Oncology and Translational Medicine
DOI 10.1007/s10330-020-0457-7

April 2021, Vol. 7, No. 2, P95–P98

CASE REPORT

A case report of iodine-125 seed placement during operation for the treatment of advanced gallbladder carcinoma with septic shock*

Zhuo Zhong[1], Fei Gao[2], Zhuo Lv[1], Zhihui Zhong[2], De Long[1] (✉)

[1] Department of Oncology, Guangzhou Hospital of Integrated Traditional and West Medicine, Guangzhou 510800, China
[2] Department of Minimally Invasive Interventional Radiology, Sun Yat-sen University Cancer Center, Guangzhou 510060, China

Abstract

This case report describes a patient with advanced gallbladder cancer who developed septic shock associated with iodine-125 (^{125}I) seed implantation. The treatment process is described to provide a clinical reference for similar cases. A 52-year-old woman with recurrence of advanced gallbladder cancer underwent ^{125}I seed implantation and developed postoperative sepsis with septic shock. The blood culture suggested infection with *Aeromonas caviae* and *Enterococcus faecalis*. Vancomycin and imipenem were immediately administered according to the drug sensitivity results, along with immunoglobulin therapy and vasoactive drugs. The patient's condition gradually stabilized after comprehensive treatment. Sepsis with septic shock is a rare but potentially fatal complication of ^{125}I seed implantation. Timely administration of broad-spectrum antibiotics, immunoglobulin therapy, and vasoactive drugs is very important to stabilize the patient's condition. Our treatment of this patient can serve as a reference for clinicians to manage this complication in similar cases.

Received: 25 September 2020
Revised: 13 November 2020
Accepted: 24 December 2020

Key words: advanced gallbladder cancer; ^{125}I seed placement; sepsis; septic shock

The pathogenesis of gallbladder cancer is complex. Studies have shown that interleukin 8, monocyte chemoattractant protein 1, and macrophage inflammatory protein 1 jointly regulate and affect the occurrence and transformation of gallbladder cancer [1]. Excision is the main treatment method [2–3]; however, the surgical effect is limited, and most cases of advanced gallbladder cancer respond poorly to chemoradiotherapy [4–5]. Gallbladder cancer is characterized by complex clinical symptoms, low quality of life, and a short survival time. Effective local control of the tumor and alleviation of clinical symptoms are the keys to prolonging survival and improving patients' quality of life. Gene sequencing, as well as targeted and comprehensive therapies, are all considered useful [6]. Radiation seed implantation brachytherapy is a type of internal radiation therapy that has recently been developed [7–8] and has the characteristics of a large radiation dose in the tumor area but causes minimal damage to adjacent normal tissues [9]. The mechanism of radioactive seed implantation therapy involves the use of gamma rays released by a radioactive seed to continuously kill tumor cells. In recent years, satisfactory results have been achieved in the treatment of prostate cancer, pancreatic cancer, lung cancer, and head and neck tumors [10–11]. Because of the ability to administer a large dose of radiation with minimal damage to the surrounding area, radioactive seed implantation therapy may be beneficial for patients who cannot undergo routine surgery for advanced gallbladder cancer.

Case report

A 52-year-old woman was hospitalized because of a 3-month history of abdominal pain, nausea, and vomiting. Another hospital had diagnosed and treated her for gallbladder cancer. The pathologic examination indicated

✉ Correspondence to: De Long. Email: longted@163.com
* Supported by the Guangzhou Huadu District Science and Technology Project (No. 20-HDWS-054).

moderately differentiated gallbladder cancer, and 6 cycles of chemotherapy were administered. A positron emission tomography-computed tomography (CT) examination in March 2019 indicated recurrence, metastasis, and biliary obstruction. Biliary stent implantation was performed in May 2019. However, the patient's abdominal pain persisted, and traditional Chinese medicine was provided in addition to analgesic therapy. An enhanced CT examination of the upper abdomen prior to seed implantation suggested postoperative gallbladder cancer recurrence with neoplastic tissue around the biliary stent and in the retroperitoneum; portal venous thrombosis was also present. Iodine-125 (^{125}I) radioactive seed implantation was selected as the main therapeutic method.

The cancer had invaded the extrahepatic bile duct, pancreatic head, duodenal ampullary portal vein, and other important organs and structures. Therefore, in accordance with the preoperative Treatment Planning System (TPS) plan (Fig. 1), we determined that 64 seeds should be implanted and that some of the needles must be routed through the bile duct and colon. The patient's clotting dysfunction was corrected before the operation, oral metronidazole was prescribed for 5 days for bowel preparation, and a cleansing enema was performed the day before surgery. The patient then underwent CT-guided ^{125}I radioactive seed implantation on July 5, 2019 (Fig. 2). During the operation, two seed needles were inserted into the hilar mass through the hepatobiliary tract, and a small amount of blood flowed back through the needle core. Another three seed needles penetrated the colonic wall and entered the tumor (Fig. 2). The patient immediately developed shivering and restlessness with a heart rate of 126 beats/min, an oxygen saturation of 88%, and a respiratory rate of 24 beats/min. Considering the possibility of bacteremia, we administered 25 mg of promethazine, 10 mg of dexamethasone, and 0.4 g of ofloxacin to stabilize the patient's vital signs. This emergency treatment gradually eased the patient's shivering, and the operation continued. Finally, 64 ^{125}I radioactive seeds were implanted, matching the preoperative TPS plan.

However, after returning to the ward, the patient developed a high fever and lost consciousness. Her heart rate increased to 130 beats/min, her blood pressure decreased to 76/47 mmHg, and her blood oxygen saturation decreased to 86%. Urgent blood examination revealed a low white blood cell count of 2.2×10^9 /L; the next day, this count increased to 33×10^9 /L, while her procalcitonin concentration rose to 70.4 ng/mL (Fig. 3). The results of a blood culture suggested that the infectious pathogens were *Aeromonas caviae* and *Enterococcus faecalis*. Considering this finding along with her clinical manifestations and laboratory test results, we concluded that the infection had originated from the intestinal canal or biliary tract and that the bacteria had entered the bloodstream through the puncture wound, resulting in sepsis and septic shock. The patient's condition was critical.

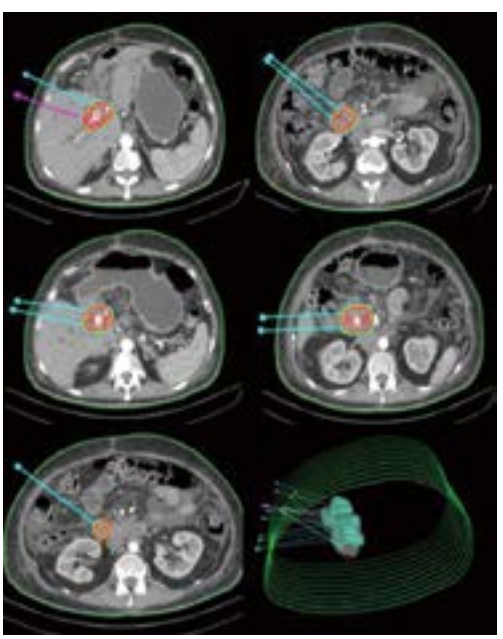

Fig. 1 Iodine-125 seed TPS plan before operation

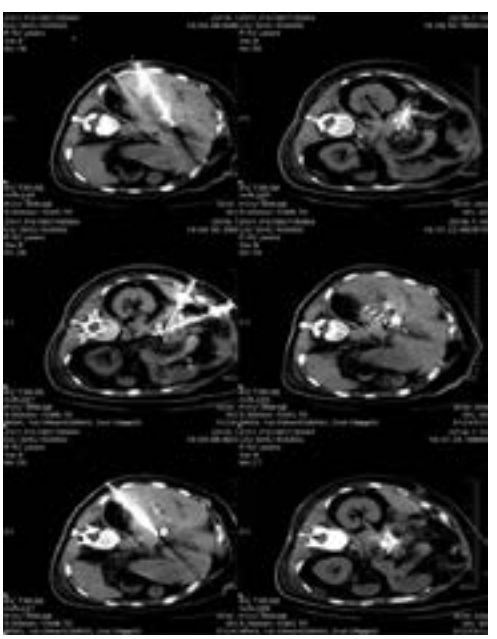

Fig. 2 Iodine-125 seed placement during operation

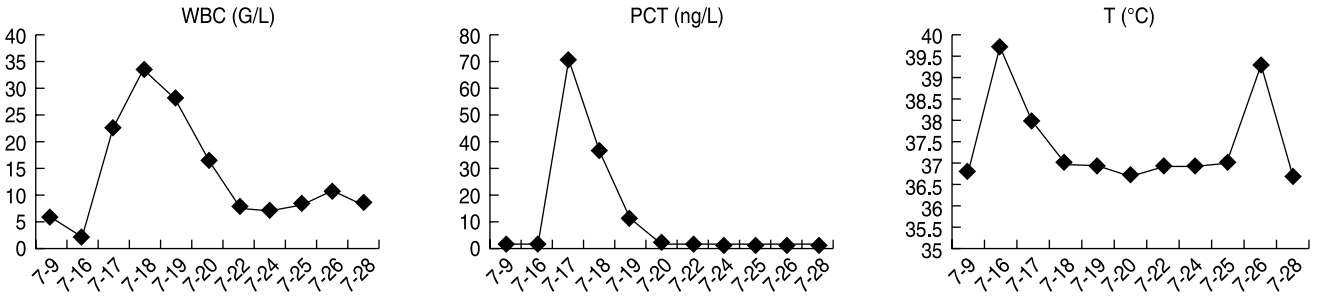

Fig. 3 Changes of infection indexes before and after treatment

Treatment and results

The patient was definitively diagnosed and immediately given active treatment to correct the shock. Norepinephrine, vasodilators, and vasoactive drugs to raise her blood pressure were administered. According to the drug sensitivity test, vancomycin and imipenem were given as anti-infection treatments on the night of the operation, and gamma globulin was given at 5 g once daily to improve immune function. Prednisone was administered at 40 mg to 80 mg once daily to prevent damage by inflammatory factors until the patient's vital signs normalized. Additionally, water, electrolyte, and acid/base imbalances were actively corrected, and nutritional support was provided. The patient's vital signs gradually stabilized, and her consciousness returned after 13 days of treatment. Her white blood cell and neutrophil counts gradually decreased to within the normal range, and her procalcitonin concentration gradually decreased to 1.67 ng/mL.

Discussion

Advanced gallbladder cancer is prone to recurrence after surgery and has a poor prognosis. In the present case, the patient developed local recurrence after cholecystectomy. The tumor invaded the hilar bile duct and the ampulla of Vater in the duodenum. The purpose of treatment was to reduce the cancer-related pain and shrink the tumor, and the patient had indications for seed implantation therapy. Because the tumor had an unclear structure and invaded the main portal vein and pancreatic head and surrounded the hepatobiliary duct, the surgical risk was relatively high. During the operation, reflux of blood was seen in the needle core when the needle punctured the biliary tract and intestine. The patient exhibited rapid shivering shortly thereafter, which was consistent with the entrance of bacteria into the bloodstream [12]. After returning to the ward, the patient developed a drop in blood pressure, unclear consciousness, and high fever, which were consistent with sepsis and septic shock. Her condition gradually stabilized with strong anti-infection and systemic supportive treatments.

Although bacteremia during seed implantation has been previously reported [13–15], severe sepsis complicated by septic shock within a very short time after the operation is rare. A significant increase in the procalcitonin concentration indicates a serious systemic inflammatory response [16], and the main evaluation criteria for ideal infection control are stabilization of the vital signs and decreases in the infection indexes [17]. In the present case, the infection was effectively controlled while enhancing the patient's immunity, and active control of the damage secondary to the systemic inflammatory response was another key to the clinical effectiveness of the treatment.

^{125}I seed implantation can effectively alleviate clinical symptoms of advanced tumors [18], but surgical safety must be fully evaluated [19]. For patients in whom the puncture needle passes through the biliary tract or intestine, adequate preparation before surgery is of vital importance. If obstructive jaundice is present, biliary drainage should be performed before surgery to reduce the risk of intraoperative biliary flora entering the blood. If the treatment plan includes puncture of multiple particle needles through the intestine, the patient should undergo not only routine intestinal preparation, but also intravenous administration of antibiotics effective against gram-negative bacilli 6 h before the operation; this can effectively prevent sepsis and septic shock.

In the present case, sepsis and septic shock had occurred before the blood culture results were available, and the timely use of broad-spectrum antibiotics with effective control of systemic inflammatory factors were the keys to early rescue. Notably, in cases of severe infection, the combination of immunoglobulin therapy and vasoactive drugs can improve the rescue rate, and the treatment in this case is worthy of reference. Additionally, in the early stages of sepsis with septic shock in our patient, there was a drop in white blood cells, which was not consistent with the manifestation of severe infection; this may have been related to temporary suppression of bone marrow function caused by the infection. When combined with the patient's other clinical manifestations, this can be

used as one of the indicators to determine the presence of severe infection.

Conflict of interest

The authors indicated no potential conflicts of interest.

References

1. Zeng L, Wang XY, Zhou LX, *et al*. Clinicopathological significance of chemotactic factor IL-8, MCP-1 and MIP-1α expressions in gallbladder carcinoma. Chinese-German J Clin Oncol, 2013, 12: 481–486.
2. Qin Q, Liu M, Wang X. Gallbladder sarcomatoid carcinoma: Seven case reports. World J Clin Cases, 2020, 8: 3881–3889.
3. Yang XW, Chen JY, Wen ZJ, *et al*. Effect of preoperative jaundice on long-term prognosis of gallbladder carcinoma with radical resection. 2020, 18: 239.
4. Liu C, Rein L, Clarke C, *et al*. Comparison of overall survival in gallbladder carcinoma at academic versus community cancer centers: An analysis of the National Cancer Data Base. J Surg Oncol, 2020, 122: 176–182.
5. Melillo A, Linden K, Spitz F, *et al*. Disparities in treatment for gallbladder carcinoma: Does treatment site matter? J Gastrointest Surg, 2020, 24: 1071–1076.
6. Zhang W, Shi JP, Li RT, *et al*. Effectiveness of Olaparib treatment in a patient with gallbladder cancer with an ATM-inactivating mutation. Oncologist, 2020, 25: 375–379.
7. Jarusevicius L, Inciura A, Juozaityte E, *et al*. Comparison of implant quality between loose and intra-operatively linked iodine-125 seeds in prostate cancer brachytherapy. J Radiat Res, 2012, 53: 439–446.
8. Straver ME, Loo CE, Alderliesten T, *et al*. Marking the axilla with radioactive iodine seeds (MARI procedure) may reduce the need for axillary dissection after neoadjuvant chemotherapy for breast cancer. Br J Surg, 2010, 97: 1226–1231.
9. Zhang FQ, Li Q, Yang H, *et al*. Clinical value of ^{125}I seeds implantation in the treatment of primary liver cancer with portal vein tumor thrombus. Chin J Nucl Med Mol Imaging (Chinese), 2020, 40: 142–146.
10. Li CG, Zhou ZP, Jia YZ, *et al*. Radioactive ^{125}I seed implantation for locally advanced pancreatic cancer: A retrospective analysis of 50 cases. World J Clin Cases, 2020, 8: 3743–3750.
11. Lee W, Daly BDT, DiPetrillo TA, *et al*. Limited resection for non-small cell lung cancer: observed local control with implantation of I-125 brachytherapy seeds. Ann Thorac Surg, 2003, 75: 237–243.
12. Singer M, Deutschman CS, Seymour CW, *et al*. The third international consensus definitions for sepsis and septic shock (sepsis -3). JAMA, 2016, 315 : 801–810.
13. Jiang YL, Ji Z, Guo FX, *et al*. Side effects of CT-guided implantation of ^{125}I seeds for recurrent malignant tumors of the head and neck assisted by 3D printing non co-planar template. Radiat Oncol, 2018, 13: 18.
14. Zhang FJ, Li CX, Jiao DC, *et al*. CT guided 125iodine seed implantation for portal vein tumor thrombus in primary hepatocellular carcinoma. Chin Med J (Engl), 2008, 121: 2410–2414.
15. Zhang L, Chen LH, Wang J, *et al*. CT-guided radioactive ^{125}I seed implantation treatment of multiple pulmonary metastases of hepatocellular carcinoma. Clin Radiol, 2014, 69: 624–629.
16. Liu GB, Cui XQ, Wang ZB, *et al*. Detection of serum procalcitonin and hypersensitive C-reactive protein in patients with pneumonia and sepsis. J Biol Regul Homeost Agents, 2018, 32: 1165–1169.
17. Nobre V, Harbarth S, Graf JD, *et al*. Use of procalcitonin to shorten antibiotic treatment duration in septic patients: a randomized trial. Am J Respir Crit Care Med, 2008, 177: 498–505.
18. Jiang P, Liu C, Wang JJ, *et al*. Computed tomography (CT)-guided interstitial permanent implantation of (125)I seeds for refractory chest wall metastasis or recurrence. Technol Cancer Res Treat, 2015, 14: 11–18.
19. Gao F, Li CX, Gu YK, *et al*. CT-guided 125I brachytherapy for mediastinal metastatic lymph nodes recurrence from esophageal carcinoma: effectiveness and safety in 16 patients. Eur J Radiol, 2013, 82: e70–e75.

DOI 10.1007/s10330-020-0457-7
Cite this article as: Zhong Z, Gao F, Lv Z, *et al*. A case report of iodine-125 seed placement during operation for the treatment of advanced gallbladder carcinoma with septic shock. Oncol Transl Med, 2021, 7: 95–98.