

World Journal of *Clinical Cases*

World J Clin Cases 2023 May 26; 11(15): 3369-3663



REVIEW

- 3369 Superior mesenteric artery syndrome: Diagnosis and management
Oka A, Awoniyi M, Hasegawa N, Yoshida Y, Tobita H, Ishimura N, Ishihara S

MINIREVIEWS

- 3385 Astrocytes in the central nervous system and their functions in health and disease: A review
Gradisnik L, Velnar T
- 3395 Progress in diagnosis and treatment of acute injury to the anterior talofibular ligament
Chen RP, Wang QH, Li MY, Su XF, Wang DY, Liu XH, Li ZL
- 3408 Synchronous manifestation of colorectal cancer and intraductal papillary mucinous neoplasms
Mirchev MB, Boeva I, Peshevska-Sekulovska M, Stoitsov V, Peruhova M
- 3418 Clinical infections in neurosurgical oncology: An overview
Velnar T, Kocivnik N, Bosnjak R
- 3434 Effectiveness and safety of subthreshold vibration over suprathreshold vibration in treatment of muscle fatigue in elderly people
Mohamed AA, Khaled E, Hesham A, Khalf A

ORIGINAL ARTICLE**Clinical and Translational Research**

- 3444 Establishment of a prognostic model related to tregs and natural killer cells infiltration in bladder cancer
Yang YJ, Xu XQ, Zhang YC, Hu PC, Yang WX

Retrospective Study

- 3457 New native tissue repair for pelvic organ prolapse: Medium-term outcomes of laparoscopic vaginal stump-round ligament fixation
Kakinuma T, Kaneko A, Kakinuma K, Imai K, Takeshima N, Ohwada M
- 3464 Demographic characteristics of patients who underwent anterior cruciate ligament reconstruction at a tertiary care hospital in India
Mlv SK, Mahmood A, Vatsya P, Garika SS, Mittal R, Nagar M
- 3471 Usefulness of transcatheter arterial embolization for eighty-three patients with secondary postpartum hemorrhage: Focusing on difference in angiographic findings
Kim BM, Jeon GS, Choi MJ, Hong NS
- 3481 Chronic otitis media and middle ear variants: Is there relation?
Gökharman FD, Şenbil DC, Aydın S, Karavaş E, Özdemir Ö, Yalçın AG, Koşar PN

Observational Study

- 3491** Observation of the effect of angiojet to treat acute lower extremity arterial embolization
Meng XH, Xie XP, Liu YC, Huang CP, Wang LJ, Liu HY, Fang X, Zhang GH
- 3502** Outbreak of methanol-induced optic neuropathy in early COVID-19 era; effectiveness of erythropoietin and methylprednisolone therapy
Tabatabaei SA, Amini M, Haydar AA, Soleimani M, Cheraqpour K, Shahriari M, Hassanian-Moghaddam H, Zamani N, Akbari MR

META-ANALYSIS

- 3511** Impact of heart failure on outcomes in patients with sepsis: A systematic review and meta-analysis
Zhu MY, Tang XK, Gao Y, Xu JJ, Gong YQ

CASE REPORT

- 3522** New clinical application of digital intraoral scanning technology in occlusal reconstruction: A case report
Hou C, Zhu HZ, Xue B, Song HJ, Yang YB, Wang XX, Sun HQ
- 3533** Rare adult neuronal ceroid lipofuscinosis associated with *CLN6* gene mutations: A case report
Wang XQ, Chen CB, Zhao WJ, Fu GB, Zhai Y
- 3542** Enzyme replacement therapy in two patients with classic Fabry disease from the same family tree: Two case reports
Harigane Y, Morimoto I, Suzuki O, Temmoku J, Sakamoto T, Nakamura K, Machii K, Miyata M
- 3552** Immune-mediated necrotizing myopathy: Report of two cases
Chen BH, Zhu XM, Xie L, Hu HQ
- 3560** Retroperitoneal cavernous hemangioma misdiagnosed as lymphatic cyst: A case report and review of the literature
Hou XF, Zhao ZX, Liu LX, Zhang H
- 3571** Malignant melanoma resection and reconstruction with the first manifestation of lumbar metastasis: A case report
Guo ZX, Zhao XL, Zhao ZY, Zhu QY, Wang ZY, Xu M
- 3578** Promising way to address massive intragastric clotting in patients with acute upper gastrointestinal bleeding: A case report
Liu SX, Shi B, Liu YF, Shan JY, Sun B
- 3583** Pyogenic spondylitis caused by *Escherichia coli*: A case report and literature review
Zou LC, Qian J, Bian ZY, Wang XP, Xie T
- 3592** Primary ovarian choriocarcinoma occurring in a postmenopausal woman: A case report
Dai GL, Tang FR, Wang DQ

- 3599** Treatment of severe open bite and mandibular condyle anterior displacement by mini-screws and four second molars extraction: A case report
Huang ZW, Yang R, Gong C, Zhang CX, Wen J, Li H
- 3612** Application of apical negative pressure irrigation in the nonsurgical treatment of radicular cysts: A case report
Chen GP, Zhang YZ, Ling DH
- 3619** Treatment of postherpetic neuralgia by bone marrow aspirate injection: A case report
Honda Pazili T
- 3625** Non-target lung embolization during portal vein embolization due to an unrecognized portosystemic venous fistula: A case report
Alharbi SR, Bin Nasif M, Alwaily HB
- 3631** Acute abdomen caused by spontaneous rupture of degenerative hysteromyoma during pregnancy: A case report
Xu Y, Shen X, Pan XY, Gao S
- 3637** Atypical progress of frozen shoulder after COVID-19 vaccination: A case report
Jo HS, Kim HM, Han JY, Park HK
- 3643** Co-existing squamous cell carcinoma and chronic myelomonocytic leukemia with *ASXL1* and *EZH2* gene mutations: A case report
Deng LJ, Dong Y, Li MM, Sun CG
- 3651** Diagnosis based on electromagnetic navigational bronchoscopy-guided biopsied peripheral lung lesions in a 10-year-old girl: A case report
Meng FZ, Chen QH, Gao M, Zeng L, Lin JR, Zheng JY
- 3658** Relationship between intralobar pulmonary sequestration and type A aortic dissection: A case report
Wang YJ, Chen YY, Lin GH

ABOUT COVER

Editorial Board Member of *World Journal of Clinical Cases*, Gulali Aktas, MD, Professor, Department of Internal Medicine, Abant Izzet Baysal University Hospital, Bolu 14030, Turkey. draliaktas@yahoo.com

AIMS AND SCOPE

The primary aim of *World Journal of Clinical Cases (WJCC, World J Clin Cases)* is to provide scholars and readers from various fields of clinical medicine with a platform to publish high-quality clinical research articles and communicate their research findings online.

WJCC mainly publishes articles reporting research results and findings obtained in the field of clinical medicine and covering a wide range of topics, including case control studies, retrospective cohort studies, retrospective studies, clinical trials studies, observational studies, prospective studies, randomized controlled trials, randomized clinical trials, systematic reviews, meta-analysis, and case reports.

INDEXING/ABSTRACTING

The *WJCC* is now abstracted and indexed in Science Citation Index Expanded (SCIE, also known as SciSearch®), Journal Citation Reports/Science Edition, Current Contents®/Clinical Medicine, PubMed, PubMed Central, Scopus, Reference Citation Analysis, China National Knowledge Infrastructure, China Science and Technology Journal Database, and Superstar Journals Database. The 2022 Edition of Journal Citation Reports® cites the 2021 impact factor (IF) for *WJCC* as 1.534; IF without journal self cites: 1.491; 5-year IF: 1.599; Journal Citation Indicator: 0.28; Ranking: 135 among 172 journals in medicine, general and internal; and Quartile category: Q4. The *WJCC*'s CiteScore for 2021 is 1.2 and Scopus CiteScore rank 2021: General Medicine is 443/826.

RESPONSIBLE EDITORS FOR THIS ISSUE

Production Editor: *Ying-Yi Yuan*; Production Department Director: *Xiang Li*; Editorial Office Director: *Jin-Lei Wang*.

NAME OF JOURNAL

World Journal of Clinical Cases

ISSN

ISSN 2307-8960 (online)

LAUNCH DATE

April 16, 2013

FREQUENCY

Thrice Monthly

EDITORS-IN-CHIEF

Bao-Gan Peng, Jerzy Tadeusz Chudek, George Kontogeorgos, Maurizio Serati, Ja Hyeon Ku

EDITORIAL BOARD MEMBERS

<https://www.wjgnet.com/2307-8960/editorialboard.htm>

PUBLICATION DATE

May 26, 2023

COPYRIGHT

© 2023 Baishideng Publishing Group Inc

INSTRUCTIONS TO AUTHORS

<https://www.wjgnet.com/bpg/gerinfo/204>

GUIDELINES FOR ETHICS DOCUMENTS

<https://www.wjgnet.com/bpg/GerInfo/287>

GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH

<https://www.wjgnet.com/bpg/gerinfo/240>

PUBLICATION ETHICS

<https://www.wjgnet.com/bpg/GerInfo/288>

PUBLICATION MISCONDUCT

<https://www.wjgnet.com/bpg/gerinfo/208>

ARTICLE PROCESSING CHARGE

<https://www.wjgnet.com/bpg/gerinfo/242>

STEPS FOR SUBMITTING MANUSCRIPTS

<https://www.wjgnet.com/bpg/GerInfo/239>

ONLINE SUBMISSION

<https://www.f6publishing.com>

Observational Study

Observation of the effect of angiojet to treat acute lower extremity arterial embolization

Xiao-Hu Meng, Xu-Pin Xie, Yong-Chang Liu, Chang-Pin Huang, Lin-Jun Wang, Han-Yi Liu, Xin Fang, Guo-Hui Zhang

Specialty type: Surgery

Provenance and peer review:

Unsolicited article; Externally peer reviewed.

Peer-review model: Single blind

Peer-review report's scientific quality classification

Grade A (Excellent): 0

Grade B (Very good): 0

Grade C (Good): C

Grade D (Fair): D

Grade E (Poor): 0

P-Reviewer: Covantsev S, Russia; Schoenhagen P, United States

Received: January 25, 2023

Peer-review started: January 25, 2023

First decision: March 14, 2023

Revised: March 25, 2023

Accepted: April 13, 2023

Article in press: April 13, 2023

Published online: May 26, 2023



Xiao-Hu Meng, Xu-Pin Xie, Yong-Chang Liu, Lin-Jun Wang, Han-Yi Liu, Department of Vascular Surgery, The Affiliated Hangzhou First People's Hospital, Zhejiang University School of Medicine, Hangzhou 310006, Zhejiang Province, China

Chang-Pin Huang, Guo-Hui Zhang, Department of General Surgery, The Affiliated Hangzhou First People's Hospital, Zhejiang University School of Medicine, Hangzhou 310022, Zhejiang Province, China

Xin Fang, Department of Vascular Surgery, The Affiliated Hangzhou Cancer Hospital, Zhejiang University School of Medicine, Hangzhou 310006, Zhejiang Province, China

Corresponding author: Guo-Hui Zhang, MBChB, Nurse, Department of General Surgery, The Affiliated Hangzhou First People's Hospital, Zhejiang University School of Medicine, No. 469 Shenban Road, Hangzhou 310022, Zhejiang Province, China. 1018885878@qq.com

Abstract

BACKGROUND

Through significant advances in the treatment of peripheral arterial occlusive disease, acute ischemia of the lower extremity is still associated with significant morbidity, limb threat and mortality. The two main causes of acute ischemia in lower extremities are arterial embolism and atherosclerotic arteries. Timely recognition and treatment of acute limb ischemia in emergency situations is essential in order to minimize the duration of ischemia.

AIM

To investigate the application effect of angiojet thrombolysis in the treatment of acute lower extremity arterial embolization.

METHODS

Sixty-two patients with acute lower extremity arterial embolization admitted to our hospital from May 2018 to May 2020 were selected. Among them, the observation group (twenty-eight cases) had received angiojet thrombolysis, and the control group (thirty-four cases) had received femoral artery incision and thrombectomy. After thrombus clearance, significant residual stenosis of the lumen was combined with balloon dilation and/or stent implantation. When the thrombus removal was not satisfactory, catheter-directed thrombolysis was performed. The incidence of postoperative complications, recurrence rate and

recovery of the two groups were compared.

RESULTS

There were no significant differences in postoperative recurrence (target vessel reconstruction rate), anklebrachial index and the incidence of postoperative complications between the two groups ($P > 0.05$); there were statistically significant differences in postoperative pain score and postoperative rehabilitation between the two groups ($P < 0.05$).

CONCLUSION

The application of angiojet in the treatment of acute lower limb artery thromboembolism disease is safe and effective, minimally invasive, quicker recovery after operation, less postoperative complications, which is more suitable for the treatment of femoral popliteal arterial thromboembolism lesions. If the thrombus removal is not satisfactory, the combination of coronary artery aspiration catheter and catheterized directed thrombolysis can be used. Balloon dilation and stent implantation can be considered for obvious lumen stenosis.

Key Words: Acute lower extremity arterial embolism; Angiojet thrombectomy; Postoperative complications; Ankle brachial index; Postoperative rehabilitation

©The Author(s) 2023. Published by Baishideng Publishing Group Inc. All rights reserved.

Core Tip: Acute lower extremity arterial embolism is a common clinical emergency. It has the characteristics of rapid onset and rapid development. If left untreated, irreversible damage to limb tissue can occur within hours. Therefore, the key to the treatment of acute lower extremity arterial embolism is to seize the time and implement effective treatment plan is of great significance. Angiojet thrombectomy is a minimally invasive technique to remove thrombectomy through percutaneous insertion of catheters. The objective of this study was to investigate the application effect of angiojet thrombectomy in the treatment of acute lower extremity arterial embolization.

Citation: Meng XH, Xie XP, Liu YC, Huang CP, Wang LJ, Liu HY, Fang X, Zhang GH. Observation of the effect of angiojet to treat acute lower extremity arterial embolization. *World J Clin Cases* 2023; 11(15): 3491-3501

URL: <https://www.wjgnet.com/2307-8960/full/v11/i15/3491.htm>

DOI: <https://dx.doi.org/10.12998/wjcc.v11.i15.3491>

INTRODUCTION

Acute lower extremity arterial embolism is a common clinical emergency. It has the characteristics of acute onset and rapid development; if treatment is not pursued in time, within hours, it can cause irreversible damage to limb tissue, even threatening life and reducing the quality of life[1,2]. Therefore, the key to the treatment of acute lower extremity arterial embolism is to pursue treatment in a timely manner and implement an effective treatment plan, which is of great significance to reduce the amputation rate and mortality. At present, the main clinical methods for acute lower extremity arterial embolization include femoral artery incision and thrombectomy and catheter-directed thrombolysis. Among them, femoral artery incision and thrombectomy can quickly and partially restore the lower limb arterial blood supply, which can effectively reduce the incidence of amputation in patients. However, it has disadvantages such as the high amount of thrombectomy trauma, large reperfusion injury reaction, high risk of general anaesthesia, and a long operation time[3,4]. Angiojet thrombectomy is a minimally invasive technique for thrombectomy by percutaneous insertion of a thrombectomy catheter. This study intends to investigate the application effect of angiojet thrombectomy in the treatment of acute lower extremity arterial embolization.

MATERIALS AND METHODS

General information

A total of sixty-two patients with acute lower extremity arterial embolization who were treated in our hospital from May 2018 to May 2020 were selected as the research subjects, including thirty-eight males and twenty-four females aged 55 to 83 years, with an average age of 69.52 ± 7.45 years, a disease duration from 2.67 to 64.17 h, an average disease duration (13.22 ± 10.85) h, a preoperative ankle

brachial index (ABI) from 0.21 to 0.46, an average ABI of (0.33 ± 0.06), a body mass index (BMI) from 18.10 to 24.62 and average BMI of (21.87 ± 1.91) (Table 1). The inclusion criteria: (1) The diagnosis of acute lower extremity arterial embolism is clear, that is, the patient had sudden symptoms of pain, paraesthesia, paralysis, pulselessness and pallor in the affected limb, and the acute lower extremity artery embolism is confirmed by computed tomography examination and d-dimer that is significantly increased; (2) Clinical classification of lower extremity ischaemia: Rutherford grade 3 or lower; and (3) The patients and their families gave informed consent and signed the informed consent. The exclusion criteria: (1) Patients with immune system diseases such as thromboangiitis obliterans; (2) Patients with a recent history of active bleeding; (3) Irreversible necrosis that occurred in the affected limb of the patient, and amputation is inevitable; (4) Patients with contraindications to anticoagulation and antiplatelet medications; (5) Those with severe liver, kidney, and cardiac insufficiency who cannot tolerate surgery; and (6) Patients and their families who refuse to sign the informed consent. Sixty-two patients were divided into an observation group (twenty-eight cases) and a control group (thirty-four cases) according to the random number table method. The observation group included seventeen males and eleven females, aged 55 to 83 years, with an average age of 69.00 ± 7.29 years; the preoperative ABI ranged from 0.21 to 0.46, with an average ABI of 0.33 ± 0.05 ; and the BMI ranged from 18.19 to 24.62, with an average BMI of 21.97 ± 1.88 . The disease duration ranged from 2.65 to 64.12 h, and the average disease duration was 13.21 ± 10.84 h (Table 2). There were fourteen patients with smoking, eleven patients with hypertension, ten patients with diabetes mellitus, nine patients with hyperlipidaemia, nine patients with coronary heart disease, and twenty-two patients with atrial fibrillation. The control group consisted of twenty-one males and thirteen females, aged 57 to 81 years, with an average age of 69.94 ± 7.66 years; the preoperative ABI ranged from 0.21 to 0.46, with an average ABI of 0.33 ± 0.06 ; and the BMI ranged from 18.10 to 24.59, with an average BMI of 21.79 ± 1.97 . The disease duration ranged from 2.70 to 63.93 h, and the average disease duration was 13.25 ± 10.87 h (Table 2). There were eighteen patients with smoking, fourteen patients with hypertension, fifteen patients with diabetes, eleven patients with hyperlipidaemia, twelve patients with coronary heart disease, and twenty-six patients with atrial fibrillation. There was no significant difference in the general data between the two groups ($P > 0.05$) (Table 2 and 3), and the data was comparable. This study was approved by the hospital ethics committee, and all patients and their families signed informed consent forms.

Research methods

Surgical methods: All patients in the observation group had undergone angiojet thrombectomy. After satisfactory local anaesthesia, angiography confirmed that the puncture was located in the common femoral artery. High-pressure angiography was performed to confirm the location and length of the lesion, the patency of the deep femoral artery, the superficial femoral artery and the condition of the subknee outflow tract. After systemic heparinization, according to different conditions, an appropriate guide wire was selected, a single curved catheter was used to open the occluded segment, and an angiojet thrombus aspiration catheter was introduced for thrombus aspiration. The risk of distal embolism should be minimized during aspiration. If there was residual local stenosis, balloon dilation could be combined, and stent placement could be performed if necessary. If distal embolism occurred, a six-French guiding catheter could be introduced into the femoral popliteal segment for local aspiration; if embolism occurred in the anterior tibial artery, posterior tibial artery or peroneal artery, a four-French angiojet thrombus aspiration catheter or coronary thrombus aspiration catheter could be combined.

All patients in the control group underwent femoral artery incision and thrombectomy. After general anaesthesia was induced, a longitudinal incision was made in the ipsilateral groin, approximately 7 cm-10 cm long, the skin and subcutaneous tissue were incised layer by layer, and the femoral artery was exposed. The common femoral artery, superficial femoral artery, and deep femoral artery were dissociated and cuffed. After systemic heparinization, the common femoral artery was transversely incised. According to the different embolization sites, different diameters of Fogarty catheters were used for thrombectomy. If thrombectomy of the inferior knee artery is performed, attention should be given to the catheter guide wire and true lumen opening. Similarly, if there was residual local stenosis, balloon dilation could be combined, and stenting could be performed if necessary.

Before the end of the operation, the blood flow velocity and thrombus load were judged by angiography in both groups.

The control group was given prophylactic anti-infective therapy (within 30 min before surgery), and both groups were given vasodilator and anticoagulant therapy after surgery. Among them, the antiplatelet drug was bayaspirin or clopidogrel, and the anticoagulant drug was warfarin or rivaroxaban. The specific medication plan, time and dosage were determined according to the patient's comprehensive condition.

Observation indicators

Both groups were followed up for twenty months. The observation indicators included: (1) Amputation, death and other prognoses of the two groups after the operation; (2) The curative effect of the two groups. For the postoperative curative effect analysis, the Coley criterion was adopted: (I) Recovery: The distal limb pulse after treatment returned to normal, with no muscle and skin necrosis and no sensorimotor disturbance; (II) Good: The distal limb pulse was weaker than that of the contralateral side, and

Table 1 Basic data of enrolled patients (n, %, mean ± SD)

Groups	Gender (male)	Gender (female)	Age (yr)	BMI	Pre-operation ABI	Course of disease (h)
Enrolled patients (n = 62)	38 (61%)	24 (39%)	55-83 (69.52 ± 7.45)	18.10-24.62 (21.87 ± 1.91)	0.21-0.46 (0.33 ± 0.06)	2.67-64.17 (13.22 ± 10.85)

BMI: Body mass index; ABI: Ankle brachial index.

Table 2 Comparison of age, pre-operation, body mass index and course of disease between the two groups (n, mean ± SD)

Groups	Age (yr)	Pre-operation ABI	BMI	Course of disease (h)
Control group (n = 34)	57-81 (69.94 ± 7.66)	0.21-0.46 (0.34 ± 0.06)	18.10-24.59 (21.79 ± 1.97)	2.70-63.93 (13.25 ± 10.87)
Observation group (n = 28)	55-83 (69.00 ± 7.29)	0.21-0.46 (0.33 ± 0.05)	18.19-24.62 (21.97 ± 1.88)	2.65-64.12 (13.21 ± 10.84)
t value	0.059	0.538	0.381	0.015
P value	0.956	0.592	0.705	0.989

ABI: Ankle brachial index; BMI: Body mass index.

Table 3 Comparison of gender difference between the two groups, n (%)

Groups	Control group (n = 34)	Observation group (n = 28)	χ^2 value	P value
Gender (male)	21 (62)	17 (61)	0.007	0.932
Gender (female)	13 (38)	11 (39)		

the symptoms disappeared; (III) Fair: After treatment, the blood supply of the distal limb was partially restored but compensatory; (IV) Poor: After the treatment, the artery of the distal limb was not patent, which was compensated by collateral vessels, and the symptoms of ischaemia were still present; and (V) Amputation and death (total effective rate = (number of cured cases + number of good cases + number of normal cases)/total number of cases × 100%); (3) The changes in ankle brachial index (ABI) values were evaluated in the two groups, and the changes in ABI values before and after surgery were taken as the judgement standard; (4) The postoperative recurrence of the two groups was evaluated, and the second operation was taken as the standard; (5) The postoperative rehabilitation conditions of the two groups, were compared including pain score (the pain score standard was evaluated by the Numerical Rating Scale (NRS) III), time to get out of bed, operation time, and postoperative hospital stay; and (6) The postoperative complications between the two groups, including ischaemia-reperfusion injury syndrome, puncture site/incision infection, lymphatic leakage, distal embolism, haemoglobinuria, haemorrhage and haematoma formation, were compared.

Statistical methods

Data processing had used SPSS 22.0 software. Measurement data were expressed as mean ± standard deviation (mean ± SD), and *t*-test was used for pairwise comparison. The enumeration data were expressed in the form of percentage (%), and the χ^2 test was used for analysis. *P* < 0.05 was considered statistically significant.

RESULTS

Comparison of the total effective rate between the two groups

Compared with the control group (97.06%), the total effective rate of the observation group (100.00%) was not significantly different (*P* > 0.05). Two patients in both groups received catheterized directed thrombolysis (CDT) treatment, and postoperative thrombus removal and lumen opening were satisfactory. In the control group, two patients with distal arterial embolization were treated with a 3-french fogarty catheter. In the observation group, four patients had distal artery embolization during the operation, and a coronary artery suction catheter was used to aspirate the thrombus. Postoperative thrombus removal and lumen opening were satisfactory. Twenty-one patients in the control group were

treated with balloon dilation (percutaneous endovascular angioplasty (PTA), and 18 patients in the observation group were treated with balloon dilation. The lumen opening was satisfactory, and there was no significant difference in the above results ($P > 0.05$) (Table 4). Twenty-eight patients underwent thrombus aspiration, the aspiration time ranged from 105 to 234 s, and the operation success rate was 100%. Postoperative angiography was used to evaluate the thrombus clearance rate (Figure 1).

Comparison of pain scores, ABI differences of preoperative and postoperative, and surgical indicators between the two groups

The pain score, operation time, time to get out of bed, and postoperative hospital stay in the observation group were all lower than those in the control group, and the differences were statistically significant ($P < 0.05$) (Table 5).

Comparison of postoperative complication rates and recurrence rates between the two groups

There was no significant difference in postoperative puncture site infection, haemorrhage, haematoma, lymphatic leakage, distal embolism, haemoglobinuria, or recurrence rate between the two groups ($P > 0.05$). However, the incidence of puncture site infection, bleeding, haematoma and lymphatic leakage in the observation group was 0, which was significantly lower than that in the control group. The statistically insignificant difference between the two groups may be related to the insufficient sample size. The number of patients with ischaemia-reperfusion injury syndrome and postoperative complications in the observation group was significantly lower than that in the control group ($P < 0.05$), and the postoperative reperfusion injury in the observation group was significantly lighter than that in the control group (Table 6).

Comparison of survival between the two groups

In the observation group, one patient (3.60%) died after the operation due to multiple organ failure; one patient (2.90%) in the control group died due to natural death, and there was no significant difference in mortality between the two groups ($P > 0.05$). The survival time of the observation group was 76.18 ± 2.51 wk and that of the control group was 77.32 ± 2.06 wk, and there was no significant difference in the survival time between the two groups ($P > 0.05$) (Tables 7 and 8). The survival curves of the two groups are shown in Figure 2.

DISCUSSION

The risk of amputation with acute lower limb ischaemia is between 15% and 30%, and the perioperative morbidity and mortality are high[5]. Acute lower limb ischaemia mainly includes acute arterial thrombosis based on lower limb arteriosclerotic occlusive disease, lower limb artery embolism, and acute lower limb artery thrombosis of an unknown cause. It is important to distinguish these conditions because the treatment and prognosis are different[6]. Embolic disease is characterized by the presence of a foreign body (embolus) that partially or completely occludes the vascular lumen. Previously thought to be the cause of rheumatic heart disease, the majority of acute lower extremity arterial embolisms (60%) are now thought to be associated with atrial fibrillation or mural thrombosis after myocardial infarction and, rarely, an embolus from valvular growth or atrial myxoma[7]. Aneurysms may also produce emboli, so the abdomen and popliteal fossa should be palpated carefully, and atherosclerosis may also cause distal emboli upon plaque rupture[8]. Hypertension, diabetes, and hyperlipidaemia can all induce the formation of cardiovascular plaques and increase the risk of thrombosis[3,9]. Coronary heart disease is either an incomplete or a complete blockage of the cardiovascular system caused by the formation of plaques in the coronary arteries. If the plaques rupture, thrombosis may occur[10]. Atrial fibrillation can lead to blood pooling in the atrium, thereby forming a thrombus, and atrial fibrillation can easily lead to thrombus shedding[11]. Currently, the majority of acute lower extremity ischaemia (approximately 70%) is caused by arterial thrombosis, which usually occurs in the presence of preexisting vascular disease and is common in patients with diabetes[12].

Traditional arterial incision and Fogarty catheter thrombectomy are very effective in the treatment of acute arterial embolization of the lower extremities, especially in cases involving a single large blood vessel. However, in some cases, such as the presence of sclerotic occlusive lesions in lower extremity arterioles or peripheral artery lesions, the early clinical results are still unsatisfactory, which may be related to the existence of potential stenosis occlusive lesions. Even secondary vascular injuries by Fogarty balloon catheters may limit clinical success[13]. Diabetic patients are generally at higher risk for severe peripheral arterial disease in the lower infra-knee artery and are at higher risk for poor outcomes after thrombectomy using the Fogarty balloon catheter. The arterial walls of diabetic patients are fragile, prone to spasms, and severely calcified, so Fogarty catheters are difficult to pass through and reach the target vessel. In these cases, bypass surgery may be used as the primary option or as a second-line treatment when thromboembolic resection fails[14]. However, conventional arteriotomy and Fogarty catheter thrombectomy or bypass surgery usually have a longer anaesthesia duration, higher surgical

Table 4 Comparison of efficacy between the two groups, *n* (%)

Groups	Recovery	Good	Fair	Poor	Amputation/death	Total effective rate
Control group (<i>n</i> = 34)	18 (52.94)	10 (29.41)	5 (14.71)	1 (2.94)	0 (0)	33 (97.06)
Observation group (<i>n</i> = 28)	16 (57.14)	8 (28.57)	4 (14.29)	0 (0.00)	0 (0)	28 (100.00)
χ^2 value						0.837
<i>P</i> value						0.360

Table 5 Comparison of surgical indicators between the two groups (*n*, mean \pm SD)

Group	Pain score (point)	ABI difference before and after operation	Operation time (h)	Time to get out of bed (h)	Hospital stay (d)
Control group (<i>n</i> = 34)	3.97 \pm 0.94	0.59 \pm 0.13	3.51 \pm 0.45	25.18 \pm 1.77	8.04 \pm 0.75
Observation group (<i>n</i> = 28)	1.71 \pm 0.71	0.56 \pm 0.11	2.53 \pm 0.32	16.32 \pm 2.48	5.80 \pm 0.98
<i>t</i> value	10.480	0.739	9.579	16.390	10.150
<i>P</i> value	0.000	0.463	0.000	0.000	0.000

ABI: Ankle brachial index.

Table 6 Comparison of postoperative complication rates and recurrence rates between the two groups, *n* (%)

Groups	Ischemia reperfusion injury syndrome (case)	Infection of puncture site/incision (case)	Bleeding at puncture site/incision (case)	Puncture site/incision hematoma (case)	Lymphatic leakage (case)	Recurrence (case)	Distal embolism (case)	Hemoglobinuria (cases)	Patients with complications (cases)
Control group (<i>n</i> = 34)	23 (0.68)	2 (0.06)	4 (0.12)	3 (0.09)	3 (0.09)	4 (0.12)	2 (0.06)	0 (0)	24 (0.71)
Observation group (<i>n</i> = 28)	10 (0.36)	0 (0)	0 (0)	0 (0)	0 (0)	3 (0.11)	4 (0.14)	3 (0.11)	10 (0.36)
χ^2 value	6.289	1.702	3.521	2.596	2.596	0.017	1.240	3.828	7.540
<i>P</i> value	0.012	0.192	0.061	0.107	0.107	0.897	0.265	0.050	0.006

Table 7 Comparison of deaths between the two groups, *n* (%)

Group	Death
Control group (<i>n</i> = 34)	1 (2.90)
Observation group (<i>n</i> = 28)	1 (3.60)
χ^2 value	0.020
<i>P</i> value	0.889

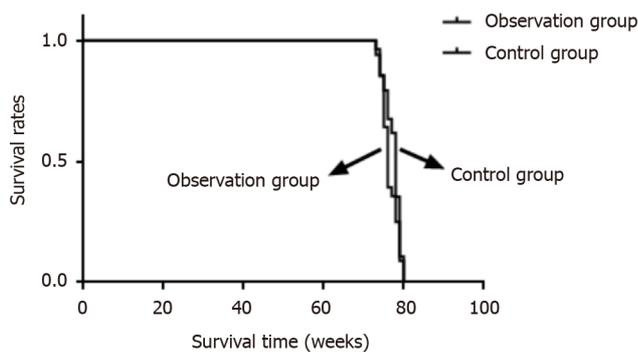
risk, more severe trauma, higher rates of thrombus retention, and higher rates of thrombus recurrence [15]. In addition, the disadvantages of open surgery include scarring of the incision, difficulty in reoperation with femoral artery dissection, increased likelihood of lymphatic leakage, incision infection, and inability of the catheter to pass through the sclerosis to occlude the diseased artery. CDT is becoming accepted for acute limb ischaemia. Based on the available clinical evidence, CDT achieves the same outcomes as open surgery in terms of the limb salvage rate and target lesion opening rate. Compared with open surgery, CDT has the advantages of less trauma and a faster recovery time. However, patients with acute limb ischaemia tend to be older, have comorbidities and have a high risk

Table 8 Comparison of survival between two groups (*n*, mean \pm SD)

Group	Survival time (wk)
Control group (<i>n</i> = 34)	77.32 \pm 2.06
Observation group (<i>n</i> = 28)	76.57 \pm 2.06
<i>t</i> value	1.432
<i>P</i> value	0.158



DOI: 10.12998/wjcc.v11.i15.3491 Copyright ©The Author(s) 2023.

Figure 1 Intraoperative angiography. A: Superficial femoral artery preoperative angiography; B: Postoperative superficial femoral artery angiography; C: Preoperative subpatellar arteriography; D: Postoperative angiography of inferior knee artery.

DOI: 10.12998/wjcc.v11.i15.3491 Copyright ©The Author(s) 2023.

Figure 2 The survival curves of the two groups.

of bleeding. Therefore, due to the strict requirements of CDT, this method is only suitable for a small number of patients. In addition, thrombolysis can cause bleeding, especially fatal cerebral haemorrhage [16]. In recent years, the application of percutaneous mechanical thrombectomy in the treatment of acute limb ischaemia has shown many advantages; it is a minimally invasive endovascular treatment, can be used for rapid thrombectomy, and requires lower doses or no thrombolytic drugs; all of these factors indicate that it has better application prospects [17].

AngioJet is an effective mechanical thrombectomy device for removing thrombi, restoring and maintaining arterial patency and alleviating symptoms and can shorten the time of special bed care for patients with severe conditions [18]. Some domestic scholars believe that it is not necessary to use the spraying mode first but directly use the suction mode [19]; however, foreign researchers believe that

spraying combined with the suction mode can achieve a better thrombolysis effect[20]. Angiojet is a hemolytic thrombectomy device that may cause hemoglobinemia and haemoglobinuria when patients are repeatedly operated on, and this occurs mainly in patients with renal insufficiency[21]. It is recommended to rehydrate patients with isotonic saline during and after surgery and alkalize urine with sodium bicarbonate. AngioJet thrombus aspiration has been applied in different diseases, including acute thrombosis and stent thrombosis, and the success rate of effective intraoperative blood flow recovery is between 60% and 90% [22]. The PEARL clinical study reported the results of mechanical thrombolysis with rheological drugs in the treatment of acute lower extremity ischaemia. The operation was successful in 83% of the 283 patients, and half of the operations were completed without the need for assisted CDT. At twenty months of follow-up, the amputation-free survival and mortality were 81% and 91%, respectively, 91% of the patients were free from bleeding requiring blood transfusion, and 95% of the patients were free from renal failure. A subgroup analysis showed that patients without subknee artery disease and patients without CDT who underwent haemolytic thrombectomy had a better prognosis[23]. In addition to the abovementioned intravascular haemolysis and acute renal insufficiency, a series of complications related to the mechanism of action of this system may occur, including vascular injury and acute embolization, stent collapse during thrombectomy, and distal embolization [24]. There may be embolism in the distal arteries after angiojet thrombectomy and thrombolysis. If the distal main artery is embolized, the 4-french angiojet catheter can be exchanged, and PTA can be used to address the distal arterial embolism. If the residual stenosis is mainly from an old thrombus due to arteriosclerosis or embolization, PTA and stent implantation should be performed; if the residual stenosis is mainly residual fresh thrombus, thrombus aspiration can be performed again. If it is invalid, CDT therapy can be performed.

In this study, angiojet thrombectomy and arterial incision thrombectomy were compared in terms of surgical efficacy, operation-related indicators, postoperative rehabilitation, postoperative complications, embolism recurrence and other aspects to explore the clinical application value of angiojet thrombectomy and provide a reference for follow-up treatment and recurrence prevention. The results of this study showed that there was no significant difference between angiojet thrombectomy and arteriotomy thrombectomy in terms of overall efficacy and postoperative embolism recurrence. In addition, compared with arterial incision and thrombectomy, angiojet thrombectomy significantly reduced the operation time, reduced postoperative pain, shortened patients' time to get out of bed and stay in hospital, and reduced the incidence of postoperative complications, which was conducive to postoperative recovery, early discharge and improvement of postoperative quality of life. In this study, 8 patients in the observation group were treated with PTA and/or stent implantation during the operation, and all patients achieved good therapeutic effects.

In conclusion, angiojet thrombectomy is a safe and effective means for the treatment of acute lower extremity arterial embolism, and it effectively reduces the operation time, postoperative pain and postoperative complication rate and speeds up the postoperative recovery.

CONCLUSION

In conclusion, angiojet thrombectomy is a safe and effective means for the treatment of acute lower extremity arterial embolism, which effectively reduces operation time, postoperative pain and postoperative complication rate and speeds up postoperative recovery. Stenosis or residual thrombus (which cannot be aspirated), can be combined with PTA and/or stenting. This study is a retrospective study with a small number of cases and a short follow-up time. The clinical application and utility of angiojet thrombectomy is limited. Therefore, a larger sample size is needed to evaluate the relevant risk factors and more clinical experience. In addition, prospective clinical studies are needed to accumulate experience and improve techniques to better grasp indications.

ARTICLE HIGHLIGHTS

Research background

Acute lower extremity arterial embolism is a clinical emergency, if not treated in time, easy to lead to limb ischemia necrosis, eventually amputation, serious damage to the physical and mental health of the patient.

Research motivation

In the past, the effect of conventional drug thrombolytic therapy was slow and limited, and the optimal treatment time was easily delayed. Timely treatment of acute limb ischemia is essential to minimize the duration of ischemia.

Research objectives

To investigate the effect of angiojet in acute lower extremity arterial embolization.

Research methods

Through the collection and analysis of patients with acute lower limb artery embolization admitted to our hospital from May 2018 to May 2020, the postoperative complication rate, recurrence rate and recovery of the two groups of patients who underwent vascular injection thrombolysis and femoral artery incision thrombolysis were compared.

Research results

There were no significant differences in postoperative recurrence, anklebrachial index and the incidence of postoperative complications between the two groups; there were statistically significant differences in postoperative pain score and postoperative rehabilitation between the two groups.

Research conclusions

It is safe and effective that the application of angiojet in the treatment of acute lower extremity arterial thromboembolism.

Research perspectives

Prospective studies should be conducted to expand the sample size and extend follow-up time to assess related risk factors and summarize more clinical experience, so as to accumulate experience, improve techniques and better grasp indications.

ACKNOWLEDGEMENTS

We thank all the doctors in the radiology department of Hangzhou First People's Hospital for their technical support.

FOOTNOTES

Author contributions: Meng XH contributed to the study conception and writing; Meng XH and Zhang GH contributed to the data collection and investigation; Meng XH and Xie XP contributed to the analysis; all authors contributed to the critical review and revision, final approval of the article and accountability for all aspects of the work.

Supported by Hangzhou Medical Health Science and Technology Project, No. 20220919Y001; and No. 20220919Y004.

Institutional review board statement: The study was reviewed and approved by the Hangzhou First People's Hospital Institutional Review Board (Approval No.IIT-20221218-0201-01).

Informed consent statement: All study participants, or their legal guardian, provided informed written consent prior to study enrollment.

Conflict-of-interest statement: All authors have no conflict of interest.

Data sharing statement: No additional data are available.

STROBE statement: The authors have read the STROBE Statement – checklist of items, and the manuscript was prepared and revised according to the STROBE Statement – checklist of items.

Open-Access: This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <https://creativecommons.org/licenses/by-nc/4.0/>

Country/Territory of origin: China

ORCID number: Xiao-Hu Meng 0000-0001-8093-9314; Xu-Pin Xie 0000-0002-8405-190X; Yong-Chang Liu 0000-0002-9876-7183; Chang-Pin Huang 0000-0003-0117-4929; Xin Fang 0000-0003-3218-2606; Guo-Hui Zhang 0000-0002-9737-5946.

S-Editor: Liu JH

L-Editor: A

P-Editor: Yuan YY

REFERENCES

- 1 **Yang M**, Chen L, Zhang M, Huang X, Zhao W, Wang H. Evidence-Based Nursing Model in Interventional Thrombolysis for Acute Lower Extremity Arterial Embolism. *Contrast Media Mol Imaging* 2022; **2022**: 4488797 [PMID: 35677027 DOI: 10.1155/2022/4488797]
- 2 **Zhao L**, Cai H, Song Q. Clinical Study on Treatment of Acute Lower Extremity Arterial Embolism With Straub Thrombus Removal System. *Front Surg* 2022; **9**: 891649 [PMID: 35574526 DOI: 10.3389/fsurg.2022.891649]
- 3 **de Donato G**, Pasqui E, Setacci F, Palasciano G, Nigi L, Fondelli C, Sterpetti A, Dotta F, Weber G, Setacci C. Acute on chronic limb ischemia: From surgical embolectomy and thrombolysis to endovascular options. *Semin Vasc Surg* 2018; **31**: 66-75 [PMID: 30876643 DOI: 10.1053/j.semvascsurg.2018.12.008]
- 4 **Araujo ST**, Moreno DH, Cacione DG. Percutaneous thrombectomy or ultrasound-accelerated thrombolysis for initial management of acute limb ischaemia. *Cochrane Database Syst Rev* 2022; **1**: CD013486 [PMID: 34981833 DOI: 10.1002/14651858.CD013486.pub2]
- 5 **Khan S**, Hawkins BM. Acute Limb Ischemia Interventions. *Interv Cardiol Clin* 2020; **9**: 221-228 [PMID: 32147122 DOI: 10.1016/j.iccl.2019.12.002]
- 6 **McNally MM**, Unvers J. Acute Limb Ischemia. *Surg Clin North Am* 2018; **98**: 1081-1096 [PMID: 30243449 DOI: 10.1016/j.suc.2018.05.002]
- 7 **Meng XH**, Xie LS, Xie XP, Liu YC, Huang CP, Wang LJ, Zhang GH, Xu D, Cai XC, Fang X. Cardiac myxoma shedding leads to lower extremity arterial embolism: A case report. *World J Clin Cases* 2022; **10**: 10606-10613 [PMID: 36312464 DOI: 10.12998/wjcc.v10.i29.10606]
- 8 **Shao C**, Wang J, Tian J, Tang YD. Coronary Artery Disease: From Mechanism to Clinical Practice. *Adv Exp Med Biol* 2020; **1177**: 1-36 [PMID: 32246442 DOI: 10.1007/978-981-15-2517-9_1]
- 9 **Suo Y**, Zhang Z, Fu H, Zhang Y, Yuan M, Wang Y, Goudis CA, Tse G, Liu T, Li G. Inhibition of renin-angiotensin axis reduces the risk of thrombus formation in the left atrial appendage in patients with hypertension complicated by atrial fibrillation. *J Renin Angiotensin Aldosterone Syst* 2018; **19**: 1470320318782623 [PMID: 29956583 DOI: 10.1177/1470320318782623]
- 10 **Dattoli-García CA**, Jackson-Pedroza CN, Gallardo-Grajeda AL, Gopar-Nieto R, Araiza-Garygordobil D, Arias-Mendoza A. Infarto agudo de miocardio: revisión sobre factores de riesgo, etiología, hallazgos angiográficos y desenlaces en pacientes jóvenes. *Arch Cardiol Mex* 2021; **91**: 485-492 [PMID: 33471784 DOI: 10.24875/ACM.20000386]
- 11 **Liang S**, Zhou L, Ye K, Lu X. Limb Salvage After Percutaneous Mechanical Thrombectomy in Patients with Acute Lower Limb Ischemia: A Retrospective Analysis from Two Institutions. *Ann Vasc Surg* 2019; **58**: 151-159 [PMID: 30769064 DOI: 10.1016/j.avsg.2018.11.025]
- 12 **Chang Z**, Yan H, Zhen Y, Zheng J, Liu Z. Lower Limb Arterial Calcification and Acute Thrombosis Risk in Patients with Peripheral Artery Disease. *Ann Vasc Surg* 2020; **63**: 227-233 [PMID: 31536790 DOI: 10.1016/j.avsg.2019.06.043]
- 13 **Davis FM**, Albright J, Gallagher KA, Gurm HS, Koenig GC, Schreiber T, Grossman PM, Henke PK. Early Outcomes following Endovascular, Open Surgical, and Hybrid Revascularization for Lower Extremity Acute Limb Ischemia. *Ann Vasc Surg* 2018; **51**: 106-112 [PMID: 29518503 DOI: 10.1016/j.avsg.2017.12.025]
- 14 **Stoberock K**, Kaschwich M, Nicolay SS, Mahmoud N, Heidemann F, Rieß HC, Debus ES, Behrendt CA. The interrelationship between diabetes mellitus and peripheral arterial disease. *Vasa* 2021; **50**: 323-330 [PMID: 33175668 DOI: 10.1024/0301-1526/a000925]
- 15 **de Athayde Soares R**, Matiolo MF, Brochado Neto FC, Cury MVM, Duque de Almeida R, de Jesus Martins M, Pereira de Carvalho BV, Sacilotto R. Analysis of the results of endovascular and open surgical treatment of acute limb ischemia. *J Vasc Surg* 2019; **69**: 843-849 [PMID: 30679009 DOI: 10.1016/j.jvs.2018.07.056]
- 16 **Huang H**, Gu J, Su H, Chen L, He X, Kong J, Shi Y, Lu Z, Yuan Y. Solitaire™ Stent Thrombectomy System in the Treatment of Acute Lower-Limb Ischemia: Comparisons in Safety and Effectiveness with Conventional Catheter-Directed Thrombolysis Therapy. *Biomed Res Int* 2022; **2022**: 6997221 [PMID: 36177056 DOI: 10.1155/2022/6997221]
- 17 **Yang X**, Li X, Yin M, Wang R, Ye K, Lu X, Li W, Cheng Y, Qin J. Percutaneous Mechanical Thrombectomy for Acute Limb Ischemia With Aorto-iliac Occlusion. *Front Surg* 2022; **9**: 831922 [PMID: 35599798 DOI: 10.3389/fsurg.2022.831922]
- 18 **Ascher E**, Kibrik P, Rizvi SA, Alsheekh A, Marks N, Hingorani A. Fast-track thrombolysis protocol for acute limb ischemia. *J Vasc Surg* 2021; **73**: 950-959 [PMID: 32437952 DOI: 10.1016/j.jvs.2020.03.061]
- 19 **Gong M**, Zhou Y, He X, Chen L, Su H. Mechanical Thrombectomy Using Kissing Y-Solitaire as a Rescue Treatment for Refractory Acute Popliteal and Infrapopliteal Occlusion in Elderly Patients. *J Vasc Interv Radiol* 2021; **32**: 1601-1605 [PMID: 34717836 DOI: 10.1016/j.jvir.2021.08.012]
- 20 **Garcia MJ**, Lookstein R, Malhotra R, Amin A, Blitz LR, Leung DA, Simoni EJ, Soukas PA. Endovascular Management of Deep Vein Thrombosis with Rheolytic Thrombectomy: Final Report of the Prospective Multicenter PEARL (Peripheral Use of AngioJet Rheolytic Thrombectomy with a Variety of Catheter Lengths) Registry. *J Vasc Interv Radiol* 2015; **26**: 777-85; quiz 786 [PMID: 25824314 DOI: 10.1016/j.jvir.2015.01.036]
- 21 **Esteras R**, Cannata-Ortiz P, Del Palacio-Tamarit M, Guerrero-Hue M, García-Caballero C, Egido J, Gimeno J, Ortiz A, Gracia-Iguacel C, Moreno JA. Podocyte and tubular involvement in AngioJet-induced kidney injury. *Clin Kidney J* 2021; **14**: 424-428 [PMID: 33564448 DOI: 10.1093/ckj/sfz104]
- 22 **Gandhi SS**, Ewing JA, Cooper E, Chaves JM, Gray BH. Comparison of Low-Dose Catheter-Directed Thrombolysis with and without Pharmacomechanical Thrombectomy for Acute Lower Extremity Ischemia. *Ann Vasc Surg* 2018; **46**: 178-186 [PMID: 28739471 DOI: 10.1016/j.avsg.2017.07.008]

- 23 **Leung DA**, Blitz LR, Nelson T, Amin A, Soukas PA, Nanjundappa A, Garcia MJ, Lookstein R, Simoni EJ. Rheolytic Pharmacomechanical Thrombectomy for the Management of Acute Limb Ischemia: Results From the PEARL Registry. *J Endovasc Ther* 2015; **22**: 546-557 [PMID: 26109628 DOI: 10.1177/1526602815592849]
- 24 **Chan PG**, Goh GS. Safety and efficacy of the AngioJet device in the treatment of thrombosed arteriovenous fistula and grafts: A systematic review. *J Vasc Access* 2018; **19**: 243-251 [PMID: 29546789 DOI: 10.1177/1129729818760977]



Published by **Baishideng Publishing Group Inc**
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA
Telephone: +1-925-3991568
E-mail: bpgoffice@wjgnet.com
Help Desk: <https://www.f6publishing.com/helpdesk>
<https://www.wjgnet.com>

