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Analysis of Thyroid Cancer Incidence Trends in Altai Krai Focusing on the Impact of Papillary Microcarcinomas on Morbidity Structure

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ABSTRACT

BACKGROUND: In recent years, the incidence of thyroid cancer has been increasing, primarily due to the rising detection of papillary microcarcinomas (T1a). However, the mortality rates have not declined. This study is devoted to evaluate trends in thyroid cancer incidence in Altai Krai, with a particular focus on the T1a subcategory.

AIM: The work aimed to study the trends of thyroid cancer incidence in Altai Krai in 2014–2023, with a focus on tumors at the papillary microcarcinoma stage (T1a), including their recurrence rates.

METHODS: Data from the regional cancer registry were used. Incidence rates, stage distribution, histological structure, and recurrence rates were assesed. The data were than compared to those from across Russia, along with the international data on active observation.

RESULTS: The incidence rate in the region was 3–4 times higher than the average rate in Russia. Stage T1 accounted for 66.4% of cases, with T1a representing 36.1%. The recurrence rate of papillary microcarcinomas remained below 4%, with a declining trend reaching 0.35% in 2023.

CONCLUSION: The high proportion of early-stage tumors and the low recurrence rate of papillary microcarcinomas highlight the potential for incorporating active surveillance strategies into Russian clinical practice.

Keywords: thyroid cancer; papillary microcarcinoma; active surveillance; incidence; Altai Krai.

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Анализ динамики заболеваемости раком щитовидной железы в Алтайском крае с акцентом на вклад папиллярных микрокарцином в структуру заболевания

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АННОТАЦИЯ

Обоснование. В последние годы растёт заболеваемость раком щитовидной железы, в основном за счёт папиллярных микрокарцином (T1a). Уровень смертности не снижается. Настоящее исследование посвящено оценке динамики заболеваемости раком щитовидной железы в Алтайском крае с акцентом на подкатегорию T1a.

Цель — изучение динамики заболеваемости раком щитовидной железы в Алтайском крае за период с 2014 по 2023 гг. с акцентом на анализ опухолей стадии папиллярных микрокарцином, включая частоту их рецидивов.

Материалы и методы. Использовали данные регионального канцер-регистра. Оценивали показатели заболеваемости, стадийное распределение, гистологическую структуру и частоту рецидивов. Выполнено сравнение с российскими данными и обзор международного опыта активного наблюдения.

Результаты. Уровень заболеваемости в регионе превышал среднероссийский в 3–4 раза. Стадия T1 встречалась в 66,4% случаев, из них T1a — в 36,1%. Доля рецидивов папиллярных микрокарцином составила менее 4% с тенденцией к снижению до 0,35% в 2023 г.

Заключение. Высокая доля ранних форм и низкий уровень рецидивов папиллярных микрокарцином подчёркивают потенциал для внедрения тактики активного наблюдения в российскую практику.

Ключевые слова: рак щитовидной железы; папиллярная микрокарцинома; активное наблюдение; заболеваемость; Алтайский край.

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BACKGROUND

In recent years, many countries, including Russia, have reported an increasing incidence of thyroid cancer (TC). One of the key factors behind this trend is the overdiagnosis of subclinical forms of papillary microcarcinoma (PMC), tumors ⩽ 1 cm in size corresponding to the T1a subcategory. Despite the rising detection rates, mortality from TC has remained stable [1], raising doubts about the necessity of aggressive surgical treatment in every case.

International studies [2–5] indicate that most PMCs are characterized by low aggressiveness and slow growth, which provided the rationale for introducing the active surveillance strategy into clinical practice. This approach was first implemented in Japan, later adopted in the United States and South Korea, and since 2024 has been included in clinical guidelines in the Russian Federation.

However, the broad implementation of active surveillance in Russia remains limited. This is due to patient referral patterns, shortage of personnel and resources in primary care, and patients' poor adherence to long-term follow-up. Moreover, regional studies [6] indicate that about one-third of PMCs demonstrate signs of invasiveness. Capsular invasion is detected in 33.3% of patients, and in 62.5% of these cases, lymph node metastases are identified. This confirms the existence of a subgroup of PMCs with potentially aggressive behavior.

Thus, in the context of the global revision of treatment approaches to microcarcinomas, a relevant task remains to identify the group of patients for whom active surveillance may be a safe alternative to surgery. This requires local data on recurrence rates, PMC growth parameters, and clinicopathological risk factors.

The present study is the first attempt to analyze the trends in TC incidence in Altai Krai with a focus on the T1a subcategory over a 10-year period. This will help identify regional epidemiological features and assess the feasibility of introducing personalized treatment approaches for patients with PMC.

AIM

The work aimed to analyze the trends in TC incidence in Altai Krai from 2014 to 2023, with a focus on T1a tumors (PMC), including their recurrence rates.

METHODS

Study Design

It was a retrospective observational study.

Eligibility Criteria

Inclusion criteria:

- Newly diagnosed malignant neoplasm of thyroid gland (ICD-10 code C73) from 2014 to 2023, registered in the regional cancer registry of Altai Krai;
- Histological verification of the diagnosis with specification of the ICD-O morphological code;
- Available data on clinical stage of the disease (including exact T category, i.e. T1a, T1b, etc.);
- Availability of complete medical records (histological report, postoperative follow-up data);
- Age ⩾ 18 years at the time of diagnosis.
- Non-inclusion criteria:
- Absence of histological verification (including records without specified ICD-O morphological code; *n* = 771);
- Absence of disease stage or T category specification (including cases coded as Tx or "not specified"; *n* = 146);
- Cases without specified T1 subcategory (T1a or T1b), excluded from the early-stage analysis;
- Incomplete medical records preventing inclusion in the analysis (including lack of follow-up data);
- Patients younger than 18 years.

Study Setting and Duration

The study was conducted at the Federal State Budgetary Healthcare Institution Altai Regional Oncology Dispensary, Ministry of Health of the Russian Federation. The follow-up period covered 10 years, from January 1, 2014, to December 31, 2023. The source of information was the regional cancer registry of Altai Krai, which includes data on patients with malignant neoplasms of the thyroid gland (ICD-10 code C73). Both newly diagnosed cases and recurrences were included in the analysis.

Study Methods

At the first stage, we compiled a dataset that included the year of diagnosis, tumor morphology (ICD-coded), clinical stage (TNM classification), and recurrence data. All data were grouped by year to construct time series and assess incidence trends.

At the second stage, records were verified: duplicates, cases without histological confirmation, without disease staging, or with incomplete clinical data were excluded. After removing incomplete and non-informative records, the final analytical dataset was formed.

At the third stage, tumors were classified by stage (T1a, T1b, T2, T3, T4), distributed by morphological subtypes

(papillary, follicular, medullary, etc.), and the proportion of each category in the overall incidence structure was calculated. Additionally, recurrence rates were analyzed, including those in the T1a subcategory.

Subgroup Analysis

The total sample included 4734 cases of malignant thyroid neoplasms registered in Altai Krai from 2014 to 2023. After excluding cases with missing stage data, the final dataset for stage distribution analysis comprised 4581 cases (see Table 1). The main study groups are presented in Table 2. According to the T category classification, the majority were stage T1 tumors (*n* = 3142; 68.6%), including the T1a subcategory (papillary microcarcinoma), *n* = 1708. Additionally, stage T2 tumors (*n* = 540) were identified which, despite their larger size, were also regarded as early-stage disease. Advanced stages (T3 and T4) were combined into a separate group (*n* = 899), reflecting the structure of advanced TC in the region. A separate focus of analysis was the recurrence rate, including the T1a subgroup. Over the 10-year period, a total of 333 recurrences were recorded, of which 67 cases were in the T1a category (group 5a). A summary of the study groups is provided in Table 2.

Main Study Outcome

The recurrence rate of papillary thyroid microcarcinoma (T1a category) is the key outcome of this study. The analysis of this indicator determines the real clinical significance of the increasing detection of microcarcinomas, clarifies the need for surgical treatment in PMC, and substantiates the prospects for implementing active surveillance strategies. Without assessing recurrence rates, it is impossible to reliably interpret epidemiological trends or provide justified recommendations for the management of patients with T1a.

Ethics Approval

The study was approved by the Ethics Committee of the State Medical University (excerpt from protocol No. 10 dated October 26, 2020).

Statistical Analysis

The sample size was not pre-calculated due to the retrospective nature of the study. The analysis included all cases classified under ICD-10 code C73 and registered in the regional cancer registry of Altai Krai from 2014 to 2023. The total sample size was 4734 patients (see Table 2).

Data were processed using Statistica version 12.7 (StatSoft Inc., USA) and Jamovi (open-source software, Russian GNU/Linux version).

Descriptive statistics were applied: the number of cases was presented in absolute values and percentages. The data were grouped by disease stage, histological types, and presence of recurrence. Incidence rates were calculated per 100,000 population using annual demographic data. Statistical trends and conclusions were based on descriptive parameters and visual assessment of long-term trends. The study was conducted in accordance with the principles of biomedical ethics, and all patient data were anonymized.

RESULTS

Marked changes were observed in the trends of primary malignant thyroid neoplasm incidence in Altai Krai from 2014 to 2023. In 2014, the incidence rate was 20.9 per 100,000 population, reaching a peak of 24.1 in 2018. For comparison, the average rate across Russia in 2017 was 6.0, almost four times lower than that in Altai Krai (22.9). In 2019, the national rate increased to 10.6 but still remained below the regional level (23.7). During the COVID-19 pandemic, a sharp decline to 13.7 was recorded in 2020, followed by recovery: in 2023, the incidence rate reached 21.4 [7]. These findings indicate pronounced regional characteristics of TC incidence in Altai Krai, distinguishing it from the national trends (see Fig. 1).

Stage T1 tumors accounted for the majority of cases—66.4% (3142 cases), with the T1a subcategory (PMC) comprising 36.1% (1708 cases). More advanced stages (T3–T4) and T2 represented 18.99% and 11.4%, respectively (see Fig. 2).

Histologically, papillary carcinoma predominated (83.3%), while follicular adenocarcinoma, medullary carcinoma, and other forms accounted for 12%, 2.4%, and less than 1%, respectively.

The overall recurrence rate decreased from 7.24% in 2014 to 2.19% in 2023, similar to mortality (see Figs. 3, 4). In the T1a group, recurrences were detected in 3.92% of patients (*n* = 67), with an annual decline from 1.12% in 2018 to 0.35% in 2023 (see Table 3). These data confirm the favorable clinical course of PMC and the effectiveness of early detection.

DISCUSSION

The findings confirmed that papillary thyroid microcarcinomas (PMC) constitute a significant proportion of thyroid cancer cases in Altai Krai, accounting for 36.08% of all registered cases. The recurrence rate in the T1a subcategory was low—3.92%, with an annual range from 0.3% to 1.2%. These results are consistent with international studies and support the hypothesis of predominantly indolent clinical behavior of PMC [2–4].

Comparative analysis of regional data revealed that, despite the high detection rate of early-stage TC (66.37% for T1) in Altai Krai, the proportion

Table 1. Distribution of Thyroid Cancer Cases by Stage in the Altai Krai, 2014–2023

Parameter	Years										
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2014–2023
Primary MN incidence (excluding “stage not specified”)	19.3	20.2	19.5	21.9	23.6	23.7	13.6	17.7	17.3	21.3	–
Primary MN incidence	20.9	21.7	20.4	22.9	24.1	23.7	13.7	17.8	17.4	21.4	–
Population	2 379 113	2 373 005	2 365 009	2 365 680	2 350 080	2 332 813	2 317 153	2 296 353	2 268 179	2 130 950	–
Total with C73 (excluding “stage not specified”)	460	480	461	518	555	552	314	407	392	453	4 592
Total with C73 of which	497	515	483	542	567	552	318	409	394	457	4 734
Stage I	378	375	362	382	403	419	230	327	316	366	3 558
Stage II	37	48	40	42	57	51	54	55	49	69	502
Stage III	31	40	30	60	61	65	17	12	12	10	338
Stage IV	14	17	29	34	34	17	13	13	15	8	194
Stage not specified	37	35	22	24	12	0	4	2	2	4	142
0	1	0	0	1	0	0	0	0	0	0	2
1	208	187	167	144	109	1	0	0	0	0	816
1a	125	149	137	173	189	233	106	198	183	215	1 708
1b	20	26	33	35	68	136	83	75	71	71	618
2	65	67	63	76	82	78	27	19	32	31	540
3	34	37	42	72	77	79	83	102	88	127	741
4	5	6	8	9	4	0	0	0	0	0	32
4a	2	5	7	7	22	23	12	8	13	5	104
4b	0	1	4	1	1	2	3	4	4	2	22
Tx	0	1	0	0	1	0	0	0	1	2	5
T not recorded	37	36	22	24	14	0	4	3	2	4	146
Recurrence (states 3–7, 9)	36	47	34	46	57	36	24	25	18	10	333
Deaths	60	64	47	46	46	35	28	23	18	12	379

Note. MN, malignant neoplasm

Table 2. Characteristics of the Study Groups of Thyroid Cancer Patients Included in the Statistical Analysis

Group	Inclusion criterion	Number, *n*	Comment
Group 1	All TC cases, 2014–2023	4 734	Baseline cohort for epidemiological analysis
Group 2	Stage T1 (including T1a and T1b)	3 142	Assessment of the contribution of early-stage forms to the distribution of TC
Group 2a	Stage T2 (early stage)	540	Additional analysis within early-stage forms
Group 3	Subcategory T1a (PMC)	1 708	Main subgroup for recurrence and trend analysis
Group 4	Stages T3–T4 (advanced stages)	899	Analysis of the proportion of advanced stages
Group 5	Cases with TC recurrences	333	Including recurrences in the T1a group (*n* = 67)
Group 5a	Cases of recurrences in the T1a subcategory	67	Subgroup for prognosis assessment in PMC with recurrence

Note: TC, thyroid cancer; PMC, papillary microcarcinoma.

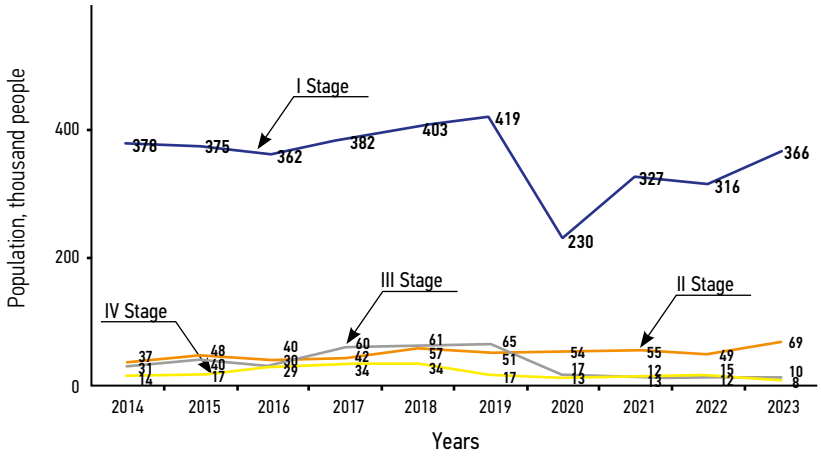

Fig. 1. Dynamics of crude thyroid cancer incidence rates in the Russian Federation and Altai krai, 2014–2023.

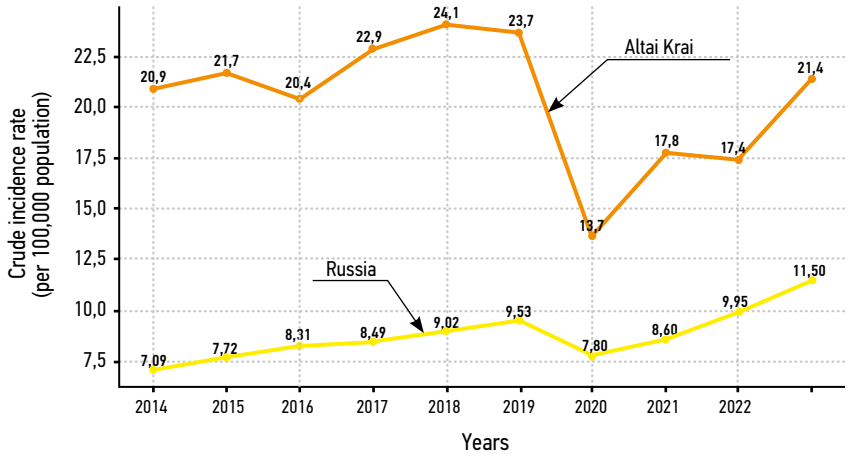

Fig. 2. Dynamics of thyroid cancer case distribution by stage in Altai krai, 2014–2023.

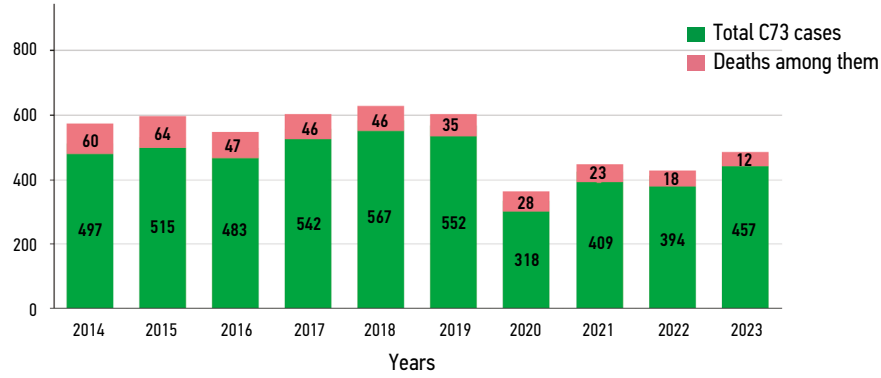

Fig. 3. Dynamics of diagnosed cases and mortality from thyroid cancer (C73) in Altai Krai, 2014–2023.

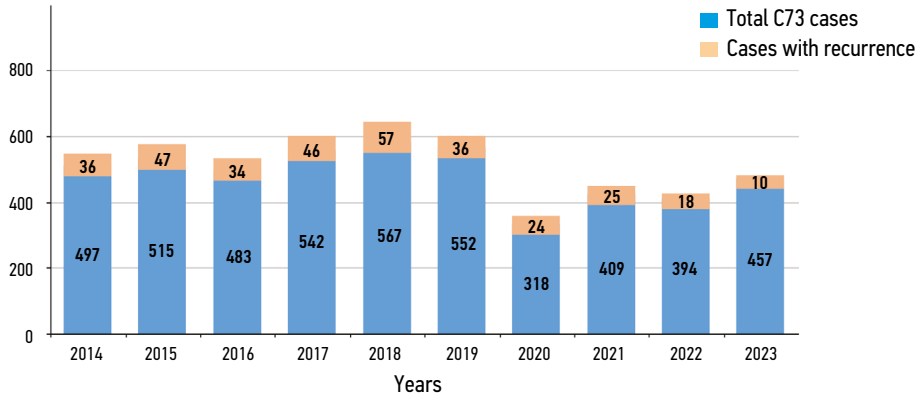

Fig. 4. Dynamics of Thyroid Cancer Recurrences in Altai Krai, 2014–2023.

Table 3. Dynamics of primary diagnoses and recurrences of papillary thyroid microcarcinoma (t1a) in the Altai Krai, 2014–2023 гг.

Parameter	Years										
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2014–2023
Total diagnosed cases per year	497	515	483	542	567	552	318	409	394	457	4 734
1a	125	149	137	173	189	233	106	198	183	215	1 708
Number of recurrences of papillary thyroid carcinoma with T1a	11	12	5	8	8	8	5	2	5	3	67
Total diagnoses with histologically verified “papillary carcinoma”	329	333	324	354	369	366	216	291	284	312	3 178

of advanced stages (18.99% for T3–T4) remains comparatively high. In contrast, in other areas such as Arkhangelsk and Orenburg Regions, this rate does not exceed 7%–10% [8, 9]. This underscores the importance not only of early diagnosis, but also of improving patient referral pathways for suspected thyroid malignancies.

Our results are comparable to those from a study conducted in Italy, where the recurrence rate among patients with PMC under an active surveillance strategy did not exceed 3% [10]. Similar findings were reported in a meta-analysis by Saravana-Bawan et al. (2024), which showed a 3.6% rate of lymph node metastasis and a 12.7% rate of delayed surgery. Notably, only one-third of these

cases were attributable to objective tumor progression, whereas in more than half, the decisive factor was a change in the patient's own preferences [11].

Nevertheless, data from Asian studies must be taken into account, as they demonstrate a higher rate of PMC progression during long-term follow-up. For example, in Korea, tumor progression within 5 years was observed in 9.6% of cases [12], whereas in Japan, the rate of tumor growth or metastasis reached 8% over 10 years [13]. These differences may be explained both by the duration of follow-up and by the characteristics of population structure and oncology care systems.

According to the published data, factors associated with an increased risk of PMC progression include age under 55 years and tumor multicentricity. In particular, multivariate analysis showed that age < 55 years (Exp B = 0.011, p = 0.000) and multifocality (Exp B = 2.686, p = 0.027) significantly increased the risk of central area metastases [14, 15]. At the same time, Korean studies demonstrated that age over 45 years was associated with a twofold reduction in progression risk [12].

A number of authors also analyzed other potential predictors of aggressive PMC behavior—such as sex, the presence of Hashimoto thyroiditis, and a history of levothyroxine replacement therapy; however, no statistically significant differences were identified for these parameters [2, 5].

Thus, the body of evidence from this study and previously published research confirms the need for an individualized approach to the management of patients with PMC. Despite the low risk of recurrence, particular attention should be given to factors potentially associated with more aggressive disease behavior. This opens up prospects for the implementation of active surveillance strategies in Russian clinical practice for carefully selected patient groups.

Study Limitations

This study has several limitations that should be taken into account when interpreting the results.

- Retrospective design. The use of data from the regional cancer registry implies dependence on the completeness and accuracy of the recorded information. Limitations in the detail of clinical parameters are possible, including the completeness of data on recurrences and the extent of follow-up.
- Dependence on registration quality. Errors or inaccuracies in coding of disease stages, histological forms, and outcomes may occur, potentially affecting the reliability of statistical estimates.
- Lack of molecular tumor profiling. Information on mutations in BRAF, RAS, and other molecular markers, which may have prognostic value and influence the risk of PMC progression, was not available in this study.
- The COVID-19 pandemic. In 2020–2021, a decline in the number of diagnosed TC cases was observed, likely attributable not to a real decrease in incidence but to reduced access to routine diagnostic services and lower healthcare-seeking activity.
- Limited follow-up data. The study did not include an analysis of individual PMC growth parameters or ultrasound follow-up data, which restricts the ability to fully assess active surveillance strategies.

Despite these limitations, the findings reflect real epidemiological trends in the region and may serve as a basis for subsequent prospective studies and the development of clinical algorithms for risk stratification in patients with PMC.

CONCLUSION

The study demonstrated that papillary microcarcinoma (T1a) constitutes a significant proportion of TC cases and is characterized by a low recurrence rate. These findings support the need for an individualized approach to treatment strategies for such patients, including the option of active surveillance in the absence of high-risk factors.

ADDITIONAL INFORMATION

Author contributions: I.M. Zakharova: investigation, formal analysis; A.F. Lazarev: supervision, conceptualization; V.D. Petrova: writing—original draft, writing—review & editing; D.I. Ganov: supervision, project administration; S.A. Terekhova: data curation, visualization, writing—original draft; N.V. Trukhacheva: formal analysis; Yu.A. Antonova: data curation; E.K. Semeryanova: data curation. All the authors approved the version of the manuscript to be published and agreed to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethics approval: The study was approved by the Ethics Committee of the Federal State Budgetary Educational Institution of Higher Education Altai State Medical University (excerpt from protocol No. 10 dated October 26, 2020).

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