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Accuracy of thyroid cancer diagnosis and surgery in patients with thyroid cancer may be affected by the Semipalatinsk Nuclear Test Site: A collaboration between Nagasaki (Japan) and Semipalatinsk (Kazakhstan) medical centers

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Background: From 1949 to 1989, 456 nuclear tests were conducted at the Semipalatinsk Nuclear Test Site (SNTS). Exposure was primarily from the first test in August 1949, an atomic bomb test in 1951, and a thermonuclear bomb test in 1953 that affected the Semipalatinsk region. Surgical procedures for patients with thyroid cancer in Semipalatinsk remain unclear. Assessing the clinical behavior of thyroid cancer in patients affected by the SNTS is crucial for confirming an accurate diagnosis and establishing standardized surgery. The first author has been collaborating with the Semey Oncology Center since 1999 to establish an optimal method to diagnose and perform thyroidectomy and lymph node dissection.
Objective: To assess the change in the diagnostic accuracy and thyroid surgery from 1999 to 2008 at Semey Oncology Center in collaboration with the Nagasaki University and Nagasaki Medical Center.
Materials and Methods: In this cross-sectional study, 169 patients with thyroid cancer who underwent thyroid surgery at the Semey Oncology Center from 1999 to 2008 were evaluated; 125 patients with papillary thyroid cancer were assessed.
Results: Before 2001, there were few preoperatively diagnosed thyroid cancer cases; since 2002, the number of preoperatively diagnosed papillary cancer cases increased. From 1999 to 2001, thyroid surgery, including cervical lymph node dissection, was not performed. Partial lobectomy was mainly performed until 2001. Since 2002, total lobectomy was most commonly performed; total thyroidectomy and lymph node dissection were rarely performed.
Conclusion: The optimal method for diagnosing thyroid cancer was performed, and an accurate diagnosis changed the surgical procedure.

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Key words: radiation-induced cancer, thyroidectomy, Semipalatinsk Nuclear Test Site

Introduction

The Semipalatinsk Nuclear Test Site (SNTS) was constructed by the former Soviet Union (USSR); it was located in the northern Kazakhstan region. The atmospheric testing site was at approximately 150 km west of Semipalatinsk. The USSR conducted atmospheric nuclear explosions at the SNTS on August 29, 1949. During the nuclear weapons testing,

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456 nuclear explosions were performed at this location. Of these 456 explosions, 88 were atmospheric and 30 were surface explosions. The last atmospheric test was conducted on December 24, 1962.[1] The main contributions to the local and regional environmental radioactive contaminations are attributed to the atmospheric tests conducted on August 29, 1949 (22 kt), September 24, 1951 (38 kt), August 12, 1953 (400 kt), March 16, 1956 (14 kt), and August 24, 1956 (27 kt). These tests are estimated to have contributed more than 85% of the collective dose of the population living close to the SNTS.[2]

Some publications which might have been influenced by the SNTS with respect to the incidence of several conditions, such as thyroid nodules and thyroid cancer.[3-5] However, it is very difficult to evaluate the biological behavior of papillary carcinoma of the thyroid, which may have been affected by radioactive fallout, if the surgical therapies are not standardized. Thyroid surgery and medical management for patients with papillary thyroid cancer were usually selected by patient assessment, such as medical care expenses, and by following the federal regulations for treatments.

Collaboration with surgeons of the Semey Oncology Center may change how surgery is performed for patients with papillary thyroid cancer. A drastic change in the treatment of patients with thyroid cancer may be economically and conceptually difficult. Therefore, we made the system easy to use, in order to access the University of Nagasaki for consultations regarding the diagnosis. In addition, the Japanese cytology technician remained at the Semipalatinsk diagnostic center several times for 3-6 months and delivered lectures on how to interpret fine needle aspiration biopsies of thyroid nodules, as part of the JICA project.

In these situations, we have collaborated with the Semey Oncology Center for thyroid surgery since 1999. The primary purpose of this collaboration was to improve the accuracy of preoperative thyroid cancer diagnosis, while the secondary purpose was to standardize thyroid surgery, especially the extent of thyroid resection.

Materials and Methods:

A total of 169 patients with different types of thyroid cancer were operated on in the Semey Oncology Center from 1999 to 2008, and 125 patients with papillary carcinoma were evaluated with respect to preoperative diagnosis and surgical procedures in this study, according to data from the Semey Oncology Center.

Surgical collaborations such as surgical lectures and live demonstrations for thyroid surgery were initiated. In addition, multidisciplinary approaches for papillary thyroid cancer including nurses, consultation by radiologic technologists, and the Japanese surgical team of thyroid specialists, also demonstrated the Japanese surgical method. Every annual visit to the Semey Oncology Center, consultation, and lectures on thyroid cancer via satellite (1999-2002) or the internet (through 2003) have been carried out since 1999 and have continued for 10 years.

We retrospectively assessed the change in the preoperative accurate diagnosis rates for thyroid cancer and surgical procedures, such as the extent of thyroid resection. These medical records were obtained when we visited the Semey Oncology Center.

A paired t test was performed to compare the partial lobectomy rates between 2000-2001 and 2002-2007.

Results

Table 1 shows the annual change in the preoperative diagnosis of thyroid cancer. Owing to the upgrade in the diagnostic accuracy of FNAB, the preoperatively diagnosed thyroid cancer rate has dramatically increased since 2000.

If thyroid cancer could be precisely diagnosed preoperatively, partial lobectomy was not recommended. Before 2000, partial lobectomy was the selected operative procedure. In general, partial lobectomy was not recommended for papillary thyroid cancer, barring certain exceptions. Therefore, partial lobectomy rate has decreased, but lobectomy rates have increased since 2002 significantly. Lymph node dissection was infrequently indicated at the Semey Oncology Center (Table 2 & 3).

Discussion

When surgeons from Semipalatinsk and Nagasaki began to collaborate in 1999, the extent of surgical resections for papillary thyroid cancers was small in comparison to the standard procedure. Preoperatively, a precise diagnosis for thyroid cancer was not made, since the health system infrastructure was not adequate due to economic and technical insufficiencies. Even if papillary thyroid cancer was diagnosed preoperatively, insufficient partial lobectomy was chosen. Most surgical procedures for patients with papillary cancer consisted of a partial lobectomy without lymph node dissection. However, this may not be sufficient for the extent of required thyroid resection. The MACIS score was introduced

to indicate the prognostic factor of papillary carcinoma and was necessary for sufficient resection of thyroid gland.[7] However, in some economic and medical situations, difficulty with thyroid hormone supply might effectuate a change in the surgical procedure, as required in some situations. Postoperative recurrence rates in Semey were not clearly investigated. The purpose of our collaboration with the Semey Oncology Center was to standardize the surgical procedures for the thyroid operation as much as possible. Preoperative diagnoses for thyroid cancer have improved during the 10-year period that began in Semipalatinsk in 1999. In addition, surgical procedures have slightly changed from a partial lobectomy to a lobectomy.

In general, thyroid cancer is a surgically treatable disease. Surgery is the most important treatment for papillary thyroid cancer under diagnostic accuracy.

Optimal diagnostic methods are regularly applied nowadays. In addition, accurate diagnosis of thyroid cancer has led to changes in the surgical procedures during the study period. Accurate diagnosis and standardized surgical procedures can help evaluate the biological characteristics of thyroid cancer cases that may be associated with the SNTS in the next decade.

Table 1. Annual change in the preoperative diagnosis of thyroid cancer. Preoperative diagnosis was made based on fine-needle aspiration biopsy (FNAB) specimens. According to the diagnostic accuracy of FNAB, preoperative rates of thyroid cancer have dramatically increased since 2002.

Preoperative Diagnosis	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Thyroid cancer (%)	1 (33)	4 (57)	16 (80)	15 (75)	19 (79)	7 (58)	8 (67)	17 (68)
Thyroid cancer (suspected)	1	1	1	2	3	3	2	4
Benign	0	2	3	1	1	1	0	3
Other disease	1	0	0	2	1	1	2	1
Total	3	7	20	20	24	12	12	25

Table 2. Partial lobectomy rate has gradually decreased. Since 2002, lobectomy rate has increased. In addition, lymph node dissection was infrequently indicated at the Semey Oncology Center.

Surgery Type	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Partial lobectomy (%)	3 (100)	5 (71)	11 (55)	7 (35)	6 (25)	2 (17)	2 (17)	4 (16)
Lobectomy	0	0	7	9	15	9	8	15
Subtotal thyroidectomy	0	1	1	1	1	0	0	2
Total thyroidectomy	0	1	1	0	2	1	2	3
Total	3	7	20	20	24	12	12	25
+ LND	1	0	0	3	0	1	3	0

LND: Lymph node dissection

Table 3. Comparison of surgical procedures rates between 2000-2001 and 2002-2007. Partial lobectomy rate has decreased, but lobectomy rate has increased significantly.

	2000-2001	2002-2007	
Average rate of partial lobectomy (%)	86	28	p=0.0048
Average rate of lobectomy (%)	0	58	p=0.002
Average rate of subtotal thyroidectomy (%)	7	4	NS
Average rate of total thyroidectomy (%)	7	9	NS

NS: not significant

Ethics approval

The requirement of obtaining informed consent was waived, due to the retrospective nature of the study.

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