Emission Computed Tomography for the Diagnosis of Mandibular Invasion by Head and Neck Cancers: A Systematic Review and Meta-Analysis

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Purpose: To detect the diagnostic efficacy of emission computed tomography (ECT) in detecting mandibular invasion caused by head and neck cancers.

Materials and Methods: Thirteen databases were searched electronically to retrieve studies for inclusion and a manual search also was conducted. Study inclusion, data extraction, and quality assessment were completed by 2 reviewers independently. Meta-DiSc 1.4 and STATA 11.0 were used to conduct the meta-analysis.

Results: Seventeen studies involving 668 participants were included. One study had a low risk of bias, 2 had a high risk, and the rest had unclear risk. Meta-analysis showed that for the diagnosis of mandibular invasion single-photon ECT (SPECT) had a mean sensitivity (SEN) of 0.96, a mean specificity (SPE) of 0.66, an area under the curve (AUC) of 0.8989, and a Q* (point on the summary reviewer operator characteristic curve when SEN equaled SPE) of 0.8300. Positron emission tomography combined with computed tomography (PET/CT) had a mean SEN of 0.83, a mean SPE of 0.90, an AUC of 0.9290, and a Q* of 0.8640. The comparison between the diagnostic efficacy of SPECT and PET/CT showed that SPECT was superior for SEN ($P = .0014$) and PET/CT had a significantly better SPE ($P = .001$). The summary diagnostic efficacy between these modalities did not differ significantly ($P > .05$).

Conclusions: The present clinical evidence showed that SPECT is an excellent tool to exclude patients with no mandibular invasion, but is not as good as PET/CT to confirm the diagnosis.

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For patients with head and neck cancers approaching the mandible, mandibular cancer invasion seems to be quite common.[1] Identification of bone invasion is of urgent importance for clinicians, which could help with the decision of whether to conduct mandibulectomy and what kind of mandibulectomy should be adopted.[2] For superior physical examinations, medical imaging is the main tool for detecting bone invasion.[3]

Each imaging diagnostic tool has advantages compared with others and none of them have 100%

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accuracy. Many studies have evaluated the efficiency of different imaging methods for detecting mandibular invasion by head and neck cancers. However, none have arrived at a systematic conclusion of how accurate these methods are. Emission computed tomography (ECT), including single-photon ECT (SPECT) and positron ECT (PET), is a nuclear medicine tomographic imaging technique; in addition, PET can be combined with CT (PET/CT).[4,5] SPECT and PET/CT have proved valuable in oncology and are considered excellent radiologic examinations for detecting bone invasion because they can visualize functional rather than anatomic changes and provide information about the extent of invasion.[6] Although widely researched, ECT is not considered the most ideal in some of the literature.[7] Researchers have reported different diagnostic efficacies of ECT in the diagnosis of mandibular invasion. Therefore, this systematic review, which aimed at determining the diagnostic efficacy of ECT for distinguishing mandibular invasion by head and neck cancers, could be important.

Materials and Methods

As a systematic review, this study was exempt from institutional review board approval and all authors followed the guidelines for research as stated in the Declaration of Helsinki.

INCLUSION CRITERIA

Those studies that met the following criteria were considered eligible for this systematic review. *1)* The study should test diagnostic accuracy and be designed as a cohort study; *2)* the participants should have been diagnosed with head and neck cancers by preoperative biopsy examination and undergone mandibulectomy; *3)* the index test should be ECT including SPECT or PET/CT; *4)* the reference standard should be pathologic diagnosis; and *5)* the outcomes should be true positive (TP), false positive (FP), false negative (FN), true negative (TN), or related data that could help calculate these values.

SEARCH STRATEGY

To find all possibly relevant studies, electronic and manual searches were conducted. The bibliographic databases searched included the Cochrane Oral Health Group's Trials Register (to Issue 4, 2014), the Cochrane Central Register of Controlled Trials (CENTRAL, through The Cochrane Library, to Issue 11, 2014), MEDLINE (through OVID, 1948 to November 21, 2014), EMBASE (through OVID, 1980 to November 21, 2014), the Cumulative Index for Nursing and Allied Health Literature (CINAHL, through EBSCO, 1980 to November 21, 2014), the Latin American and Caribbean Health Sciences (LILACs, through BIREME 1980 to November 21, 2014), the Chinese Biomedical Literature Databases (CBM, 1978 to November 21, 2014), the China National Knowledge Infrastructure (CNKI, 1994 to November 21, 2014), the VIP database (1989 to November 21, 2014), and the Wangfang database (1998 to November 21, 2014). The Grey Literature databases also were searched electronically through Science Paper Online (to November 21, 2014), the System for Information on Grey Literature in Europe (OpenSIGLE, 1980 to 2005), and the World Health Organization International Clinical Trials Registry Platform (WHO ICTRP, to November 21, 2014). The search strategies were designed according to the Cochrane Handbook for Systematic Reviews of Diagnostic Test Accuracy, Version 0.4, which suggested a combination of Medical Subject Heading terms with free text words.[8] The terms used included *head and neck neoplasms; neoplasm invasiveness; jaw; tomography, emission-computed, single-photon; positron-emission tomography; sensitivity;* and *specificity*.

The manual search covered 14 related journals and references of the included studies were searched further for any eligible studies.

STUDY INCLUSION

Study selection was performed by 2 independent reviewers. Titles and abstracts were initially screened to find possibly eligible studies. Full texts of the possibly eligible studies were read further to judge whether they met the inclusion criteria. Any discrepancies between the 2 reviewers were resolved by discussion.

QUALITY ASSESSMENT

QUADAS-2 was adopted as the tool for quality assessment. It included 4 domains: patient selection, index test, reference standard, and flow and timing.[9] Each domain was assessed for risk of bias, and the first 3 domains also were assessed for concerns regarding applicability. Signaling questions were included to help judge risk of bias. In this systematic review, QUADAS-2 was tailored by omitting 2 signaling questions and developing review-specific guidance to judge the risk of bias. The 2 deleted signaling questions in the full QUADAS-2 tool were: "If a threshold was used, was it prespecified?" and "Did all patients receive the same reference standard?" For the patient selection part, 3 signal questions were included: "Was a consecutive or random sample of patients enrolled?," "Was a case-and-control design avoided?," and "Did the study avoid inappropriate exclusions?" For the index test part, 1 signal question was included: "Were the index test results interpreted without knowledge of the results of the reference standard?" For the reference standard part, 2 signal questions were included: "Was the reference standard likely to correctly classify