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Oncology Treatment Discovery

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Analysis of the Feasibility of Dual-Tracer Sentinel Lymph Node Biopsy After Neoadjuvant Chemotherapy for Breast Cancer

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Abstract: *Objective:* The feasibility and safety of double-tracer sentinel lymph node biopsy (SLNB) for breast cancer patients after neoadjuvant chemotherapy and the possibility of exempting axillary lymph node dissection (ALND). *Methods:* The clinical data of 116 patients admitted to the Second Department of Breast Surgery of Baotou Cancer Hospital from July 2020 to May 2023 were collected. The patients underwent SLNB after neoadjuvant chemotherapy, and the data of the patients were analyzed. *Results:* Among the 116 breast cancer patients who underwent SLNB, sentinel lymph node (SLN) was not detected in 1 case, indicating a detection rate of 99.13% (115/116); 35 cases were positive for ALN and 22 cases were positive for SLN, indicating a sensitivity of 62.86 % (22/35); SLNB was successfully performed in 115 cases, indicating an accuracy of 73.91 % (85/115); 7 cases were false negative, and 35 cases were ALN positive, with a false negative rate of 37.14 % (13/35). *Conclusion*: SLNB cannot wholly replace ALND in breast cancer patients after neoadjuvant chemotherapy. In this experiment, when the number of SLN detected was ≥ 3 or when the breast mass reached pathological complete response, the dual-tracer SLNB could accurately predict the local status of ALN. However, randomized clinical trials with large sample sizes will be needed to consolidate this conclusion.

Keywords: Breast cancer; Neoadjuvant chemotherapy; Sentinel lymph node biopsy; Axillary lymph node

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1. Research background

Breast cancer is one of the most prevalent malignant tumors among women in China, whether it is in urban or rural areas and it is also ranks top four in terms of mortality rate [1]. With the advancement of technology, breast cancer treatment has entered the era of precision medicine. The concepts and methods of treatment have also undergone tremendous changes. Neoadjuvant chemotherapy (NAC) can effectively bring about local downstaging of intermediate and advanced breast cancer. It enhances the advantages of specific drug therapies for breast cancer patients, thereby improving their prospects for retaining their breasts following NAC [2].

Sentinel lymph node (SLN) refers to the first group of lymph nodes that the primary tumor passes when it metastasizes. SLNs serve as the first barrier to preventing the spread of a tumor, and their clinical significance has been valued. SLN biopsy (SLNB) can accurately evaluate the patient's axillary lymph nodes (ALNs) and reduce complications such as postoperative edema caused by total axillary dissection without affecting the patient's survival. Approximately 40% of breast cancer patients who are undergoing NAC have positive ALNs that can be converted into negative lymph nodes through ultrasound [3]. When axillary lymph nodes achieve pathological complete response (pCR), this group of patients may be exempted from ALN dissection (ALND). In recent years, the feasibility of SLN biopsy in evaluating ALN status in early breast cancer has been recognized [4], and the best method has been determined. Most studies believe that the choice of tracer should be either isosulfan blue or the double-tracer method i.e., combining the patent blue-V and nuclide tracer method [5]. However, for most grassroots or Western hospitals, the use of nuclides is subject to many restrictions, so it cannot be used clinically. Therefore, this study used methylene blue-indocyanine green (ICG) fluorescence combined with methylene blue dual-tracer SLN to retrospectively study the clinical utility and impact of dual-tracer SLNB in patients after NAC.

2. Research subjects and methods

2.1. Case selection and general information

The clinical data of breast cancer patients admitted to Baotou Cancer Hospital from July 2020 to May 2023 were collected.

Inclusion criteria: (1) Patients diagnosed with untreated female breast cancer; (3) patients with untreated stage I, II, and III breast cancer; (3) patients diagnosed with invasive breast cancer through preoperative evaluation and puncture; (4) patients who meet the preoperative criteria; (4) patients with NAC indications and had been given targeted therapy using taxanes, anthracyclines, trastuzumab, pertuzumab, platinum, or other drugs; (5) patients who underwent surgery and had their lesions and ALN status evaluated with imaging data before surgery.

Exclusion criteria: (1) Patients who could not tolerate preoperative NAC or surgery after pre-treatment evaluation; (2) patients who could not continue this study due to personal or other reasons; (3) patients with inflammatory breast cancer, bilateral breast cancer, or recurrent breast cancer; (4) patients who had previously undergone breast or axillary surgery; (5) patients who had suffered from other cancers and received chemotherapy and targeted therapy.

One hundred sixteen breast cancer patients were screened, all of whom were female. The patients' ages ranged from 34 to 71 years old, with an average age of 51.65 years. The tumor was located in the right breast in 61 cases (52.58%) and in the left breast in 55 cases (47.42%). As for the molecular classification of breast cancer, there were 37 cases of triple-negative breast cancer (31.90%), 48 cases of HER-2-positive breast cancer (41.38%), 15 cases of Luminal-A breast cancer (12.93%), and 16 cases of Luminal-B breast cancer (13.79%).

2.2. NAC regimen

Before surgery, a suitable NAC plan was formulated based on the patient's pathological type, physical condition, and economic factors. The plan included (1) taxanes, anthracyclines, and platinum drugs; (2) herceptin and/or pertuzumab combined chemotherapy. After each cycle, the efficacy was evaluated, and the dosage and regimen of chemotherapy were adjusted based on the patient's response to the drug, blood routine, blood biochemistry, color ultrasound, and enhanced MRI. After completing chemotherapy, the primary tumor and ALN status were evaluated through clinical examinations and imaging methods.

2.3. Tracer selection

The tracer used was ICG fluorescence combined with methylene blue.

2.4. SLNB

The patient underwent modified radical mastectomy or breast-conserving surgery. Methylene blue was injected into the subcutaneous tissue above the nipple and outside the areola. After massaging for 3–5 minutes, 5% ICG was injected at the upper and outer points of the areola. The infrared searcher could detect a luminous lymphatic vessel that continued until it disappeared in the armpit. It found the blue-stained lymphatic vessels and luminous lymph nodes, which were identified as sentinel lymph nodes. Care was taken to avoid damaging the light-stained lymphatic vessels during the operation. The SLN was removed, and the lymph nodes that had been imaged were confirmed by an infrared searcher and sent for frozen pathology.

2.5. Experimental result evaluation criteria

Clinical evaluation criteria: The breast tumors were evaluated using the RECIST criteria [6], which were divided into complete response, partial response, stable disease, and progressive disease. The ALNs were evaluated based on the American Joint Committee on Cancer (AJCC), 8th Edition standards; cTNM staging and ypTNM staging were used for pre-NAC and post-NAC clinical staging, respectively.

Pathological evaluation standards: pCR is defined as the absence of invasive cancer components in the lesion, with only vascular fibrous tissue stromal components remaining, or only ductal carcinoma *in situ*. The pCR of ALN is defined as the absence of cancer in the ALN upon pathological examinations.

2.6. SLN evaluation criteria

The evaluation standard of Louisville University in the United States was adopted for SLN [8]. The detection rate (DR), accuracy, false negative rate (FNR), and sensitivity of SLNB were calculated.

$$Sensitivity\ (\%) = \frac{Number\ of\ positive\ SLN\ cases}{Number\ of\ positive\ ALN\ cases} \times 100\% \quad (1)$$

$$Accuracy\ (\%) = \frac{True\ positive\ SNL\ cases + number\ of\ true\ negative\ cases}{Total\ number\ of\ SNL\ cases} \times 100\% \quad (2)$$

$$FNR\ (\%) = \frac{Number\ of\ false\ negative\ SLN\ cases}{True\ positive\ SLN\ cases + number\ of\ false\ negative\ cases} \times 100\% \quad (3)$$

$$\mathrm{DR}\ (\%) = \frac{\text{Number of detected cases}}{\text{Total number of cases}} \times 100\% \quad (4)$$

2.7. Statistical analysis

Statistical analysis was performed using SPSS 26.0. Classified data were described by relative numbers, including age, terminal illness, affected breast, BMI, tumor stage before NAC, ALN stage before and after NAC, ALN status before and after NAC, clinical stage, molecular classification, KI-67 expression, mass pCR, medication regimen and cycle, surgical plan, number of SLN detected. Other factors were subjected to a single-factor chi-square test or precise probability test. Factors such as mass pCR, number of detected SLN, and clinical stage that were statistically significant ($P < 0.05$) in the univariate analysis were included in the multivariate logistic regression equation analysis, and OR and CI 95% were used, with $\alpha = 0.05$ (two-tailed).

3. Result

3.1. SLN metastasis

Among the 116 breast cancer patients who underwent SLNB, sentinel lymph node (SLN) was not detected in 1 case, indicating a detection rate of 99.13% (115/116); 35 cases were positive for ALN and 22 cases were positive for SLN, indicating a sensitivity of 62.86 % (22/35); SLNB was successfully performed in 115 cases, indicating an accuracy of 73.91 % (85/115); 7 cases were false negative, and 35 cases were ALN positive, indicating a false negative rate of 37.14 % (13/35).

3.2. Correlation between SLN metastasis and pathological features

There was a significant correlation between whether pCR was achieved and the number of SLN detected ($P < 0.05$). Other factors showed no correlation with the FNR of SLN ($P > 0.05$). There was a significant correlation between the pre-NAC tumor stage, whether PCR was achieved, the number of SLN detected, and the accuracy of SLN detection ($P < 0.05$). There was no correlation between other factors and the accuracy of SLN detection ($P > 0.05$). Further details are shown in **Table 1**.

Table 1. Relationship between clinical and pathological factors in patients with breast cancer after NAC and the efficiency of double-tracer SLNB

Item	Accuracy (% [*n/N*])	χ^2	*P*	FNR (% [*n/N*])	χ^2	*P*
Age (years)		0.001	0.985		–	0.480*
< 50	74 (37/50)			46.15 (6/13)		
≥ 50	73.85 (48/65)			31.82 (7/22)		
Pre-NAC tumor staging (stage)		–	0.935		–	0.545*
cT1	77.78 (14/18)			33.33 (1/3)		
cT2	72.53 (66/91)			41.38 (12/29)		
cT3	80 (4/5)			0 (0/3)		
cT4	100 (1/1)			-		
Pre-NAC lymph node staging (stage)		4.064	0.131		–	0.065*
cN0	78.82 (67/85)			28 (7/25)		
cN1	56.25 (9/16)			100 (3/3)		
cN2	64.29 (9/14)			42.86 (3/7)		
Post-NAC lymph nodes		2.832	0.243		–	0.249*
ypN1	76.47 (78/102)			32.26 (10/31)		
ypN2	57.14 (4/7)			100 (2/2)		
ypN3	50 (3/6)			50 (1/2)		
Lymph node status before and after NAC		12.171	0.095		–	0.064*
cN0–ypN0	79.76 (67/84)			25 (6/24)		
cN0–ypN1	0 (0/1)			100 (1/1)		
cN1–ypN0	44.44 (4/9)			100 (2/2)		
cN1–ypN1	80 (4/5)			100 (1/1)		
cN1–ypN2	50 (1/2)			-		
cN2–ypN0	77.78 (7/9)			40 (2/5)		
cN2–ypN1	0 (0/1)			-		

Table 1. (Continued)

Item	Accuracy (% [*n/N*])	χ^2	*P*	FNR (% [*n/N*])	χ^2	*P*
cN2–ypN2	50 (2/4)			50 (1/2)		
Left and right breasts		0.789	0.375		–	0.733*
Left	77.78 (42/54)			33.33 (6/18)		
Right	70.49 (43/61)			41.18 (7/17)		
Menopause		0.746	0.388		–	0.055*
No	71.43 (55/77)			48 (12/25)		
Yes	78.95 (30/38)			10 (1/10)		
Stage		11.565	0.041		–	0.176*
I	80 (12/15)			33.33 (1/3)		
IIA	79.17 (57/72)			28.57 (6/21)		
IIB	36.36 (4/11)			100 (3/3)		
IIIA	61.54 (8/13)			50 (3/6)		
IIIB	100 (1/1)			0 (0/1)		
IIIC	100 (3/3)			0 (0/1)		
Molecular typing		2.472	0.480		–	0.234*
A	72.73 (8/11)			66.67 (2/3)		
B	68.75 (11/16)			37.5 (3/8)		
TNBC	81.25 (39/48)			16.67 (2/12)		
HER-2 overexpression	67.5 (27/40)			50 (6/12)		
HER-2 expression		2.639	0.104		–	0.220*
Negative	68.18 (45/66)			42.86 (12/28)		
Positive	81.63 (40/49)			14.29 (1/7)		
KI-67 expression		0.427	0.514		–	1
Low	69.7 (23/33)			38.46 (5/13)		
High	75.61 (62/82)			36.36 (8/22)		
Mass pCR		13.530	< 0.001		–	0.001*
No	58.18 (32/55)			68.75 (11/16)		
Yes	88.33 (53/60)			10.53 (2/19)		
Plan		1.927	0.382		–	0.302*
TP	70.97 (44/62)			50 (9/18)		
TCBHP	90.91 (10/11)			20 (1/5)		
other	73.81 (31/42)			25 (3/12)		
Number of cycles		0.014	0.904		–	0.519*
< 6	66.67 (6/9)			0 (0/2)		
≥ 6	74.53 (79/106)			39.39 (13/33)		
Surgical plan		0.022	0.882		–	0.164*
Breast conservation	74.55 (41/55)			23.53 (4/17)		
Improvement	73.33 (44/60)			50 (9/18)		
Number of SLN detections		13.638	0.003		–	0.015*

Table 1. (Continued)

Item	Accuracy (% [*n/N*])	χ^2	*P*	FNR (% [*n/N*])	χ^2	*P*
0	33.33 (4/12)			75 (6/8)		
1	60 (6/10)			50 (4/8)		
2	72.41 (21/29)			28.57 (2/7)		
≥ 3	84.38 (54/64)			8.33 (1/12)		
BMI		5.810	0.121		–	1*
Underweight	100 (2/2)			–		
Normal	81.25 (52/64)			35.29 (6/17)		
Overweight	63.64 (21/33)			40 (4/10)		
Obese	62.5 (10/16)			37.5 (3/8)		

Note: *Exact probability test

3.3. The relationship between the FNR of SLN and the number of detections

After stratifying by the number of detected Sentinel Lymph Nodes (SLNs), among 8 patients with zero detected SLNs, the false-negative rate of Sentinel Lymph Node Biopsy (SLNB) was 75% (6/8). For 8 patients with one detected SLN, the false-negative rate of SLNB was 50% (4/8). Among 7 patients with two detected SLNs, the false-negative rate of SLNB was 28.57% (2/7). For 12 patients with three or more detected SLNs, the false-negative rate of SLNB was 8.33% (1/12).

3.4. The relationship between the FNR of SLN and the rate of pCR

After stratifying according to whether the pCR was achieved, the FNR of SLNB among the 19 patients with pCR was 10.53% (2/19), and the false negative rate of SLNB among the 16 patients with non-pCR was 68.75% (11/16).

3.5. Multivariate logistic regression analysis on FNR

The statistically significant factors in the single-factor analysis were included in the multivariate logistic regression analysis. Definition and assignment of variables in the regression equation: The dependent variable was whether there was a false negative in SLN (Yes = 1, No = 0), and the independent variables included the number of SLN detections (0, 1, 2 and ≥ 3) and whether there was a mass pCR (No = 1, Yes = 0). The results revealed that in comparison to mass pCR, mass non-pCR exhibited an OR of 14.257, with a 95% CI ranging from 1.884 to 107.894. Moreover, in contrast to the number of SLN detections (0), the number of SLN detections (≥ 3) displayed an OR of 0.046, with a 95% CI of 0.02 to 0.863. Therefore, this indicates that the above indicators were related to the false negative detection of SLNB after breast cancer NAC (**Table 2**).

Table 2. Multivariate logistic regression analysis of clinical and pathological factors in patients with breast cancer after NAC and false-negative SLNB using double-tracer method

Index	B	SE	Wals	*P-value*	OR	95% CI
Mass PCR	2.657	1.033	6.622	0.010	14.257	1.884–107.894
SLN detections (0)	0.000		4.279	0.233	1.000	
SLN detections (1)	-1.128	1.294	0.760	0.383	0.324	0.026–4.087
SLN detections (2)	-1.285	1.399	0.843	0.358	0.277	0.018–4.295
SLN detections (≥ 3)	-3.072	1.492	4.239	0.040	0.046	0.002–0.863

3.6. Multivariate logistic regression analysis on accuracy

The statistically significant factors in the single-factor analysis were included in the multifactor binary logistic regression equation analysis. Definition and assignment of variables in the regression equation: The dependent variable was whether the diagnosis of SLN was accurate (No = 0, Yes = 1), the independent variables included the number of SLN detected (0, 1, 2, and 3), whether mass pCR was achieved (No = 0, Yes = 1) and stage (I, IIA, IIB, IIIA, IIIB, and IIIC). The results indicated that, compared to non-PCR tumors, the OR for PCR-positive tumors was 7.87495%, with a CI of 1.595 to 13.869. When comparing cases with zero detected SLNs to cases with three or more detected SLNs, the OR was 9.04, with a 95% CI of 1.764 to 46.33. The above indicators are related to the detection accuracy of SLNB after NAC for breast cancer (**Table 3**).

Table 3. Multivariate logistic regression analysis of clinical and pathological factors and the accuracy of SLNB using dual-tracer method in patients with breast cancer after NAC

Index	*B*	*SE*	*Wals*	*P-value*	*OR*	*95%CI*
Mass pCR	1.630	0.536	9.249	0.002	5.103	1.785–14.590
SLN detections (0)	0.000		8.193	0.042	1.000	
SLN detections (1)	1.309	1.051	1.552	0.213	3.701	0.472–29.013
SLN detections (2)	1.165	0.895	1.693	0.193	3.206	0.554–18.542
SLN detections (≥ 3)	2.202	0.834	6.973	0.008	9.04	1.764–46.33
Installment (I)	-20.12	21514.617	0.001	0.999	0.001	0.001–0.001
Stage (IIA)	-20.845	21514.617	0.001	0.999	0.001	0.001–0.001
Installment (IIB)	-19.361	21514.617	0.001	0.999	0.001	0.001–0.001
Stage (IIIA)	-21.407	21514.617	0.001	0.999	0.001	0.001–0.001
Stage (IIIB)	-40.718	45588.964	0.001	0.999	0.001	0.001–0.001
Stage (IIIC)	0.000		2.990	0.701	1.000	

4. Discussion

NAC can reduce the number of tumor cells in breast cancer patients and the size of the primary tumor. Besides, it also lowers the tumor stage, allowing patients to have more surgical opportunities and a higher success rate of breast conservation [1]. NAC can also be used to evaluate the effectiveness of treatment and further improve the pCR. SLN can act as an indicator to assess the status of ALN, and patients with negative results can avoid undergoing ALN dissection, reducing surgical complications and improving patients' postoperative quality of life [9]. An SLNB185 prospective clinical study [10] from Italy confirmed that SLNB can safely replace ALND in SLN-negative patients. This trial prospectively enrolled 516 patients with early breast cancer. The results of a median follow-up of 64.6 months showed no statistically significant difference in breast cancer-related events, including ALN recurrence, distant metastasis, and mortality in the SLNB and ALND groups. Subsequently, a series of prospective, multicenter, large-sample clinical trials such as ALMANAC, NSABP-B32, and ACOSOG Z0010 [11-13] have confirmed that patients with negative SNL have the same local symptoms after SLNB compared with ALND as well as recurrence rate, disease-free survival rate, and overall survival rate. The research results established the standard treatment status of SLNB in patients with clinically negative ALN early breast cancer. However, there is still controversy about whether SLNB using a dual-tracer method after NAC can avoid axillary lymph node dissection.

The SLNB detection rate using the double tracer method was 99.13%. However, the FNR was 37.14 %, which was higher than the acceptable clinical standard of 10% [14]. Some foreign multicenter prospective studies have evaluated the accuracy and feasibility of SLNB after NAC. The ACOSOG Z1071 and SENTINA experiments showed that the accuracy of sentinel lymph nodes after neoadjuvant chemotherapy in patients with positive axillary lymph nodes was low, and the false negative rate was too low [15-16]. The results of ACOSOG Z1071 clinical trial showed that the detection and FNR of SLNB were 92.9% and 12.6%, respectively. In the SNFNAC study of 153 patients, the FNR of SLNB was 13.3%, which was not within the ideal range of ≤ 10% [14]. Therefore, the results of these multicenter prospective trials do not support SLNB as a routine evaluation method for ALN after NAC. However, when the dual-tracer method is used, the SENTINA study results showed that the SLNB detection rate increased to 87.8% and the FNR dropped to 8.6%; the FNRs when detecting 1 and 2 SLNs were 24.3% and 24.3%, respectively; and 18.5% when more than 2 SLNs were obtained, with an FNR of 4.9% [15]. Besides, the ACOSOG Z1071 clinal trial also showed that the detection rate of SLNB using the double-tracer method was 93.8%, while the FNR was 10.8%, which is an acceptable level [17]. These experiments used the dual-tracer method combined with radionuclides, but hospital qualifications and other reasons limited the implementation of the radionuclide tracer method. In addition, using metal marking clips to mark ALN that have been confirmed to have metastases before NAC is beneficial to assessing marked ALN after NAC and improves the accuracy of ALN assessment. ACOSOG Z1071 experiment marked 203 patients with positive ALNs. The results showed that when the marking clip was located in the sentinel lymph node, the false negative rate was 6.8%. When the marking clip was located outside the sentinel lymph node, the false negative rate increased to 19.0% [18]. Therefore, it can be seen that after NAC, many factors are involved to reduce the FNR of SLNB to 10%. Our country is relatively conservative in exempting ALN dissection compared to foreign countries. The "Standardized Operating Guidelines for Sentinel Lymph Node Biopsy in Breast Cancer (2022 Essential Edition)" [19] recommends ALND to be performed on patients who are still cN+ after NAC. For patients initially confirmed with positive axillary lymph node metastasis, who, after neoadjuvant NAC, have downgraded to clinically negative axillary lymph nodes, the performance of SLNB should meet the following conditions: before neoadjuvant therapy, positive lymph nodes need to be marked and identified through biopsy, or SLNB should be conducted using dual tracers (preferably radioactive isotope + dye) with the detection of three or more sentinel lymph nodes. This procedure, after thorough discussion with the patient, is employed to guide subsequent decisions regarding axillary lymph nodes. After full communication with the patient, it will be used to guide subsequent ALN-related issues. This study also drew relevant conclusions about the number of SLN detected.

As the usage of radionuclide combined dye method is restricted in some hospitals due to poor nuclide availability, high cost, and high risk of radiation exposure, this study used ICG fluorescence combined with methylene blue as tracers. Methylene blue is low-cost, safe, and easy to use. However, its success rate is lower than the nuclide method or the combination of the two. ICG has been proven to be a safe tracer [20]. A study by Kitai *et al.* in Japan [21] reported that ICG fluorescence imaging can be used in SLNB technology to allow real-time lymphography and guide the direction of lymphatic vessels, and it causes less adverse reactions and is sensitive and non-radioactive. The report of Vermersch [22] suggested that when the two are combined, the risk of methylene blue allergy will not increase.

Further exploration is necessary regarding the clinical application of dual-tracer SLNB following NAC for breast cancer. This exploration aimed to ascertain if it could potentially serve as a standard treatment method, obviating the need for ALND after NAC in breast cancer patients. However, this study has certain limitations. The surgeries were performed by a single operator with substantial clinical experience, possibly introducing

bias errors. Additionally, the sample size was limited, so multicenter, large-sample randomized and controlled trials will be needed to validate the experimental outcomes observed in this study.

5. Conclusion

In summary, SLNB showed a high FNR based on the results of this study, so it cannot wholly replace ALND after NAC in breast cancer patients. Nevertheless, when three or more SLN were detected or when the breast mass achieved a pCR, SLNB exhibited accuracy in predicting the local status of ALNs. However, the accuracy of these findings must be further validated through randomized clinical trials with larger sample sizes.

6. Prospects

SLN hold significant importance in breast surgery, playing a pivotal role in assessing ALNs. Advancements in imaging, biopsy technology, artificial intelligence, and big data have enabled precise evaluation of the lymph node status. With these advancements, companies can devise comprehensive and personalized plans, ensuring accurate regional treatment tailored to the condition of axillary lymph nodes following NAC.

Disclosure statement

The author declares no conflict of interest.

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Research Progress on Eradicating *Helicobacter pylori* to Prevent Gastric Cancer

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Abstract: Gastric cancer is a malignant tumor that originates in the gastric mucosal epithelium. It mainly occurs in people over 50 years old. With the increasing work pressure, *Helicobacter pylori* infection, and other factors, gastric cancer patients are also getting younger. Gastric cancer has no obvious symptoms in its early stages. Therefore, gastric cancer patients are often diagnosed at the middle and late stages of the disease. The prognosis and survival rate of gastric patients are not ideal. Therefore, prevention should be taken for people who are at risk of getting gastric cancer. *Helicobacter pylori* is a significant cause of the occurrence and development of gastric cancer. The bacterium produces various virulence factors, triggering the Correa cascade reaction, ultimately culminating in the development of gastric cancer. Clinically, it is believed that eradication of *Helicobacter pylori* can reverse precancerous lesions of the stomach and therefore prevent gastric cancer, but it has not been confirmed yet. This article explores explicitly the research progress on eradicating *Helicobacter pylori* in the context of gastric cancer prevention.

Keywords: Helicobacter pylori; Eradication methods; Gastric cancer prevention; Atrophic gastritis

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1. Introduction

Helicobacter pylori is a type I gram-negative bacterium that is spiral-shaped (spirillum). *Helicobacter pylori* can infect the human gastric mucosa, and the environment in which it grows is microaerobic. *Helicobacter pylori* is highly contagious and is mainly transmitted orally or through feces. Globally, there are a vast number of people infected with *Helicobacter pylori*. According to incomplete statistics, about 10 million people in China are infected with *Helicobacter pylori*, accounting for 20% to 30% of the world's total. *Helicobacter pylori* can accelerate the development of various gastric-related diseases, which may eventually develop into gastric cancer. B-cell mucosa-associated lymphoid tissue lymphoma and peptic ulcer are some of the more common causes of gastric diseases. The role of *Helicobacter pylori* in promoting the occurrence and development of gastric cancer has been clinically proven, and it is also a significant cause of gastric cancer [1]. As early as 1994, the World Health Organization listed *Helicobacter pylori* as a Class I carcinogen. Carrying out eradication

treatment can better prevent the occurrence of gastric cancer. When infected by *Helicobacter pylori*, the human body will secrete many pathogenic factors, among which cytotoxin-related factor A and vacuolated cytotoxin A are two of the more common ones. With the secretion of these pathogenic factors, the antioxidant function and protein connection function of the gastric mucosa will be affected. The imbalance of these pathogenic factors will ultimately induce gastric cancer. However, there is still considerable clinical controversy about whether eradicating *Helicobacter pylori* can prevent gastric cancer, so further research is needed.

2. The mechanism by which *Helicobacter pylori*-related virulence factors lead to gastric cancer

2.1. Vacuolating cytotoxin A and the pathogenesis of gastric cancer

Helicobacter pylori is produced by various virulence factors, of which vacuolating cytotoxin A is typical. This toxin can form a selective ion channel for *Helicobacter pylori*, feeding off the products of metabolism and electrolytes in human cells. This mechanism allows *Helicobacter pylori* to survive. Vacuolating cytotoxin A causes the cytoplasm to transform into vacuoles gradually, further affecting the target cells' functions, such as interfering with the mitochondrial membrane and stimulating cell apoptosis [2]. Relevant studies [3] have shown that when the human body is infected with *Helicobacter pylori* and there is a presence of vacuolating cytotoxin A, the level of cytotoxin-related gene A will increase.

Cytotoxin-related factor A is another virulence factor associated with Helicobacter pylori. This additional virulence factor accumulates in gastric epithelial cells due to the influence of vacuolating cytotoxin A. Over time, this accumulation can lead to the development of gastric cancer. Another clinical study analysis [4] showed that the patients who were negative for vacuolating cytotoxin A antibodies were at higher risk of developing gastric cancer compared to patients who were positive for cytotoxin A antibodies. Therefore, there is a significant correlation between the occurrence of gastric cancer and vacuolating cytotoxin A.

2.2. Cytotoxin-related gene A and the pathogenesis of gastric cancer

Cytotoxin-related gene A is a virulence factor secreted by *Helicobacter pylori*. The protein of this virulence factor can reach gastric epithelial cells based on the type IV secretion system. The C-terminus of cytotoxin-related gene A appears tyrosine phosphorylated, which is fatal. Scaffolding proteins may also be formed as a result, and there are independent and dependent cases of amino acid phosphorylation. Still, in either case, they will interact with signaling proteins in the human body, and the cells in the human body will be continuously induced to undergo morphological changes. Changes in this aspect increase cell energy, hindering their normal movement and proliferation and ultimately leading to cancer development. Research indicates that the induction of cytotoxin-related gene A can lead to the polarization of epithelial cells, causing a shift in the phenotype towards a more invasive aspect. When working in conjunction with cancer-promoting proteins and *Helicobacter pylori*, cytotoxin-related gene A contributes to an increased expression of itself in human gastric epithelial cells. Ultimately, this process can induce gastric cancer. Moreover, abnormal expression of cytotoxin-related gene A can result in cancerous damage or genetic instability, further contributing to the development of gastric cancer [5].

3. Research progress on the role of *Helicobacter pylori* eradication in preventing gastric cancer

3.1. Progress in the prevention of non-atrophic gastritis by eradicating *Helicobacter pylori*

Once infected with *Helicobacter pylori*, patients are prone to chronic non-atrophic gastritis. *Helicobacter pylori* can be found in patients with gastritis through examinations. At the same time, they will also experience

structural changes in the gastric mucosa. *Helicobacter pylori* has multiple effects on the human gastric mucosa. Firstly, patients infected with *Helicobacter pylori* will experience chronic non-atrophic gastritis, which will develop into acute gastritis. If *Helicobacter pylori* is eradicated, the inflammation will gradually subside. If *Helicobacter pylori* is not eliminated, the number of parietal cells that secrete gastric acid and the main cells that secrete digestive enzymes will continue to decrease, eventually leading to atrophy of the gastric mucosa. Atrophic gastritis is a lesion before gastric cancer that will significantly increase the risk of gastric cancer. Some scholars [6] conducted a group test patients who tested positive for *Helicobacter pylori* and randomly divided these patients into an eradication group and a control group. Patients in the eradication group underwent *Helicobacter pylori* eradication treatment, and patients in the control group underwent placebo treatment. Then, the patients were followed up for seven years. After seven years, none of the patients who did not develop atrophic gastritis developed gastric cancer. Meanwhile, among the patients in the control group who did not have atrophic gastritis, six of them developed gastric cancer. This indicates that the incidence of gastric cancer in non-atrophic gastritis patients can be effectively reduced through the eradication of *Helicobacter pylori*.

3.2. Progress in *Helicobacter pylori* eradication in preventing atrophic gastritis

Patients with atrophic gastritis exhibit chronic inflammation in the gastric mucosa, accompanied by significant atrophy in the gastric glands. The patient's lesions may have fibrosis, intestinal metaplasia, or pseudopyloric metaplasia. Statistics [7] show that patients who are positive for *Helicobacter pylori* are five times more likely to develop atrophic gastritis compared to patients who are negative for *Helicobacter pylori*. This shows that *Helicobacter pylori* infection is closely related to atrophic gastritis development. In patients with atrophic gastritis, the two virulence factors of Helicobacter pylori are closely associated with gastric mucosa atrophy. Helicobacter pylori induces various inflammatory factors through bacterial oxidation, leading to their accumulation in the gastric mucosa. Therefore, gastric epithelial cell damage is prone to occur. Clinical follow-up of patients with atrophic gastritis five years later found that after successfully eradicating *Helicobacter pylori*, gastric mucosal atrophy was significantly reduced, and the patient's mucosa could eventually heal. However, whether the eradication of Helicobacter pylori can prevent atrophic gastritis from developing further into gastric cancer is still debatable. According to relevant literature [8], patients with atrophic gastritis who do not exhibit intestinal metaplasia did not develop gastric cancer after the eradication of *Helicobacter pylori*. In contrast, among patients with atrophic gastritis and intestinal metaplasia, some individuals still developed gastric cancer after the eradication of *Helicobacter pylori*. Therefore, this shows that the eradication of Helicobacter pylori might be effective in preventing gastric cancer in certain groups of patients. For patients with mild atrophic gastritis, the *Helicobacter pylori* eradication can effectively prevent the occurrence of gastric cancer. However, this treatment might not be effective in preventing gastric cancer for patients with moderate to severe atrophic gastritis. Therefore, for patients with atrophic gastritis, it is necessary to promptly evaluate the degree of gastric mucosal lesions and carry out *Helicobacter pylori* eradication treatment as early as possible to improve the gastric mucosal lesions better, to reduce the risk of gastric cancer effectively [9].

3.3. Progress in the prevention of intestinal metaplasia by eradicating *Helicobacter pylori*

Intestinal metaplasia refers to the replacement of the human gastric mucosa with epithelium resembling that of the small intestine mucosa. Intestinal metaplasia is often caused by the stimulation of persistent inflammation in the gastric mucosa, and patients infected with *Helicobacter pylori* have persistent inflammation. Persistent inflammation plays a crucial role in intestinal metaplasia, which is closely related to the occurrence of gastric cancer. Therefore, to prevent the occurrence of gastric cancer, it is also necessary to avoid intestinal metaplasia. A retrospective study [10] showed that about 42% of gastric cancer patients included in the study had intestinal epithelial changes, and about

17% of these patients showed severe mucosal lesions and intestinal epithelial changes. Notably, these patients not only presented with larger tumors but also had a higher incidence of submucosal invasion. This shows that intestinal metaplasia is an essential factor in the occurrence and development of gastric cancer.

4. Conclusion

In summary, *Helicobacter* pylori plays a vital role in the occurrence and development of gastric cancer, and more and more clinical evidence has confirmed that the eradication of *Helicobacter pylori* can effectively reduce the risk of gastric cancer. Although the eradication of *Helicobacter pylori* has a significantly lower anti-cancer effect in patients with severe intestinal metaplasia and atrophic gastritis, the sooner *Helicobacter pylori* eradication treatment is carried out, the more effective it is for the patient. By further exploring the connection between *Helicobacter pylori* and gastric cancer and carrying out *Helicobacter pylori* eradication treatment as early as possible the incidence of clinical gastric cancer can be effectively reduced, protecting the lives of patients.

Disclosure statement

The authors declare no conflict of interest.

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Therapeutic Effect of Indometacin, Furazolidone, and Cuscohygrinolis α-Acetylbenzoacetate Suppository Combined with Fuzhiqing Ointment in Treating Anal Fissure: An Observation of 98 Cases

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Abstract: *Objective:* To assess the efficacy of the combined application of indometacin, furazolidone, and cuscohygrinolis α-acetylbenzoacetate suppository and Fuzhiqing ointment in treating patients with anal fissures. *Methods:* A total of 98 patients diagnosed with anal fissures between January 2021 and December 2022 were selected as the study participants. They were randomly assigned to two groups using the random number table method. The control group received treatment with indometacin, furazolidone, and cuscohygrinolis α-acetylbenzoacetate suppository, while the observation group underwent a combination treatment involving indometacin, furazolidone, and cuscohygrinolis α-acetylbenzoacetate suppository and Fuzhiqing ointment. The two groups were compared in terms of pain level, wound bleeding, and changes in wound granulation health. Additionally, the time for symptom disappearance, improvement in anal function, and occurrence of related adverse reactions were recorded. *Results:* The observation group exhibited lower pain score, wound bleeding score, and wound granulation health score compared to the control group ($P < 0.05$). The observation group also showed shorter times for the disappearance of symptoms as well as a quicker time for complete anal fissure healing compared to the control group ($P < 0.05$). No relevant adverse reactions were observed in any of the patients. *Conclusion:* The addition of Fuzhiqing ointment to the treatment of patients with anal fissures using metronidazole ester suppositories promotes the improvement of disease symptoms and enhances the health of wound granulations. This combined treatment demonstrates a positive effect on the overall healing process of the disease, indicating a broad application value.

Keywords: Anal fissure; Metronidazole ester suppository; Fuzhiqing ointment; Wound granulation health; Blood in the stool

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1. Introduction

Anal fissure, a common anal disease characterized by a linear or oval-shaped tear in the skin distal to the dentate line of the anal canal, manifests through symptoms such as anal pain, blood in the stool, and difficulty

in defecation [1]. Traditional treatment approaches encompass local drug treatment and surgical interventions. However, these methods exhibit certain limitations and potential side effects. In recent years, a novel treatment method involving the combined application of metronidazole ester suppository and Fuzhiqing ointment has gained widespread acceptance in treating anal fissures [2].

Indometacin, furazolidone, and cuscohygrinolis α-acetylbenzoacetate suppository, a local anti-inflammatory drug with analgesic, anti-inflammatory, and hemostatic properties, has demonstrated effectiveness in alleviating pain symptoms and promoting the healing of anal fissures [3]. Concurrently, Fuzhiqing ointment, a traditional Chinese medicine (TCM) preparation, exhibits qualities such as heat and detoxification clearance, putrefaction removal, muscle growth promotion, swelling reduction, and pain relief. This ointment contributes to enhancing local blood circulation, reducing inflammatory reactions, softening scar tissue associated with anal fissures, and facilitating wound healing [4].

The purpose of this study is to investigate the application effect of combining indometacin, furazolidone, and cuscohygrinolis α-acetylbenzoacetate suppository with Fuzhiqing ointment in treating anal fissures. The aim is to offer patients a more effective and safer treatment option, thereby enhancing their quality of life and promoting recovery.

2. Materials and methods

2.1. General information

The subjects of observation in this study were selected from patients diagnosed and treated for anal fissures at the anorectal clinic of Yuxi People's Hospital. A total of 98 cases were included, comprising 24 males and 64 females, with a disease duration ranging from one month to two years. The treatment period extended from January 2021 to December 2022. Using the random number table method, patients were grouped into the control and observation groups, each consisting of 49 participants.

The control group consisted of 11 males and 38 females, with a mean age of 48.45 ± 2.26 years and a mean disease duration of 9.74 ± 1.05 months. According to anal fissure classification, 31 cases were grade II and 18 cases were grade III. The observation group comprised 13 males and 26 females, with a mean age of 48.52 ± 2.33 years and a mean disease duration of 9.86 ± 1.13 months. According to anal fissure classification, 35 cases were grade II and 14 cases were grade III. When comparing the data presented in the study between the two groups of patients with anal fissures, no significant difference was observed ($P > 0.05$).

Inclusion criteria included individuals who met the diagnostic criteria for anal fissure, with a normal appearance and function of the anus with no history of relevant surgical treatment, a disease duration exceeding 6 weeks, evident pain symptoms before and after defecation in the middle position behind the anus, aggravated symptoms after defecation, and anal fissure stage II-III with good medication compliance.

Exclusion criteria included individuals with perianal abscess, rectal mucosal prolapse, and other rectal diseases, severe organic diseases, critical conditions making clinical efficacy and safety difficult to judge, and pregnant or lactating women.

2.2. Method

Subjects in the control group were treated with indometacin, furazolidone, and cuscohygrinolis α-acetylbenzoacetate suppository, one pill administered twice a day, and placed into the anus for two consecutive weeks.

Subjects in the observation group were treated with indometacin, furazolidone, and cuscohygrinolis α-acetylbenzoacetate suppository and Fuzhiqing ointment. One metronidazole suppository was dipped in an

appropriate amount of Fuzhiqing ointment, and the medicine was placed into the anus twice a day, continuously for two weeks.

During the treatment process, patients in both groups refrained from using other drugs and avoided consuming spicy and irritating foods.

2.3. Observation indicators

(1) Statistical study on improvement in pain level, wound bleeding, and granulation health: The study encompassed the evaluation of pain level, wound bleeding, and granulation health improvement in both patient groups. The patient's pain level was assessed before and after medication using a digital simulation scoring method, with a total score of 10 points. A lower score indicated greater symptom improvement. Wound bleeding and granulation health were evaluated using a five-point scoring method, ranging from 0 to 4. A score of 0 indicated no bleeding symptoms, while a score of 4 indicated persistent bleeding. For granulation health, a score of 0 represented a healthy state, while a score of 4 indicated severe edema, necessitating medical intervention for improvement.

(2) Recording of time-based patient observations between groups: The study recorded various time-related parameters between groups, including the time for wound pain to disappear, the time for bleeding cessation, the time for the disappearance of tenesmus, and the time for complete healing of the anal fissure.

(3) Recording of adverse reactions during medication: Any adverse reactions occurring during the study were systematically recorded.

2.4. Statistical processing

All data in this study were entered into SPSS 22.0 for processing. Measurement data between groups were expressed as mean ± standard deviation (SD), and results were obtained using a *t*-test. Count data were represented as percentages, and results were obtained using a chi-squared test. If there was a statistically significant difference in the test data, it was expressed as $P < 0.05$.

3. Results

3.1. Comparison of pain levels, wound bleeding, and granulation health scores between groups

Upon analyzing the data presented in **Table 1**, it was observed that before treatment, there were no significant differences in pain scores, wound bleeding scores, and granulation health scores between the groups ($P > 0.05$). However, following medication, the scores for subjects in the observation group were significantly lower than those in the control group ($P < 0.05$).

Table 1. Comparison of the changes in pain, wound bleeding, and granulation health scores between the two groups of anal fissure patients ($n = 49$, points)

Group	Pain score		Wound bleeding score		Granulation health score	
	Before	After	Before	After	Before	After
Control group	6.25 ± 0.98	5.17 ± 0.52	3.22 ± 0.23	2.48 ± 0.16	3.08 ± 0.24	2.39 ± 0.16
Observation group	6.33 ± 0.86	3.69 ± 0.38	3.25 ± 0.31	1.74 ± 0.13	3.15 ± 0.28	1.85 ± 0.14
t	0.430	16.086	0.544	25.127	1.329	17.780
P	0.669	0.001	0.588	0.001	0.187	0.001

3.2. Comparison of symptom disappearance time between groups

Upon analyzing the data in **Table 2**, no significant differences were found in the time it took for symptoms to disappear, as well as the time for complete healing of the anal fissure, before the initiation of treatment between the two groups ($P > 0.05$). After treatment, however, the observation group exhibited significantly short times for the disappearance of each symptom and the complete healing of anal fissure healing compared to the control group ($P < 0.05$).

Table 2. Comparison of symptom disappearance time between two groups of patients with anal fissure ($n = 49$, d)

Group	Wound pain disappearance time	Bleeding disappearance time	Tenesmus disappearance time	Anal fissure complete healing time
Control group	8.03 ± 1.19	8.16 ± 1.41	9.21 ± 1.45	11.96 ± 2.24
Observation group	6.21 ± 0.85	5.39 ± 1.02	7.36 ± 0.98	8.16 ± 1.47
t	8.712	11.142	7.400	9.928
P	0.001	0.001	0.001	0.001

3.3. Analysis of the incidence of adverse reactions

Notably, none of the anal fissure patients included in this study experienced any adverse reactions related to the medication.

4. Discussion

Anal fissure, a common anal disease characterized by linear or oval-shaped tears beneath the dentate line of the anal canal, often results from damage or overstretching of tissues around the anus. Common causes include conditions such as constipation, poor defecation, and anal sphincter spasm, manifesting through symptoms such as pain, itching, bleeding, and difficulty in defecation. If left untreated, anal fissures may lead to bacterial infection, causing local redness, swelling, exudation, burning pain, and other symptoms [5]. Prolonged non-treatment may result in anal stenosis and fistula formation, further escalating the risk of severe infection and inflammation. Early intervention is crucial to improving disease symptoms and enhancing patients' quality of life.

The key components of indometacin, furazolidone, and cuscohygrinolis α-acetylbenzoacetate suppositories are indometacin and furazolidone. Indometacin, a non-steroidal anti-inflammatory drug (NSAID), possesses analgesic, antipyretic, anti-inflammatory, antispasmodic, and microcirculatory improvement properties. It inhibits prostaglandin synthesis, thereby reducing the release of inflammatory mediators. Furazolidone, an anti-infection drug, effectively sterilizes or inhibits gram-positive and gram-negative bacteria, while cuscohygrinolis α-acetylbenzoacetate, an anticholinergic agent, inhibits the action of the neurotransmitter acetylcholine, further alleviating pain.

Fuzhiqing ointment, a TCM preparation, incorporates ingredients such as *Rehmannia glutinosa*, Cortex Phellodendri, *Sophora flavescens*, known for their heat-clearing, detoxifying, putrefaction removal, muscle growth promotion, astringent, hemostatic, swelling reduction, and analgesic properties. This ointment effectively relieves pain, itching, and bleeding associated with anal fissures and contributes directly to their treatment through topical application [6-8]. Fuzhiqing ointment aids in removing putrefaction, promoting granulation growth, constricting blood vessels, reducing bleeding, and facilitating anal fissure wound healing. Its anti-inflammatory effects improve the inflammatory response, relieving pain and swelling, while also enhancing local blood circulation and promoting wound healing [9,10].

The study results indicate that the symptom scores, symptom disappearance times, and complete healing times of anal fissures in the observation group were significantly better than those in the control group. This suggests that the addition of Fuzhiqing ointment to the treatment of anal fissures with indometacin, furazolidone, and cuscohygrinolis α-acetylbenzoacetate suppositories can effectively alleviate symptoms such as pain and bleeding, positively influencing wound healing and promoting the recovery of anal function. The combined use of these medications capitalizes on their respective advantages, enhancing the overall therapeutic effect [11]. indometacin, furazolidone, and cuscohygrinolis α-acetylbenzoacetate suppository relieves pain and inflammation, promoting anal fissure healing, while Fuzhiqing ointment addresses uncomfortable symptoms such as itching and burning sensation, supporting wound healing. Their combined use comprehensively treats anal fissures, reducing patient symptoms and improving their quality of life [11]. The medicinal ingredients in Fuzhiqing ointment additionally contribute to scar tissue softening, granulation tissue hyperplasia, wound repair, dehumidification, and alleviation of anal fissure itching, promoting overall healing and improved anal function [12].

In conclusion, the combined use of indometacin, furazolidone, and cuscohygrinolis α-acetylbenzoacetate suppository with Fuzhiqing ointment proves to be an effective treatment for anal fissures, providing relief from pain symptoms, putrefaction removal, muscle growth promotion, and anal fissure healing [13]. However, this study has limitations, including a small sample size and a short research duration. Further clinical studies should conduct larger sample sizes and longer-term follow-up investigations to further validate these results.

Disclosure statement

The author declares no conflict of interest.

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Analysis of the Effect of Letrozole on Patients Undergoing Postoperative Endocrine Therapy for Breast Cancer

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Abstracts: *Objective:* To investigate the effect of letrozole on patients undergoing postoperative endocrine therapy for breast cancer. *Methods:* The period of the study was from June 2021 to January 2023, and 40 patients who were undergoing postoperative endocrine therapy for breast cancer were grouped into two groups by randomized numerical table method: the observation group and the control group. The observation group was given letrozole and the control group was given tamoxifen. At the end of the medication, the results of each index of the two groups were compared. *Results:* After medication, The Kupperman score of the observation group was lower and Karnofsky Performance Scale (KPS) score was higher compared to the control group ($P < 0.05$). Besides, the high-density lipoprotein cholesterol (HDL-C) level of the observation group was higher than that of the control group after treatment ($P < 0.05$). Moreover, the adherence to medication and regular follow-up rate of the observation group was higher than that of the control group ($P < 0.05$). Lastly, all liver function indexes of the observation group were lower than those of the control group after treatment ($P < 0.05$). *Conclusion*: Letrozole is more effective in treating breast cancer patients who are undergoing postoperative endocrine therapy, with less impact on blood lipids and liver function. Therefore, it is worthy of further research and application.

Keywords: Breast cancer; Postoperative endocrine therapy; Letrozole; Efficacy

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1. Introduction

Breast cancer is a malignant tumor disease that is highly prevalent among women. It is life-threatening and has a mortality rate, making timely treatment very important. As the population ages, the incidence of breast cancer among the elderly has been increasing. Patients in this demographic often experience a significant decline in bodily functions, resulting in slow cell growth and low invasiveness, coupled with high positive rates of progesterone receptors and estrogen receptors. Surgery is usually the primary treatment option for breast cancer, and it is especially important to provide effective endocrine therapy after the surgery. Endocrine therapy is usually performed at the later stage of the disease, most patients have small subclinical metastatic foci in the early stage of the disease, which leads to the ineffectiveness of the therapy. Neoadjuvant chemotherapy is a

systemic treatment that can reduce the stage of malignant tumors and control local foci to increase the success rate of the treatment. This approach is highly safe as it will damage the patient's body while controlling the progression of the disease, thus prolonging patients' survival and improving their quality of life after surgery. Common endocrine therapy drugs include letrozole and tamoxifen. Letrozole is an effective aromatase inhibitor in endocrine therapy for breast cancer [1]. The purpose of this paper is to investigate the effect of letrozole in patients with postoperative endocrine therapy for breast cancer.

2. General information and methodology

2.1. Baseline data

Patients with postoperative endocrine therapy for breast cancer were selected for this study (admitted between June 2021 and January 2023). The patients were divided into 2 groups, with 20 cases in each group. The study was approved by the Medical Ethics Committee.

Inclusion criteria: (1) diagnosed with hormone receptor-positive breast cancer through postoperative pathological confirmation [2]; (2) all blood lipids and lipid-related data were collected in the fasting state in the morning; (3) patients and their families signed informed consent; (4) hormone levels were in the menopausal state, i.e., aged < 60 years old, with a duration of natural menopause of ≥ 12 months; (5) have not received chemotherapy, tamoxifen, or triamcinolone acetonide therapy recently, FSH and estradiol levels were within the postmenopausal range.

Exclusion criteria: (1) Combined organ failure lesions; (2) cognitive disorders; (3) recently received other anticancer treatments; (4) the presence of other malignant lesions.

The average age of the patients in the observation group was 49.55 ± 2.45 years old, ranging from 42 to 57 years old. The pathological types in this group were 17 cases of invasive lobular carcinoma, 2 cases of invasive ductal carcinoma, and 1 case of mixed type. The TNM stages of the patients were 12 cases of stage IIb, 5 cases of stage IIIa, and 3 cases of stage IIIb. As for the comorbidities, there were 8 cases of diabetes mellitus, 8 cases of hypertension, and 4 cases of coronary artery disease.

The average age of the patients in the control group was 49.63 ± 2.99 years old, ranging from 43 to 57 years old. The pathological types in this group were invasive lobular carcinoma (16 cases), invasive ductal carcinoma (3 cases), and mixed type (1 case). The TNM stages of the patients were stage IIb (11 cases), stage IIIa (6 cases), and stage IIIb (3 cases). As for the comorbidities, there were diabetes mellitus (9 cases), hypertension (7 cases), and coronary heart disease (4 cases).

All patients in this study were females. The general information of the two groups showed no statistical difference ($P > 0.05$).

2.2. Methods

Both groups of patients were treated with radical mastectomy for breast cancer (radical mastectomy for breast cancer), and their endocrine therapy was given after the operation, and different drugs were chosen respectively.

Tamoxifen (approval number: H32021472; manufacturer: Yangzijiang Pharmaceutical Group Co., Ltd.) was chosen as the therapeutic drug for the control group; the patients were instructed to take the drug orally at a dose of 20 mg, once a day, for a total of 30 days (1 cycle). For the observation group, letrozole (approval number: H19991001; manufacturer: Jiangsu Hengrui Pharmaceutical Co., Ltd.) was administered at a dosage of 2.5 mg, once a day, for a total of 30 days.

The effect of the drugs was assessed every 2 cycles. A total of 5 assessments were done throughout the study.

2.3. Observation indicators

The Kupperman score and Karnofsky Performance Scale (KPS score), medication adherence and regular follow-up rate, lung function indexes, and blood lipid levels of the two groups after treatment were compared.

The patients' symptoms were evaluated using the modified Kupperman scale, which included nine symptoms: insomnia, skeletal muscle pain, agitation, hot flashes and sweating, fatigue, palpitations, vertigo, headache, depression, and irritability. Scores of 0, 1, 2, and 3 indicated the absence of symptoms, occasional occurrence, frequent but tolerable symptoms, and frequent and insurmountable symptoms, respectively. A lower score reflected a more noticeable improvement in symptoms. Additionally, the patients' quality of life was assessed using the KPS score. The KPS score was employed to gauge the patients' overall quality of life. The scoring scale demonstrated a positive correlation, indicating that higher scores were associated with better quality of life for the patients.

Determination of liver function indexes [3]: Venous blood was drawn from the patient in a fasting state before and after treatment, with a total volume of 5 mL. An automatic biochemical analyzer was utilized to measure the levels of aspartate aminotransferase (AST), alanine aminotransferase (ALT), and direct bilirubin (DBIL). All procedures were conducted in strict accordance with the provided instructions, and the required supporting reagents were employed.

2.4. Statistical treatment

The statistical software used for this study was SPSS 25.00, with $P < 0.05$ indicating statistical significance.

3. Results

3.1. Treatment-related indexes

The Kupperman and KPS scores were compared between the two groups ($P < 0.05$), as shown in **Table 1**.

Table 1. Comparison of treatment-related indexes (mean ± standard deviation, points)

Group	Cases (*n*)	Kupperman		KPS	
		Before treatment	After treatment	Before treatment	After treatment
Observation group	20	28.22 ± 2.17	20.33 ± 2.41*	72.63 ± 3.45	81.63 ± 3.78*
Control group	20	28.23 ± 2.18	25.63 ± 2.79*	72.65 ± 3.46	73.63 ± 3.01*
t	-	0.015	6.429	0.018	7.404
P	-	0.989	0.000	0.986	0.000

Note: *$P < 0.05$ compared to before treatment.

3.2. Medication adherence and follow-up rate

The medication adherence and regular follow-up rate of the observation group were higher than that of the control group ($P < 0.05$), as shown in **Table 2**.

Table 2. Comparison of drug treatment adherence and regular follow-up rate in the two groups (n; %)

Group	Cases (*n*)	Medication adherence	Regular follow-up rate
Observation group	20	19 (95.00)	18 (90.00)
Control group	20	12 (60.00)	10 (50.00)
χ^2	-	7.025	7.619
P	-	0.008	0.006

3.3. Liver function indexes

All liver function indexes of the observation group were lower than those of the control group after treatment ($P < 0.05$), as shown in **Table 3**.

Table 3. Comparison of liver function indexes (IU/L)

Group	AST		ALT		DBIL	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Observation group (n = 20)	58.63 ± 3.55	57.36 ± 2.01*	61.39 ± 4.55	61.63 ± 4.01*	11.96 ± 2.02	11.52 ± 1.02*
Control group (n = 20)	58.65 ± 3.45	69.52 ± 2.78*	61.38 ± 4.71	79.55 ± 5.78*	11.97 ± 2.93	19.55 ± 1.97*
t	0.018	15.852	0.007	11.392	0.013	16.188
P	0.986	0.000	0.995	0.000	0.990	0.000

Note: *$P < 0.05$ compared to before treatment.

3.4. Blood lipid levels

After treatment, the HDL-C level of the observation group was higher than that of the control group ($P < 0.05$). However, there was no significant difference in the levels of LDL-C, TG, and TC between the two groups ($P > 0.05$), as shown in **Table 4**.

Table 4. Comparison of changes in blood lipid levels (mmol/L)

Group	HDL-C		LDL-C		TG		TC	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Observation group (n = 20)	1.53 ± 0.32	1.48 ± 0.32*	2.89 ± 1.64	2.61 ± 1.02*	1.85 ± 1.04	1.74 ± 0.03*	4.88 ± 1.64	4.51 ± 1.34*
Control group (n = 20)	1.54 ± 0.21	1.22 ± 0.21*	2.91 ± 1.57	2.58 ± 1.24*	1.86 ± 0.21	1.75 ± 0.34*	4.89 ± 1.54	4.99 ± 1.31*
t	0.117	3.038	0.039	0.084	0.042	0.131	0.020	1.146
P	0.908	0.004	0.969	0.934	0.967	0.869	0.984	0.259

Note: *$P < 0.05$ compared to before treatment

4. Discussion

Breast cancer is a common malignant tumor among females that is usually treated by surgery. However, the surgical procedure is prone to complications, so it is necessary to strengthen the postoperative treatment. It is very important to carry out endocrine therapy after surgery, and the commonly used drugs include aromatase inhibitors, tamoxifen, etc. As a hormone-dependent systemic disease, breast cancer can be managed and treated effectively through endocrine therapy. This treatment approach works by reducing the levels of estrogen in the body and blocking the progression of the hormone-signaling pathway. By altering the environment necessary for tumor growth, endocrine therapy aims to control and treat breast cancer effectively [4,5].

According to the National Comprehensive Cancer Network (NCCN) guidelines, endocrine therapy should be preferred for hormone receptor-positive patients. The study results revealed that the observation group exhibited higher adherence to drug treatment and a more consistent follow-up rate compared to the control group. Additionally, the observation group had a lower Kupperman score and a higher KPS score than the control group. These findings suggest that postoperative endocrine treatment with letrozole not only

enhances patients' adherence to drug treatment but also improves their regular follow-up rates. As a typical third-generation aromatase inhibitor, letrozole is different from other drugs in that it can irreversibly inhibit the combination of aromatase and androgen substrate. By permanently deactivating aromatase, it disrupts the conversion process of androgen into estrogen, effectively lowering estrogen levels in patients' bodies. This contributes to the accelerated improvement of symptoms with a high level of safety and minimal adverse effects. The drug's safety profile and low incidence of adverse reactions enhance patient compliance, leading to a significant improvement in follow-up rates. This suggests that the application of postoperative letrozole not only enhances clinical efficacy but also improves the overall quality of life for patients [6,7]. As a new type of directional enzyme inhibitor, its mechanism of action is to inhibit the synthesis and production of aromatase, thereby effectively reducing the level of estrogen and eliminating the stimulating effect of estrogen on tumor growth. According to relevant studies, letrozole exhibits greater activity in the human body compared to amiloride. This class of drugs also demonstrates higher selectivity towards its active target. Notably, letrozole's impact on human thyroid function, saline corticosteroids, and glucocorticoids remains limited. Even at large doses, it does not inhibit the secretion of adrenal cortical steroids, so it is believed that letrozole may have a more favorable therapeutic effect [8].

With prolonged endocrine medication, various side effects may arise. Foreign studies indicate that long-term use of AIs can predominantly lead to menopausal symptoms due to decreased estrogen levels, such as irritability and hot flashes. Additionally, adverse events may include issues like abnormal bone events, cardiovascular events, and disturbed lipid metabolism. Among these, abnormal lipid metabolism is a commonly observed condition in menopausal women and represents an independent risk factor for cardiovascular disease. It is crucial to consider the side effects and prognosis of endocrine therapy for patients on long-term treatment to enhance clinical efficacy while minimizing adverse events associated with endocrine therapy. In the observation group, the HDL-C level decreased after treatment, but it was higher than that of the control group ($P < 0.05$). This is because letrozole can inhibit aromatase in peripheral and tumor tissues and also reduce plasma estrogen levels, which can cause an increase in lipid levels [9]. Aromatase inhibitors not only inhibit aromatase's effects on androstenedione and testosterone but also influence the prognosis of endocrine therapy. By inhibiting the conversion of androstenedione and testosterone to estrone and estradiol, aromatase inhibitors reduce estrogen levels, hindering estrogen's positive effects on blood lipids. This inhibition slows down the clearance of chylomicron remnants in the liver and reduces LDL uptake by the liver, the anabolic metabolism of HDL, and bile acids' secretion, leading to a decrease in cholesterol elimination from the body. Consequently, blood lipid levels increase [10]. Compared to the control group, the changes in blood lipids in the observation group were lesser, indicating that letrozole has less effect on blood lipids.

The liver function indexes of the observation group were better compared to the control group. This is because letrozole can inhibit peroxidative stress disorders in the body and enhance aromatase activity, which leads to a smaller impact on liver function. Over a 6-month drug administration period, abnormalities in liver function may occur with letrozole. Patients may experience loosening of hepatocyte cytoplasm around the lobule, mild hepatocyte edema, occasional hepatocyte point necrosis, and congestion in part of the region surrounding interlobular blood vessels and the central vein of the lobule. Additionally, eosinophilic changes may be observed. These findings suggest that prolonged endocrine treatment with letrozole may lead to liver damage. However, letrozole, by inhibiting estrogen biosynthesis, avoids the accumulation of androgen precursors. Therefore, compared to anti-estrogen drugs, letrozole exhibits a more significant anti-tumor effect. It does not affect luteinizing hormone, progesterone levels, thyroid function, or follicle-stimulating hormone in the body. Clinical studies indicate that letrozole has no potential toxicity to various target organs and systems in

the human body. Importantly, it remains unaffected by the patient's liver and kidney function, age, and gender. Dose adjustment is unnecessary according to clinical findings.

5. Conclusion

In conclusion, the application of letrozole in postoperative endocrine therapy of breast cancer can significantly improve the efficacy of the treatment and also enhance the quality-of-life level of patients. Therefore, it is worthy of further application and research.

Disclosure statement

The author declares no conflict of interest.

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Analysis of High-Resolution CT Diagnosis for Pulmonary Ground-Glass Nodules

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Abstract: *Objective:* To analyze the diagnostic value of high-resolution CT for pulmonary ground-glass nodules. *Methods:* 60 patients with pulmonary ground-glass nodules admitted from June 2021 to December 2022 were selected as research subjects. All patients underwent surgical pathological and high-resolution CT examinations, and the findings observed under high-resolution CT were recorded. The surgical pathology examination results were used as the benchmark in determining the size of the ground-glass nodules and analyzing the detection rate of various signs of benign and malignant lesions and the consistency of the diagnostic results. *Results:* After surgical pathological examination, 42 cases were determined to be malignant lesions, and 18 cases were benign lesions. The maximum diameter of pulmonary ground-glass nodules ranged from 5 to 35 mm (10.79 ± 0.71 mm). The detection rate of malignant lesions was higher than that of benign lesions. The consistency of the results of high-resolution CT examination for lesions was 88.33%, and the misdiagnosis rate was 11.67%. The accurate identification rate of malignant pulmonary ground-glass nodules was higher than that of benign pulmonary ground-glass nodules ($P < 0.05$). *Conclusion:* High-resolution CT is highly accurate in diagnosing pulmonary ground-glass nodules, especially malignant ones.

Keywords: Pulmonary ground-glass nodules; High-resolution CT; Clinical diagnosis

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1. Introduction

The incidence and mortality of lung cancer rank first in China and also globally. The awareness of physical examination has been increasing in recent years, leading to an increase in early lung cancer detection rate. Imaging examinations are often used in lung examinations. For example, high-resolution CT is often used in physical examinations for early lung cancer screening. Early-stage lung cancer can be clinically cured, but the five-year survival rate of late-stage lung cancer is very low, which is less than 5% [1], so early diagnosis is crucial for improving prognosis. Ground-glass opacity (GGO) is characterized by a localized increase in density within the lung parenchyma. Unlike solid masses, GGO retains partial transparency, allowing internal structures like blood vessels and bronchi to remain visible. This opacity pattern can be associated with various conditions such as atelectasis, interstitial thickening, air space disease, increased capillary capacity, or a combination of

these factors. Nodules with GGO in lung CT are pulmonary ground-glass nodules. Studies [2] have shown that there is a clear correlation between pulmonary ground-glass nodules and early lung cancer. Pulmonary ground-glass nodules are likely to be early-stage lung adenocarcinoma or pre-invasive lesions (adenocarcinoma *in situ*, atypical adenomatous hyperplasia). Pulmonary ground-glass nodules can be divided into two types based on the presence or absence of solid components and density uniformity: mixed ground-glass and pure ground-glass nodules. Pulmonary ground-glass nodules have a higher malignancy rate than solid nodules [3]. Early identification of benign and malignant pulmonary ground-glass nodules is critical to treating the disease and improving prognosis. The application of high-resolution CT in diagnosing benign and malignant pulmonary ground-glass nodules was analyzed in this study with a sample size of 60 patients.

2. Materials and methods

2.1. Information

60 patients with pulmonary ground-glass nodules were selected as research subjects (admission period: June 2021 to December 2022), which consisted of 39 male patients and 21 female patients, aged between 21 and 75 years old, with an average age of 55.34 ± 10.13 years old. The clinical imaging and surgical pathological examination data of 60 patients were complete, excluding patients who had received anti-tumor treatment or needle biopsy. All patients gave informed consent to this study.

2.2. Method

High-resolution CT examination was performed using a 64-slice, 128-slice spiral CT scanner (Philips) with volumetric scanning capabilities. During the examination, the patients remained supine with their hands raised above their heads. The scanning parameters were set as follows: The tube rotation speed, tube current, tube voltage, layer thickness, and layer interval were set at 0.4s, 30–150 mA, 120 kV, 5 mm, and 5 mm, respectively. ASIR-V iterative reconstruction is implemented. Image post-processing involved techniques such as multi-plane reorganization and maximum density projection. The interval, layer thickness, and matrix were set at 0.8 mm, 1.0 mm, and 1024 × 1024, respectively. The results were read by two experienced radiologists (intermediate and senior professional titles or above) double-blindly. If their opinions differed, they would discuss each other or have the results evaluated by a higher-level expert.

2.3. Observation indicators

The maximum diameter of pulmonary ground-glass nodules was observed under high-resolution CT.

With the results of surgical pathology examinations as the gold standard, the detection rate of various signs of benign and malignant lesions and the consistency rate of the diagnostic results were analyzed.

The criteria for diagnosing benign and malignant pulmonary ground-glass nodules with high-resolution CT: if three or more of the following seven signs appear, the nodule is likely to be malignant, and vice versa. The signs are as follows: increased CT value (>-556Hu), vacuolar sign/air bubble sign, vascular bundles, pleural indentation, spiculation, lobulation, and interface sign.

2.4. Statistical analysis

The data in the article were input into statistical software (software version: SPSS25.0) for analysis. Measurement data (in line with normal distribution) were represented using mean ± standard deviation and count data were represented as (n [%]). Independent sample t-tests and χ^2 tests were conducted. Statistical significance was considered if $P < 0.05$.

3. Results

3.1. Surgical pathology examination results

Among the 60 patients with pulmonary ground-glass nodules, surgical pathological examination determined that 42 were malignant and 18 were benign. The details are shown in **Table 1**.

Table 1. Surgical pathology examination results [*n* (%)]

Malignant lesions	Number of cases	Benign lesions	Number of cases
Preinvasive lesions (adenocarcinoma *in situ*)	18	Atypical adenomatoid hyperplasia	5
Invasive lesions (invasive adenocarcinoma and minimally invasive adenocarcinoma)	20	Non-neoplastic lesions	10
Squamous cell carcinoma	4	Tuberculosis	2
-	-	Positive granulomatous lesions	1
-	-	Fungal infection	1
Total	42 (70.00)	Total	18 (30.00)

3.2. High-resolution CT examination results

The maximum diameters of the pulmonary ground-glass nodules were 5–35 mm (10.79 ± 0.71 mm). Among the 60 patients, 26 of them showed an increased CT value (>-556Hu), 25 exhibited vacuolar sign/air bronchial sign, 23 had vascular bundles, and 26 showed pleural indentation. Besides, there were 31 cases of spicules, 26 cases of lobulation, and 42 cases of interface signs. Signs were more common among the malignant cases compared to the benign ones ($P < 0.05$), as shown in **Table 2**

Table 2. High-resolution CT examination results [*n* (%)]

	Malignant (*n* = 42)	Benign (*n* = 18)	χ^2	*P*
Increased CT value (>-556Hu)	22 (52.38)	4 (22.22)	4.667	0.031
Vacuolar/air bubble sign	21 (50.00)	4 (22.22)	4.000	0.046
Vascular bundle	21 (50.00)	2 (11.11)	8.061	0.005
Pleural indentation	22 (52.38)	4 (22.22)	4.667	0.031
Spiculation	27 (64.29)	4 (22.22)	8.927	0.003
Lobation	25 (59.52)	1 (11.11)	14.945	0.001
Interface sign	33 (78.57)	9 (50.00)	4.898	0.027

3.3. Rate and consistency of CT diagnosis

Taking the surgical pathology diagnosis results as the gold standard, the high-resolution CT diagnosis results were consistent in 53 cases, with a consistency of 88.33%. 7 cases were misdiagnosed, indicating a misdiagnosis rate of 11.67%. Among the 18 cases diagnosed as benign lesions by pathology, 10 were diagnosed as benign by high-resolution CT, demonstrating a consistency of 55.56%. Among the 50 cases diagnosed as malignant by high-resolution CT diagnosis, 42 cases were diagnosed as malignant lesions by pathology, so the consistency was 84.00%. The comparison showed that high-resolution CT examination was more accurate in identifying malignant pulmonary ground-glass nodules ($\chi^2 = 5.952$, $P = 0.015$).

4. Discussion

Lung cancer is a significant cause of death in China because most lung cancers are already in the advanced stage when diagnosed, and only palliative treatment can be given at this time. Although various new treatment technologies and targeted therapy are constantly being developed, the survival of advanced lung cancer is still very low. The cure rate of surgery for carcinoma *in situ* is very high. If it is stage I lung cancer, the ten-year survival rate after surgery is over 90% [4]. In short, early detection and early treatment are the key to disease treatment. The main manifestation of early-stage lung cancer is ground-glass nodules in the lungs, which have a relatively low metabolic rate. Therefore, it is difficult to diagnose through tumor marker detection. Puncture under CT guidance is invasive and less sensitive. Research [5] has found that observing the edges and morphology of pulmonary ground-glass nodules can determine the nature of the disease.

CT examination is a very common imaging diagnostic method. However, there is some risk of misdiagnosis using conventional CT. High-resolution CT offers higher-definition images attributed to its thinner scanning layer compared to ordinary CT. Commonly used for smaller bones and chest examinations, high-resolution CT is particularly effective in detecting air cavity nodules, ground-glass opacities, and other abnormalities. Biopsies can be conducted based on findings from high-resolution CT examinations, allowing for careful lesion observation. Additionally, the implementation of high spatial frequency algorithm reconstruction further enhances diagnostic efficiency [6]. Atypical adenomatous hyperplasia in pre-invasive lesions is a benign lesion with no distinction between high and low grades. In high-resolution CT imaging, if the diameter of pure ground glass nodules is ≥ 6.8mm, has clear borders, or shows a vacuolar/air bubble sign, etc., they are more likely to be adenocarcinoma *in situ*. There is a certain overlap in CT imaging between minimally invasive adenocarcinoma and adenocarcinoma *in situ*. The lesions of these two pathological types have clean edges and nodular miliary dissemination in the surrounding lung parenchyma. Microinvasive adenocarcinoma usually has a diameter of ≤ 3cm and pathological examination reveals adherent growth with partial or no alveolar collapse, along with residual air-containing alveolar tissue. In these cases, infiltrative lesions within the lesion usually have a maximum diameter of ≤ 5 mm, and there is an absence of tumor necrosis, lymphatic necrosis, or blood vessel necrosis. High-resolution CT images often show mixed ground-glass nodules, with fewer pure and solid nodules [7]. If the pulmonary ground-glass nodules come with pleural indentation, lobation, interface signs, or vacuolar/air bubble signs, minimally invasive adenocarcinoma may be present. Invasive adenocarcinomas are generally mixed ground-glass nodules, mostly irregular in shape, with tumor cell clusters as the main solid component, and also include macrophages accumulated in the alveoli, alveolar collapse, intra-alveolar bleeding, etc. Still, in imaging, it is impossible to effectively differentiate between invasive adenocarcinoma and minimally invasive adenocarcinoma in terms of lesion margin, shape, density, size of the lesion, size of solid components within the lesion, spiculation, vacuolar sign, and pleural indentation.

This study shows that the CT value of malignant pulmonary ground-glass nodules is increased (>-556 Hu). The incidence rates of vacuole sign/air bronchial sign, vascular bundles, pleural indentation, spiculation, lobulation, and interface sign were more common in malignant cases than those in benign cases, and these signs are risk factors for the malignant tendency of pulmonary ground-glass nodules. Vacuolar signs are an indicator of pulmonary ground-glass nodules, a gas-density shadow with a diameter of less than 5 mm within the lesion. These signs can take various shapes, such as dilated small bronchi, residual alveolar spaces, or air-containing lung tissue invaded by tumor tissue. The appearance of vascular bundles is associated with tumor tissue infiltrating toward the bronchus, perivascular sheath, or interlobular septa. Scar formation or fibrosis around the lesion pulls adjacent blood vessels, leading to the concentration of vessels toward the tumor body, resulting in the vascular bundle sign. Pleural indentation is caused by fibrosis and scar formation within the lesion, where

the contractile force of the fibrous interstitium pulls the free visceral pleura, resulting in depression without local pleural adhesion [9].

Spiculation and lobulation are characteristic features observed in the edges of pulmonary ground-glass nodules. Spiculation is attributed to the tumor's desmoplastic reaction, featuring fibrous bands, or tumor cells moving towards adjacent bronchi or perivascular sheaths, often accompanied by local lymphatic infiltration. This sign can be categorized based on the length of the burrs, distinguishing between short burrs (< 5mm) and long burrs (≥ 5mm), with malignant manifestations typically characterized by short, stiff, and radial arrangements. On the other hand, lobulation refers to the uneven outline of the nodule edge and can be classified into shallow lobulation, medium lobulation, and deep lobulation.

The uneven growth rate of the tumor compared to its surroundings, combined with the obstruction by the pulmonary interstitial framework, bronchi, and blood vessels, leads to the more pronounced protrusion and formation of lobules. Pathological examination of specimens reveals fibrous hyperplasia of the interlobular septa. Research indicates that spiculation and lobulation signs serve as characteristic features of malignant pulmonary ground-glass nodules, suggesting their utility in distinguishing between benign and malignant nodules. Additionally, the presence of the interface sign typically indicates malignancy [11]. This sign results from the accumulated growth of tumor cells or pseudomembrane formation in the surrounding lung tissue, delineating the boundary between the lesion and the lung. In contrast, non-tumor lesions often exhibit inflammatory infiltrates, potentially due to exudative changes or localized fibrosis of the alveolar solid interstitium, resulting in a blurred boundary with the surrounding lung tissue [12]. Therefore, the interface sign can act as an indicator of benign and malignant pulmonary ground-glass nodules. In this study, 60 patients with pulmonary ground-glass nodules were pathologically diagnosed; 48 were malignant, and 12 were benign. Using this as the gold standard, the diagnostic accuracy rate of high-resolution CT was 88.33%, and the misdiagnosis rate was 11.67%, among which the accurate identification rate is higher in malignant pulmonary ground-glass nodules.

5. Conclusion

In conclusion, the analysis above indicates that high-resolution CT signs related to the edges, size, and adjacent structures of pulmonary ground-glass nodules are useful for distinguishing between benign and malignant nodules. Internal signs have limited differential value, while signs such as the vacuole sign/air bronchial sign and increased density can aid in differentiation. For older patients with elevated CT values (> -556Hu) and exhibiting signs like vacuole, vascular bundling, pleural depression, spiculation, lobulation, and interface, consideration for malignant pulmonary ground-glass nodules is warranted. Further judgment should be based on individual patient conditions, and early detection and treatment can significantly improve prognosis. In summary, high-resolution CT proves valuable in the detection and differential diagnosis of pulmonary ground-glass nodules.

Disclosure statement

The author declares no conflict of interest.

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Clinical Efficacy of Transurethral Resection of Bladder Tumors and its Impact on Patient Prognosis

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Abstract: *Objective:* To explore the clinical benefits of transurethral resection of bladder tumors (TURBT) in treating bladder cancer. *Methods:* 60 bladder cancer cases were divided into a control group and an observational group according to their surgical plans. The control group underwent traditional open surgery, while the observation group underwent TURBT. The general surgical observation indicators, postoperative complication rates, and prognosis were compared between the two groups. *Results:* The operative time, urinary catheter indwelling time, and hospitalization time of the observation group were shorter than those of the control group. Besides, the observation group also had smaller intraoperative blood loss compared to the control group. The postoperative complications and the disease recurrence rate after 1 year of follow-up of the observation group were both lower than those of the control group ($P < 0.05$). There was no statistically significant difference in mortality between the two groups after 1 year of follow-up ($P > 0.05$). *Conclusion:* TURBT can shorten the operative time and accelerate the recovery of bladder cancer patients. Besides, it also has a lower risk of postoperative complications and recurrence. Therefore, it should be popularized in clinical practice.

Keywords: Transurethral resection of bladder tumors; Bladder cancer; Clinical efficacy; prognosis

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1. Introduction

Bladder cancer is one of the top ten common malignant tumors and also the most common type of urogenital tumor. As the name suggests, it refers to malignant tumors on the bladder mucosa. Most of the patients are middle-aged and older men, and the disease is more prevalent in Western countries. However, in recent years, with the changes in diet and living habits, the number of people who have bladder cancer in China has also increased [1]. There are currently many methods for treating bladder cancer, with surgery being the preferred option. However, open surgery is highly invasive. It could easily cause urinary incontinence, erectile dysfunction, and other complications that will seriously affect the patient's quality of life. There is still a high probability of disease recurrence after surgery [2]. Transurethral resection of bladder tumors (TURBT) has been

used clinically in China since the 1980s, it has been proven to effectively preserve organs while maximizing the removal of lesions with less stress damage [3]. In this study, 60 bladder cancer patients were selected as samples to study the application of TURBT.

2. Materials and methods

2.1. Materials

60 bladder cancer cases were enrolled, all of which were treated between October 2020 and October 2022. The patients were divided into a control group and an observation group based on the type of surgery received, with 30 cases in each group. The control group consisted of 25 males and 5 females, aged between 55 and 80 years old, with a mean of 67.53 ± 8.19 years; the course of disease ranged from 2 to 13 months, with a mean of 7.51 ± 3.18 months. There were 26 males and 4 females in the observation group, aged 55 to 82 years old, with a mean of 67.68 ± 8.25 years; the duration of the disease was 2 to 14 months, with a mean of 7.55 ± 3.20 months. There was no significant difference in the baseline data between the two groups ($P > 0.05$). Inclusion criteria: (1) Diagnosed with bladder cancer by pathological examination; (2) no invasion of perivesical tissue; (3) first case and had complete clinical data; (4) met the relevant indications for surgical treatment; (5) conscious and able to communicate normally and had no history of mental, cognitive, or psychological diseases; (6) signed informed consent. Exclusion criteria: (1) Presence of severe dysfunction of important organs such as heart, lung, and kidney; (2) presence of other malignant tumors; (3) presence of severe urinary system infection; (4) presence of blood system and immune system diseases; (5) contraindications related to surgical treatment; (6) transferred to another hospital midway or dropped out of the study.

2.2. Method

The control group received traditional open surgery. The patients were instructed to assume a prone position (buttocks are elevated), and general anesthesia was administered. After the anesthesia came into effect, a 7–10 cm incision was made in the middle of the lower abdomen. After incising the bladder tissue layer by layer, the tumor tissues were removed via electrosurgery. Tumor tissues in the ureter were also removed together. Subsequently, a drainage tube will be left in place, and the abdominal wall will be closed layer by layer to complete the operation. After surgery, pirarubicin was used to perfuse the bladder according to routine procedures, and relevant antibiotics and chemotherapy drugs were administered according to the doctor's instructions.

The observation group underwent TURBT. Epidural anesthesia was administered at the lithotomy position at the bladder. After the anesthesia took full effect, a resectoscope was slowly inserted through the urethra to observe internal lesions and locate the tumor. After locating it and determining the quantity, size, and other characteristics of the tumor, the tumor tissues were effectively resected in an antegrade or lateral manner "from far to near" and "from small to large." The resection range must include the tumor tissue and its base. The superficial muscle tissue 2 cm above the tumor should be cut to a depth that reaches the deep muscle layer of the bladder. Finally, after confirming that the tumor tissue has been completely removed, rinse it with an appropriate amount of distilled water and leave a urinary catheter to complete the operation. Postoperative operations were the same as those in the above group.

2.3. Observation indicators

(1) General observation indicators of surgery

The operative time, intraoperative blood loss, urinary catheter indwelling time, and hospitalization time

were compared normatively between the two groups.

(2) Postoperative complication rate and prognosis

The incidence rates of postoperative complications, including infection, ureteral injury, bladder bleeding, bladder spasm, etc., were counted and compared between the two groups. At the same time, the two groups were followed up for one year to compare the recurrence rate of the disease during the statistical period with the mortality rate.

2.4. Statistical analysis

SPSS25.0 for Windows was used for data processing. The measurement data were represented as mean ± standard deviation and analyzed using a *t*-test; the count data were represented as percentages and analyzed using a chi-square test. $P < 0.05$ indicated statistical significance.

3. Results

3.1. General observation indicators

As shown in **Table 1**, the operative time, intraoperative blood loss, urinary catheter indwelling time, and hospitalization time of the two groups were lower than those of the control group ($P < 0.05$).

Table 1. Comparison of observation results of general surgical indicators (mean ± standard deviation)

Group	Number of cases, *n*	Operative time (min)	Intraoperative blood loss (mL)	Urinary catheter indwelling time (d)	Hospitalization day (d)
Control group	30	78.95 ± 12.62	36.14 ± 5.82	8.49 ± 3.59	10.05 ± 4.98
Observation group	30	37.85 ± 5.98	19.54 ± 2.14	4.25 ± 1.96	5.08 ± 2.16
t	-	16.120	14.663	5.678	5.015
P	-	0.001	0.001	0.001	0.001

3.2. Postoperative complication rates and prognosis

As can be seen from **Table 2**, the postoperative complication and the disease recurrence rates after 1 year of follow-up of the observation group were significantly lower than those of the control group ($P < 0.05$). There was no difference in the mortality rate between the two groups after 1 year of follow-up ($P > 0.05$).

Table 2. Comparison of postoperative complication rates and prognosis (*n* [%])

Group name	Number of cases, *n*	Postoperative complications					Prognosis	
		Infection	Ureteral injury	Bladder bleeding	Bladder spasms	Total value	Disease recurrence rate	Mortality rate
Control group	30	2(6.67)	1 (3.33)	1 (3.33)	2 (6.67)	6 (20.00)	8 (26.67)	1 (3.33)
Observation group	30	1 (3.33)	0 (0.00)	0 (0.00)	0 (0.00)	1 (3.33)	2 (6.67)	0 (0.00)
χ^2	-	-	-	-	-	4.043	4.320	1.017
P	-	-	-	-	-	0.044	0.038	0.313

4. Discussion

The pathological types of bladder cancer differ from country to country or region to region. In Western Europe and the United States, the primary type of bladder cancer is urothelial cancer. In contrast, bladder squamous

cell carcinoma is more common in Africa. Bladder cancer is less prevalent in Eastern Europe and Asia, with most of the cases being superficial bladder cancer, which is a non-muscle-invasive malignant tumor limited to the urothelium. It is relatively common in new cases, accounting for up to 75–85%, and the progression and recurrence rates are relatively high, 40% and 70% respectively [4,5]. At present, the clinical causes of bladder cancer have not yet been clearly understood. Still, two causative factors have been clear, namely smoking and occupational exposure to aromatic amine chemicals. In addition, the clinical manifestations of bladder cancer have been statistically analyzed in a large number of clinical trials. It was found that more than 90% of the patients had hematuria as their initial clinical symptom, with different manifestations such as painless, intermittent, gross hematuria, or even microscopic hematuria. A few patients may not have gross hematuria symptoms but will develop urinary urgency, frequent urination, glucose in urine, difficulty urinating, and bladder irritation [6,7].

Surgical treatment is the primary treatment option for bladder cancer. However, traditional open surgery has larger incisions and can easily cause more bleeding and tissue damage. Therefore, the probability of postoperative complications is higher, and the prognosis is relatively unsatisfactory [8]. In recent years, as the concept of "humanistic care" continues to deepen in clinical practice, organ preservation has gradually been emphasized in surgical procedures. When applied to patients with bladder cancer, it means removing lesions as much as possible without affecting urethral function. Still, an optimum surgical procedure is yet to be formulated [9]. TURBT is the currently recommended minimally invasive surgery type. It has the following advantages [10-12] : (1) Transurethral insertion of the resectoscope does not cause too much trauma, the blood loss during the operation is less, and the stress reaction that can be induced is also smaller. (2) The electrosurgical lens can display the lesions in high definition and increases the field of view, which is more conducive to the discovery and removal of small lesions, thus reducing the risk of disease recurrence. (3) The operation preserves urethral function and is less likely to damage the urethral tissue and surrounding bladder tissue. Therefore, the probability of postoperative complications is smaller, making it more conducive to improving the patient's quality of life. According to the results of this study, compared to the control group, the operation time and postoperative recovery time of the observation group were shorter, and the total postoperative complications and disease recurrence rate were only 3.33% and 6.67%, respectively. This proves that the TURBT is superior to traditional open surgery.

5. Conclusion

In summary, TURBT can shorten treatment time, and reduce stress injuries, postoperative complications, and the probability of disease recurrence, of bladder cancer patients. Therefore, this procedure should be popularized in clinical practice.

Disclosure statement

The author declares no conflict of interest.

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The Effect of Fiberoptic Bronchoscopy Combined with Alveolar Lavage in the Treatment of Severe Lung Infection After Gastric Cancer Surgery

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Abstract: *Objective:* To explore the effect of fiberoptic bronchoscopy combined with alveolar lavage in the treatment of severe lung infection after gastric cancer surgery. *Methods:* 60 patients with severe lung infection after gastric cancer surgery who were admitted into The First Hospital of Nanping from January 2020 to June 2023 were selected as study subjects. The patients were randomly divided into a control group and an experimental group, with 30 cases in each group. The control group was treated with conventional treatment methods, and the experimental group was treated with fiberoptic bronchoscopy combined with alveolar lavage. The clinical efficacy of the treatment and the blood gas index levels (PaO_2, $PaCO_2$, SpO_2) and serum inflammatory factor levels (CRP, IL-6, IL-8) of the two groups were evaluated. *Results:* The treatment received in the experimental group was more effective than that of the control group ($P < 0.01$). Besides, the PaO_2 and SpO_2 of the patients in the experimental group were higher than those of the control group after treatment; the $PaCO_2$ of the experimental group was lower than that of the control group; and the differences were statistically significant ($P < 0.01$). Both groups showed a significant decrease in CRP, IL-6, and IL-8 levels after the treatment ($P < 0.01$). *Conclusion:* Fiberoptic bronchoscopy combined with alveolar lavage is effective in treating severe lung infection after gastric cancer surgery, so it should be popularized in clinical practice.

Keywords: Gastric cancer; Fiberoptic bronchoscopy; Alveolar lavage; Severe lung infection

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1. Introduction

Gastric cancer is a common malignant tumor of the digestive tract, and it is mainly treated by surgery. However, the surgery may lead to several complications, especially severe lung infection, which brings great pain, treatment difficulty, and economic burden to patients. Lung infection is usually treated with antibiotic therapy and symptomatic treatment, but its effect is less ideal [1]. Fiber bronchoscopy combined with alveolar lavage is a novel minimally invasive procedure that involves removing airway secretions and local necrotic tissues through direct microscopic visualization of the lesion site. It improves the concentration of drugs in the infected site, achieving a better therapeutic effect [2]. In recent years, more and more studies have shown that fiberoptic

bronchoscopy combined with alveolar lavage is effective in treating lung infections, but its application in the treatment of severe lung infection after gastric cancer surgery is limited. Therefore, this study aimed to investigate the therapeutic effect of fiberoptic bronchoscopy combined with alveolar lavage in the treatment of severe lung infection after gastric cancer surgery.

2. General information and methods

2.1. Baseline data of the subjects

60 patients with severe lung infection after gastric cancer surgery who came to our hospital for treatment from January 2020 to June 2023 were selected as the study subjects. Among them, 35 patients were male, with an average age of 56.24 ± 10.2 years old, and 25 patients were female, with an average age of 53.27 ± 9.25 years old. The patients were divided into a control group and an experimental group, with 30 cases in each group. There was no statistically significant difference between the two groups in terms of gender, age, and other general information ($P > 0.05$).

Inclusion criteria: (1) diagnosed with gastric cancer and had undergone gastric cancer surgery, (2) clinically diagnosed with severe lung infection.

Exclusion criteria: (1) history of lung surgery, (2) presence of other serious diseases such as cardiac, hepatic, renal insufficiency, and so on.

2.2. Treatment methods

The control group was treated with conventional treatment methods [3]. The experimental group was treated with fiberoptic bronchoscopy combined with alveolar lavage, which included the following aspects: (1) Preparations were made before the surgery, including necessary laboratory tests and imaging tests, such as blood routine, electrocardiogram, chest X-ray, and computed tomography (CT) scan. The patients' families signed an informed consent form and the patients did preoperative fasting, oral cleaning, etc. (2) During the surgery, the patients were semi-recumbent, using local anesthesia, a fiberoptic bronchoscope was inserted into the airway through the nasal cavity, and the position of the fiberoptic bronchoscope was adjusted according to the site of the lesion to observe the airway. Tracheal or bronchial secretions were extracted and sent for a drug sensitivity test. Thereafter, under direct bronchoscopic visualization, alveolar lavage was performed using saline or drug solutions to remove infected or space-occupying lesions. Subsequently, the fiberoptic bronchoscope was withdrawn, the patients' vital signs and any complications were observed and they were instructed to abstain from food and water for 2 hours and given the necessary medications.

2.3. Detection method

Fasting venous blood of patients 1 day before and 3 days after fiberoptic bronchoscopy combined with alveolar lavage treatment was collected for laboratory testing.

2.4. Observation indicators

Clinical symptoms, CT scans, and blood routine indexes were used to evaluate the clinical efficacy of the treatments (**Table 1**), and the total efficacy = (cured + improved)/100%.

Table 1. Clinical efficacy evaluation indexes

Clinical efficacy indicators	Clinical symptoms	CT scan	Hematologic indicators
Cure	Disappearance of clinical symptoms	Complete lesion absorption	Normal
Improvement	Improvement in clinical symptoms	Partial lesion absorption	Improved
Ineffective	No improvement in clinical symptoms	The lesion was not absorbed	No improvement

The changes in blood gas indexes and serum inflammatory factor levels of patients in the two groups were observed and the evaluation indicators are shown in **Table 2**.

Table 2. Blood gas indicators and serum inflammatory factor level indicators

Indicators	Specific indicators	Acronym
Blood gas indicators	Blood oxygen partial pressure	PaO_2
	Carbon dioxide partial pressure	$PaCO_2$
	Oxygen saturation	SpO_2
Inflammatory factor levels	C-reactive protein	CRP
	Interleukin	IL-6, IL-8

2.5. Statistical analysis

The study data were entered into SPSS 22.0 software for statistical analysis. Measurement information were expressed as mean ± standard deviation and were analyzed using a *t*-test; *Z*-test was used for comparison between groups; $P < 0.05$ indicated a statistically significant difference.

3. Results

3.1. Clinical efficacy

The clinical efficacy of the treatment received in the experimental group (29/96.67%) was significantly higher than that of the control group (22/73.33%), and the difference was statistically significant at $P < 0.05$.

Table 3. Comparison of clinical efficacy levels between the two groups

Group	Ineffective	Improved	Cured	Total efficacy
Control group (n = 30)	8	12	10	22 (73.33)
Observation group (n = 30)	1	9	20	29 (96.67)
Z		2.923		
P		0.035		

3.2. Blood gas indicators

The PaO_2 of both groups was similar before treatment ($P > 0.05$); after the treatment, the scores of $PaCO_2$ indexes of the two groups were significantly reduced, with the experimental group showing a greater decrease than the control group ($P < 0.01$). The SpO_2 scores of the two groups increased after treatment, with the experimental group showing a greater increase ($P < 0.01$), as shown in **Table 4**.

Table 4. Comparison of blood gas parameters

Blood gas indicators	Time	Control group (n = 30)	Observation group (n = 30)	t	P
PaO_2	Before treatment	47.25 ± 8.21	48.10 ± 10.05	0.359	0.721
	After treatment	59.25 ± 9.15	66.25 ± 10.35	2.775	0.007
t		0.347	6.891	–	–
P		0.000	0.000	–	–
$PaCO_2$	Before treatment	72.12 ± 8.25	71.39 ± 10.14	0.306	0.761
	After treatment	55.58 ± 8.69	36.24 ± 9.21	8.366	0.000
t		7.561	14.051	–	–
P		0.000	0.000	–	–
SpO_2	Before treatment	80.12 ± 10.12	79.99 ± 10.02	0.00	0.960
	After treatment	89.25 ± 9.25	98.57 ± 6.28	4.566	0.000
t		3.648	8.606	–	–
P		0.000	0.000	–	–

3.3. Inflammatory factor levels

After treatment, the experimental group's CRP, IL-6, and IL-8 levels were significantly lower than the control group ($P < 0.01$), as shown in **Table 5**.

Table 5. Comparison of inflammatory factor levels

Inflammatory factor levels	Time	Control group (n = 30)	Observation group (n = 30)	t	P
CRP	Before treatment	122.56 ± 28.35	120.25 ± 27.58	0.320	0.750
	After treatment	25.12 ± 2.25	6.58 ± 2.10	32.994	0.000
t		18.766	22.509	–	–
P		0.000	0.000	–	–
IL-6	Before treatment	90.25 ± 20.15	89.98 ± 20.24	0.052	0.959
	After treatment	12.59 ± 2.17	25.62 ± 2.54	21.363	0.000
t		20.988	17.443	–	–
P		0.000	0.000	–	–
IL-8	Before treatment	310.25 ± 81.26	309.62 ± 82.19	0.030	0.976
	After treatment	45.67 ± 9.68	25.68 ± 10.05	7.847	0.000
t		17.709	18.782	–	–
P		0.000	0.000	–	–

4. Discussion

Gastric cancer is one of the most common malignant tumors worldwide, with an increasing number of cases every year and a high mortality rate. Surgical intervention is still the primary method for treating gastric cancer. However, various complications are prone to occur after gastric cancer surgery, with lung infection being the most common, and patients with severe lung infection are in critical condition [4], requiring timely and effective treatment. Common treatment modalities such as antibiotic therapy, continuous oxygenation, etc. are not effective [5,6]. Thus, along with the development of fiberoptic bronchoscopy technology, the treatment of

fiberoptic bronchoscopy combined with alveolar lavage has been widely used in the treatment of postoperative severe lung infections after gastric cancer surgery. This method is favored for its benefits of minimal trauma and high efficacy [7].

This treatment method is superior in treating lung infections for several reasons. (1) Removal of pathogenic microorganisms and secretions: bronchoscopy allows direct observation of the lesion site of lung infection and the removal of pathogenic microorganisms and excess secretions. This helps to reduce the symptoms of infection and prevent the spread of infection. (2) Improvement of intrapulmonary ventilation and lung function: Through fiberoptic bronchoscopy alveolar lavage, the secretions and obstructions in the airways can be effectively removed, improving intrapulmonary ventilation, and thus restoring the lung function of the patient. As a result, the respiratory condition of the patient will be improved and respiratory difficulties will be alleviated [8,9]. (3) Direct local drug delivery: through fiberoptic bronchoscopy, therapeutic drugs such as antibiotics can be delivered directly to the infected alveolar site, increasing the concentration of the drug in the infected site, improving the penetration and concentration of the drug in the lungs, thus improving the antimicrobial effect [10]. (4) Promotion of lung tissue repair: Alveolar lavage fluid can flush out inflammatory factors and harmful substances, reducing the inflammatory response of the lungs. It can also deliver nutrients and growth factors for lung tissue repair, which can help to repair the damaged tissues in the lungs [11] (5) Precise diagnosis: fiberoptic bronchoscopy allows direct observation of the lesions of lung infection. Besides, samples of lesions can be collected for bacterial culture and drug sensitivity test, which allows precise diagnosis and treatment [12]; (6) Reducing antibiotic resistance: The results of bacterial culture and drug sensitivity test of pathogenic microorganisms obtained by fiberoptic bronchoscopy combined with alveolar lavage can guide doctors in selecting antibiotics to avoid antibiotic abuse and the possibility of drug resistance. (7) Improving the patient's quality of life: Fiberoptic bronchoscopy combined with alveolar lavage can be carried out under local anesthesia, which is less traumatic to the patient. This approach is easy and safe to operate, facilitating a quicker patient recovery. Additionally, it has the potential to shorten hospitalization durations and enhance the overall quality of life for the patient.

In recent years, there have been many studies showing the superiority of this treatment modality [13]. Ye [14] found that this treatment method can downregulate the level of inflammatory factors and improve respiratory function when treating patients with lung infections after lung cancer surgery. Yang et al. [15] found that the treatment method can improve the clinical therapeutic effect of patients and reduce the level of inflammatory factors. These results are consistent with the findings of this paper.

Although this technology is widely used, it is not without limitations. On one hand, it is expensive, which may bring a certain economic burden to patients. On the other hand, it comes with certain risks for the elderly, frail, or patients with other serious diseases. Therefore, there are several things to be noted when implementing this treatment regimen. (1) The indications should be well-defined: This technique is only applicable for treating lung infections after gastric cancer surgery, not to other types of infections or non-infectious diseases. Therefore, it is important to ensure that the patients meet the treatment requirements. (2) Making good preoperative preparations: It is necessary to understand the patient's medical history, signs, laboratory tests, and imaging tests, and evaluate the patient's condition and surgical risks before the operation. Besides, it is necessary to explain to the patient and his family the purpose, procedure, and possible risks of the surgery and make sure that they sign the informed consent. (3) During the surgery, it is crucial to strictly adhere to aseptic operating procedures. Simultaneously, maintaining an open respiratory tract is essential to prevent respiratory distress or asphyxia resulting from the procedure. Furthermore, continuous monitoring of the patient's vital signs is necessary, and any abnormalities should be promptly addressed. (4) Post-operative

nursing precautions: It is necessary to keep the patient's respiratory tract open after the operation to avoid violent coughing and forceful breathing. At the same time, it is necessary to closely observe the changes in the patient's vital signs. Symptoms like fever, chest pain, and dyspnea should be dealt with promptly. In addition, it is also necessary to pay attention to oral hygiene to prevent oral infection. (5) Prevention of complications: Fibrooptic bronchoscopy combined with alveolar lavage may cause some complications, such as hemorrhage, pneumothorax, cardiac arrhythmia, and so on. Therefore, several preventive measures should be taken, such as controlling blood pressure, avoiding violent coughing, and appropriate use of sedatives. (6) Rational use of antibiotics: Fiberoptic bronchoscopy combined with alveolar lavage can guide doctors in choosing suitable antibiotics to avoid antibiotic abuse. Therefore, antibiotics need to be selected according to the results of pathogenic microorganism culture and drug sensitivity tests, and the patients should use them according to the doctor's instructions.

The sample size of this study was small, so it may not fully reflect its the true effectiveness of this treatment in treating severe lung infection after gastric cancer surgery. Therefore, further expansion of the study sample size and long-term, rigorous controlled experiments are needed in the future to verify the reliability of its findings. In addition, this study may have the problem of too short a time frame, which may lead to the inability to adequately assess its long-term effect in the treatment of postoperative combined severe lung infection after gastric cancer.

Disclosure statement

The author declares no conflict of interest.

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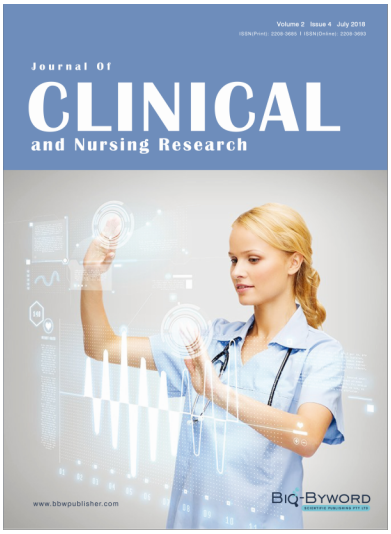

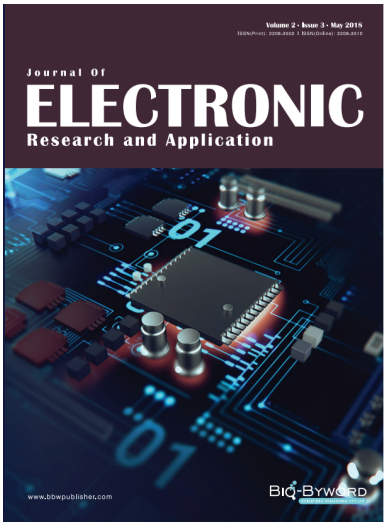

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