



# Efficacy of Bronchial Artery Infusion/ Chemoembolization Combined with Platinum-Based Chemotherapy and PD-I Inhibitor in Initially Unresectable Stage III Non-Small Cell Lung Cancer

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**Background:** To evaluate the efficacy of bronchial arterial infusion/bronchial arterial chemoembolization (BAI/BACE) combined with platinum-based doublet chemotherapy and PD-1 inhibitor in patients with initially unresectable stage III non-small cell lung cancer (NSCLC).

**Methods:** This retrospective study analyzed 42 patients with initially unresectable stage III NSCLC treated between September 2020 and March 2025. Patients were divided into the BAI group (n=20), which received BAI/BACE combined with platinum-based doublet chemotherapy and PD-1 inhibitor, and the Non-BAI group (n=22), which received platinum-based doublet chemotherapy and PD-1 inhibitor alone. Objective response rate (ORR), progression-free survival (PFS), and overall survival (OS) were compared between the groups. Patients were further categorized into the surgery group (n=19) and the Non-surgery group (n=23) whether they underwent resection after induction therapy, and their survival outcomes were compared.

**Results:** The overall ORR was 64.3%. The ORR of the BAI group was significantly higher than the Non-BAI group (80.0% vs 50.0%,  $P=0.043$ ). Survival analysis showed that the 2-year PFS and OS rates for the entire cohort were 41.2% and 64.3%, respectively. The BAI group had significantly better 2-year PFS (52.8% vs 29.1%,  $P=0.032$ ) and OS (78.3% vs 51.7%,  $P=0.022$ ) than the Non-BAI group. Treatment-related adverse events were predominantly grade I–II, with no significant differences between groups. Following induction therapy, 64.3% (27/42) of patients achieved successful downstaging, and the surgical conversion rate was 45.2% (19/42). The pathological complete response (pCR) and major pathological response (MPR) rates were 10.5% (2/19) and 36.8% (7/19), respectively. Furthermore, the surgery group showed significantly better 2-year PFS (64.8% vs. 20.7%,  $P=0.001$ ) and OS (93.8% vs. 39.6%,  $P=0.001$ ) than the Non-surgery group.

**Conclusion:** BAI/BACE combined with immunochemotherapy demonstrates promising efficacy and a manageable safety profile in the conversion therapy of initially unresectable stage III NSCLC. Successful downstaging followed by surgery is associated with improved survival outcomes. Nevertheless, given the small sample size and retrospective design, these findings should be considered exploratory and warrant validation in larger prospective studies.

**Keywords:** bronchial arterial infusion, bronchial arterial chemoembolization, immunotherapy, chemotherapy, non-small cell lung cancer

## Introduction

Lung cancer remains the leading cause of cancer-related mortality worldwide, with non-small cell lung cancer (NSCLC) accounting for approximately 85% of all cases.<sup>1,2</sup> Approximately one-third of NSCLC patients are diagnosed at stage III, a highly heterogeneous disease with traditionally poor outcomes and 5-year survival rates ranging from 13% to 36%.<sup>3,4</sup> According to the 8th edition of the TNM classification,<sup>3</sup> stage III NSCLC is considered initially unresectable under the

following conditions: (1) involvement of multiple ipsilateral mediastinal lymph node metastases forming a bulky mass or involving multiple stations (Stage IIIA: T1-2 N2; Stage IIIB: T3-4 N2); (2) involvement of contralateral hilar or mediastinal lymph nodes, or ipsilateral or contralateral scalene or supraclavicular lymph nodes (Stage IIIB: T1-2 N3; Stage IIIC: T3-4 N3); or (3) tumor invasion of critical mediastinal structures such as the heart, aorta, or esophagus (Stage IIIA: T4 N0-1).

For patients with initially unresectable stage III NSCLC, definitive concurrent chemoradiotherapy (CCRT) has long been the standard of care. However, historically, CCRT alone yielded modest outcomes, with a median progression-free survival (PFS) of only approximately 8 months.<sup>5</sup> Immune checkpoint inhibitors (ICIs), particularly those targeting the programmed death-1/programmed death-ligand 1 (PD-1/PD-L1) pathway, have revolutionized the treatment landscape for NSCLC. The landmark PACIFIC trial demonstrated that consolidation with durvalumab following CCRT significantly prolongs survival, establishing CCRT plus durvalumab as the new standard of care, with 5-year PFS and overall survival (OS) rates reaching 33.1% and 42.9%, respectively.<sup>6</sup> Despite this breakthrough, the CCRT plus durvalumab regimen is not without limitations. Radiation-induced pneumonitis remains a significant concern, with real-world studies reporting an overall incidence of 35% (grade  $\geq 3$ : 6%).<sup>7</sup> Moreover, a substantial proportion of patients are unsuitable for thoracic radiation due to extensive tumor invasion or poor pulmonary function.

In parallel, the integration of PD-1/PD-L1 inhibitors with chemotherapy has revolutionized the perioperative treatment of resectable NSCLC, significantly improving pathological response rates and survival outcomes.<sup>8-16</sup> Consequently, this success has naturally prompted the exploration of chemoimmunotherapy in the unresectable setting, with several studies demonstrating preliminary efficacy.<sup>17-22</sup> However, a subset of patients-especially those with high tumor burden and extensive local invasion-exhibit suboptimal responses to systemic chemoimmunotherapy alone. Enhancing induction therapy to improve pathological response and surgical conversion rates remains a pressing clinical challenge. Therefore, there is growing interest in developing integrated strategies that synergize with systemic therapy to achieve better local control and facilitate tumor downstaging.

Bronchial artery infusion (BAI) and bronchial artery chemoembolization (BACE) are locoregional interventional techniques that enable precise, high-intensity drug delivery to pulmonary lesions while minimizing systemic toxicity.<sup>23-25</sup> Emerging evidence suggests that locoregional therapies such as BAI/BACE may also modulate the tumor immune microenvironment. Specifically, by inducing tumor cell necrosis and releasing tumor-associated antigens, BAI/BACE can promote dendritic cell maturation and enhance T-cell priming, thereby potentially converting immunologically “cold” tumors into “hot” tumors that are more responsive to immune checkpoint inhibitors.<sup>26,27</sup> This immunomodulatory effect provides a strong rationale for combining BAI/BACE with PD-1 inhibitors. Nevertheless, the clinical potential of this combined approach with systemic therapies warrants further investigation. Therefore, this study aimed to evaluate the efficacy of BAI/BACE combined with platinum-based doublet chemotherapy and a PD-1 inhibitor in patients with initially unresectable stage III NSCLC. This represents a novel multimodal approach that synergizes local and systemic therapies to potentially improve conversion rates and long-term outcomes, offering a potential alternative in appropriately selected patients.

## Methods

### Patients Selection

We conducted a retrospective review of 42 patients with initially unresectable stage III NSCLC treated at our institution between September 2020 and March 2025. The inclusion criteria were: (1) histologically confirmed NSCLC staged as unresectable stage III according to the 8th edition of the TNM classification;<sup>3</sup> (2) no contraindications to interventional therapy, chemotherapy, or immunotherapy. Exclusion criteria included: (1) severe cardiac, pulmonary, hepatic, or renal dysfunction; (2) prior antitumor therapy (including radiotherapy, chemotherapy, or immunotherapy); (3) active autoimmune disease. PD-L1 expression data were not available for most patients due to the retrospective nature of the study and were therefore not included in the analysis.

## Treatment Protocols

### Systemic Therapy

All patients received a PD-1 inhibitor (tislelizumab 200 mg or sintilimab 200 mg) combined with platinum-based doublet chemotherapy every 3 weeks for 2–3 cycles. Chemotherapy regimens were selected based on histology: paclitaxel (135 mg/m<sup>2</sup>) plus cisplatin (75 mg/m<sup>2</sup>) or gemcitabine (1000 mg/m<sup>2</sup>) plus cisplatin (75 mg/m<sup>2</sup>) for squamous cell carcinoma; pemetrexed (500 mg/m<sup>2</sup>) plus carboplatin (AUC=5) for adenocarcinoma.

### BAI/BACE Procedure

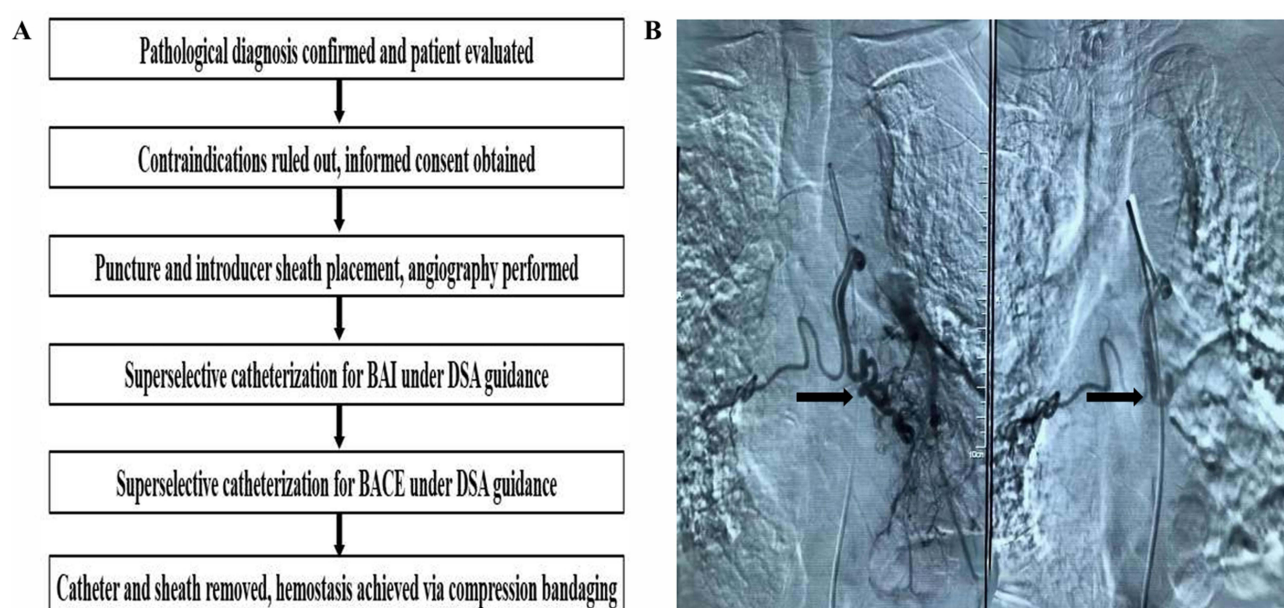
Patients in the BAI group additionally underwent BAI/BACE, with the choice determined by tumor vascularity and the feasibility of superselective catheterization. Under local anesthesia, femoral artery access was obtained. After selective bronchial arteriography to identify tumor-feeding vessels, a microcatheter was advanced superselectively. BAI was performed using albumin-bound paclitaxel (dose reduced by 20% compared to systemic administration). This was followed by BACE using gelfoam particles (350–560 μm) mixed with epirubicin. The procedure was repeated every 3–4 weeks for 1–3 sessions. In this cohort, 60% (12/20) of patients underwent BAI/BACE approximately 3 weeks before the first cycle of chemoimmunotherapy, while 40% (8/20) underwent it about 3 weeks after the first cycle. This variation was based on clinical judgment, scheduling constraints, and patient preferences. The interventional procedural workflow is shown in Figure 1A, and the bronchial arteriography is presented in Figure 1B.

### Assessment of Response and Toxicity

Tumor response was evaluated according to RECIST v1.1,<sup>28</sup> including complete response (CR), partial response (PR), and stable disease (SD) and progressive disease (PD), objective response rate (ORR). Pathological response was assessed using pathological complete response (pCR) and major pathological response (MPR) definitions. Adverse events were graded per CTCAE v5.0.<sup>29</sup>

### Follow-Up

Patients were followed every 3 months with imaging and laboratory tests. Progression-free survival (PFS) was defined as the time from treatment initiation to disease progression or death from any cause. Overall survival (OS) was defined as the time from treatment initiation to death or last follow-up.



**Figure 1** BAI/BACE procedure flowchart and bronchial artery angiograms. **(A)** Flowchart illustrating the BAI/BACE procedure. **(B)** Representative bronchial artery angiograms before and after embolization. Left panel: Pre-embolization angiogram shows dilated, hypertrophied, tortuous and disorganized tumor-feeding arteries (black arrow). Right panel: Post-embolization angiogram confirms the successful occlusion of the tumor-feeding arteries (black arrow), with no residual tumor blush.

## Statistical Analysis

Statistical analyses were performed using SPSS 26.0. Categorical variables were compared using the chi-square or Fisher’s exact test. Survival curves were generated by the Kaplan–Meier method and compared with the Log rank test. Univariate and multivariate analyses were conducted using Cox proportional hazards models. A two-sided  $P < 0.05$  was considered statistically significant.

## Results

### Baseline Characteristics

The baseline characteristics of 42 patients were analyzed and summarized in Table 1. The cohort comprised 27 males and 15 females, the median age was 71.5 years (range 57–79), and 59.5% were older than 70 years. 24 patients (57.1%) showed Eastern Cooperative Oncology Group score (ECOG) performance status of 0–1. 19 patients (45.2%) had a history of smoking. 57.1% of the patients had underlying diseases. There were 23 patients (54.8%) with central lung cancer and 19 patients (45.2%) with peripheral lung cancer. Histology was squamous cell carcinoma in 24 patients (57.1%) and adenocarcinoma in 18 patients (42.9%). The distribution among stages IIIA, IIIB, and IIIC was 31.0%, 38.0%, and 31.0%, respectively. There were no significant differences in baseline characteristics between the BAI and Non-BAI groups.

### Treatment Response

The treatment responses are shown in Table 2. After 2–3 cycles of induction therapy among the 42 patients, the complete response (CR) rate was 2.4%, partial response (PR) rate was 61.9%, overall response rate (ORR) was 64.3%, stable

**Table 1** The Clinical Characteristics Between the BAI and Non-BAI Groups [n (%)]

Characteristics	Overall (n=42)	BAI Group (n=20)	Non-BAI Group (n=22)	P value
ECOG score				0.327
0–I	24(57.1)	13(65.0)	11(50.0)	
2	18(42.9)	7(35.0)	11(50.0)	
Age (year)				0.231
≤ 70	17(40.5)	10(50.0)	7(31.8)	
> 70	25(59.5)	10(50.0)	15(68.2)	
Gender				0.461
Male	27(64.3)	14(70.0)	13(59.1)	
Female	15(35.7)	6(30.0)	9(40.9)	
Smoking				0.554
No	23(54.8)	10(50.0)	13(59.1)	
Yes	19(45.2)	10(50.0)	9(40.9)	
Underlying disease				0.372
No	18(42.9)	10(50.0)	8(36.4)	
Yes	24(57.1)	10(50.0)	14(63.6)	
Pathological type				0.108
Squamous carcinoma	24(57.1)	14(70.0)	10(45.5)	
Adenocarcinoma	18(42.9)	6(30.0)	12(54.5)	
Tumor location				0.976
Central	23(54.8)	11(55.0)	12(54.5)	
Peripheral	19(45.2)	9(45.0)	10(45.5)	
Clinical stage				0.971
IIIA	13(31.0)	6(30.0)	7(31.8)	
IIIB	16(38.0)	8(40.0)	8(36.4)	
IIIC	13(31.0)	6(30.0)	7(31.8)	

**Abbreviation:** ECOG, Eastern Cooperative Oncology Group.

**Table 2** Comparison of Tumor Response Between the BAI Group and Non-BAI Group [n (%)]

Tumor Response	Overall (n=42)	BAI Group (n=20)	Non-BAI Group (n=22)	P value
CR	1(2.4)	1(5.0)	0(0)	0.476
PR	26(61.9)	15(75.0)	11(50.0)	0.096
SD	11(26.2)	4(20.0)	7(31.8)	0.384
PD	4(9.5)	0(0)	4(18.2)	0.109
ORR	27(64.3)	16(80.0)	11(50.0)	0.043

**Abbreviations:** CR, complete response; PR, partial response; SD, stable disease; PD, progressive disease, ORR, overall response rate.

disease (SD) rate was 26.2%, and progression disease (PD) rate was 9.5%. The ORR was significantly higher in the BAI group than in the Non-BAI group (80.0% vs. 50.0%,  $P=0.043$ ).

### Perioperative Outcomes

After induction therapy, 64.3% (27/42) of patients achieved downstaging, and 45.2% (19/42) underwent radical surgery. The pCR and MPR rates were 10.5% and 36.8%, respectively. Perioperative complications occurred in 31.6% (6/19) of surgical patients, with no grade  $\geq$ III complications or mortality (Table 3).

### Survival Outcomes

Kaplan-Meier survival analysis (Figure 2A and B) showed that the 2-year PFS and OS rates for the entire cohort were 41.2% and 64.3%, respectively. The BAI group showed significantly better 2-year PFS (52.8% vs. 29.1%,  $P=0.032$ ) and OS (78.3% vs. 51.7%,  $P=0.022$ ) than the Non-BAI group (Figure 2C and D). Moreover, the surgery group had significantly superior 2-year PFS (64.8% vs. 20.7%,  $P=0.001$ ) and OS (93.8% vs. 39.6%,  $P=0.001$ ) compared to the Non-surgery group (Figure 2E and F).

### Prognostic Factors

Univariate analysis (Log rank test) revealed that tumor location, disease stage, and induction treatment modality were significantly associated with patient progression-free survival (PFS) (all  $P<0.05$ ). Age, disease stage, and induction treatment modality were significantly associated with overall survival (OS) (all  $P<0.05$ ). These significant variables factors were subsequently included in a multivariate Cox proportional hazards analysis which demonstrated that disease stage and induction treatment modality were independent prognostic factors for both PFS and OS (all  $P<0.05$ ) (Tables 4 and 5).

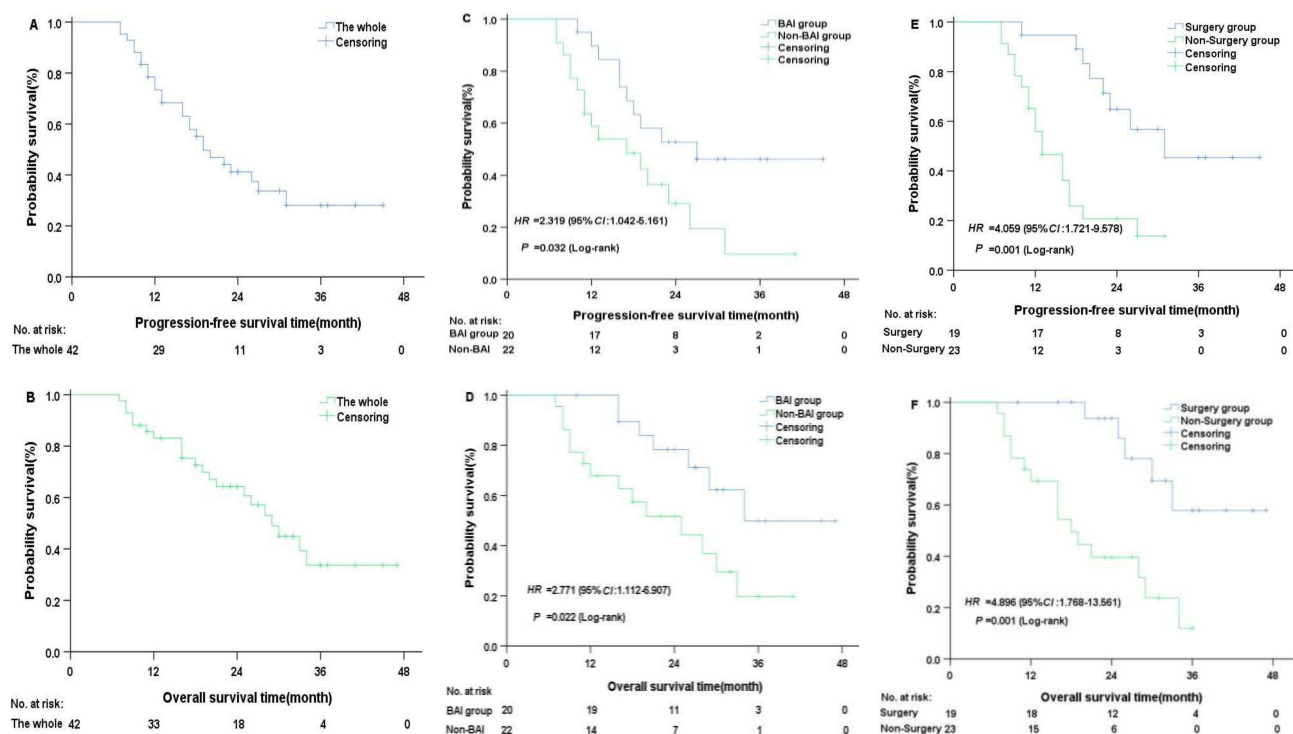
### Side Effects

Adverse events in both the BAI and Non-BAI groups were predominantly grade I–II. The most common adverse events were hematologic toxicities, including leukopenia, neutropenia, anemia, and thrombocytopenia. No significant differences were observed between the two groups (all  $P>0.05$ ) (Table 6).

**Table 3** Perioperative Results [n (%)]

Variable Factors	Overall (n=19)
Pathological response	
pCR	2(10.5)
MPR	7(36.8)
Surgical complication	
Infection	1(5.3)
Fever	2(10.5)
Chest pain	3(15.8)

**Abbreviations:** pCR, pathological complete response, MPR, major pathological response.



**Figure 2** The survival curve of progression-free survival and overall survival for stage III NSCLC patients. **(A and B)** Kaplan-Meier curves of progression-free survival and overall survival for the whole patients. **(C and D)** Kaplan-Meier curves of PFS and OS for BAI group vs Non-BAI group. **(E and F)** Kaplan-Meier curves of PFS and OS for surgery group vs Non-surgery group.

## Discussion

Patients with initially unresectable stage III NSCLC represent a heterogeneous population requiring multidisciplinary team (MDT) management.<sup>30,31</sup> Standard treatment has evolved from concurrent chemoradiotherapy (CCRT) alone to CCRT followed by durvalumab consolidation, as established by the PACIFIC trial.<sup>5,6</sup> Despite this paradigm shift, two major challenges persist: radiation-induced pneumonitis (up to 35% incidence in real-world settings) and the substantial proportion of patients ineligible for thoracic radiation due to tumor extent or poor pulmonary function.<sup>7</sup> While chemoimmunotherapy has shown promise in this setting, its benefits in real-world practice remain limited-particularly among patients with high tumor burden and extensive local invasion who are deemed unresectable-highlighting the urgent need for more effective induction strategies. Therefore, exploring integrated treatment approaches that synergize

**Table 4** Univariate and Multivariate Analysis of PFS in Stage III NSCLC Patients

Clinical Characteristics	Univariate Analysis		Multivariate Analysis		
	$\chi^2$	P	HR	95% CI	P
ECOG score (2 vs 0-1)	0.578	0.447			
Age (>70year vs ≤70year)	2.470	0.116			
Gender (Female vs Male)	2.577	0.108			
Smoking (Yes vs No)	0.232	0.630			
Underlying disease (Yes vs No)	0.757	0.384			
Pathological type (Adenocarcinoma vs Squamous)	0.012	0.912			
Tumor location (Peripheral vs Central)	4.263	<b>0.039</b>	1.877	0.825-4.270	0.133
Stage (IIIC vs IIIB vs IIIA)	7.855	<b>0.020</b>	2.461	1.370-4.422	<b>0.003</b>
Treatment (Non-BAI group vs BAI group)	4.599	<b>0.032</b>	3.829	1.560-9.401	<b>0.003</b>

**Note:** Table 4 black bold text indicates statistical significance ( $P < 0.05$ ).  
**Abbreviation:** ECOG, Eastern Cooperative Oncology Group.

**Table 5** Univariate and Multivariate Analysis of OS in Stage III NSCLC Patients

Clinical Characteristics	Univariate Analysis		Multivariate Analysis		
	$\chi^2$	P	HR	95% CI	P
ECOG score (2 vs 0-1)	2.897	0.089			
Age (>70year vs ≤70year)	4.763	<b>0.029</b>	1.931	0.699-5.331	0.204
Gender (Female vs Male)	0.318	0.573			
Smoking (Yes vs No)	0.948	0.330			
Underlying disease (Yes vs No)	3.137	0.077			
Pathological type (Adenocarcinoma vs Squamous)	0.086	0.769			
Tumor location (Peripheral vs Central)	1.597	0.206			
Stage (IIIC vs IIIB vs IIIA)	9.457	<b>0.009</b>	2.452	1.263-4.758	<b>0.008</b>
Treatment (Non-BAI group vs BAI group)	5.273	<b>0.022</b>	3.224	1.274-8.158	<b>0.013</b>

**Note:** Table 5 black bold text indicates statistical significance ( $P < 0.05$ ).

**Abbreviation:** ECOG, Eastern Cooperative Oncology Group.

**Table 6** Comparison of Side Effects Between the BAI Group and Non-BAI Group [n (%)]

Side Effects	Overall n (%)	BAI Group (n=20)	Non-BAI (n=22)	P value
Leukopenia				
I~II	10(23.8)	7(35.0)	3(13.6)	0.152
III~IV	5(11.9)	3(15.0)	2(9.1)	0.555
Neutropenia				
I~II	6(14.3)	3(15.0)	3(13.6)	1
III~IV	3(7.1)	2(10.0)	1(4.5)	0.598
Anemia				
I~II	11(26.2)	6(30.0)	5(22.7)	0.592
III~IV	3(7.1)	2(10.0)	1(4.5)	0.598
Thrombocytopenia				
I~II	8(19.0)	4(20.0)	4(18.2)	1
III~IV	4(9.5)	3(15.0)	1(4.5)	0.333
Elevated transaminases				
I~II	5(11.9)	2(10.0)	3(13.6)	1
III~IV	0(0)	0(0)	0(0)	-
Hyperbilirubinemia				
I~II	2(4.8)	1(5.0)	1(4.5)	1
III~IV	0(0)	0(0)	0(0)	-
Hypothyroidism				
I~II	2(4.8)	1(5.0)	1(4.5)	1
III~IV	0(0)	0(0)	0(0)	-
Fatigue				
I~II	5(11.9)	3(15.0)	2(9.1)	0.656
III~IV	0(0)	0(0)	0(0)	-

with chemoimmunotherapy to enhance efficacy and create opportunities for surgical resection has become a critical research priority.

With advancements in interventional oncology, bronchial arterial infusion (BAI) and chemoembolization (BACE) have emerged as minimally invasive techniques for lung cancer. By enabling superselective delivery of high-concentration chemotherapeutic agents directly to the tumor and embolizing its feeding arteries, BAI/BACE offers highly effective local control with minimal systemic toxicity, and is recommended for stage IIIb and above NSCLC.<sup>23-25</sup> For patients who are unsuitable for or unwilling to undergo thoracic radiation, BAI/BACE provides a valuable alternative that preserves lung function while avoiding radiation-related toxicities. Moreover, beyond its direct cytoreductive effect,

BACE induces ischemic necrosis and a distinct pattern of immunogenic cell death characterized by hypoxia-driven immune modulation, suggesting synergistic potential with immunotherapy that may exceed that of radiation.<sup>26,27</sup> Despite this biological rationale, high-level evidence regarding the clinical value of combining BAI/BACE with systemic chemoimmunotherapy remains lacking. Therefore, this study aims to investigate the therapeutic effect of this comprehensive therapy on patients with initially diagnosed inoperable stage III non-small cell lung cancer.

Our study demonstrated that, compared with chemoimmunotherapy alone, the combination of BAI/BACE with chemoimmunotherapy significantly improved the objective response rate (ORR: 80.0% vs. 50.0%) and prolonged both 2-year progression-free survival (PFS: 52.8% vs. 29.1%) and overall survival (OS: 78.3% vs. 51.7%). Multivariate analysis further confirmed that this combined regimen was an independent favorable prognostic factor, suggesting a definitive survival benefit. We hypothesize that the underlying mechanism may be related to the synergistic interaction between BAI/BACE and systemic chemoimmunotherapy.<sup>26,27,32</sup> First, BAI/BACE enables superselective delivery of high-concentration chemotherapeutic agents directly to the tumor, rapidly reducing tumor burden. Second, by embolizing the tumor-feeding arteries, BAI/BACE induces substantial ischemic necrosis, leading to the release of tumor-associated antigens and damage-associated molecular patterns (DAMPs). This process of immunogenic cell death can promote dendritic cell maturation and enhance T-cell priming, thereby converting an immunologically “cold” tumor microenvironment into a “hot”, inflamed state that is more responsive to PD-1 blockade. This immunomodulatory effect provides a strong mechanistic rationale for the observed clinical synergy and is supported by emerging preclinical evidence.

Notably, the combined approach facilitated tumor downstaging in 64.3% of patients, and achieved a surgical conversion rate of 45.2% (19/42). Patients who underwent curative resection had significantly improved survival outcomes, with superior 2-year PFS (64.8% vs. 20.7%) and OS (93.8% vs. 39.6%) rates compared to non-surgical patients. This marked survival advantage likely reflects not only the direct benefit of surgical resection itself, but also, more fundamentally, the efficacy of the BAI/BACE combined chemoimmunotherapy regimen in achieving substantial tumor downstaging—it was this downstaging that enabled these initially unresectable patients to become surgical candidates in the first place. Perioperative complications were manageable (31.6%), with no treatment-related mortality. Regarding pathological efficacy, the major pathological response (MPR) rate among resected patients was 36.8%, which compares favorably with the 32.3% reported by Deng et al<sup>17</sup> in a similar cohort of initially unresectable stage IIIB patients. However, the pathological complete response (pCR, 10.5%) was lower than the 18.2–43.8% range reported in several other studies.<sup>18–22</sup> Several factors may account for this discrepancy. First, our cohort exclusively comprised patients with truly unresectable stage III disease, who typically have a higher tumor burden than those enrolled in studies that included potentially resectable or borderline resectable patients. Second, the timing and number of BAI/BACE sessions varied among patients, which may have influenced the depth of pathological response. Third, the absence of PD-L1 expression data precluded identification of patients most likely to achieve pCR with immunotherapy-containing regimens. It is important to note that pCR is a stringent endpoint, and the observed MPR rate of 36.8% still indicates substantial pathological regression in a significant proportion of patients—an outcome previously associated with improved survival. Future studies with larger sample sizes and standardized protocols are needed to better characterize the pathological response to this combined approach and to identify optimal candidates for treatment.

Finally, the safety analysis revealed that adverse events in both groups were predominantly grade I–II, with hematological toxicity being the most common. No significant differences were observed between the groups, indicating that the addition of BAI/BACE did not increase treatment toxicity and the regimen was well tolerated. Nevertheless, several limitations of this study must be acknowledged. The retrospective design introduces inherent selection and information biases. The small sample size limits statistical power and may overestimate effect sizes, warranting cautious interpretation. The absence of PD-L1 expression data precludes biomarker-based analysis and limits identification of patients most likely to benefit. Additionally, variability in the timing of BAI/BACE relative to systemic therapy may have influenced outcomes, and optimal sequencing could not be assessed. Finally, the lack of direct comparison with CCRT restricts positioning of this strategy within the current treatment landscape. Notwithstanding these limitations, our findings provide a foundation for future investigations.

## Conclusions

In conclusion, BAI/BACE combined with chemoimmunotherapy shows promising efficacy and a manageable safety profile in the induction therapy of initially unresectable stage III NSCLC. The surgical conversion rate of 45.2% and the favorable survival outcomes associated with successful downstaging underscore the potential of this multimodal approach to enable radical treatment in patients otherwise deemed inoperable. Given the exploratory nature of this retrospective study, these findings should be interpreted with caution and require validation in larger prospective trials with standardized protocols and predefined selection criteria based on biomarkers such as PD-L1 expression and tumor characteristics.

## Data Sharing Statement

The datasets generated and/or analysed during the current study are not publicly available due to patient privacy concerns but are available from the corresponding author on reasonable request.

## Ethical Statement

This retrospective study was approved by the Ethics Committee of the Sixth People's Hospital of Chengdu (No.: 2025-KY-011). The need for informed consent was waived by the same ethics committee due to the retrospective nature of the study, which involved the analysis of anonymized clinical data without posing additional risks to patients and with strict protection of patient privacy. This study was conducted in accordance with the principles of the Declaration of Helsinki.

## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

The authors declare no conflicts of interest in this work.

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