Low versus High Dose Radioactive Iodine-131 Ablation of Remnant Thyroid Tissue after Surgical Treatment of Differentiated Thyroid Carcinoma

Thesis

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Abstract

This study is now redirected to Avoid the unneeded use of high doses of RAI-131 in post-operative ablation of residual thyroid tissue in cases of differentiated thyroid cancer with no gross residual disease or distal metastasis and to increase patient convenience, through administering low dose of ^{131}I to the postoperative patients indicated for ablation guided by pathology report, operative data, and trustable neck U.S. This study suggests that the low dose RAI-131 is as effective as the high doses in post-operative ablation of the residual thyroid tissue in patients of differentiated cancer with no gross residual disease or distal metastasis.

Keywords

- RAI-131
- Carcinoma
- ATC
- AGES
- FDG 18 –PET
- LT

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List of Abbreviations

AGES	(age, grade, extent, size)
AIT	Auto immune thyroiditis
AJCC	American Joint Committee on Cancer
AMES	(age, metastases, extent, size)
At 211	Astatin 211
ATA guidelines	American association guidelines
ATC	Anaplastic thyroid carcinomas
BRAF	B-type Rapidly growing fibrosarcoma kinase
CE CT	Contrast-enhanced computed tomography
Ci	Curie
CT	Computed tomography
DTC	Differentiated thyroid cancer
DxWBS	Diagnostic 131I whole-body scan
EBRT	External beam radiotherapy
ES	Elastosonography
FCT	Follicular thyroid cancer
FDG 18 -PET	Flurodeoxy glucose 18- positron emission tomography

FNAC	Fine needle aspiration cytology
FRTL-5	Fisher rat thyrocyte cell line no. 5”
FSH	Follicle stimulating hormone
GBq	Gega Bequrel
Gy	gray
HCC	Hürthle cell cancer
HT	Hashimoto’s thyroiditis
I123	Iodine 123
I131	iodine 131
IHC	immunohistochemical staining
kev	kiloelectron volt
LID	Low iodine diet
LN	lymph nodes
LT	Levothyroxin
MACIS	(metastases, age, completeness of resection, invasion, size)
MAPK	Mitogen-activated protein kinase
MBQ	Mega Becquerel
mCi	milli Curie

MDCT	Multi detectors computed tomography scanners
MEN	Multiple endocrine neoplasia (MEN)
MRI	Magnetic resonance imaging
MTC	Medullary thyroid cancers
NIS	Sodium-iodine symporter
NPV	Negative predictive value
PAX8/PPAR	Paired box gene 8/peroxisome proliferators activated receptor gamma rearrangemen
PDTC	Poorly differentiated thyroid carcinomas
PI3KCA	Phosphatidyleinositol 3- kinase cancer genes
PPV	positive predictive value
PTC	Papillary thyroid cancer
PTEN	Phosphatase and tensin homolog
PTMC	Papillary Thyroid Micro carcinoma
RAA	Radioactive iodine remnant ablation
RAI	Radioactive iodine
RAIU	Radioactive iodine uptake
RAS	Rat sarcoma
RBE	Radiobiologic effectiveness

RET/PTC	Rearrangements during transfection/papillary thyroid cancer
rhTSH	Recombinant human TSH
RTE	Real-Time Elastography
RxWBS	Post therapy whole body scan
SPECT	Single photon emission computed tomography
Tc99m	Technetium-99m
Tc 99m MIBI	Technitium99 m methoxyisobutylisonitrile
Tg	Thyroglobulin
TgAb	Anti-thyroglobulin antibodies
THW	Thyroid hormone withdrawal
TL 201	Thallium 201
TSH	Thyroid stimulating hormone
U.S	Ultrasound
WBS	Whole body scan
WDTC	Well differentiated thyroid cancer
WHO	World Health Organization

Introduction

Radioactive iodine (I^{131}) of the remaining thyroid tissue after total/near total thyroidectomy is well recognized as part of treatment of patients with differentiated thyroid carcinoma. High dose ablation (80-120 mCi) is part of Kasr Alaini guidelines for management of intermediate risk patients with differentiated thyroid carcinoma after surgical excision. Patients receiving high dose of I^{131} must be hospitalized for 2-3 days to prevent unnecessary radiation exposure of their families and the community. Using low dose (30 mCi) for ablation was believed to be significantly less effective than high doses.

Recently many studies have been published arguing that low dose (30mCi) RAI^{131} ablation is as effective as higher doses. Unlike higher doses patients receiving low doses of RAI^{131} (up to 30 mCi) are not required to stay in the hospital and treatment can be given on out-patient basis and patients are allowed to go home with certain written instructions. If we are able to prove this, it would have a tremendous effect on our practice regarding the hospital stay, overall cost of management and delay time patients need to experience waiting for a hospital room in the crowded centers.

Objectives of the study:

To compare results of the high and low doses of radioactive iodine-131 in postoperative ablation of differentiated thyroid cancer.

Pathology of Differentiated Thyroid Cancer

Thyroid cancer accounts for about 1% of human malignant neoplasm. However, it is the most common endocrine malignancy, comprising 90% of all endocrine malignant tumors (1). The incidence shows predominance for females with male: female ratio about 1:1.5 to 1:3, with a peak incidence seen in people 40–50 years old (2).

Classification of Malignant Thyroid Tumors (3)

A) Primary malignant tumors

Malignant tumors of follicular cells (Approximately 90% of thyroid tumors are derived from follicular cells**)**

- Papillary carcinoma.
- Follicular carcinoma.
- Oxyphilic or Hurthle cell carcinoma.
- Poorly differentiated carcinoma.
- Undifferentiated (anaplastic) carcinoma.

Malignant tumors of calcitonin-producing C cells

- Medullary carcinoma (5%).

Malignant tumors of mixed follicular and C cells

Miscellaneous epithelial tumors (rare)

- Squamous cell carcinoma.
- Adenosquamous carcinoma.
- Mucin-producing carcinoma.

Malignant non-epithelial (rare) tumors

- Malignant lymphoma.
- Sarcomas.
- Hemangioendothelioma.

B) Secondary tumors

- Metastatic melanoma.

- Metastatic renal cell carcinoma.
- Metastatic breast carcinoma.
- Metastatic pulmonary carcinoma.

Differentiated thyroid carcinoma

Papillary thyroid carcinoma (PTC) and follicular thyroid carcinoma (FTC) are together referred to as DTC. They contribute to 80% of thyroid cancer; they tend to be sporadic although occasionally PTC is familial (4)**.**

Papillary Thyroid Carcinoma

Papillary thyroid carcinoma is the most common well differentiated thyroid cancer (WDTC) representing 75%-85%, characterized by a complex branching architecture in which the surfaces of the papillary cores are covered by neoplastic cells. The diagnostic features include nuclear enlargement and irregularity, overlapping, clearing (ground glass or Orphan Annie) appearance, which is considered the main criterion for diagnosing papillary carcinoma, nuclear grooves, and the optical phenomenon caused by cytoplasmatic pseudo inclusions (pale karyoplasm condensing continuously to the nuclear membrane)(5).

The nuclei are densely arranged and often overlap each other (shingle roof pattern). Psammoma bodies (round laminated calcifications) are present in approximately 50% of cases and occur typically within the stroma or lymphatic channels. Intratumoral fibrosis and lymphocytic infiltrates are also common features of these tumors (5)**.**