

ENT-S01

Ultrasound Combined with Microbubbles for Inner Ear Drug Delivery

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Intratympanic (IT) delivery of therapeutic agents is often utilized to treat inner ear diseases. Compared with the systemic route for drug delivery, this delivery route has superior characteristics, including the lack of interference from the blood-labyrinth barrier and the lack of systemic adverse effects of drugs. Ultrasound in conjunction with microbubbles exerts physical effect including the amplified acoustic emissions to cause micro-jetting, microstreaming, and rectified radiation force, and the application including sonoporation, sonophoresis, and capillary permeation. Additionally, recently it has been demonstrated the feasibility of utilizing US-mediated MB cavitation via the external auditory canal to facilitate drug delivery into the inner ear. In this presentation, we aim to report the feasibility of the recent progress of using microbubble-enhanced approach for inner-ear enhanced drug delivery.

ENT-S02

Differences in the Ultrasonographic Appearance of Thyroid Nodules after Radiofrequency Ablation

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Radiofrequency ablation (RFA) is a well-tolerated approach to treating benign thyroid

nodules (TNs), but no index can predict its success. Other than size decrease, little is known about TN appearance on ultrasonography (US) after RFA. A total of 116 patients (137 nodules) were included in the study. Characteristics were quantified using commercial software. TNs were classified into 2015 American Thyroid Association (ATA) sonographic patterns and American College of Radiology Thyroid Imaging Reporting and Data System (ACR TI-RADS) categories. The average volume reduction ratio (VRR) was 74.51% in one year (95% confidence interval, 70.63–78.39%). The only pre-ablation US feature significantly different between nodules with VRR<50% and VRR>50% was the cyst composition (0.05 vs. 0.02, p-value=0.02). The VRR and margin change in the first three months after ablation were found to be leading indicators significantly correlated to the VRR in six months with correlation coefficients (r)=0.72 and -0.28 (p-value <0.0001 and =0.0008) and VRR in one year with r=0.65 and -0.17 (p-value <0.0001 and =0.046), respectively. After RFA, more TNs became ATA high suspicion (2.9% vs. 19.7%, p<0.0001) and more appeared to be the non-ATA patterns (12.4% vs. 23.4%, p<0.0001). Also, a greater number of post-RFA TNs were classified as ACR-TIRADS categories 4 and 5 (40.1% vs. 70.1%, p<0.0001). In conclusion, RFA therapy is effective for treating TNs. Pre-ablation cyst components, 3-month post-ablation volume reduction, and margin change of TNs were related to the 6-month and 1-year response. Clinicians should consider that TNs would appear peculiar on US after RFA, mistakenly suggesting malignant potential.

ENT-S03

Development of Ultrasound-guided RFA

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Radiofrequency ablation (RFA) is a wide-used minimal invasive surgery for oncology therapy. During RFA procedure, ultrasound imaging plays an

importance role for guiding the percutaneous insertion of the RF electrode to the target area. In addition, the ablation zone will be monitored by the ultrasound image during the procedure. In order to verify the ablation zone completeness, the ultrasound contrast agent will be suggested to use before and after the ablation. For the same purpose to verify the ablation zone, we developed an imaging processing tool and algorithm aiming to assist the clinical professional simply performing this post-ablation verification. Further, we repeatedly verified and optimized our tool through ex-vivo tissue study. With the ex-vivo tissue tests, our tool could perform the ablation zone measurement with an error less than 2 mm in comparison with the tissue slice. Further, we will optimize and present the performance of our ultrasound-guided iRFA tool with the in-vivo animal model. On the other hand, We aim to provide the technology solution to meet clinical needs of RFA. Hence, we have developed the ultrasound-guided iRFA platform to provide the one-stop shop RFA service.

ENT-S04

Recent Advance of Sonography Guide Intervention on Thyroid Nodule

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Sonography guided Fine needle aspiration (FNA) is the gold standard evaluation of thyroid nodule. With the publication of Bethesda system for reports thyroid cytopathology, the adequacy of cellularity is important for diagnosis of thyroid nodule. Recent advance including the technique of FNA and the interpretation of FNA results will be review in this talk.

The intervention and treatment of thyroid nodule is also an emerging field of interest. Several guidelines have been published to recommend the indication, technique and follow up for thyroid nodule followed treatment procedure. For recurrent thyroid cyst, ethanol injection is the first line

intervention, as for solid benign thyroid nodules, radiofrequency ablation (RFA) is treatment of choice for patients refuse surgery. The recent advance technique and the efficacy of these intervention will also be review in this talk.

ENT-S05

Recurrent Laryngeal Nerve Injury in Ultrasound-guided Ethanol Ablation and Radiofrequency Ablation Procedures for Thyroid Diseases

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Ethanol ablation (EA) and radiofrequency ablation (RFA) have been increasingly proposed as treatment options for thyroid diseases. Thyroid ultrasound-guided ablation procedures can reduce the need for surgery and avoid surgical complications especially in benign thyroid lesions. Dysphonia after thyroid ablation procedures is one of major concerns for both patients and physicians. Recurrent laryngeal nerve (RLN) injury in the EA procedure is usually caused by the spillage of ethanol outside the lesion and directly contacting the nerve to cause protein denaturation; and RLN injury in the RFA is usually caused by lateral thermal spread and causing protein denaturation even into endoneurium without direct contact between the device and nerve, and result in more risk of irreversible RLN injury. To illustrate the mechanism of RLN injury during EA and RFA, the intraoperative neuromonitoring (IONM) system, a technique that has been widely used in open and remote thyroid surgeries, showed great potential. In this talk, the latest research on the mechanism of RLN injury during thyroid ablation procedures will be introduced.

ENT-S06

Sonographic Predictor for Airway Assessment: An Alternative Tool for Predicting the Difficult Airway during Covid-19 Pandemic

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Upper airway assessment in selected patients before intubation may reduce the number of unanticipated difficult intubation and modified the airway management plan. However, due to the COVID-19 pandemic, and the disease is mainly transmitted via the respiratory route, laryngoscopy may create infectious aerosols during endoscope manipulation, a hazard for otolaryngologists and staff involved.

Alternative tools should be considered to predict difficult airway. Neck sonography is a non-invasive diagnostic tool that is available in the operating room and emergency departments, several sonographic parameters have been shown as possible indicators of a difficult airway, including skin to the hyoid bone, skin to the epiglottis, skin to the anterior commissure of vocal cords, pre-epiglottis space to distance between epiglottis and midpoint between vocal cords, hyomental distance in neutral and hyomental distance in extended position, and the ratio of hyomental distance in neutral to extended.

These sonographic parameters may help identify patients with difficult airway, but cannot replace laryngoscope examination especially in patients with head and neck tumor history. Neck sonography may be an alternative choice for difficult airway evaluation at COVID-19 patients.

ENT-P01

Preliminary Data on Ultrasound Application in Nasal Trauma

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Background: Nasal bone fracture is the most common facial fracture and is usually diagnosed by clinical examination. Although clinical examinations are considered standard for diagnosing nasal fractures, hematoma and edema of adjacent tissues make it difficult to diagnose them. Conventional radiography remains the standard imaging procedure but is prone to misinterpretation. Computed tomography (CT) is considered to be a more accurate diagnostic tool than conventional radiography for complex facial fractures, especially mid-facial fractures. However, CT is not readily available and exposes the patient to high doses of penetrating radiation. The purpose of this study was to evaluate and compare the clinical utility of ultrasound (US).

Materials and methods:

Subjects

Patients with nasal trauma prospectively underwent US examinations of the nose from April 2021. Plain radiographs were obtained in all cases, and CT was performed if there were multiple facial fractures or periorbital complications. Exclusion criteria included a previous history of nasal bone fracture, other maxillofacial fracture, pregnancy, and an unstable patient condition.

Ultrasound: Ultrasound data were acquired using Hitachi Arietta 60 ultrasound machine, equipped with a linear array transducer (L64 Hitachi Medial System, a linear 38 mm, 18-5 MHz). The midface of the patients was prepared by approximately a one-centimeter layer of commercial ultrasound coupling gel. The transducer was gently applied to this layer while avoiding the inclusion of air bubbles between transducer space and gel. The acquisition of transverse ultrasonographic data started from the midline of the gallebella in a noncontracted state to the nasal tip. The data of the lateral nasal wall (LNW) was acquired by adjusting the transducer to an oblique position placing on the LNW.

Results: 4 female patients with nasal trauma underwent US examinations of the nose. Plain radiographs were obtained in all cases, CT was

performed in one patient who had periorbital ecchymosis. One patient underwent closed reduction. Nasal fracture lines in LNW were found in 2 patients with US. No fracture line was found in all conventional radiography or CT.

Conclusion: Advantages of US include the ability to be rapidly performed, and the absence of radiation. The preliminary data showed promising results that US to be useful for detecting fine nasal bone fracture lines.

ENT-P02

Machine Learning on Ultrasound Texture Analysis Data for Characterizing of Salivary Glandular Tumors: A Feasibility Study

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Background: Objective quantitative texture characteristics may be helpful in salivary glandular tumor differential diagnosis. This study uses machine learning (ML) to explore and validate the performance of ultrasound (US) texture features in diagnosing salivary glandular tumors.

Materials and methods: 122 patients with salivary glandular tumors, including 71 benign and 51 malignant tumors, are enrolled. A representative brightness mode US pictures are selected for further Gray Level Co-occurrence Matrix (GLCM) texture analysis. We use t-test to test the significance and use receiver operating characteristic curve method to find optimal cut-point for these significant features. After splitting 80% data into training set and 20% data into testing set, we use five machine learning models: k-nearest Neighbors (kNN), Naïve Bayes, Logistic regression, Artificial Neural Networks (ANN) and supportive vector machine (SVM) to explore and validate the performance of US GLCM texture features in diagnosing salivary glandular tumors.

Results: This study includes 49 female and 73 male patients, with a mean age of 53 years old, ranging from 21 to 93. We find that six GLCM texture features (contrast, inverse difference movement, entropy, dissimilarity, inverse difference and difference entropy) are significantly different between benign from malignant tumors ($p < 0.05$). On ML, the overall accuracy rates are 74.3% (95%CI: 59.8-88.8%), 94.3% (86.6-100%), 72% (54-89%), 84% (69.5-97.3%) and 73.5% (58.7-88.4%) for kNN, Naïve Bayes, Logistic regression, one node ANN and SVM, respectively.

Conclusion: US texture analysis with ML has potential as an objective and valuable tool for assessment of salivary gland tumors.

(Keywords: ultrasound; texture analysis; machine learning)