] using guinea pigs showed sound-sensitivity of the mammalian otolith organs using single-unit recording technique. McCue *et al*^[10] reported that saccular afferents responded to sound stimulation and that best frequencies of responses were between 500 and 1000 Hz. Murofushi *et al*^[12] showed that sound-sensitive otolith afferents could be also tilt-sensitive and were in the caudal part of the superior vestibular nerve as well as the inferior vestibular nerve. Both groups reported that irregularly firing units, which are from type I hair cells, responded to sound well. Their studies confirmed that hair cells in the saccular macula, especially type I cells could respond to sound. McCue *et al*^[10] also suggested that preferred frequencies of the saccule were between 500 and 1000 Hz while Murofushi *et al*^[13] suggested that the utricle might be also respond to sound. Curthoys *et al*^[14] studied responsibilities to BCV. Their study showed that irregularly firing otolith afferents also responded to BCV well.

RECORDING METHODS AND NORMAL RESPONSES OF VEMP

cVEMP

Surface electrodes are used for recording. Active electrodes are placed on the belly of the sternocleidomastoid muscle (SCM) with reference electrodes on the lateral end of the upper sternum. The ground electrode is placed on the nasion. Nowadays 500 Hz short tone bursts (STB) (rise/fall time = 1 ms, plateau time = 2 ms, 125-130 dB SPL, ACS) are usually used as stimuli. Clicks are also applicable. The repetition rate of stimulation presentation is 5 Hz, and the time window for analysis is -20-80 ms. Signals are bandpass-filtered (20-2000 Hz) and 100 responses are averaged. BCV can be also used. Subjects must be instructed to keep contracting their SCM during recording. As methods for contraction, rotation of the neck or raising the head from the pillow is recommended.

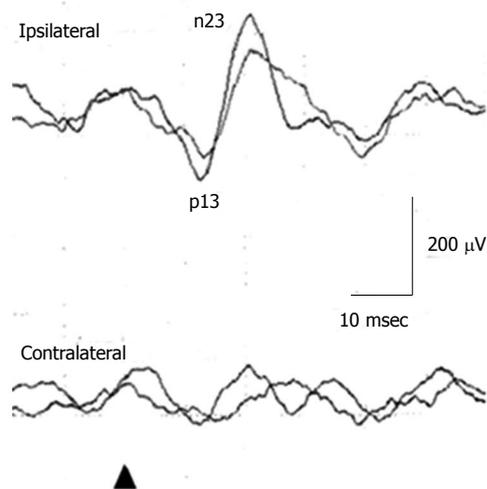


Figure 1 Cervical vestibular evoked myogenic potential waveforms in a healthy subject.

In a healthy subject, to 125 dB SPL 500 Hz ACS STB, the first positive deflection, of which the peak is around 15 ms is recorded in the ipsilateral SCM to the stimulated ear, followed by the negative deflection, of which the peak is around 23 ms (Figure 1). Conventionally, the first positive peak and the following negative peak are called p13 and n23 respectively. Absence of responses, large interaural asymmetry of p13-n23 amplitudes, prolonged peak latencies, and abnormal thresholds of responses are regarded as abnormal responses^[1]. Concerning cVEMP, a published guideline should be referenced^[5].

For assessment of amplitudes, correction of amplitudes using background muscle activities is desirable. For assessment of interaural asymmetry of amplitudes, percent cVEMP asymmetry has been used^[15,16]. Percent cVEMP asymmetry = $100 (CA_{cu} - CA_{ca}) / (CA_{cu} + CA_{ca})$ = corrected amplitude of p13-n23 on the unaffected (affected) side. The upper limit of percent cVEMP asymmetry in our laboratory is 41.6. The above-mentioned guideline indicated 50.0 as a strict standard of the upper limit of percent cVEMP asymmetry^[15]. As latencies can be affected by recording conditions, each laboratory should set their own normal range. The upper limit of p13 latency in our laboratory is 17.7 msec (125 dB SPL 500 Hz STB ACS)^[16]. Thresholds lower than 95 dB SPL (500 Hz STB ACS) are definitely abnormal.

It should be taken into consideration that subjects with conduction problems in the middle ear would show absence of responses even though they had normal vestibular function. Air-bone gap more than 15 dB makes recording of cVEMP to ACS useless.

oVEMP

Surface electrodes are used for recording. Active electrodes are placed just beneath the lower eye lids with reference electrodes 2 cm below active electrodes^[16]. The ground electrode is placed on the nasion. STB of 500 Hz (rise/fall time = 1 ms, plateau time = 2 ms, 125-130 dB SPL, ACS) are standard stimuli. Clicks are not used because healthy subjects frequently show absence of re-

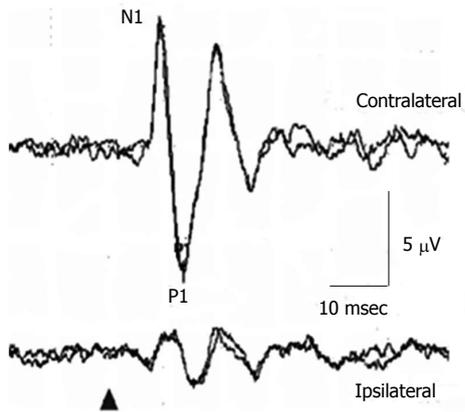


Figure 2 Ocular vestibular evoked myogenic potential waveforms in a healthy subject.

responses^[5]. Instead, BCV are used more frequently for recording oVEMP than cVEMP^[17]. The repetition rate of stimulation is 5 Hz, and the time window for analysis is -20-80 ms. Signals are bandpass-filtered (20-2000 Hz) and 100 responses are averaged. Other ranges of bandpass-filter may be used (e.g., 5-500 Hz)^[17]. Subjects must be instructed to keep upward gaze during recording (approx. 20 deg).

In a healthy subject, to 125 dB SPL 500 Hz ACS STB, the first negative deflection, of which the peak is around 11 msec, is recorded beneath the contralateral eye to the stimulated ear, followed by the positive deflection, of which the peak is around 15 ms (Figure 2)^[16]. Conventionally, the first negative peak and the following positive peak are called N1 and P1. Absence of responses, large interaural asymmetry of N1-P1 amplitudes, prolonged peak latencies, and abnormal thresholds of responses are regarded as abnormal responses. For assessment of interaural asymmetry of amplitudes, percent oVEMP asymmetry has been used^[16]. The formula is basically the same as percent cVEMP asymmetry. The upper limit of percent oVEMP asymmetry in our laboratory is 44.3. The upper limit of N1 latency in our laboratory is 13.6 msec (125 dB SPL 500 Hz STB ACS)^[16]. As latencies can be affected by recording conditions, each laboratory should set their own normal range. Thresholds lower than 105 dB SPL (500 Hz STB ACS) are abnormal.

Pathways of VEMP

Main pathways related to VEMP are considered as follow (Figure 3). The main neural pathway of cVEMP is uncrossed in the brainstem. cVEMP mainly reflects sacculo-colic reflexes to sound stimulation. Saccular afferents project to the vestibular nucleus through the inferior vestibular nerve. Neurons in the vestibular nucleus (inhibitory) project to the motoneurons in the ipsilateral accessory nerve nucleus through the ipsilateral medial vestibulo-spinal tract^[1,18].

The main neural pathway of oVEMP is crossed in the brainstem^[5]. oVEMP mainly reflects utriculo-ocular reflexes to sound stimulation^[16,19]. Utricular afferents

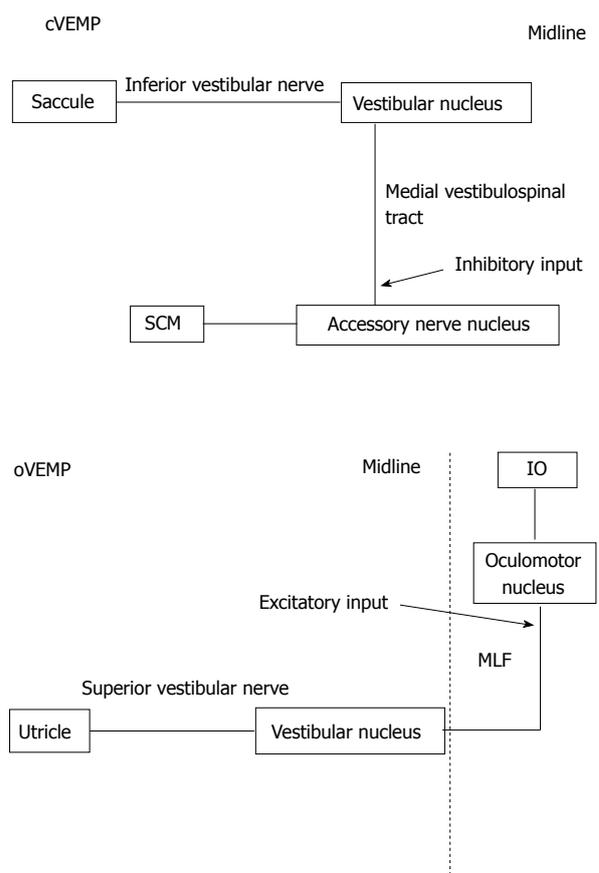


Figure 3 Supposed neural pathway of Cervical vestibular evoked myogenic potential and ocular vestibular evoked myogenic potential. cVEMP : Cervical vestibular evoked myogenic potential; oVEMP: Ocular vestibular evoked myogenic potential; SCM: Sternocleidomastoid muscle; IO: Inferior oblique muscle; MLF: Medial longitudinal fasciculus.

project to the vestibular nucleus through the superior vestibular nerve. Neurons in the vestibular nucleus (excitatory) project to the contralateral oculomotor nucleus through the contralateral medial longitudinal fasciculus (MLF)^[20]. oVEMP responses are mainly from the inferior oblique muscle^[21]. However, the pathway of oVEMP is still somewhat controversial.

Clinical application of VEMP

VEMP has been clinically applied to various diseases or conditions which might have abnormal findings in the vestibular system.

Vestibular neuritis

Conventional diagnostic criteria of Vestibular neuritis (VN) were as follow: (1) a single attack of acute spontaneous vertigo lasting at least several hours without accompanying auditory symptoms; (2) absence of other cranial nerve or central nervous system symptoms or signs; and (3) severe canal paresis (CP) on caloric testing (CP more than 50%)^[22]. These criteria are good for detection of acute deafferentation of the superior vestibular nerve, but they cannot detect deafferentation of the inferior vestibular nerve. In VN patients diagnosed accord-

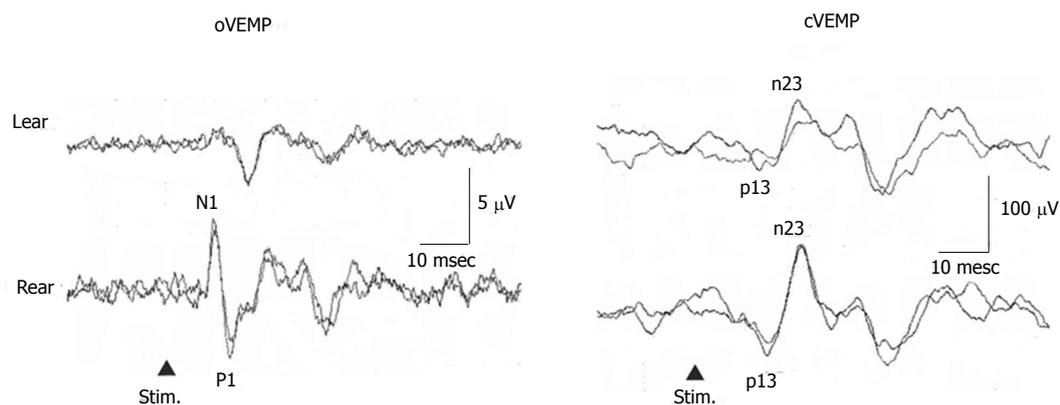


Figure 4 Vestibular evoked myogenic potential responses of a 57-year-old man with episodic lateral tilt sensation diagnosed as having idiopathic otolithic vertigo. He showed absent oVEMP to the left ear stimulation. cVEMP: Cervical vestibular evoked myogenic potential; oVEMP: Ocular vestibular evoked myogenic potential.

ing to these conventional diagnostic criteria, cVEMPs were absent or decreased in amplitudes in one third to half of patients^[1,22], while oVEMPs were abnormal in most patients^[16]. Patients with absent or highly decreased caloric responses and abnormal cVEMP responses can be regarded as superior and inferior (total) VN, while patients with absent or highly decreased caloric responses but normal cVEMP responses can be regarded as superior VN with spared inferior vestibular nerve functions. This classification lead to a new clinical entity, inferior VN with spared superior vestibular nerve functions^[23]. According to retrospective study by Chihara *et al*^[23], at the period when 24 patients were diagnosed as total VN and 34 patients were diagnosed as superior VN, 13 patients were regarded as inferior VN. Patients with inferior VN showed tendency of milder and shorter symptoms than patients with total or superior VN. Clinical application of cVEMP enabled us to diagnose patients as having inferior VN. These patients, otherwise, would be left as undiagnosed.

Meniere's disease

One of distinct features of VEMP in Meniere's disease (MD) patients is a shift of a preferred frequency in cVEMP^[24,25]. Healthy subjects show the largest amplitudes and the lowest thresholds in ACS cVEMP to stimulation of STB around 500 Hz. On the other hand, MD patients frequently showed a shift of a preferred frequency to 1000 Hz. Node *et al*^[26] found that the preferred frequency shift was normalized by dehydration using furosemide. Probably, the frequency shift was caused by endolymphatic hydrops in the saccule. Endolymphatic hydrops in the saccule can be also detected by glycerol-VEMP test. Murofushi *et al*^[27] found that 50% of MD patients with abnormal cVEMP prior to glycerol administration showed significant improvement of VEMP responses in 3 h after oral administration of glycerol (1.3 mg/kg body weight) on the affected side.

Benign paroxysmal positional vertigo

The whole aspects of VEMP findings in patients with Benign paroxysmal positional vertigo (BPPV) are not

clarified yet. Some investigators reported unilaterally abnormal oVEMP in patients with posterior canal BPPV^[28]. Abnormal oVEMPs could be decrease or augmentation of responses. Seo *et al*^[28] assumed that reduced responses on the affected side might be from partial degeneration of the utricular hair cells and that augmented responses might be from hypermobility of stereocilia due to detachment of otoconia. On the other hand, Nakahara *et al*^[29] reported bilaterally abnormal oVEMP in patients with posterior canal BPPV. They assumed that bilaterally abnormal (= absent) oVEMP might reflect utricular degeneration as a background of BPPV. Further study is required concerning VEMP in BPPV.

Vestibular schwannoma

Majority of patients with Vestibular schwannoma (VS) showed absent or decreased responses on the affected side, while some had prolonged latencies^[30,31]. According to Ushio *et al*^[31], sensitivity of cVEMP was 80.0%, while specificity was 52.7%. Although it is expected that combined application of cVEMP with caloric tests might be useful for prediction of the nerve origin of VS, Ushio *et al*^[32] did not find correlation of results of these tests to the nerve origin. However, Murofushi *et al*^[33] reported that a patient with very small VS from the inferior vestibular nerve showed abnormal cVEMP to clicks with normal cVEMP to 500 Hz ACS STB, normal caloric responses, and normal auditory brainstem responses (ABR). Study concerning prediction of the nerve origin of VS using physiological tests should be focused on cases with very small mass. Kinoshita *et al*^[34] and Murofushi *et al*^[35] reported that oVEMP might be also useful for diagnosis of VS. However, diagnostic values of oVEMP are remained to be clarified.

Superior canal dehiscence syndrome

Dehiscence of the bone overlying the superior (anterior) semicircular canal was first described in 1998 by Minor *et al*^[36]. It has been reported that this condition (SCDS) manifests as various vestibular and/or auditory symptoms^[36-38]. While detection of dehiscence with computed tomography scans is essential for definite diagnosis, it

has been also reported that augmentation of VEMP responses, especially oVEMP to ACS is marked^[37,39,40]. ACS oVEMP might be useful for screening of SCDS in dizzy patients. Zuniga *et al*^[40] reported that an n10 (N1 in this paper) amplitude of greater than 9.3 μV and a peak-to-peak amplitude (N1-P1 in this study) of greater than 17.1 μV exhibited 100% sensitivity and specificity for SCDS.

Idiopathic otolithic vertigo

Murofushi *et al*^[41,42] reported that some patients complained of lateral tilting sensation in the roll plane, or tilting or translational sensation in the pitch plane without rotatory vertigo. Majority of patients with these symptoms had absent or decreased responses of oVEMP and/or cVEMP (Figure 4). Patients with tilting sensation in the roll plane had tendency to show abnormal oVEMP, while patients with tilting or translational sensation in the pitch plane had tendency to show abnormal cVEMP. Murofushi *et al*^[41,42] proposed “idiopathic otolithic vertigo” as a new clinical entity, because the otolith organs are sensors of linear acceleration and dysfunction of them could result in illusion of linear movement^[43]. Abnormal VEMP findings may be essential for diagnosis of otolithic vertigo. As a next step, pathophysiology of idiopathic otolithic vertigo should be clarified.

Sensorineural hearing loss

Sensorineural hearing loss itself does not affect cVEMP or oVEMP. Patients with total hearing loss showed normal responses^[1,3,44,45].

VEMP is a still developing technique and new discovery is expected. I hope that many clinicians and researchers may be interested in it.

REFERENCES

- Murofushi T, Kaga K. VEMP: its basics and clinical applications. Tokyo: Springer Japan, 2009: 101-109 [DOI: 10.1007/978-4-431-85908-6_12]
- Colebatch JG, Halmagyi GM. Vestibular evoked potentials in human neck muscles before and after unilateral vestibular deafferentation. *Neurology* 1992; **42**: 1635-1636 [PMID: 1641165]
- Colebatch JG, Halmagyi GM, Skuse NF. Myogenic potentials generated by a click-evoked vestibulocollic reflex. *J Neurol Neurosurg Psychiatry* 1994; **57**: 190-197 [PMID: 8126503]
- Rosengren SM, McAngus Todd NP, Colebatch JG. Vestibular-evoked extraocular potentials produced by stimulation with bone-conducted sound. *Clin Neurophysiol* 2005; **116**: 1938-1948 [PMID: 15979939 DOI: 10.1016/j.clinph.2005.03.019]
- Chihara Y, Iwasaki S, Ushio M, Murofushi T. Vestibular-evoked extraocular potentials by air-conducted sound: another clinical test for vestibular function. *Clin Neurophysiol* 2007; **118**: 2745-2751 [PMID: 17905655 DOI: 10.1016/j.clinph.2007.08.005]
- Halmagyi GM, Weber KP, Aw ST, Todd MJ, Curthoys IS. Impulsive testing of semicircular canal function. In: ed. by Kaga K, Starr A. *Neuropathies of the auditory and vestibular eighth cranial nerves*. Tokyo: Springer Japan, 2009: 93-109 [DOI: 10.1007/978-4-431-09433-3_11]
- Young ED, Fernández C, Goldberg JM. Responses of squirrel monkey vestibular neurons to audio-frequency sound and head vibration. *Acta Otolaryngol* 1977; **84**: 352-360 [PMID: 303426]
- Didier A, Cazals Y. Acoustic responses recorded from the saccular bundle on the eighth nerve of the guinea pig. *Hear Res* 1989; **37**: 123-127 [PMID: 2914808]
- McCue MP, Guinan JJ. Acoustically responsive fibers in the vestibular nerve of the cat. *J Neurosci* 1994; **14**: 6058-6070 [PMID: 7931562]
- McCue MP, Guinan JJ. Spontaneous activity and frequency selectivity of acoustically responsive vestibular afferents in the cat. *J Neurophysiol* 1995; **74**: 1563-1572 [PMID: 8989393]
- Murofushi T, Curthoys IS, Topple AN, Colebatch JG, Halmagyi GM. Responses of guinea pig primary vestibular neurons to clicks. *Exp Brain Res* 1995; **103**: 174-178 [PMID: 7615033]
- Murofushi T, Curthoys IS. Physiological and anatomical study of click-sensitive primary vestibular afferents in the guinea pig. *Acta Otolaryngol* 1997; **117**: 66-72 [PMID: 9039484]
- Murofushi T, Curthoys IS, Gilchrist DP. Response of guinea pig vestibular nucleus neurons to clicks. *Exp Brain Res* 1996; **111**: 149-152 [PMID: 8891646]
- Curthoys IS, Kim J, McPhedran SK, Camp AJ. Bone conducted vibration selectively activates irregular primary otolithic vestibular neurons in the guinea pig. *Exp Brain Res* 2006; **175**: 256-267 [PMID: 16761136 DOI: 10.1007/s00221-006-0544-1]
- Papathanasiou ES, Murofushi T, Akin FW, Colebatch JG. International guidelines for the clinical application of cervical vestibular evoked myogenic potentials: an expert consensus report. *Clin Neurophysiol* 2014; **125**: 658-666 [PMID: 24513390 DOI: 10.1016/j.clinph.2013.11.042]
- Murofushi T, Nakahara H, Yoshimura E, Tsuda Y. Association of air-conducted sound oVEMP findings with cVEMP and caloric test findings in patients with unilateral peripheral vestibular disorders. *Acta Otolaryngol* 2011; **131**: 945-950 [PMID: 21563874 DOI: 10.3109/00016489.2011.580003]
- Iwasaki S, Smulders YE, Burgess AM, McGarvie LA, Macdougall HG, Halmagyi GM, Curthoys IS. Ocular vestibular evoked myogenic potentials to bone conducted vibration of the midline forehead at Fz in healthy subjects. *Clin Neurophysiol* 2008; **119**: 2135-2147 [PMID: 18639490 DOI: 10.1016/j.clinph.2008.05.028]
- Kushiro K, Zakir M, Ogawa Y, Sato H, Uchino Y. Saccular and utricular inputs to sternocleidomastoid motoneurons of decerebrate cats. *Exp Brain Res* 1999; **126**: 410-416 [PMID: 10382625]
- Iwasaki S, McGarvie LA, Halmagyi GM, Burgess AM, Kim J, Colebatch JG, Curthoys IS. Head taps evoke a crossed vestibulo-ocular reflex. *Neurology* 2007; **68**: 1227-1229 [PMID: 17420408 DOI: 10.1212/01.wnl.0000259064.80564.21]
- Uchino Y, Sasaki M, Sato H, Imagawa M, Suwa H, Isu N. Utriculoocular reflex arc of the cat. *J Neurophysiol* 1996; **76**: 1896-1903 [PMID: 8890302]
- Weber KP, Rosengren SM, Michels R, Sturm V, Straumann D, Landau K. Single motor unit activity in human extraocular muscles during the vestibulo-ocular reflex. *J Physiol* 2012; **590**: 3091-3101 [PMID: 22526888 DOI: 10.1113/jphysiol.2011.226225]
- Murofushi T, Halmagyi GM, Yavor RA, Colebatch JG. Absent vestibular evoked myogenic potentials in vestibular neurolabyrinthitis. An indicator of inferior vestibular nerve involvement? *Arch Otolaryngol Head Neck Surg* 1996; **122**: 845-848 [PMID: 8703387]
- Chihara Y, Iwasaki S, Murofushi T, Yagi M, Inoue A, Fujimoto C, Egami N, Ushio M, Karino S, Sugawara K, Yamasoba T. Clinical characteristics of inferior vestibular neuritis. *Acta Otolaryngol* 2012; **132**: 1288-1294 [PMID: 23039337 DOI: 10.3109/00016489.2012.701326]
- Rauch SD, Zhou G, Kujawa SG, Guinan JJ, Herrmann BS. Vestibular evoked myogenic potentials show altered tuning in patients with Ménière's disease. *Otol Neurotol* 2004; **25**: 333-338 [PMID: 15129114]
- Murofushi T, Ozeki H, Inoue A, Sakata A. Does migraine-associated vertigo share a common pathophysiology with

- Meniere's disease? Study with vestibular-evoked myogenic potential. *Cephalalgia* 2009; **29**: 1259-1266 [PMID: 19911463 DOI: 10.1111/j.1468-2982.2009.01860.x]
- 26 **Node M**, Seo T, Miyamoto A, Adachi A, Hashimoto M, Sakagami M. Frequency dynamics shift of vestibular evoked myogenic potentials in patients with endolymphatic hydrops. *Otol Neurotol* 2005; **26**: 1208-1213 [PMID: 16272944]
- 27 **Murofushi T**, Matsuzaki M, Takegoshi H. Glycerol affects vestibular evoked myogenic potentials in Meniere's disease. *Auris Nasus Larynx* 2001; **28**: 205-208 [PMID: 11489361]
- 28 **Seo T**, Saka N, Ohta S, Sakagami M. Detection of utricular dysfunction using ocular vestibular evoked myogenic potential in patients with benign paroxysmal positional vertigo. *Neurosci Lett* 2013; **550**: 12-16 [PMID: 23827225 DOI: 10.1016/j.neulet.2013.06.041]
- 29 **Nakahara H**, Yoshimura E, Tsuda Y, Murofushi T. Damaged utricular function clarified by oVEMP in patients with benign paroxysmal positional vertigo. *Acta Otolaryngol* 2013; **133**: 144-149 [PMID: 22992120 DOI: 10.3109/00016489.2012.720030]
- 30 **Murofushi T**, Matsuzaki M, Mizuno M. Vestibular evoked myogenic potentials in patients with acoustic neuromas. *Arch Otolaryngol Head Neck Surg* 1998; **124**: 509-512 [PMID: 9604975]
- 31 **Ushio M**, Iwasaki S, Murofushi T, Sugawara K, Chihara Y, Fujimoto C, Nakamura M, Yamaguchi T, Yamasoba T. The diagnostic value of vestibular-evoked myogenic potential in patients with vestibular schwannoma. *Clin Neurophysiol* 2009; **120**: 1149-1153 [PMID: 19394267 DOI: 10.1016/j.clinph.2009.01.017]
- 32 **Ushio M**, Iwasaki S, Chihara Y, Kawahara N, Morita A, Saito N, Murofushi T. Is the nerve origin of the vestibular schwannoma correlated with vestibular evoked myogenic potential, caloric test, and auditory brainstem response? *Acta Otolaryngol* 2009; **129**: 1095-1100 [PMID: 19034733 DOI: 10.1080/00016480802552543]
- 33 **Murofushi T**, Takehisa M. Vestibular schwannoma with absent vestibular evoked myogenic potentials to clicks but normal ABR, caloric responses and vestibular evoked myogenic potentials to 500 Hz tone bursts. *Acta Otolaryngol* 2010; **130**: 525-528 [PMID: 19883178 DOI: 10.3109/00016480903258016]
- 34 **Kinoshita M**, Iwasaki S, Fujimoto C, Inoue A, Egami N, Chihara Y, Ushio M, Yamasoba T. Ocular vestibular evoked myogenic potentials in response to air-conducted sound and bone-conducted vibration in vestibular schwannoma. *Otol Neurotol* 2013; **34**: 1342-1348 [PMID: 23945552 DOI: 10.1097/MAO.0b013e31828d6539]
- 35 **Murofushi T**, Wakayama K, Chihara Y. oVEMP to air-conducted tones reflects functions of different vestibular populations from cVEMP? *Eur Arch Otorhinolaryngol* 2010; **267**: 995-996 [PMID: 20376469 DOI: 10.1007/s00405-010-1246-7]
- 36 **Minor LB**, Solomon D, Zinreich JS, Zee DS. Sound- and/or pressure-induced vertigo due to bone dehiscence of the superior semicircular canal. *Arch Otolaryngol Head Neck Surg* 1998; **124**: 249-258 [PMID: 9525507]
- 37 **Welgampola MS**, Myrie OA, Minor LB, Carey JP. Vestibular-evoked myogenic potential thresholds normalize on plugging superior canal dehiscence. *Neurology* 2008; **70**: 464-472 [PMID: 18250291 DOI: 10.1212/01.wnl.0000299084.76250.4a]
- 38 **Mikulec AA**, McKenna MJ, Ramsey MJ, Rosowski JJ, Herrmann BS, Rauch SD, Curtin HD, Merchant SN. Superior semicircular canal dehiscence presenting as conductive hearing loss without vertigo. *Otol Neurotol* 2004; **25**: 121-129 [PMID: 15021770]
- 39 **Komiyama S**, Nakahara H, Tsuda Y, Yoshimura E, Murofushi T. Assessing ocular vestibular evoked myogenic potential (oVEMP) amplitudes is a useful method for screening for superior canal dehiscence: A report of 2 cases. *Equilibrium Res*. In Press
- 40 **Zuniga MG**, Janky KL, Nguyen KD, Welgampola MS, Carey JP. Ocular versus cervical VEMPs in the diagnosis of superior semicircular canal dehiscence syndrome. *Otol Neurotol* 2013; **34**: 121-126 [PMID: 23183641 DOI: 10.1097/MAO.0b013e31827136b0]
- 41 **Murofushi T**, Nakahara H, Yoshimura E. Assessment of the otolith-ocular reflex using ocular vestibular evoked myogenic potentials in patients with episodic lateral tilt sensation. *Neurosci Lett* 2012; **515**: 103-106 [PMID: 22465248 DOI: 10.1016/j.neulet.2012.02.084]
- 42 **Murofushi T**, Komiyama S, Yoshimura E. Do patients who experience episodic tilting or translational sensations in the pitch plane have abnormal sacculo-colic reflexes? *Neurosci Lett* 2013; **553**: 95-98 [PMID: 23973336 DOI: 10.1016/j.neulet.2013.08.002]
- 43 **Brandt T**. Otolithic vertigo. *Adv Otorhinolaryngol* 2001; **58**: 34-47 [PMID: 11885553]
- 44 **Ozeki H**, Matsuzaki M, Murofushi T. Vestibular evoked myogenic potentials in patients with bilateral profound hearing loss. *ORL J Otorhinolaryngol Relat Spec* 1999; **61**: 80-83 [PMID: 10095197]
- 45 **Chihara Y**, Iwasaki S, Ushio M, Fujimoto C, Kashio A, Kon-do K, Ito K, Asakage T, Yamasoba T, Kaga K, Murofushi T. Ocular vestibular-evoked myogenic potentials (oVEMPs) require extraocular muscles but not facial or cochlear nerve activity. *Clin Neurophysiol* 2009; **120**: 581-587 [PMID: 19211302 DOI: 10.1016/j.clinph.2008.12.030]

P- Reviewers: El-Banhawy O, Gouveris H, Li HB

S- Editor: Qi Y **L- Editor:** A **E- Editor:** Wu HL



GENERAL INFORMATION

World Journal of Otorhinolaryngology (*World J Otorhinolaryngol*, *WJO*, online ISSN 2218-6247, DOI: 10.5319) is a peer-reviewed open access (OA) academic journal that aims to guide clinical practice and improve diagnostic and therapeutic skills of clinicians.

Aim and scope

WJO covers topics concerning endoscopy, rhinology, pharyngology, laryngology, tracheo-esophagology, otology, tracheology, cancer, nasal symptomatology, congenital nasal diseases, inflammatory diseases of the external nose, rhinitis, allergic rhinitis, nasal polyps, nasal septal diseases, nasal bleeding, nasal or sinus foreign bodies, sinusitis, rhinogenic complications, diagnostic imaging, evidence-based medicine, epidemiology and nursing. The current columns of *WJO* include editorial, frontier, diagnostic advances, therapeutics advances, field of vision, mini-reviews, review, topic highlight, medical ethics, original articles, case report, clinical case conference (Clinicopathological conference), and autobiography. Priority publication will be given to articles concerning diagnosis and treatment of otorhinolaryngologic diseases. The following aspects are covered: Clinical diagnosis, laboratory diagnosis, differential diagnosis, imaging tests, pathological diagnosis, molecular biological diagnosis, immunological diagnosis, genetic diagnosis, functional diagnostics, and physical diagnosis; and comprehensive therapy, drug therapy, surgical therapy, interventional treatment, minimally invasive therapy, and robot-assisted therapy.

We encourage authors to submit their manuscripts to *WJO*. We will give priority to manuscripts that are supported by major national and international foundations and those that are of great basic and clinical significance.

WJO is edited and published by Baishideng Publishing Group (BPG). BPG has a strong professional editorial team composed of science editors, language editors and electronic editors. BPG currently publishes 43 OA clinical medical journals, including 42 in English, has a total of 15471 editorial board members or peer reviewers, and is a world first-class publisher.

Columns

The columns in the issues of *WJO* will include: (1) Editorial: The editorial board members are invited to make comments on an important topic in their field in terms of its current research status and future directions to lead the development of this discipline; (2) Frontier: The editorial board members are invited to select a highly cited cutting-edge original paper of his/her own to summarize major findings, the problems that have been resolved and remain to be resolved, and future research directions to help readers understand his/her important academic point of view and future research directions in the field; (3) Diagnostic Advances: The editorial board members are invited to write high-quality diagnostic advances in their field to improve the diagnostic skills of readers. The topic covers general clinical diagnosis, differential diagnosis, pathological diagnosis, laboratory diagnosis, imaging diagnosis, endoscopic diagnosis, biotechnological diagnosis, functional diagnosis, and physical diagnosis; (4) Therapeutics Advances: The editorial board members are invited to write high-quality therapeutic advances in their field to help improve the therapeutic skills of readers. The topic covers medication therapy, psychotherapy, physical therapy, replacement therapy, interventional therapy, minimally invasive therapy, endoscopic therapy, transplantation therapy, and surgical therapy; (5) Field of Vision: The editorial board members are invited to write

commentaries on classic articles, hot topic articles, or latest articles to keep readers at the forefront of research and increase their levels of clinical research. Classic articles refer to papers that are included in Web of Knowledge and have received a large number of citations (ranking in the top 1%) after being published for more than years, reflecting the quality and impact of papers. Hot topic articles refer to papers that are included in Web of Knowledge and have received a large number of citations after being published for no more than 2 years, reflecting cutting-edge trends in scientific research. Latest articles refer to the latest published high-quality papers that are included in PubMed, reflecting the latest research trends. These commentary articles should focus on the status quo of research, the most important research topics, the problems that have now been resolved and remain to be resolved, and future research directions. Basic information about the article to be commented (including authors, article title, journal name, year, volume, and inclusive page numbers; (6) Minireviews: The editorial board members are invited to write short reviews on recent advances and trends in research of molecular biology, genomics, and related cutting-edge technologies to provide readers with the latest knowledge and help improve their diagnostic and therapeutic skills; (7) Review: To make a systematic review to focus on the status quo of research, the most important research topics, the problems that have now been resolved and remain to be resolved, and future research directions; (8) Topic Highlight: The editorial board members are invited to write a series of articles (7-10 articles) to comment and discuss a hot topic to help improve the diagnostic and therapeutic skills of readers; (9) Medical Ethics: The editorial board members are invited to write articles about medical ethics to increase readers' knowledge of medical ethics. The topic covers international ethics guidelines, animal studies, clinical trials, organ transplantation, *etc.*; (10) Clinical Case Conference or Clinicopathological Conference: The editorial board members are invited to contribute high-quality clinical case conference; (11) Original Articles: To report innovative and original findings in otorhinolaryngology; (12) Brief Articles: To briefly report the novel and innovative findings in otorhinolaryngology; (13) Meta-Analysis: Covers the systematic review, mixedtreatment comparison, meta-regression, and overview of reviews, in order to summarize a given quantitative effect, *e.g.*, the clinical effectiveness and safety of clinical treatments by combining data from two or more randomized controlled trials, thereby providing more precise and externally valid estimates than those which would stem from each individual dataset if analyzed separately from the others; (14) Case Report: To report a rare or typical case; (15) Letters to the Editor: To discuss and make reply to the contributions published in *WJO*, or to introduce and comment on a controversial issue of general interest; (16) Book Reviews: To introduce and comment on quality monographs of otorhinolaryngology; and (17) Autobiography: The editorial board members are invited to write their autobiography to provide readers with stories of success or failure in their scientific research career. The topic covers their basic personal information and information about when they started doing research work, where and how they did research work, what they have achieved, and their lessons from success or failure.

Name of journal

World Journal of Otorhinolaryngology

ISSN

ISSN 2218-6247 (online)

Instructions to authors

Launch date

December 28, 2011

Frequency

Quarterly

Editors-in-Chief

Tsutomu Nakashima, MD, PhD, Professor, Department of Otorhinolaryngology, Nagoya University Graduate School of Medicine, 65, Tsurumai-cho, Showa-ku, Nagoya 466-8550, Japan

Steven J Wang, MD, FACS, Associate Professor in Residence, Department of Otolaryngology-Head and Neck Surgery, University of California, San Francisco, 2233 Post St, 3rd Floor-Box 1225, San Francisco, CA 94115, United States

Editorial office

Jin-Lei Wang, Director
Xiu-Xia Song, Vice Director
World Journal of Otorhinolaryngology
Room 903, Building D, Ocean International Center,
No. 62 Dongsihuan Zhonglu, Chaoyang District,
Beijing 100025, China
Telephone: +86-10-85381891
Fax: +86-10-85381893
E-mail: editorialoffice@wjgnet.com
Help Desk: <http://www.wjgnet.com/esps/helpdesk.aspx>
<http://www.wjgnet.com>

Publisher

Baishideng Publishing Group Inc
8226 Regency Drive,
Pleasanton, CA 94588, USA
Telephone: +1-925-223-8242
Fax: +1-925-223-8243
E-mail: bpgoffice@wjgnet.com
Help Desk: <http://www.wjgnet.com/esps/helpdesk.aspx>
<http://www.wjgnet.com>

Instructions to authors

Full instructions are available online at http://www.wjgnet.com/2218-6247/g_info_20100722180338.htm.

Indexed and Abstracted in

Digital Object Identifier.

SPECIAL STATEMENT

All articles published in journals owned by the BPG represent the views and opinions of their authors, and not the views, opinions or policies of the BPG, except where otherwise explicitly indicated.

Biostatistical editing

Statistical review is performed after peer review. We invite an expert in Biomedical Statistics to evaluate the statistical method used in the paper, including *t*-test (group or paired comparisons), chi-squared test, Ridit, probit, logit, regression (linear, curvilinear, or stepwise), correlation, analysis of variance, analysis of covariance, *etc.* The reviewing points include: (1) Statistical methods should be described when they are used to verify the results; (2) Whether the statistical techniques are suitable or correct; (3) Only homogeneous data can be averaged. Standard deviations are preferred to standard errors. Give the number of observations and subjects (*n*). Losses in observations, such as drop-outs from the study should be reported; (4) Values such as ED50, LD50, IC50 should have their 95% confidence limits calculated and compared by weighted probit analysis (Bliss and Finney); and (5) The word “significantly” should be replaced by its synonyms (if it indicates extent) or the *P* value (if it indicates statistical significance).

Conflict-of-interest statement

In the interests of transparency and to help reviewers assess any potential bias, *WJO* requires authors of all papers to declare any compet-

ing commercial, personal, political, intellectual, or religious interests in relation to the submitted work. Referees are also asked to indicate any potential conflict they might have reviewing a particular paper. Before submitting, authors are suggested to read “Uniform Requirements for Manuscripts Submitted to Biomedical Journals: Ethical Considerations in the Conduct and Reporting of Research: Conflicts of Interest” from International Committee of Medical Journal Editors (ICMJE), which is available at: http://www.icmje.org/ethical_4conflicts.html.

Sample wording: [Name of individual] has received fees for serving as a speaker, a consultant and an advisory board member for [names of organizations], and has received research funding from [names of organization]. [Name of individual] is an employee of [name of organization]. [Name of individual] owns stocks and shares in [name of organization]. [Name of individual] owns patent [patent identification and brief description].

Statement of informed consent

Manuscripts should contain a statement to the effect that all human studies have been reviewed by the appropriate ethics committee or it should be stated clearly in the text that all persons gave their informed consent prior to their inclusion in the study. Details that might disclose the identity of the subjects under study should be omitted. Authors should also draw attention to the Code of Ethics of the World Medical Association (Declaration of Helsinki, 1964, as revised in 2004).

Statement of human and animal rights

When reporting the results from experiments, authors should follow the highest standards and the trial should conform to Good Clinical Practice (for example, US Food and Drug Administration Good Clinical Practice in FDA-Regulated Clinical Trials; UK Medicines Research Council Guidelines for Good Clinical Practice in Clinical Trials) and/or the World Medical Association Declaration of Helsinki. Generally, we suggest authors follow the lead investigator's national standard. If doubt exists whether the research was conducted in accordance with the above standards, the authors must explain the rationale for their approach and demonstrate that the institutional review body explicitly approved the doubtful aspects of the study.

Before submitting, authors should make their study approved by the relevant research ethics committee or institutional review board. If human participants were involved, manuscripts must be accompanied by a statement that the experiments were undertaken with the understanding and appropriate informed consent of each. Any personal item or information will not be published without explicit consents from the involved patients. If experimental animals were used, the materials and methods (experimental procedures) section must clearly indicate that appropriate measures were taken to minimize pain or discomfort, and details of animal care should be provided.

SUBMISSION OF MANUSCRIPTS

Manuscripts should be typed in 1.5 line spacing and 12 pt. Book Antiqua with ample margins. Number all pages consecutively, and start each of the following sections on a new page: Title Page, Abstract, Introduction, Materials and Methods, Results, Discussion, Acknowledgements, References, Tables, Figures, and Figure Legends. Neither the editors nor the publisher are responsible for the opinions expressed by contributors. Manuscripts formally accepted for publication become the permanent property of Baishideng Publishing Group Co., Limited, and may not be reproduced by any means, in whole or in part, without the written permission of both the authors and the publisher. We reserve the right to copy-edit and put onto our website accepted manuscripts. Authors should follow the relevant guidelines for the care and use of laboratory animals of their institution or national animal welfare committee. For the sake of transparency in regard to the performance and reporting of clinical trials, we endorse the policy of the ICMJE to refuse to publish papers on clinical trial results if the trial was not recorded in a publicly-accessible registry at its outset. The only register now available, to our knowledge, is <http://www.clinicaltrials.gov> sponsored by the United States National Library of Medicine and we encourage all potential contributors to register with it. However, in the case that other registers become available you will be duly notified.

A letter of recommendation from each author's organization should be provided with the contributed article to ensure the privacy and secrecy of research is protected.

Authors should retain one copy of the text, tables, photographs and illustrations because rejected manuscripts will not be returned to the author(s) and the editors will not be responsible for loss or damage to photographs and illustrations sustained during mailing.

Online submissions

Manuscripts should be submitted through the Online Submission System at: <http://www.wjgnet.com/esp/>. Authors are highly recommended to consult the ONLINE INSTRUCTIONS TO AUTHORS (http://www.wjgnet.com/2218-6247/g_info_20100722180338.htm) before attempting to submit online. For assistance, authors encountering problems with the Online Submission System may send an email describing the problem to wjotorhinology@wjgnet.com, or by telephone: +86-10-85381892. If you submit your manuscript online, do not make a postal contribution. Repeated online submission for the same manuscript is strictly prohibited.

MANUSCRIPT PREPARATION

All contributions should be written in English. All articles must be submitted using word-processing software. All submissions must be typed in 1.5 line spacing and 12 pt. Book Antiqua with ample margins. Style should conform to our house format. Required information for each of the manuscript sections is as follows:

Title page

Title: Title should be less than 12 words.

Running title: A short running title of less than 6 words should be provided.

Authorship: Authorship credit should be in accordance with the standard proposed by ICMJE, based on (1) substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; (2) drafting the article or revising it critically for important intellectual content; and (3) final approval of the version to be published. Authors should meet conditions 1, 2, and 3.

Institution: Author names should be given first, then the complete name of institution, city, province and postcode. For example, Xu-Chen Zhang, Li-Xin Mei, Department of Pathology, Chengde Medical College, Chengde 067000, Hebei Province, China. One author may be represented from two institutions, for example, George Sgourakis, Department of General, Visceral, and Transplantation Surgery, Essen 45122, Germany; George Sgourakis, 2nd Surgical Department, Korgialenio-Benakio Red Cross Hospital, Athens 15451, Greece

Author contributions: The format of this section should be: Author contributions: Wang CL and Liang L contributed equally to this work; Wang CL, Liang L, Fu JF, Zou CC, Hong F and Wu XM designed the research; Wang CL, Zou CC, Hong F and Wu XM performed the research; Xue JZ and Lu JR contributed new reagents/analytic tools; Wang CL, Liang L and Fu JF analyzed the data; and Wang CL, Liang L and Fu JF wrote the paper.

Supportive foundations: The complete name and number of supportive foundations should be provided, *e.g.*, Supported by National Natural Science Foundation of China, No. 30224801

Correspondence to: Only one corresponding address should be provided. Author names should be given first, then author title, affiliation, the complete name of institution, city, postcode, province, country, and email. All the letters in the email should be in lower case. A space interval should be inserted between country name and email address. For example, Montgomery Bissell, MD, Professor of Medicine, Chief, Liver Center, Gastroenterology Division, University of California, Box 0538, San Francisco, CA 94143, United

States. montgomery.bissell@ucsf.edu

Telephone and fax: Telephone and fax should consist of +, country number, district number and telephone or fax number, *e.g.*, Telephone: +86-10-85381892 Fax: +86-10-85381893

Peer reviewers: All articles received are subject to peer review. Normally, three experts are invited for each article. Decision on acceptance is made only when at least two experts recommend publication of an article. All peer-reviewers are acknowledged on Express Submission and Peer-review System website.

Abstract

There are unstructured abstracts (no less than 200 words) and structured abstracts. The specific requirements for structured abstracts are as follows:

An informative, structured abstract should accompany each manuscript. Abstracts of original contributions should be structured into the following sections: AIM (no more than 20 words; Only the purpose of the study should be included. Please write the Aim in the form of "To investigate/study/..."), METHODS (no less than 140 words for Original Articles; and no less than 80 words for Brief Articles), RESULTS (no less than 150 words for Original Articles and no less than 120 words for Brief Articles; You should present *P* values where appropriate and must provide relevant data to illustrate how they were obtained, *e.g.*, 6.92 ± 3.86 vs 3.61 ± 1.67 , $P < 0.001$), and CONCLUSION (no more than 26 words).

Key words

Please list 5-10 key words, selected mainly from *Index Medicus*, which reflect the content of the study.

Core tip

Please write a summary of less than 100 words to outline the most innovative and important arguments and core contents in your paper to attract readers.

Text

For articles of these sections, original articles and brief articles, the main text should be structured into the following sections: INTRODUCTION, MATERIALS AND METHODS, RESULTS and DISCUSSION, and should include appropriate Figures and Tables. Data should be presented in the main text or in Figures and Tables, but not in both.

Illustrations

Figures should be numbered as 1, 2, 3, *etc.*, and mentioned clearly in the main text. Provide a brief title for each figure on a separate page. Detailed legends should not be provided under the figures. This part should be added into the text where the figures are applicable. Keeping all elements compiled is necessary in line-art image. Scale bars should be used rather than magnification factors, with the length of the bar defined in the legend rather than on the bar itself. File names should identify the figure and panel. Avoid layering type directly over shaded or textured areas. Please use uniform legends for the same subjects. For example: Figure 1 Pathological changes in atrophic gastritis after treatment. A: ...; B: ...; C: ...; D: ...; E: ...; F: ...; G: ... *etc.* It is our principle to publish high resolution-figures for the E-versions.

Tables

Three-line tables should be numbered 1, 2, 3, *etc.*, and mentioned clearly in the main text. Provide a brief title for each table. Detailed legends should not be included under tables, but rather added into the text where applicable. The information should complement, but not duplicate the text. Use one horizontal line under the title, a second under column heads, and a third below the Table, above any footnotes. Vertical and italic lines should be omitted.

Notes in tables and illustrations

Data that are not statistically significant should not be noted. ^a*P* <

Instructions to authors

0.05, ^b $P < 0.01$ should be noted ($P > 0.05$ should not be noted). If there are other series of P values, ^c $P < 0.05$ and ^d $P < 0.01$ are used. A third series of P values can be expressed as ^e $P < 0.05$ and ^f $P < 0.01$. Other notes in tables or under illustrations should be expressed as ¹F, ²F, ³F; or sometimes as other symbols with a superscript (Arabic numerals) in the upper left corner. In a multi-curve illustration, each curve should be labeled with ●, ○, ■, □, ▲, △, etc., in a certain sequence.

Acknowledgments

Brief acknowledgments of persons who have made genuine contributions to the manuscript and who endorse the data and conclusions should be included. Authors are responsible for obtaining written permission to use any copyrighted text and/or illustrations.

REFERENCES

Coding system

The author should number the references in Arabic numerals according to the citation order in the text. Put reference numbers in square brackets in superscript at the end of citation content or after the cited author's name. For citation content which is part of the narration, the coding number and square brackets should be typeset normally. For example, "Crohn's disease (CD) is associated with increased intestinal permeability^[1,2]". If references are cited directly in the text, they should be put together within the text, for example, "From references^[19,22-24], we know that..."

When the authors write the references, please ensure that the order in text is the same as in the references section, and also ensure the spelling accuracy of the first author's name. Do not list the same citation twice.

PMID and DOI

Please provide PubMed citation numbers to the reference list, e.g., PMID and DOI, which can be found at <http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed> and <http://www.crossref.org/SimpleTextQuery/>, respectively. The numbers will be used in E-version of this journal.

Style for journal references

Authors: the name of the first author should be typed in bold-faced letters. The family name of all authors should be typed with the initial letter capitalized, followed by their abbreviated first and middle initials. (For example, Lian-Sheng Ma is abbreviated as Ma LS, Bo-Rong Pan as Pan BR). The title of the cited article and italicized journal title (journal title should be in its abbreviated form as shown in PubMed), publication date, volume number (in black), start page, and end page [PMID: 11819634 DOI: 10.3748/wjg.13.5396].

Style for book references

Authors: the name of the first author should be typed in bold-faced letters. The surname of all authors should be typed with the initial letter capitalized, followed by their abbreviated middle and first initials. (For example, Lian-Sheng Ma is abbreviated as Ma LS, Bo-Rong Pan as Pan BR) Book title. Publication number. Publication place: Publication press, Year: start page and end page.

Format

Journals

English journal article (list all authors and include the PMID where applicable)

- 1 **Jung EM**, Clevert DA, Schreyer AG, Schmitt S, Rennert J, Kubale R, Feuerbach S, Jung F. Evaluation of quantitative contrast harmonic imaging to assess malignancy of liver tumors: A prospective controlled two-center study. *World J Gastroenterol* 2007; **13**: 6356-6364 [PMID: 18081224 DOI: 10.3748/wjg.13.6356]

Chinese journal article (list all authors and include the PMID where applicable)

- 2 **Lin GZ**, Wang XZ, Wang P, Lin J, Yang FD. Immunologic effect of Jianpi Yishen decoction in treatment of Pixu-diarhoea. *Shijie Huaren Xiaohua Zazhi* 1999; **7**: 285-287

In press

- 3 **Tian D**, Araki H, Stahl E, Bergelson J, Kreitman M. Signature

of balancing selection in Arabidopsis. *Proc Natl Acad Sci USA* 2006; In press

Organization as author

- 4 **Diabetes Prevention Program Research Group**. Hypertension, insulin, and proinsulin in participants with impaired glucose tolerance. *Hypertension* 2002; **40**: 679-686 [PMID: 12411462 PMID:2516377 DOI:10.1161/01.HYP.0000035706.28494.09]

Both personal authors and an organization as author

- 5 **Vallancien G**, Emberton M, Harving N, van Moorselaar RJ; Alf-One Study Group. Sexual dysfunction in 1, 274 European men suffering from lower urinary tract symptoms. *J Urol* 2003; **169**: 2257-2261 [PMID: 12771764 DOI:10.1097/01.ju.0000067940.76090.73]

No author given

- 6 21st century heart solution may have a sting in the tail. *BMJ* 2002; **325**: 184 [PMID: 12142303 DOI:10.1136/bmj.325.7357.184]

Volume with supplement

- 7 **Geraud G**, Spierings EL, Keywood C. Tolerability and safety of frovatriptan with short- and long-term use for treatment of migraine and in comparison with sumatriptan. *Headache* 2002; **42** Suppl 2: S93-99 [PMID: 12028325 DOI:10.1046/j.1526-4610.42.s2.7.x]

Issue with no volume

- 8 **Banit DM**, Kaufer H, Hartford JM. Intraoperative frozen section analysis in revision total joint arthroplasty. *Clin Orthop Relat Res* 2002; (**401**): 230-238 [PMID: 12151900 DOI:10.1097/00003086-200208000-00026]

No volume or issue

- 9 Outreach: Bringing HIV-positive individuals into care. *HRS-A Careaction* 2002; 1-6 [PMID: 12154804]

Books

Personal author(s)

- 10 **Sherlock S**, Dooley J. Diseases of the liver and biliary system. 9th ed. Oxford: Blackwell Sci Pub, 1993: 258-296

Chapter in a book (list all authors)

- 11 **Lam SK**. Academic investigator's perspectives of medical treatment for peptic ulcer. In: Swabb EA, Azabo S. Ulcer disease: investigation and basis for therapy. New York: Marcel Dekker, 1991: 431-450

Author(s) and editor(s)

- 12 **Breedlove GK**, Schorfheide AM. Adolescent pregnancy. 2nd ed. Wiczorek RR, editor. White Plains (NY): March of Dimes Education Services, 2001: 20-34

Conference proceedings

- 13 **Harnden P**, Joffe JK, Jones WG, editors. Germ cell tumours V. Proceedings of the 5th Germ cell tumours Conference; 2001 Sep 13-15; Leeds, UK. New York: Springer, 2002: 30-56

Conference paper

- 14 **Christensen S**, Oppacher F. An analysis of Koza's computational effort statistic for genetic programming. In: Foster JA, Lutton E, Miller J, Ryan C, Tettamanzi AG, editors. Genetic programming. EuroGP 2002: Proceedings of the 5th European Conference on Genetic Programming; 2002 Apr 3-5; Kinsdale, Ireland. Berlin: Springer, 2002: 182-191

Electronic journal (list all authors)

- 15 Morse SS. Factors in the emergence of infectious diseases. Emerg Infect Dis serial online, 1995-01-03, cited 1996-06-05; 1(1): 24 screens. Available from: URL: <http://www.cdc.gov/ncidod/eid/index.htm>

Patent (list all authors)

- 16 **Pagedas AC**, inventor; Ancel Surgical R&D Inc., assignee. Flexible endoscopic grasping and cutting device and positioning tool assembly. United States patent US 20020103498. 2002 Aug 1

Statistical data

Write as mean \pm SD or mean \pm SE.

Statistical expression

Express *t* test as *t* (in italics), *F* test as *F* (in italics), chi square test as χ^2 (in Greek), related coefficient as *r* (in italics), degree of freedom as ν (in Greek), sample number as *n* (in italics), and probability as *P* (in italics).

Units

Use SI units. For example: body mass, *m* (B) = 78 kg; blood pressure, *p* (B) = 16.2/12.3 kPa; incubation time, *t* (incubation) = 96 h; blood glucose concentration, *c* (glucose) 6.4 ± 2.1 mmol/L; blood CEA mass concentration, *p* (CEA) = 8.6 24.5 $\mu\text{g/L}$; CO₂ volume fraction, 50 mL/L CO₂, not 5% CO₂; likewise for 40 g/L formaldehyde, not 10% formalin; and mass fraction, 8 ng/g, *etc.* Arabic numerals such as 23, 243, 641 should be read 23243641.

The format for how to accurately write common units and quantum numbers can be found at: http://www.wjgnet.com/2218-6247/g_info_20100724224620.htm.

Abbreviations

Standard abbreviations should be defined in the abstract and on first mention in the text. In general, terms should not be abbreviated unless they are used repeatedly and the abbreviation is helpful to the reader. Permissible abbreviations are listed in Units, Symbols and Abbreviations: A Guide for Biological and Medical Editors and Authors (Ed. Baron DN, 1988) published by The Royal Society of Medicine, London. Certain commonly used abbreviations, such as DNA, RNA, HIV, LD50, PCR, HBV, ECG, WBC, RBC, CT, ESR, CSF, IgG, ELISA, PBS, ATP, EDTA, mAb, can be used directly without further explanation.

Italics

Quantities: *t* time or temperature, *c* concentration, *A* area, *l* length, *m* mass, *V* volume.

Genotypes: *gyrA*, *arg 1*, *c myc*, *c fos*, *etc.*

Restriction enzymes: *EcoRI*, *HindI*, *BamHI*, *Kho I*, *Kpn I*, *etc.*

Biology: *H. pylori*, *E. coli*, *etc.*

Examples for paper writing

All types of articles' writing style and requirement will be found in the link: <http://www.wjgnet.com/esps/NavigationInfo.aspx?id=15>

RESUBMISSION OF THE REVISED MANUSCRIPTS

Authors must revise their manuscript carefully according to the revision policies of Baishideng Publishing Group Co., Limited. The revised version, along with the signed copyright transfer agreement,

responses to the reviewers, and English language Grade A certificate (for non-native speakers of English), should be submitted to the online system *via* the link contained in the e-mail sent by the editor. If you have any questions about the revision, please send e-mail to esps@wjgnet.com.

Language evaluation

The language of a manuscript will be graded before it is sent for revision. (1) Grade A: priority publishing; (2) Grade B: minor language polishing; (3) Grade C: a great deal of language polishing needed; and (4) Grade D: rejected. Revised articles should reach Grade A.

Copyright assignment form

Please download a Copyright assignment form from http://www.wjgnet.com/2218-6247/g_info_20100724224507.htm.

Responses to reviewers

Please revise your article according to the comments/suggestions provided by the reviewers. The format for responses to the reviewers' comments can be found at: http://www.wjgnet.com/2218-6247/g_info_20100724224317.htm.

Proof of financial support

For papers supported by a foundation, authors should provide a copy of the approval document and serial number of the foundation.

Statement about anonymous publication of the peer reviewers' comments

In order to increase the quality of peer review, push authors to carefully revise their manuscripts based on the peer reviewers' comments, and promote academic interactions among peer reviewers, authors and readers, we decide to anonymously publish the reviewers' comments and author's responses at the same time the manuscript is published online.

PUBLICATION FEE

WJO is an international, peer-reviewed, OA online journal. Articles published by this journal are distributed under the terms of the Creative Commons Attribution Non-commercial License, which permits use, distribution, and reproduction in any medium and format, provided the original work is properly cited. The use is non-commercial and is otherwise in compliance with the license. Authors of accepted articles must pay a publication fee. Publication fee: 698 USD per article. All invited articles are published free of charge.



Published by **Baishideng Publishing Group Inc**

8226 Regency Drive, Pleasanton, CA 94588, USA

Telephone: +1-925-223-8242

Fax: +1-925-223-8243

E-mail: bpgoffice@wjgnet.com

Help Desk: <http://www.wjgnet.com/esps/helpdesk.aspx>

<http://www.wjgnet.com>

