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Application of magnetic resonance cholangiopancreatography and endoscopic retrograde cholangiopancreatography in biliary obstruction

Zheng Zhou, HaiYan Wu

ABSTRACT

Introduction: Biliary obstruction is a common clinical disease, and magnetic resonance cholangiopancreatography (MRCP) and endoscopic retrograde cholangiopancreatography (ERCP) play an important role in the diagnosis and treatment of biliary obstruction. This study explores the localization, qualitative diagnosis, and treatment effects of MRCP and ERCP on biliary obstruction diseases.

Methods: Retrospective analysis of patients diagnosed with biliary obstruction who underwent MRCP examination and ERCP treatment from October 2022 to October 2024. The patients were divided into jaundice group and non-jaundice group according to their clinical characteristics. The clinical characteristics, treatment, and accuracy of localization and qualitative diagnosis of the two groups were analyzed.

Results: A total of 78 patients with biliary obstruction who underwent MRCP examination and ERCP treatment were collected, with 39 cases in jaundice group and 39 cases in the non-jaundice group. The total bilirubin level and alkaline phosphatase (ALT) level in the jaundice group were significantly lower than those before surgery, with significant differences. In terms of localization and qualitative diagnosis in both the jaundice group and non-jaundice group, the results indicate that the combination of MRCP and ERCP has a high accuracy rate for the localization and qualitative diagnosis of biliary obstruction.

Conclusions: In the diagnosis of biliary obstruction diseases, MRCP and ERCP have their own advantages and disadvantages. By combining the strengths of both, accuracy of localization and qualitative diagnosis of biliary obstruction can be improved to some extent. In terms of treatment, the bilirubin and ALT levels in the jaundice group improved significantly after ERCP, indicating that ERCP is more effective in patients with biliary obstruction complicated with jaundice.

Keywords: Endoscopic retrograde cholangiopancreatography (ERCP), Localization and qualitative diagnosis, Magnetic resonance cholangiopancreatography (MRCP)

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INTRODUCTION

Biliary obstruction is divided into benign and malignant biliary obstruction. Common causes of benign biliary obstruction include intrahepatic and extrahepatic bile duct stones, Mirrizi syndrome, and inflammatory stenosis of the bile duct. Malignant biliary stenosis is often caused by choriocarcinoma, pancreatic cancer, ampullary tumors, metastatic liver cancer, and metastatic gastric cancer. Magnetic resonance cholangiopancreatography (MRCP) is an imaging examination method for detecting biliary obstruction, while endoscopic retrograde

cholangiopancreatography (ERCP) is an endoscopic diagnostic and therapeutic method and technology for biliary obstruction [1, 2]. The combination of MRCP and ERCP has significant clinical application value in the diagnosis and treatment of biliary obstruction diseases.

We will compare the clinical characteristics, bilirubin levels, and ALT levels between jaundice group and non-jaundice group. To analyze the accuracy of localization and qualitative diagnosis of MRCP and ERCP in jaundice group and non-jaundice group. A retrospective collection of 78 cases of biliary obstruction patients who underwent ERCP treatment from October 2022 to October 2024. This is a single-center study. Further study the role of MRCP combined with ERCP in the treatment of biliary obstruction patients.

MATERIALS AND METHODS

Retrospective analysis of patients diagnosed with biliary obstruction who underwent MRCP examination and ERCP treatment from October 2022 to October 2024. The patients were divided into jaundice group and non-jaundice group according to their clinical characteristics. The clinical characteristics, treatment, and accuracy of localization and qualitative diagnosis of the two groups were analyzed. A total of 78 patients with biliary obstruction who underwent MRCP examination and ERCP treatment were collected, with 39 cases in jaundice group and 39 cases in the non-jaundice group. The total bilirubin level and ALT level were detected in both groups.

Inclusion criterion	Exclusion criterion
1. All cases were diagnosed with biliary obstruction diseases based on abdominal ultrasound and MRCP. 2. Patients with elevated alkaline phosphatase (ALT), γ-glutamyl transpeptidase (GGT), total bilirubin (TBIL), and direct bilirubin (DBIL) levels indicating biliary obstruction and dilatation of the common bile duct. 3. Patients with suspicion of diseases such as bile duct stones, bile duct ascariasis, duct cancer, pancreatic cancer, and liver cancer. 4. All cases signed the informed consent for ERCP-guided biliary drainage. 5. Patients with obstruct jaundice who need nasobiliary drainage or biliary stent drainage. 6. ALT range from 5 U/L to 500 U/L, TBIL range from 10 μmol/L to 200 μmol/L.	1. Patients with severe cardiopulmonary and cerebrovascular diseases such as heart failure, respiratory failure, shock, and coma, poor general condition, unable to tolerate ERCP bile duct drainage. 2. Patients with mental illness who cannot cooperate. 3. Patients without obvious bile duct obstruction diseases such as simple liver damage, gallstones, cholecystitis, pancreatitis, etc. 4. Patients with concurrent myocardial infarction or severe liver kidney function disorders, severe infection, serious diabetes, and malignant tumors. 5. Patients with pacemakers, stents, or coronary artery bypass grafts, or other conditions that prevent MRI examination. 6. Patients with claustrophobia. 7. Pregnant women and those allergic to contrast agents.

Statistical analysis

Data from patients with biliary obstruction were collected and analyzed. Categorical variables were analyzed using the chi-square test, and continuous variables were analyzed using the *t*-test. The accuracy of localization and qualitative diagnosis was analyzed using the chi-square test. The treatment effects of the two groups were compared IBM SPSS Statistics 24.0 software (SPSS South Asia Pvt. Ltd).

RESULTS

1. Comparison of clinical characteristics between the two groups of patients:
   There was no significant difference between the two groups of patients in terms of age and gender. Details can be seen in Tables 1 and 2.
2. Comparison of bilirubin levels and ALT levels between the two groups:
   The postoperative bilirubin levels of the jaundice group were significantly lower than those before the operation, and the difference was statistically significant, the postoperative bilirubin levels of the non-jaundice group were slightly higher than those before the operation, and the difference was not statistically significant.
   The postoperative ALT level of the jaundice group was significantly lower than that before the operation, and the difference was statistically significant, while the operative ALT level of the non-jaundice group was lower than that before the operation, but the difference was not statistically significant. It suggested that the postoperative bilirubin level and ALT level of the jaundice group were significantly lower than those before the operation, and the difference was significant, while the postoperative bilirubin and ALT levels of the non-jaundice group were not significantly different from those before the operation, and the difference was not significant, which indicates that the curative effect of the jaundice group was better. Details can be seen in Tables 3–6.
3. Check success rate: In this study, both groups of patients completed the ERCP procedure, with a success rate of 100% for ERCP. One patient in the jaundice group did not complete the MRCP examination, with a completion rate of 97.4% for

MRCP in the jaundice group; two patients in the non-jaundice group did not complete the MRCP examination, with a completion rate of 94.9% MRCP in the non-jaundice group.

4. Diagnostic value: In this study, there were 58 cases of choledocholithiasis, 3 cases of pancreatic cancer, 2 cases of cholangiocarcinoma, 2 cases of hepatocellular carcinoma, 7 cases of inflammatory stricture of the bile duct, 3 cases inflammatory stricture of the papilla, and 3 cases of periampullary tumor. In the jaundice group, there was 1 case of pancreatic, 2 cases of cholangiocarcinoma, 3 cases of inflammatory stricture of the papilla, 3 cases of inflammatory stricture of the bile, and 30 cases of choledocholithiasis. In the non-jaundice group, there were 2 cases of pancreatic cancer, 2 cases of hepatocellular carcinoma, 4 cases of inflammatory stricture of the bile duct, 3 cases of periampullary tumor, and 28 of choledocholithiasis. Details can be seen in Tables 7 and 8.

Table 1: Comparison of age between two groups of patients

Group	Age (years)	t value	P value
Jaundice group	65.92±12.82	0.974	0.333
Non-jaundice group	68.51±10.55		

Table 2: Comparison of gender between two groups of patients

Group	Gender		X^2	P value
	Male	Female		
Jaundice group	22	17	1.847	0.174
Non-jaundice group	16	23		

Table 3: Comparison of preoperative and postoperative bilirubin in the jaundice group

Jaundice group	Bilirubin (μmol/L)	t value	P value
Preoperative	82.03±48.67	4.233	0.000
Postoperative	41.50±34.75		

Table 4: Comparison of preoperative and postoperative bilirubin in non-jaundice group

Non-jaundice group	Bilirubin (μmol/L)	t value	P value
Preoperative	17.95±6.83	−0.889	0.377
Postoperative	19.83±11.26		

Table 5: Comparison of ALT preoperative and postoperative in the jaundice group

Jaundice group	ALT (U/L)	t value	P value
Preoperative	240.96±199.54	3.060	0.003
Postoperative	125.84±124.09		

Table 6: Comparison of ALT preoperative and postoperative in the non-jaundice group

Non-jaundice group	ALT (U/L)	t value	P value
Preoperative	56.91±61.20	1.199	0.234
Postoperative	42.66±41.98		

Table 7: Comparison of the accuracy of MRCP and ERCP in the diagnosis of obstructive jaundice

	Final diagnosis	Total number	MRCP diagnosis	MRCP position	MRCP qualitative	ERCP diagnosis	ERCP position	ERCP qualitative
Jaundice group	Cholecystolithiasis	30	30	28	28	30	29	28
	Inflammatory stenosis of the nipple	3	3	2	1	3	2	2
	Cholangitis stenosis	3	3	2	2	3	3	2
	Pancreatic cancer	1	1	1	0	1	1	1
	Cholangiocarcinoma	2	2	1	1	2	2	1
Non-jaundice group	Cholecystolithiasis	28	28	27	26	28	27	27
	Cholangitis stenosis	4	4	2	3	4	3	3
	Pancreatic cancer	2	2	1	0	2	2	1
	Liver cancer	2	2	1	0	2	1	1
	Tumor of the ampulla of Vater	3	3	1	1	3	2	1

Table 8: Comparison of the accuracy of MRCP combined with ERCP in the diagnosis of obstructive jaundice

	Final diagnosis	Total number	MRCP + ERCP diagnosis	MRCP + ERCP position	MRCP + ERCP qualitative
Jaundice group	Cholecystolithiasis	30	30	29	29
	Inflammatory stenosis of the nipple	3	3	3	2
	Cholangitis stenosis	3	3	3	3
	Pancreatic cancer	1	1	1	1
	Cholangiocarcinoma	2	2	2	1
Non-jaundice group	Cholecystolithiasis	28	28	27	27
	Cholangitis stenosis	4	4	4	3
	Pancreatic cancer	2	2	2	1
	Liver cancer	2	2	2	1
	Tumor of the ampulla of Vater	3	3	2	2

Obstruction localization diagnosis accuracy

In the jaundice group: MRCP localization diagnosis accuracy 87.18% (34/39), ERCP localization diagnosis accuracy 94.87% (37/39), there was no significant difference between the two (chi-square 0.066, P = 0.797); the localization diagnosis accuracy of the two methods combined (MRCP and ERCP) was 97.4% (38/39), which was not significantly different from MRCP (chi-square 0.116, P = 0.73) and not significantly different from ERCP (chi-square 0.007, P = 0.934).

In the non-jaundice group: the accuracy of MRCP localization diagnosis was 82.05% (32/39), accuracy of ERCP localization diagnosis was 89.74% (35/39), and there was no significant difference between the two (chi 0.072, P = 0.788); the accuracy of combined localization diagnosis of the two methods (MRCP and ERCP) was 94.87% (37/39), which was not significantly different from MRCP (chi-square 0.192, P = 0.661) and not significantly different from ERCP (chi-square 0.029, P = 0.865).

Accuracy of qualitative diagnosis of obstruction

In the jaundice group: the accuracy of MRCP qualitative diagnosis was 82.05% (32/39), the accuracy of ERCP qualitative diagnosis was 87.18% (34/39), and there was no significant difference between ERCP and MRCP (chi-square 0.033, P = 0.856); the accuracy of qualitative diagnosis of the two methods combined (MRCP and ERCP) was 92.31% (36/39). There was no significant difference between the two methods combined and MRCP (chi-square 0.16, P = 0.723). There was no significant difference between the two methods combined and ERCP (chi-square 0.030, P = 0.86).

In the non-jaundice group: the accuracy of qualitative diagnosis of MRCP was 76.92% (30/39), the accuracy of qualitative diagnosis of ERCP was 84.62% (33/39), and there was no significant difference between the two chi-square 0.079, P = 0.779; the accuracy of qualitative diagnosis of the two methods combined (MRCP and ERCP was 87.18% (34/39), which was not significantly

different from MRCP (chi-square 0.137, P = 0.711) and not significantly different from ERCP (chi-square 0.008, P = 0.929).

Comparison between jaundice group and non-jaundice group: There was no significant difference in the accuracy of MRCP localization diagnosis between two groups (chi-square 0.033, P = 0.856). There was no significant difference in the accuracy of ERCP localization diagnosis the two groups (chi-square 0.029, P = 0.865). There was no significant difference in the accuracy of combined (MR and ERCP) localization diagnosis between the two groups (chi-square 0.007, P = 0.934). There was no significant difference in accuracy of MRCP qualitative diagnosis between the two groups (chi-square 0.036, P = 0.850). There was no significant difference the accuracy of ERCP qualitative diagnosis between the two groups (chi-square 0.008, P = 0.929). There was no significant in the accuracy of combined (MRCP and ERCP) qualitative diagnosis between the two groups (chi-square 0.030, P = 0.862).

DISCUSSION

Endoscopic retrograde cholangiopancreatography is usually used as the gold standard for diagnosing pancreatic and biliary diseases in clinical practice, and at the same time, therapeutic such as biliary drainage, stone removal, and stent placement are carried out under ERCP. However, ERCP also has complications, such as pancreatitis, bleeding, and perforation [3, 4]. Due to factors such as Billroth II surgery, pancreaticojejunostomy, pyloric obstruction, periampullary tumors or diverticula, ERCP may fail or show incomplete results. In addition, ERCP is limited to a certain extent in clinical application due to technical level of the operator, instruments and equipment, and patient cooperation.

Magnetic resonance cholangiopancreatography (MRCP) can be used for pancreatic and biliary imaging, to evaluate b obstruction, to show the location of biliary obstruction and dilated bile ducts, non-invasiveness, no X-ray exposure, no need for contrast agents, rotate in multiple directions, observe from multiple angles, using the liquid water in the body as a contrast agent, with heavily T2-weighted pulse sequences as the imaging, static or slowly flowing bile or pancreatic juice appears as high signal, solid organs (such as the liver), and rapidly flowing blood appear as low signal or no signal the white high signal bile duct tree and pancreatic duct, against the black low signal background, can be clearly displayed and radiological diagnosis and analysis can be performed [5, 6]. However, MRCP is a magnetic resonance cholangiopancreatography examination, which is not suitable for patients with metal clips or stents in the, claustrophobia, and those who have undergone heart pacemaker implantation. For patients with poor general condition, physical weakness, and inability to cooperate with magnetic examination, it is limited to a certain extent. In this study, 3 cases did not complete the MRCP examination, and the analysis of the reasons was that 1 case had a history of heart pacemaker implantation, and 2 cases were elderly patients with multiple underlying diseases and physical weakness who could not cooperate with the MRCP examination.

In this study, both jaundice and non-jaundice groups of patients underwent MRCP examination and ERCP surgery. There was no significant difference in age and gender between the two groups of patients. The study suggested that the postoperative total bilirubin level and ALT level in the jaundice group were significantly lower than those before the operation, with significant differences (P < 0.05), while the postoperative total bilirubin and ALT in the non-jaundice group did not change significantly compared with those before the operation, and there was no significant difference, indicating that the treatment effect in the jaundice group was better. The possible reason for this may be that the patients in the jaundice group had obstruction of the common bile duct, and the ER surgery relieved the obstruction, making the bile flow smoothly and reducing jaundice, while the patients in the non-jaundice group did not have obvious bile duct before the ERCP surgery, and there was bile duct inflammation, edema after the ERCP surgery, including postoperative bleeding, pancreatitis, and other factors, which to the total bilirubin level and ALT level did not change significantly, and there was no significant difference.

There were 58 cases of choledocholithiasis, 3 cases of pancreatic cancer, 2 cases of cholangiocarcinoma, 2 cases of hepatocellular carcinoma, 7 cases of inflammatory stricture of the bile duct, 3 cases of papillary inflammatory stricture, and 3 cases of periampullary tumor in this study. The obstruction site and etiology of biliary obstruction diseases were preliminarily judged by MRCP and then ERCP diagnosis and treatment were further clarified the site and etiology of biliary obstruction, and biopsy pathology or surgical treatment was performed when necessary. The accuracy localization diagnosis and qualitative diagnosis of biliary obstruction diseases can be improved by MRCP and ERCP. Some studies have shown that MRCP plays an important role in localization diagnosis of biliary obstruction [7, 8]. MRCP can show the dilated bile duct proximal to the biliary obstruction, and it can also show the of the space-occupying lesion in the bile duct, which also has a great value in the diagnosis of biliary and pancreatic tumors, and the tumors show equal high signal on MRCP images, but the diagnosis needs to be confirmed by biopsy pathology, so MRCP has a certain value in qualitative diagnosis [9, 10].

In this study, in terms of localization diagnosis, the accuracy of MRCP localization diagnosis was 87.18% in jaundice group, the accuracy of ERCP localization diagnosis was 94.87%, and the accuracy of localization diagnosis of the two methods combined (MR and ERCP) was 97.44%; in the non-jaundice group, the accuracy of MRCP localization diagnosis was 82.0%, the accuracy

of ERCP localization diagnosis was 89.74%, and the accuracy of localization diagnosis of the two methods combined (MRCP and ERCP) was 94.87%. In terms of qualitative diagnosis, the accuracy of MRCP qualitative diagnosis was 82.05% in the jaundice group, the accuracy of ERCP qualitative diagnosis was 87.18%, and the accuracy of qualitative diagnosis of the two methods combined (MRCP ER) was 92.31%. In the non-jaundice group, the accuracy of MRCP qualitative diagnosis was 82.05%, accuracy of ERCP qualitative diagnosis was 87.18%, and the accuracy of qualitative diagnosis of the two methods combined (MRCP and ERCP) was 92.31%. These results suggest that the accuracy of MRCP combined with ERCP in the localization and qualitative diagnosis of biliary obstruction is relatively high. In summary, in the diagnosis of biliary obstruction diseases, MRCP and ERCP have their own advantages and disadvantages. By combining the strengths of both, MRCP combined ERCP can improve the accuracy of localization diagnosis and qualitative diagnosis of biliary obstruction to a certain extent. In terms of treatment, the bilirubin and ALT of patients in the jaundice group were improved after ERCP, and the effect was good, indicating that the effect of ERCP in patients with biliary obstruction with jaundice is better.

CONCLUSION

In the diagnosis of biliary obstruction diseases, MRCP and ERCP have their own advantages and disadvantages. By combining the strengths of both, accuracy of localization and qualitative diagnosis of biliary obstruction can be improved to some extent. In terms of treatment, the bilirubin and ALT levels in the jaundice group improved significantly after ERCP, indicating that ERCP is more effective in patients with biliary obstruction complicated with jaundice.

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Author Contributions

Zheng Zhou – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

HaiYan Wu – Acquisition of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Guarantor of Submission

The corresponding author is the guarantor of submission.

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Conflict of Interest

Authors declare no conflict of interest.

Data Availability

All relevant data are within the paper and its Supporting Information files.

ABOUT THE AUTHORS

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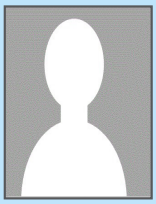

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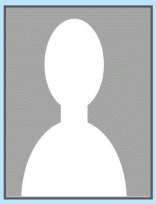

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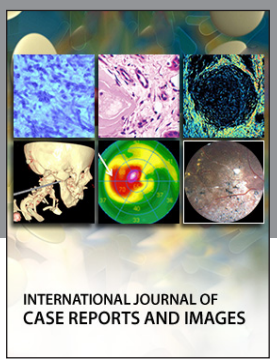

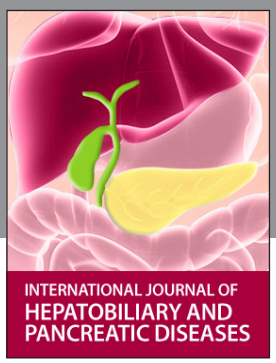

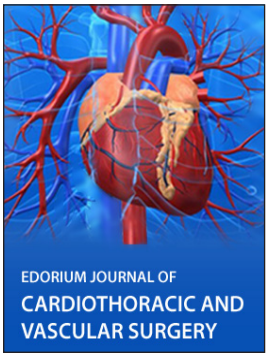

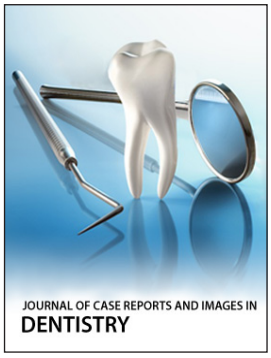

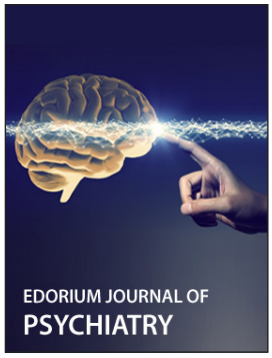

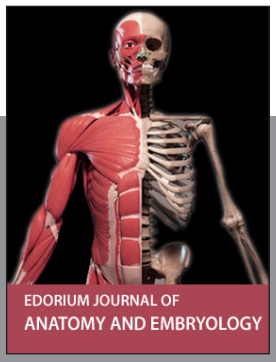

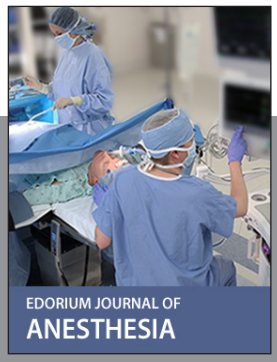

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