

Three-Dimensional Printed Plate-Guided I¹²⁵ Brachytherapy for Malignant Parotid Tumors

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Purpose: The treatment of malignant parotid tumors with ¹²⁵I brachytherapy is rarely reported. This study evaluated the efficacy and dose and response of ¹²⁵I brachytherapy in patients with malignant tumors.

Materials and Methods: From July 2014 through August 2017, 39 patients with malignant parotid tumors were treated with ¹²⁵I brachytherapy. Thirty-five patients were treated with conservative surgical resection before brachytherapy. Four patients were treated with brachytherapy alone. Clinical outcomes and side effects were evaluated. Clinical factors were investigated to determine correlations with local control (LC) and side effects.

Results: Mean follow-up was 25 months (range, 7 to 47 months). The LC rate was 87.2% and the overall survival rate was 97.4%. High tumor grade and large tumor showed a propensity for local recurrence. Acute skin toxicity occurred in 87.2% of patients and grade 3 and 4 radioepidermitis was found in 20.5% of patients. In total, 89.7% of patients with facial nerve dysfunction recovered within 12 months.

Conclusions: ¹²⁵I brachytherapy was a feasible treatment option for patients with malignant parotid tumors. Although side effects were minimal, strict follow-up was necessary for patients treated with a high dose.

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Malignant tumors of the parotid gland compose a group of histologically diverse neoplasms. Parotid gland carcinomas account for approximately 0.5% of all cancers and no more than 5% of tumors in the head and neck region.¹ The etiology of malignant parotid tumor has not been clearly established.²

Although these tumors progress slowly and can be easily diagnosed for superficial location, there are

often patients with adjacent organ invasion at stage T4 in whom the facial nerves are the most vulnerable.³ Traditionally believed to be radioresistant, the main treatment is surgery to remove the tumors radically without compromising the facial nerve. This therapeutic strategy will directly lead to facial esthetic deficits and affect patients' social communication.^{1,4} In recent years, resection combined with radiotherapy

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has become the main treatment option for tumors with an advanced stage or high clinical grade (T3 or T4).^{5,6}

Compared with external-beam radiotherapy, ¹²⁵I brachytherapy can consistently irradiate a limited area by delivering low doses of radiation precisely into the tumor and sparing adjacent unaffected tissue.⁷ Since the introduction of ¹²⁵I brachytherapy for prostate cancers and local control (LC) in 1975,⁸ many research reports have documented the feasibility of ¹²⁵I brachytherapy for many kinds of malignant tumors.^{9,10} Conventional stent insertion combined with ¹²⁵I seeding was recently reported to prolong the survival of a patient with advanced stage esophageal cancer.¹¹ With the recent development of the brachytherapy treatment planning system (BTPS) and individual plates, the accuracy of radioactive seed implants has been enhanced and ¹²⁵I brachytherapy can be applied to head and neck cancer.¹² In the present study, the authors reviewed their experience with the preliminary results of malignant parotid gland tumors treated with ¹²⁵I brachytherapy guided by individual plates.

Materials and Methods

STUDY DESIGN AND PATIENT SELECTION

The authors performed a retrospective evaluation of 39 patients (15 men and 24 women) with malignant parotid gland tumors treated with ¹²⁵I brachytherapy guided by individual plates from July 2014 through August 2017 at the School and Hospital of Stomatology at Wuhan University (Wuhan, China). The tumors were diagnosed by incisional biopsy examination or routine pathologic microscopy. Mucoepidermoid carcinoma in 11 patients was divided into a low-differentiated group, a medium-differentiated group, and a high-differentiated group. The extent of disease was classified by pathologic or clinical stages (¹²⁵I brachytherapy alone) according to the Cancer Staging Classification of the American Joint Committee on Cancer (2010).¹³ All patients with complete data and under follow-up were enrolled in this study. Patient characteristics are listed in Table 1.

The treatment methods and procedures were approved by the ethics committees of the School and Hospital of Stomatology at Wuhan University. Written informed consent was obtained from all patients included in this study.

TREATMENT

Thirty-five patients underwent surgical resection before ¹²⁵I brachytherapy, of which 17 underwent conservative surgical resection. The closely adherent facial nerve trunks were stripped from the tumor

Table 1. CHARACTERISTICS OF PATIENTS AND TUMORS

Characteristics	Value	%
Women/men	24/15	61.5/38.5
Age (yr), median (range)	42.8 (19-72)	
Follow-up period (mo), median (range)	24.4 (7-47)	
Clinical tumor stage		
T1	7	17.9
T2	19	48.
T3	3	7.7
T4	10	25.6
Histology		
Mucoepidermoid carcinoma	11	28.2
Low differentiated	1	
Medium differentiated	3	
High differentiated	7	
Adenoid cyst carcinoma	6	15.4
Acinic cell carcinoma	6	15.4
Pleomorphic adenoma	5	12.8
cancer		
Epithelial and myoepithelial carcinoma	2	5.1
Myoepithelial carcinoma	3	7.7
Salivary duct carcinoma	3	7.7
Squamous cell carcinoma	2	5.1
Adenocarcinoma	1	2.6
Treatment		
Parotidectomy and brachytherapy	35	89.7
Positive margin	14	40.0
Negative margin	17	48.6
Uncertain	4	11.4
Brachytherapy alone	4	10.3
¹²⁵ I seed activity (mCi)	0.6-0.8	
Prescription doses (Gy)		
100-120	27	69.2
120-140	12	30.8
Facial paralysis, yes/no	13/26	33.3/66.7

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mass. The infiltrated facial nerve trunks of 14 patients were separated from the tumor mass, leaving positive surgical margins. In 1 patient, the ruptured nerve was resutured during the operation. In 4 patients, parotid gland cancers were located in specific anatomic regions. One tumor was found in the skull base and another tumor involved the external jugular vein. Two tumors involved the facial nerves. Biopsy tumor specimens from these 4 patients were examined, and these patients underwent ¹²⁵I brachytherapy alone.

Only 1 patient underwent neck dissection for enlarged lymph nodes. The others did not undergo neck dissection because there was no evidence of metastasis through clinical examination and imaging tests.

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