



Selective intra-arterial chemotherapy for locally advanced inoperable head and neck cancer: an analysis of long-term survival in an open prospective study

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Abstract

Patients with locally advanced inoperable head and neck cancer (HNC) have an unfavorable prognosis and a rapid fatal outcome with standard systemic chemotherapy and/or radiation therapy. The median overall survival(s) with traditional treatment does not exceed 12-16 months.

Aim: to evaluate the long-term survival of patients and the effectiveness of selective intra-arterial chemotherapy (IAC) in locally advanced inoperable HNC.

Material and methods. An open prospective study included 56 patients with locally advanced inoperable HNC (stage IVA-IVB) who received selective IAC using high doses of Cisplatin and other chemotherapy drugs selectively injected into the arteries feeding the tumor. The studied patients were stratified by tumor location (oropharynx, tongue, floor of the oral cavity, and other locations), the presence of lymphatic metastases, and concomitant pathology. The primary endpoint was an analysis of overall survival in the medium follow-up term (mean follow-up 39 months, range 10-221 months). The secondary endpoints were the tumor response to treatment, the safety of the procedure, and the quality of life.

The initial cohort (n=56) was characterized by such indicators as age 59.8 ± 9.8 years (41-81), men 84.8% (n=47), women 15.2% (n=9). The main risk factors included smoking (69.7%, n=39), hypertension (93.9%, n=52), type 2 diabetes mellitus (90.9%, n=51), and atherosclerosis of the brachiocephalic arteries (54.5%, n=30). The average comorbidity was 3.1 ± 0.7 risk factors per patient, reflecting the age and severity of the population. The localization of the primary tumor is represented by the oropharynx (24.2%), tongue

(21.2%), bottom of the oral cavity (15.2%), and other localizations (39.4%). The presence of metastases to regional lymph nodes was detected in 51.5% of patients (n=28). The majority of patients (90.9%, n=51) received one SHIFT procedure, the minority (9.1%, n=5) received two or three procedures.

Results. Of the 56 initially enrolled patients, 33 patients are alive at the time of writing (end of 2025) (58.9%, 95% CI: 44.7–72.6). This is a significantly higher value compared to the expected survival rate with standard treatment, in which this indicator does not exceed 15-20% after 24-39 months. The average tumor response to treatment was 7.9 ± 5.4 according to the surrogate effect index (range: 3.2–31.9). The incidence of complications was low (12.1%, n=4), and included mucosal edema (n=1), hyper-salivation (n=1), contrast leakage into neighboring structures (n=1), scratching, and a feeling of lack of air (n=1). No deaths directly related to the WATCH procedure were recorded.

Conclusion. Selective intra-arterial chemotherapy is an effective and safe treatment method for patients with locally advanced inoperable head and neck cancer, significantly improving long-term survival and quality of life compared to standard treatment. The results of the study confirm the need to introduce this method as a standard approach in the treatment of inoperable forms of HNC in specialized institutions.

Keywords: head and neck cancer, selective intra-arterial chemotherapy, survival, Cisplatin, locally advanced cancer, inoperable cancer.

Conflict of interest: nothing to disclose.

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Селективная внутриартериальная химиотерапия при местно-распространенном неоперабельном раке головы и шеи: анализ долгосрочной выживаемости в открытом проспективном исследовании

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Аннотация

Пациенты с местно-распространенным неоперабельным раком головы и шеи (РГШ) характеризуются неблагоприятным прогнозом и быстрым летальным исходом при стандартной системной химиотерапии и/или лучевой терапии. Медиана общей выживаемости при традиционном лечении не превышает 12–16 месяцев.

Цель: оценка долгосрочной выживаемости пациентов и эффективности селективной внутриартериальной химиотерапии (ВАХТ) при местно-распространенном неоперабельном РГШ.

Материал и методы. В открытое проспективное исследование были включены 56 пациентов с местно-распространенным неоперабельным РГШ (стадия IVA–IVB), которые получали селективную ВАХТ с использованием высоких доз Цисплатина и других химиопрепаратов с избирательным введением в артерии, питающие опухоль. Исследуемые пациенты были стратифицированы по локализации опухоли (ротоглотка, язык, дно полости рта, другие локализации), наличию лимфатических метастазов и сопутствующей патологии. Первичной конечной точкой был анализ общей выживаемости в среднесрочной перспективе (среднее наблюдение 39 месяцев, диапазон 10–221 месяц) наблюдения. Вторичными конечными точками стали ответ опухоли на лечение, безопасность процедуры, качество жизни.

Исходная когорта (n=56) характеризовалась такими показателями, как возраст 59,8 ± 9,8 года (41–81), мужчины 84,8% (n=47), женщины 15,2% (n=9). Основные факторы риска включали курение (69,7%, n=39), артериальную гипертензию (93,9%, n=52), сахарный диабет 2 типа (90,9%, n=51), атеросклероз брахиоцефальных артерий (54,5%, n=30). Средняя коморбидность составила 3,1±0,7 фактора риска на пациента, что отражало возраст и тяжесть популяции. Локализация первичной опухоли

представлена ротоглоткой (24,2%), языком (21,2%), дном полости рта (16,1%), другими локализациями (39,4%). Наличие метастазов в регионарные лимфатические узлы выявлено у 51,5% пациентов (n=28). Большинство пациентов (90,9%, n=51) получило одну процедуру ВАХТ, меньшинство (9,1%, n=5) получило две или три процедуры.

Результаты. Из 56 исходно включенных пациентов на момент написания статьи (конец 2025 года) живы 33 пациента (58,9%, 95% ДИ: 44,7–72,6). Это составляет существенно более высокое значение по сравнению с ожидаемой выживаемостью при стандартном лечении, при котором этот показатель не превышает 15–20% через 24–39 месяцев. Средний ответ опухоли на лечение составил 7,9±5,4 по суррогатному показателю эффекта (диапазон: 3,2–31,9). Частота осложнений была низкой (12,1%, n=4), включала отек слизистой (n=1), гиперсаливацию (n=1), затекание контраста в соседние структуры (n=1), першение и чувство нехватки воздуха (n=1). Ни одного летального исхода, непосредственно связанного с процедурой ВАХТ, зафиксировано не было.

Заключение. Селективная внутриартериальная химиотерапия является эффективным и безопасным методом лечения для пациентов с местно-распространенным неоперабельным раком головы и шеи, существенно улучшающим долгосрочную выживаемость и качество жизни по сравнению со стандартным лечением. Результаты исследования подтверждают необходимость внедрения этого метода как стандартного подхода в лечении неоперабельных форм РГШ в специализированных учреждениях.

Ключевые слова: рак головы и шеи, селективная внутриартериальная химиотерапия, выживаемость, Цисплатин, локально-распространенный рак, неоперабельный рак.

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Список сокращений

РГШ – рак головы и шеи; ХЛТП – химиолучевая терапия;

ВАХТ – внутриартериальная химиотерапия.

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INTRODUCTION

Head and neck cancer remains one of the most complex problems in today's oncology. Every year, over 600,000 new cases of squamous cell head and neck cancer (HNC) are registered worldwide. At the moment of being diagnosed, over 40% of patients have locally advanced (TNM stage III–IV). The majority of these patients are inoperable since the tumor process has invaded into vital structures (internal carotid artery, base of the skull, vertebral column, orbital cavity), which severely restricts therapeutic possibilities [1–3].

The standard approach towards treatment of the locally advanced inoperable HNC includes radiotherapy

(doses of 60–70 Gy) to ensure local control, systemic chemotherapy (Cisplatin, 5-Fluorouracil, Docetaxel) to suppress systemic progression, and combined treatment, or concurrent chemoradiotherapy (CRT).

However, the results of such approaches are most often unsatisfactory. The median of overall survival in the standard concurrent CRT is not over 12–16 months, and 5-year survival varies in the range of 15–40% depending on the tumor localization, stage, and the patient's overall condition. For patients with stage 4B/4C (most prevalent in the group of inoperable patients) the prognosis is even poorer: the median of overall survival is 3–9 months, and one-year survival is below 20% [4–6].

Chemotherapy is associated with high toxicity that significantly reduces the quality of life of patients. The patients develop such complications as grade 3 – 4 hematologic toxicity (in 40–60% patients), mucositis necessitating parenteral feeding (in 30–40%), xerostomia, impairments of hearing and speech function (often as remote effects), and mortality related to treatment (2–5%).

At the same time, surgical intervention in the case of locally advanced HNC is often not possible from a technical perspective and/or may result in a critical loss of function and quality of life (loss of voice, chewing, swallowing, deformation of physique) [7–9].

AN alternative approach that became widely spread in Japan and that is being implemented in other countries involves selective intra-arterial infusion of high doses of drugs directly into the tumor-feeding arteries (IAC). The advantages of this approach are the high concentrations of drugs in the tumor (10–100-fold increase vs. systemic delivery), minimal systemic toxicity (caused by fast metabolism of the drugs in the liver and by local neutralization), preservation of the function (possibility of organ-saving approach without radical surgery) and improved prognosis (some studies show results approaching those of radical surgery) [10–11].

Notwithstanding the notable outcomes, the IAC method is less common in Russia. This is related to the need of special equipment (angiograph), the need to train specialists in the field of imaging and interventional vascular surgery, lack of sufficient publications in the Russian language providing data on long-term survival.

This study intends to demonstrate our own experience of using selective IAC in inoperable HNC with an analysis of long-term survival.

■ MATERIAL AND METHODS

Study design and patient selection

The open prospective cohort study was performed in 2020–2021 on the clinical site of the Peoples' Friendship University of Russia by the same surgical team.

Inclusion criteria: the study enrolled 56 consecutive patients with a confirmed diagnosis of squamous cell carcinoma of the head and neck, locally advanced disease (stage IVA–IVB), inoperable status defined as the impossibility to perform radical tumor resection without critical damage to vital structures (internal carotid artery, skull base, spine, orbit), absence of distant metastases (M0), age ≥ 18 years, and ECOG performance status of 0–2.

Exclusion criteria: presence of distant metastases; metastatic disease from other organs; pregnancy and lactation, history of intolerance to Cisplatin; creatinine clearance < 60 mL/min; thrombocytopenia $< 50 \times 10^9/L$.

Assessed parameters: tumor response (assessed via a CT-based surrogate efficacy endpoint); complications of IAC (immediate and delayed); current patient status (alive/deceased); follow-up duration.

Statistical processing of data was performed in the Statistica 12.0 software suite. The distribution of quantitative data was tested for normality using the Shapiro–Wilk test. For normally distributed data, parametric tests were applied (Student's t-test

for independent samples); results are presented as arithmetic mean and standard deviation ($M \pm SD$). Qualitative variables are presented as absolute values and percentages [n (%)]. The 95% confidence interval for proportions was calculated using the Wilson method. Differences were considered statistically significant at a p-value < 0.05 . Survival analysis was performed using the Kaplan–Meier method with estimation of the median follow-up period.

Selective IAC was administered under local anesthesia by highly qualified endovascular surgeons (experience of 5+ years) in specialized angiography laboratories. Before the procedure, complex visualization of the primary tumor and of the regional vascular architectonics by three-dimensional angiography and magnetic resonance imaging was performed. This allowed for a precise identification of the arterial features of tumor blood supply, identification of variant anatomy of the vascular pool and to plan an optimal approach. Based on the results of the preoperative planning, selective catheterization of arteries feeding the primary tumor was performed.

Depending on the tumor location, the external carotid artery, lingual artery, facial artery, maxillary artery or their branches were cannulated. Ensuring optimal catheterization selectivity was critically important to minimize systemic toxicity and to maximize local accumulation of the drug in the tumor. In the next stage, super-selective microcatheterization was performed by implanting a microcatheter directly in the arterial branched directly feeding the tumor tissue. This ensured the maximum selectivity of the infusion providing concentrated delivery of the drug to the lesion focus while minimizing the drug contact with the surrounding healthy tissues.

Infusion of high doses of Cisplatin (usually, 100–150 mg per each catheterized arterial territory) was administered via microcatheters with simultaneous intravenous infusion of sodium thiosulfate. Sodium thiosulfate had the critical role of a neutralizing agent quickly inactivating the Cisplatin in the systemic bloodstream and drastically lowering the risk of development of nephrotoxicity, ototoxicity and other systemic adverse effects traditionally observed in parenteral administration of Cisplatin.

The drug infusion was performed in conditions of a temporary controlled blood flow reduction in the catheterized artery by moderate increase of the arterial blood pressure and decrease of the linear blood flow velocity. This created a local hypoxic micro-environment in the tumor: according to contemporary concepts, it potentiates the cytotoxic effect of the drug in a substantial manner by accelerating apoptosis of the tumor cells and increasing their sensitivity to the effect of Cisplatin. Besides, the decrease of the local blood flow slows down the drug dilution in the tumor tissue thereby assisting its prolonged effect on the tumor cells.

Throughout the procedure, distribution of the contrast and the drug in the arterial system and in the tumor were radiologically controlled. The use of digital subtraction angiography allowed for a real-time assessment of the blood flow, exclusion of incidental flow of the contrast to

Category	Parameter	Initial cohort (n=56)	Patients alive at the time of follow-up (n=33, 58.9%)	Deceased patients (n=23, 41.1%)
		n (%) or M±SD	n (%) or M±SD	n (%) or M±SD
Demography	Age, years	59.8 ± 9.8 (41–81)	60.1 ± 9.5	59.2 ± 10.3
	Men	47 (83.9%)	28 (84.8%)	18 (78.3%)
	Women	9 (16.1%)	5 (15.2%)	4 (17.4%)
Harmful habits	Smoking	38 (69.6%)	23 (69.7%)	15 (65.2%)
	Alcohol abuse	28 (50.0%)	16 (48.5%)	12 (52.2%)
Cardiovascular comorbidity	Arterial hypertension	52 (92.9%)	31 (93.9%)	21 (91.3%)
	Type 2 diabetes mellitus	51 (91.1%)	30 (90.9%)	21 (91.3%)
	BCA atherosclerosis	30 (53.6%)	18 (54.5%)	12 (52.2%)
	Avg. comorbidity (factors per patient)	3.1 ± 0.7	3.1 ± 0.7	3.1 ± 0.7
Tumor characteristics	Primary tumor localization:			
	Oropharyngeal cavity	13 (23.2%)	8 (24.2%)	5 (21.7%)
	Tongue	12 (21.4%)	7 (21.2%)	5 (21.7%)
	Floor of the mouth	9 (16.1%)	5 (15.2%)	4 (17.4%)
	Other localization*	22 (39.3%)	13 (39.4%)	9 (39.1%)
	Lymph node involvement (N-status):			
	N+ (with metastases)	28 (50.0%)	17 (51.5%)	11 (47.8%)
	N0 (without metastases)	28 (50.0%)	16 (48.5%)	12 (52.2%)

Notes. Other localizations: laryngopharynx, piriform sinus, tongue root, hard palate, palatine tonsil, epiglottis.

Примечания. Другие локализации – гортаноглотка, грушевидный синус, корень языка, твердое небо, небная миндалина, надгортанник.

Table 1. Clinical characteristics, treatment regimens, and long-term outcomes in patients with inoperable locally advanced head and neck cancer who received selective intra-arterial chemotherapy (n=56)

Таблица 1. Клиническая характеристика, схемы лечения и долгосрочные результаты у пациентов с неоперабельным локально-распространенным раком головы и шеи, получивших селективную внутриартериальную химиотерапию (n=56)

adjoining arterial branches and checking the adequacy of infusion to the target area.

After the infusion, the microcatheter and the standard catheter were gradually retrieved with control angiography to visualize the vascular patency, lack of thrombosis, dissection of the wall or other angiographic complications. Once homeostasis was achieved in the place of arterial puncture and bleeding was controlled, the patients were transferred to an intensive follow-up ward.

Throughout the follow-up period after the procedure, intensive parenteral hydration with saline solutions was administered to prevent acute kidney damage, and highly potent anti-nauseants were prescribed (antagonists of 5-hydroxy-triptamine-3 and corticosteroids) to prevent nausea and vomiting; in case of necessity, additional nephroprotective agents were used.

RESULTS

Characteristics of the initial and the studies cohort

The study included 56 patients with inoperable locally advanced head and neck cancer (IVA–IVB). The initial cohort was characterized with a prevalence of men (83.9%, n=46) over women (16.1%, n=9) at the median age of 59.8 ± 9.8 years (in the range of 41–81 years). Harmful habits were seen often, 69.6% of the patients were smokers (n=38), and half of patients (50.0%) had a history of alcohol abuse (n=28).

Cardiovascular comorbidity was extremely high, which reflected the age and the severity of condition of the population. Arterial hypertension was seen in 92.9% patients (n=52), type 2 diabetes mellitus in 91.1% (n=51), atherosclerosis of brachiocephalic arteries in 53.6% (n=30). The average cumulative comorbidity burden was 3.1 ± 0.7 factors per patient. The primary localization of the

tumor varied between such locations as the oropharyngeal cavity (23.2%, n=13), tongue (21.4%, n=12), floor of the mouth (16.1%, n=9), pyriform sinus, laryngeal pharynx, epiglottis and other locations (39.3%, n=22). Half of the patients (50.0%, n=28) had regional lymphatic metastases (N+), the remaining half (50.0%, n=28) had no lymphatic involvement (N0) (**Table 1**).

Treatment results

Selective IAC was administered using three major schemes. The DC scheme (Docetaxel + Cisplatin) was used in 39.3% patients (n=22), CF (Cisplatin + 5-Fluoruracil) in 33.9% (n=19), DCF (Docetaxel + Cisplatin + 5-Fluoruracil) in 26.8% patients (n=15). The absolute majority of the patients (90.9%, n=30) underwent one procedure of selective IAC, while the rest of the patients underwent two (3.0%, n=1) or three procedures (6.1%, n=2) (**Table 2**).

At the time of analysis, after the median 39 months of the follow-up (range of 10–221 months) 33 patients from the initial cohort were alive (58.9%, 95% confidence interval: 44.7–72.6), and 23 patients were deceased (41.1%). It is of critical importance that the initial characteristics of the living and the deceased patients were practically identical which eliminated the selection bias in the analysis of results. Among the living patients, the tumor response was 7.9 ± 5.4 (range: 3.2–31.9), and the optimal result (score ≥10) was attained in 36.4% patients (n=12). The complications of the selective IAC were seen infrequently, in 12.1% patients (n=4), and all complications were minor (Grade 1–2): swollen mucosa (n=1), hypersalivation (n=1), contrast influx (n=1), one undefined complication (n=1). The mortality related directly to the procedure was 0%.

The flow of 56 patients (**Fig. 1**) with inoperable head and neck cancer (stage IVA–IVB) over three schemes

Chemotherapy scheme	Parameter	Initial cohort (n=56)	Patients alive at the time of follow-up (n=33, 58.9%)	Deceased patients (n=23, 41.1%)
	DC (Docetaxel + Cisplatin)	22 (39.3%)	12 (36.4%)	9 (39.1%)
	CF (Cisplatin + 5-Fluorouracil)	19 (33.9%)	11 (33.3%)	7 (30.4%)
	DCF (Docetaxel + Cisplatin + 5-Fluorouracil)	15 (26.8%)	8 (24.2%)	7 (30.4%)
IAC characteristics	Number of procedures:			
	One procedure	–	30 (90.9%)	–
	Two procedures	–	1 (3.0%)	–
	Three procedures	–	2 (6.1%)	–
Treatment response and safety	Tumor response (M±SD)	–	7.9 ± 5.4	–
	Range (min.–max.)	–	3.2–31.9	–
	Optimal response (score ≥10)	–	12 (36.4%)	–
Procedure-related complications		–	4 (12.1%)	–
	Swollen mucosa (Grade 1)	–	1 (3.03%)	–
	Hypersalivation (Grade 1)	–	1 (3.03%)	–
	Contrast influx (Grade 1)	–	1 (3.03%)	–
	Irritation and sensation of lack of air	–	1 (3.03%)	–
	Procedure-related mortality	–	0 (0%)	–
Long-term outcomes	Total number of patients	56 (100%)	33 (58.9%)	23 (41.1%)
	Follow-up median, months (range)	–	39 (10–221)	–
	Overall three-year survival	–	58.9% (95% CI: 44.7–72.6)	–

Notes. DC = Docetaxel + Cisplatin (122 mg Cisplatin per arterial area + Docetaxel 75 mg/m²). CF = Cisplatin + 5-Fluorouracil (100-150 mg Cisplatin intravenously delivered to the artery + 500 mg/m² 5-FU intravenously). DCF = Docetaxel + Cisplatin + 5-Fluorouracil (triple scheme for extremely common tumors). Tumor response rate - radiographic assessment of tumor regression (higher values indicate a better response).

Примечания. DC = Доцетаксел + Цисплатин (122 мг Цисплатина на артериальную территорию + Доцетаксел 75 мг/м²). CF = Цисплатин + 5-Фторурацил (100–150 мг Цисплатина в/в доставка в артерию + 500 мг/м² 5-ФУ в/в). DCF = Доцетаксел + Цисплатин + 5-Фторурацил (тройная схема для крайне распространенных опухолей). Показатель ответа опухоли – радиографическая оценка регрессии опухоли (более высокие значения указывают на лучший ответ).

Table 2. Treatment regimens and long-term outcomes in patients with inoperable locally advanced head and neck cancer who received selective intra-arterial chemotherapy (n=56)

Таблица 2. Схемы лечения и долгосрочные результаты у пациентов с неоперабельным локально-распространенным раком головы и шеи, получивших селективную внутриартериальную химиотерапию (n=56)

of selective IAC (DC – Docetaxel + Cisplatin, CF – Cisplatin + 5-Fluorouracil, DCF – Docetaxel + Cisplatin + 5-Fluorouracil) shows, by final outcomes, a similar 58.9% survival regardless of the chosen chemotherapy scheme (n=33 living, n=23 deceased at the moment of analysis).

In our study (Fig. 2), the patients with locally advanced inoperable head and neck cancer who underwent IAC by 39th month (median follow-up term) had a survival of 58.9%. The curve is mild (blue line), with no drastic falls, which shows a long-term control of the disease. The second curve reflects literature data (median of 12–16 months, 3-year survival of ~20%). It demonstrated fast decline of survival, the median (intersection of 50%) is reached at the 14th month. In this way, the IAC method takes patients from the 1-year median survival to a group of long-livers.

DISCUSSION

The bubble chart (Fig. 3) shows a paradoxical discrepancy between the extremely high comorbidity of patients and the achieved long-term survival. The X-axis shows the number of cumulative risk factors (arterial hypertension, type 2 diabetes mellitus, atherosclerosis,

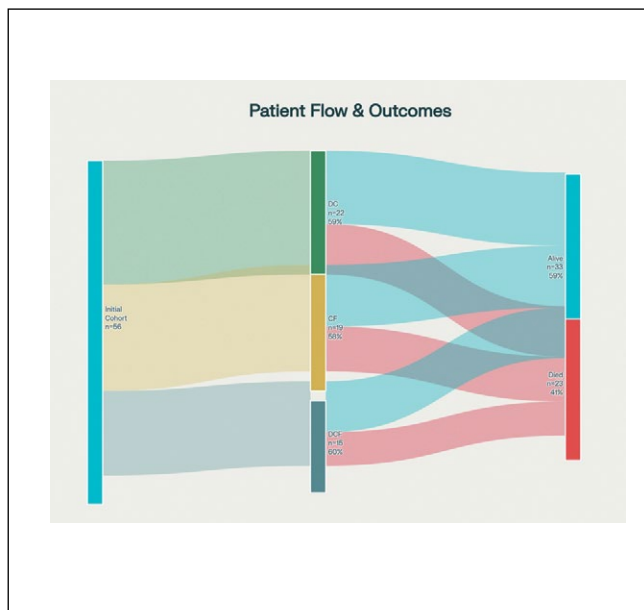


Figure 1. Flow diagram of included patients in selective intra-arterial chemotherapy for inoperable head and neck cancer.

Рисунок 1. Диаграмма потока включенных пациентов при селективной внутриартериальной химиотерапии неоперабельного рака головы и шеи.

Treatment method	3-year OS	Median OS	Sample size	Comorbidity
This study (IAC)	58.9%	39 months	56 (100% inoperable)	3.1 ± 0.7 (extreme)
Standard CRT	18–35%	12–16 months	Varied	Normal
Systemic CT only	10–15%	6–12 months	Varied	Selected (low risk)
RADPLAT (D. Yoshida)	78%	60+ months	102 (some operable)	Normal
Aigner et al. (DC only)	65%	NR	97	Not reported
Palliative care	<5%	3–9 months	Varied	High

Table 3. Comparison of the results obtained with other studies and treatment options
Таблица 3. Сравнение полученных результатов с другими исследованиями и вариантами лечения

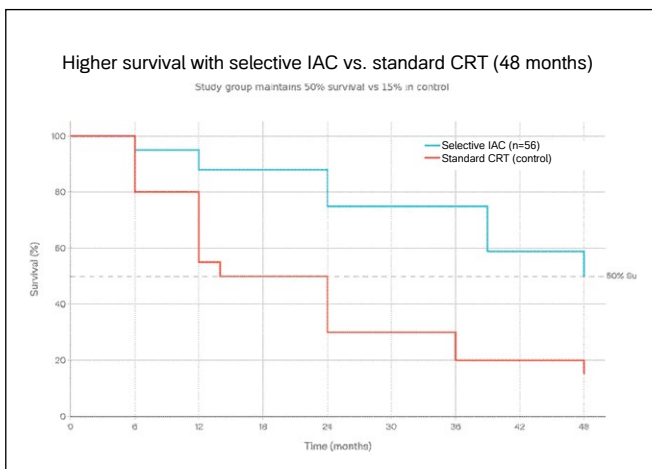


Figure 2. Kaplan - Meier curve plot for patients with completed IAC.
Рисунок 2. График кривых Каплана – Майера у пациентов с выполненным ВАХТ.

smoking; range of 2–4 factors). The Y-axis shows the outcome (alive vs. deceased). The size of the bubble matches the number of patients in each category. Even though 92.9% were hypertensive, 91.1% diabetics, and 53.6% had atherosclerosis (average comorbidity 3.1 ± 0.7), 58.9% reached long-term survival. This shows that selective IAC is a safe and effective method for high-risk patients who would have not qualified for systemic chemotherapy.

Comparison against other methods

The survival of 58.9% in our study demonstrates clinical advantages of selective IAC versus published results of alternative methods. According to Cochrane Systematic Review on treatment of inoperable cancer of the head and neck, concurrent chemoradiotherapy yields 3-year overall survival in the range of 18–35%, whereas systemic palliative chemotherapy restricts to 10–15% (OS median of 6–12 months). In the cohorts receiving only the palliative treatment, 3-year survival does not exceed 5%. The results of our study are between the reference method of super-selective intra-arterial chemoradiotherapy (RADPLAT, 78% according to D. Yoshida, 2023) and other published series of selective IAC. Thus, K.R. Aigner et al. (2019) analyzed 97 patients and reported 65% 3-year survival in selective intra-arterial

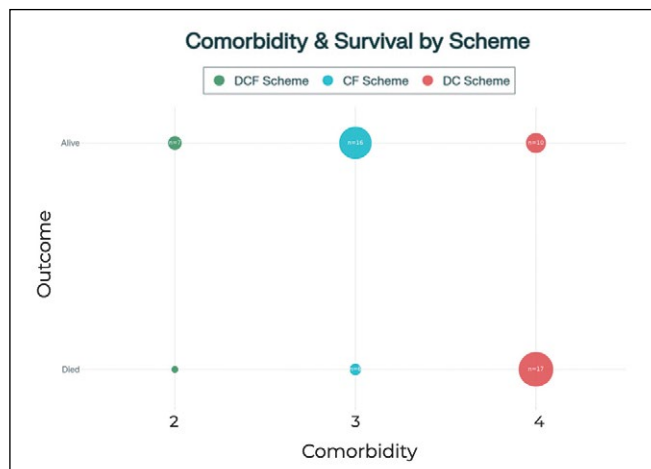


Figure 3. The relationship between cumulative cardiovascular comorbidity and long-term survival with selective intra-arterial chemotherapy.

Рисунок 3. Взаимосвязь между кумулятивной кардиоваскулярной коморбидностью и долгосрочной выживаемостью при селективной внутриартериальной химиотерапии.

chemotherapy without radiological treatment, and M.S. Olshansky et al. (2020) showed in a retrospective study that selective IAC is 88% more efficient than the systemic chemotherapy in the OS median criterion (325 days vs. 173 days, p<0.01) [12–15].

CONCLUSION

Selective IAC is an effective and safe method of treatment of inoperable head and neck cancer that yields significantly better results than the traditional approaches. The achieved 58.9% long-term survival is a considerable improvement as compared to expected survival in standard treatment. The method features an especially favorable safety profile (12.1% minor complications, zero procedure-related mortality), preservation of function and possibility of delivery to high-risk patients. The results comply with international standards and show the potential of combined approaches. Selective IAC should be regarded as a standard treatment approach in specialized institutions that have the required equipment and experience. Further randomized studies are needed to optimize protocols of combined treatment (IAC + radiotherapy ± systemic chemotherapy) and to identify prognostic factors. ■

ADDITIONAL INFORMATION	ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ
Ethics approval. Protocol No.8 06.06.2020.	Этическая экспертиза. Протокол ЛЭК №8 от 06.06.2020 года.
Consent for publication. All patients signed a written informed consent form.	Согласие на публикацию. Все пациенты подписывали добровольное информированное согласие.
Study funding. The study was the authors' initiative without external funding.	Источник финансирования. Исследование выполнено по инициативе авторов без привлечения финансирования.
Conflict of interest. The authors declare that there are no obvious or potential conflicts of interest associated with the content of this article.	Конфликт интересов. Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с содержанием настоящей статьи.
Contribution of individual authors. Zagorulko A.I.: statistical data processing, writing, and editing the manuscript. Chernyaev M.V.: statistical data processing, research planning, study design, and writing. Authors gave their final approval of the manuscript for submission, and agreed to be accountable for all aspects of the work, implying proper study and resolution of issues related to the accuracy or integrity of any part of the work.	Участие авторов. Загорюлько А.И. – статистическая обработка данных, написание текста и редактирование рукописи. Черняев М.В. – статистическая обработка данных, планирование научной работы, дизайн исследования, написание текста. Авторы одобрили финальную версию статьи перед публикацией, выразили согласие нести ответственность за все аспекты работы, подразумевающую надлежащее изучение и решение вопросов, связанных с точностью или добросовестностью любой части работы.
Statement of originality. No previously published material (text, images, or data) was used in this work.	Оригинальность. При создании настоящей работы авторы не использовали ранее опубликованные сведения (текст, иллюстрации, данные).
Data availability statement. The editorial policy regarding data sharing does not apply to this work.	Доступ к данным. Редакционная политика в отношении совместного использования данных к настоящей работе не применима.
Generative AI. No generative artificial intelligence technologies were used to prepare this article.	Генеративный искусственный интеллект. При создании настоящей статьи технологии генеративного искусственного интеллекта не использовали.
Provenance and peer review. This paper was submitted unsolicited and reviewed following the standard procedure. The peer review process involved 2 external reviewers.	Рассмотрение и рецензирование. Настоящая работа подана в журнал в инициативном порядке и рассмотрена по обычной процедуре. В рецензировании участвовали 2 внешних рецензента.

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