Journal of Clinical and Medical Images

Research Article

ISSN: 2640-9615 | Volume 8

Clinical Application of Color Doppler Ultrasound Guided Inferior Vena Cava Filter Placement Through Femoral Vein

Dong Liu[2#], Ying Huang[3#], Tianqing Yao[2#], Yinchen Ran[2], Ke Tian[2], Lei Zhou[2], Zhumin Cao[2*] and Kai Deng[1*]

[1]Department of General Surgery, The First Affiliated Hospital of Chongqing Medical College, Chongqing, 400061, China

[2]Department of Vascular Surgery, The Seventh People's Hospital of Chongqing, Chongqing, 400054, China

[3]Department of Rehabilitation Medicine, HONGLOU Hospital of Chongqing,400053, China

[*]Corresponding author:

Zhumin Cao (MD,PhD),
Department of Vascular Surgery, The Seventh People's Hospital of Chongqing, Chongqing, 40054, China

Received: 08 Jan 2025
Accepted: 12 Feb 2025
Published: 18 Feb 2025
J Short Name: JCMI

Citation:

Zhumin Cao, Clinical Application of Color Doppler Ultrasound Guided Inferior Vena Cava Filter Placement Through Femoral Vein. J Clin Med Img. 2025; V8(7): 1-4

Keywords:

Color Ultrasound Guidance; Inferior Vena Cava Filter; Lower Extremity Deep Vein Thrombosis; Pulmonary Embolism

Author contribution:

#First author: Dong Liu, Completed the case #First author: Dong Liu, Completed the case collection and paper writing.
#Co-first author: Ying Huang,Tianqing Yao, Complete the operation.

***Co-corresponding author:**

Kai Deng(MD)Data analysis and completed the surgery.

1. Abstract

Objective

To evaluate the clinical application of inferior vena cava filter (IVCF) guided by color Doppler flow imaging (CDFI) in patients with lower extremity deep vein thrombosis (DVT).

Methods

Thirty three patients with deep vein thrombosis of lower extremities were treated with CDFI guided IVCF implantation through femoral vein. The shape and position of IVCF were monitored by color ultrasound and X-ray, and PE and filter complications were followed up.

Results

33 patients were examined by CDFI before operation. The femoral vein, common iliac vein bifurcation, inferior vena cava, left and right deep vein openings were clearly displayed. All veins had no variation and thrombosis. Under the guidance of CDFI, convertible filters were implanted through femoral vein, with a success rate of 100%. After operation, CDFI and X - ray confirmed that the filter was placed in the correct position, fully unfolded, without displacement or inclination. Among them, 29 cases were converted under X-ray guidance, and 8 cases were captured thrombus, with the capture rate of 24.2%. The filter did not tilt, shift, break or puncture the blood vessel wall, and there was no pulmonary embolism.

Conclusion

CDFI guided IVCF implantation through femoral vein is a safe and reliable method, which can effectively prevent the occurrence of pulmonary embolism caused by lower limb deep vein thrombosis; Compared with X-ray guided IVCF implantation, it has the advantages of simplicity, ease, non radiation, low cost, bedside CDFI guidance for critically ill patients who are not suitable for moving, and surgery for patients with renal insufficiency and contrast allergy. The operation has high clinical application value and is easy to be popularized in grass-roots hospitals.Pulmonary embolism (PE) is a common clinical disease that can cause sudden clinical death, with a mortality rate of up to 20% -30% [1-2]. Studies have shown that most of the emboli of PE originate from deep venous [3] of the lower limbs. Inferior vena cava filter (IVCF) implantation can

significantly reduce the incidence of PE [4-5], and effectively prevent the occurrence of fatal PE [6]. Our hospital successfully inserted IVCF33 by color ultrasound guidance, all of which are reported as follows.

2. Data and Methods

2.1. Subject Investigated

A total of 33 cases successfully performed in our hospital from October 2015 to July 2016 were selected as the study subjects.33 patients after strict screening: color ultrasound examination without inferior vena cava malformation, variation, color ultrasound could clearly show the femoral vein, common iliac vein bifurcation, inferior vena cava, left and right deep vein opening position, and no thrombosis in the approach route, and meeting the indications of IVCF implantation.33 patients were 14 central, 3 peripheral and 16 mixed.19 had left lower limbs, 12 had right lower limbs, and 2 had both lower limbs.25 males and 8 females, aged 51-84 years, mean age around 64 years; duration 3-14 days, mean around 8 days.7 trauma, 1 tumor, and the remaining 25 had no obvious inducement.

2.2. Key Instrument

2.3. The Toshiba Aplio400 color Doppler ultrasound diagnostic instrument was used, with the high-frequency probe (6-12 MHz) and the abdominal probe (2-3.5MHz). Plain abdominal films were performed in CR, model number Fujifilm Velocity T.

2.4. Filter Type

The VenaTech Convertible convertible filter produced by Belan, France.

3. Method

Preoperative preparation Patients are absolutely in bed; fast for 8 hours; clean enema before surgery, eliminate the interference of intestinal gas on color ultrasound; and skin preparation in sur- gical area.

The filter placement route mainly selects bilateral femoral vein approach; those with deep vein thrombosis in both lower limbs.

Filter placement method The patient is placed in the supine position to fully expose the abdomen and bilateral inguinal area. The location of the thrombus was defined again, no thrombus in the iliac and femoral veins in the healthy side, and no malforma- tion of the inferior vena cava, and the inner diameter of the inferior vena cava (<32mm) was measured. Focus on the location of the right renal vein into the inferior vena cava, and mark the projec- tion of the body surface (R line). mark another line about 1.0cm below this as the position of the tip of the filter sheath. Finally, the common iliac vein bifurcation was found, and the projection position of the body surface was marked. In the inguinal area, the Seldinger puncture technique was used in the healthy femoral vein to send the guide wire into the inferior vena cava, and then into

the 9F sheath along the guide wire, and the tip reached the C line. Contrast again with Sonnovi, the contrast ejection point is at line C, that is, the position is confirmed. Connect the filter to the sheath, Femoral up, the push rod will send the filter to the specified posi- tion, fix the push rod, remove the sheath, release the filter, release the sheath and the push rod, press the puncture point to stop the bleeding, and cover the sterile accessories.

Monitoring after filter placement, on the 1,7 and 14 days after the operation, the X-ray abdominal plain examination to monitor the filter position (tilt, displacement), opening, CDFI monitoring of the inferior vena cava and the presence of thrombosis around the filter. CDFI was monitored 1,3,6 and 12 months after filter pla- cement to understand the usual conditions of lower limb veins and inferior vena cava.

Figure 1: Line C: and 1.0cm distal to the renal vein plane.

Figure 2: IVCF was accurate released.

Figure 3: The first postoperative dayX-ray abdominal plain radiograph:Position of the filter (without tilt, shift) and it's opening.

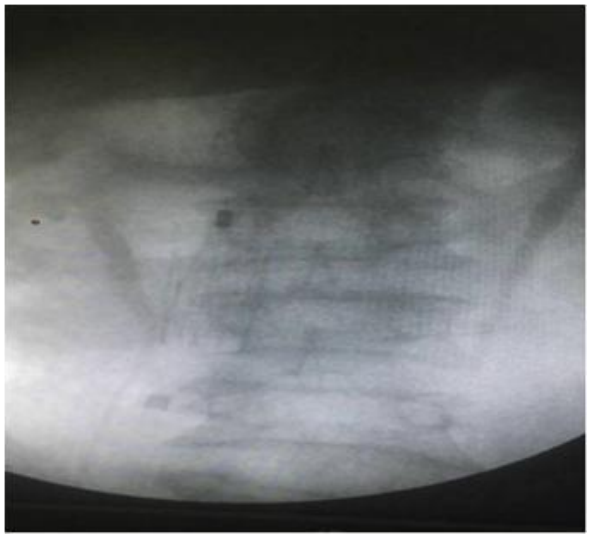

Figure 4: The seventh postoperative dayX-ray abdominal plain radiograph:Position of the filter (without tilt, shift) and it's opening.

4. Results

In this group, 33 cases of color ultrasound guidance were successful at one time, and there was no hematoma, thrombus or arteriovenous fistula at the puncture site. In addition, the IVCF was successfully inserted with 1.0-1.5cm under the right renal vein inlet and 2.0cm above the iliac vein bifurcation. Intraoperative CDFI confirmed good morphology of IVCF, without displacement, tilt, or injury to the inferior cava wall. The CDFI shows a smooth blood flow filter. Postoperative X-ray confirmed the IVCF morphology, good position, no shedding, displacement, tilt, and incomplete deployment. After anticoagulation, thrombolysis and clearing treatment, the patient's symptoms were relieved, the lower limb swelling gradually subsided, and there was no obvious obstacle in walking. The follow-up showed no pulmonary embolism or other complications.

5. Discussion

In recent decades, domestic data show that the number of PE inpatients and the ratio of the total number of inpatients have increased year by year, especially in the early 21st century, the increase trend is more obvious [7]. Due to the development of endovascular technology, IVCF is used in patients with DVT and PE through its mechanical intervention to capture the thrombus and thus protect against PE. After filter placement, the incidence of PE due to thrombus shedding can greatly reduce the [8-9].The display rate of inferior vena cava, deep veins, deep veins and common iliac veins was between 90% and 98.5% [10-11]. It can show the shape of blood vessels, lumen, thrombus (acute or chronic thrombus). At the same time, IVCF, guidewire and sheath are quite different from blood composition and tube wall, so CDFI can clearly display the position of IVCF, guidewire and sheath, which can guide the release of IVCF to the correct position. Fully shows that CDFI is fully able to successfully guide the placement of IVCF.In addition, compared with X-line guidance, CDFI guidance has obvious advantages: (1) a wide range of people: pregnant women, patients with contrast agent allergy and severe renal insufficiency can use CDFI guidance.(2) Radiation damage without radiation: X-ray has different degrees of harm to human body, and radiation damage to radiation can be avoided by CDFI.(3) Bedside operation: For some patients who cannot be moved (such as patients in the intensive care unit), the bedside operation can be carried out.(4) Complications without blind puncture: blind puncture may cause false puncture, hematoma at the puncture site, arteriovenous fistula, gas embolism and other complications; under the guidance of CDFI, the puncture success rate is 100%, effectively avoiding the occurrence of these complications.(5) The cost is relatively low: placement via X line, which requires imaging under DSA, and placement through CDFI can save this cost.In order to be safer, attention should be paid to the IVCF guided by CDFI: (1) determine the entry route before surgery to ensure that there is no deformity, variation or thrombosis in the inferior vena cava, iliac vein and femoral vein.(2) Before releasing the filter, ensure that the filter is located in the inferior vena cava 1.0-1.5cm below the entrance of the right renal vein.(3) The patient is absolutely in bed; fast for 8 hours; clean the enema before surgery, and eliminate the interference of intestinal gas on color ultrasound.(4) The filter is selected by the diameter of the inferior vena cava: avoid the complications such as damaging the wall of the inferior vena cava, displacement, tilt and falling off caused by the small filter.In conclusion, IVCF placement guided by CDFI is a safe, reliable and effective method, and CDFI can be evaluated and monitored before, during and after surgery. Moreover, compared with X-ray guidance, it has the advantages of simple, easy to operate, no radiation, low cost, feasible bedside CDFI guidance for critical patients unsuitable for moving, and surgery for patients with renal insufficiency and contrast allergy. The operation has high clinical application value and is easy to be promoted in primary hospitals.

References

1. Failla PJ, Reed KD, Summer WR. Inferior vena caval filters: key considerations. J Am J Med Sci. 2005; 330(2):82-87.
2. Hann CL, Streiff MB. The role of vena caval filters in the management of venous thromboembolism. J Blood Rev. 2005; 19(4):179-202.
3. Guo Danjie, Chen Hong, Wu Chun. The European Society of Cardiology guidelines for the diagnosis and treatment of acute pulmonary embolism. Chinese Medical Guide. 2001; 3 (1): 26-44.
4. Hong Duo, Zhang Xitong. Clinical use of the IVC filter. J Interventional Imaging and Therapeutics in China. 2010; 7 (1): 82-85.
5. Stein PD, Matta F,Keyes DC. Impact of vena cava filters on in-hospital case fatality rate from pulmonary embolism. J Am J Med. 2012; 125(5):478-484.
6. Athanasoulis CA, Kaufman JA, Halpern EF, et al. Inferior vena caval filters: Review of a 26-year single-center clinical experience. Radiology. 2000; 216(1):54-66.
7. Zou Zhipeng, He Jianguo, Cheng Xiansheng. The change of hospitalization composition ratio and mortality in patients with pulmonary artery thromboembolism. Chinese Journal of Medicine. 2005; 85(23): 1605-1607.
8. The PREPIC Study Group. Eight-year follow-up of patients with permanent vena cava filers in the prevention of pulmonary embolism: the PREPIC(Prevention du Risque d'EmboliePulmonaire par Interruption Cave)randomized study. Circulation. 2005; 112(3):416-422.
9. Lambert M, Mismetti P.Usefulness of inferior vena cava filters.J Mal Vasc. 2011; 36(Suppl 1):S48-50.
10. Conners MS, Becker S, Guzman RJ. Duplex scan-directed placement of inferior vena cava filters; A five-year institutional experience. J Vasc Surg. 2002; 35(2):286-291.
11. Friedland M, Kazmers A, Kline R. Vena cava duplex imaging before cacal interruption. J Vasc Surg. 1996; 24(4):608-613.