Must pilots permanently quit flying career after treatment for colorectal cancer? - Medical waiver for Air Force pilots with colorectal cancer: Three case reports

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Abstract

BACKGROUND
Colorectal cancer (CRC) could seriously threaten the physical and mental health of pilots. Shall they end their flying after treatment of CRC? With this study, we investigated the possibility of a gradual medical waiver for such pilots to fly aircrafts again after treatment of CRC.

CASE SUMMARY
We analyzed the medical waiver and clinical data of 3 pilots with CRC, who had accepted the treatment at the Department of General Surgery, Air Force Medical Center (formerly, Air Force General Hospital) between 2013 and 2018. All 3 cases underwent a series of comprehensive treatment courses, including radical resection of CRC, sequential radiotherapy, and chemotherapy. The follow-up results were satisfactory. After passing through the high-risk period of recurrence and metastasis of CRC, they all were given a medical waiver for flying again. Medical observation showed that their flying operations were safe.

CONCLUSION
The CRC treatment shall follow the guidelines for diagnosis and treatment and should simultaneously protect the combating capabilities of pilots as much as possible. It is safe for pilots with CRC, who are continuously monitored under medical observation after passing through the high-risk period of recurrence and metastasis, to undertake military flight missions again.
INTRODUCTION

Colorectal cancer has become one of the most common malignant tumors in China[1]. The onset age of patients with colorectal cancers in China is about 10 years earlier than that in the West[1]. About 40% of the patients are under 40-years-old and most of them have been in the middle or late stage upon diagnosis.

In general, some pilots rely on alcohol and tobacco to relieve the huge mental and physical exhaustion during flight training[3]. The combination of high sugar, high calorie and high protein foods as well as environment of high temperature, coldness, electromagnetic radiation, high acceleration, low pressure and hypoxia makes Air Force pilots a high-risk group for colorectal cancers, which could seriously threaten their physical and mental health or even their careers. In recent years, the General Surgery Department of the Air Force Medical Center has treated 3 Air Force pilots with colorectal cancers, who had been allowed to fly aircrafts again after comprehensive treatment.

CASE PRESENTATION

Chief complaints
Case 1: A male training aircraft pilot at the age of 44 years, who had suffered from hematochezia for more than 1 mo.

Case 2: A male training aircraft pilot at the age of 52 years, who had suffered from dyschezia for about 2 mo.

Case 3: A male bomber pilot at the age of 48, who had suffered from intermittent lower abdominal pain for about 6 mo.

History of present illness
Case 1: In October 2013, the patient was hospitalized due to “blood in stool for more than 1 mo”. About 1 mo before the hospitalization, he found fresh blood in his stool, which was amorphous with increased frequency and tenesmus.

Case 2: In October 2015, the patient was hospitalized due to “difficulty in defecation for 2 mo”. At 2 mo before that, he had difficulty in defecation for no clear reason.

Case 3: Due to “intermittent lower abdominal pain for more than 6 mo”, the patient was hospitalized. At 6 mo before that, the patient felt lower abdominal pain for no clear reason. The condition worsened right after eating but became relieved afterwards. The stool was occasionally amorphous with no mucus and blood. No obvious abnormalities were found upon clinical assessment in local hospitals. During the period, the abdominal pain and discomfort symptoms occasionally occurred, but the patient could still operate aircrafts. On March 31, 2016, moderately differentiated adenocarcinomas in his descending colon was diagnosed through enteroscopy.
History of past illness
No other abnormal health conditions were reported in any of the 3 cases.

Personal and family history
All 3 cases had no specific history of genetic diseases.

Physical examination upon admission
Case 1: Digital rectal examination found a hard discoid mass of about 3 cm × 2 cm at 12 o’clock position when the patient was in the knee-chest posture.

Case 2: The digital rectal examination found the lower margin of a nodular mass at the 7-12 o’clock position when the patient was in the knee-chest posture. It was found to be hard and fixed, and the finger sheath was stained with blood.

Case 3: No abnormalities were found in the physical examination and digital rectal examination.

Laboratory examinations
All routine laboratory findings were within normal limits in all 3 cases.

Imaging examinations
Case 1: The enteroscopy saw a cauliflower-like lump 5-8 cm away from the anus in the intestinal cavity, with hyperemia on the surface and unclear boundaries. The follow-up pathological report showed moderately differentiated tubular adenocarcinoma. The ultrasound colonoscopy determined a T3-4 phase. The positron emission tomography/computed tomography found that the local rectal intestinal wall was unevenly thickened with active metabolism. It was diagnosed as likely rectal cancer. There were numerous small lymph nodes with slightly increased metabolism around the rectum, as shown in (Figure 1A-C).

Case 2: The enteroscopy saw a circular cauliflower-like lump of about 4 cm long at 5 cm away from the anus, with ulcer on the surface. The intestinal cavity was so narrow that the scope could hardly pass through it. The tissue around was fragile and easy to bleed. The pelvic magnetic resonance imaging found that the rectal wall was irregularly thickened. Rectal cancer was considered likely, with a few small lymph nodes in the presacral region (Figure 1D-F).

Case 3: Reexamination by enteroscopy showed that the sigmoid colon (about 35 cm away from the anus) had a circumferential cauliflower-like lesion of 3 cm in length with uneven surface, ulceration, and clear boundaries. The surrounding tissue was fragile and easy to bleed. The intestinal cavity was narrow. The pathological report showed a moderately differentiated adenocarcinoma. The abdominal computed tomography found that the middle and lower segments of the descending colon (5-6 cm long) was irregular thickened on the intestinal wall and the intestinal cavity was narrow with unclear boundary. There were numerous lymph nodes around the intestine with diameter about 1.0 cm, as shown in Figure 2.

FINAL DIAGNOSIS

Case 1 and Case 2
Rectal cancer with local lymph nodes metastasis (cT2N1M0).

Case 3
Descending colon cancer with local lymph nodes metastasis (cT4N1M0).

TREATMENT

Case 1
On October 31, 2013, the patient accepted the “transabdominal radical treatment for rectal cancer” under general anesthesia. The postoperative pathological report showed that protuberant moderately differentiated adenocarcinoma (about 0.5 cm × 3.5 cm × 1.5 cm) had invaded into the muscular layer. Intravascular cancer thrombus could be seen but without definite nerve invasion. Lymph node metastasis could be seen (3/23). The pathological stage was IIIa (pT2N1bM0). The patient did well during the postoperative recovery process, which included eight rounds of XELOX chemotherapy combined with concurrent radiotherapies (50Gy/25f). The treatment...
was completed in August 2014.

**Case 2**
On November 25, 2015, the patient accepted the “transabdominal radical treatment for rectal cancer and prophylactic ileostomy” under general anesthesia. The postoperative pathological report showed that the rectal ulcerative moderately differentiated adenocarcinoma had invaded into the serosa layer. The intravascular tumor thrombus and nerve invasion could be seen. No lymph node metastasis was found (0/15). The pathological stage was IIb (pT4aN0M0). After three rounds of XELOX chemotherapies, the patient accepted local radiotherapy (50Gy/25f) and took capecitabine orally, then accepted another four rounds of XELOX chemotherapies. Closure of the ileostomy was performed in July 2016.

**Case 3**
On April 19, 2016, the patient accepted “laparoscopic exploration and hand-assisted laparoscopic left hemicolectomy” under general anesthesia. Postoperative pathological report showed that the ulcerative moderately differentiated adenocarcinoma of colon (3 cm × 3 cm × 2 cm) had invaded into the serosa layer with no vascular thrombus or lymph node metastasis (0/14). The pathological stage was IIb (pT4aN0M0). The patient took six rounds of XELOX chemotherapies.

**OUTCOME AND FOLLOW-UP**

**Case 1**
After the treatment process ended in August 2014, no recurrence or metastasis was observed in follow-up visits, which took place every 6 mo. In June 2016, the patient was allowed to fly aircrafts (only those with two seats) again. To date, it has been 38 mo since the medical waiver for flight was granted. His average flight time is about 250 h per year. No recurrence or metastasis has been observed in medical examination (Figure 3A, B and Figure 4A).

**Case 2**
In the follow-up visits of every 6 mo, no recurrence or metastasis was found. In February 2018, the patient was qualified in flight test. It has been 18 mo since the medical waiver for flight was granted. His average flight time is about 220 h per year. No recurrence or metastasis has been observed in medical examination (Figure 3C, D and Figure 4B).
Case 3
In the follow-up visits of every 6 mo, no recurrence or metastasis was found. In June 2018, the patient was qualified in flight test. It has been 14 mo since the medical waiver for flight was given. His average flight time is about 240 h per year. No recurrence or metastasis has been observed in medical examination (Figure 5).

DISCUSSION
The acute obstruction, bleeding and perforation induced by CRC may cause disability during flight. While the chronic bleeding caused by tumors is very hidden, the secondary anemia may cause flight accidents. Digital rectal examination, occult blood in stool, tumor markers and electronic colonoscopy are the most important means for early diagnosis of CRC. None of the 3 cases presented herein was diagnosed at the early stage, due to the following reasons: (1) Lack of characteristic symptoms in the early stage of colorectal cancer; (2) The pilots had good physical constitution and strong disease tolerance; and (3) The troops are stationed far away from cities, where there are poor medical conditions. Therefore, Air Force physicians should be alert to early symptoms and pay attention to the digital rectal examination. It is also very important to carry out digestive endoscopy and tests of tumor markers, stool occult blood and other targeted laboratory parameters during annual physical examination for early detection of CRC for high-risk groups.

Military flight has stringent requirements for the health of pilots. The China Military regulations stipulate the following: (1) Those with obvious dysfunctions after treatment of abdominal organ diseases or injuries are unqualified; (2) Those with obvious dysfunctions after treatment of anal and rectal diseases are unqualified; (3) Those with malignant tumors or benign tumors that affect their normal functions are unqualified; and (4) Those having good curative effects after the treatment for early malignant tumors shall be evaluated separately. The Air Force physicians shall try their best to protect the flight functions of pilots other than following the diagnosis and treatment criteria for common groups. Further evaluation shall be made on the choice of surgical methods (laparoscopy or laparotomy), the size of incision (whether abdominal wall muscle is damaged), the delineation of radiotherapy target area, the setting of radiation dose, and the choice of chemotherapeutic drugs, etc. Beside radical cancer treatment as the primary goal, it is important to prepare a comprehensive treatment plan for the pilots with CRC so that they can fly aircrafts again after surgeries.

At present, there is no military regulation on medical waiver for pilots with CRC to fly aircrafts again. The United States Military Forces also have different or even conflicting regulations on such medical waiver for the pilots of different aircrafts. For example: (1) The medical waiver can be granted to pilots who have undergone surgical removal of all gross tumors, or who have completed adjuvant treatment without any side effects of treatment, or who have no evidence of tumor after operations. However, those with lymph node metastasis shall be considered until 2 years after the completion of treatment. And (2) In general, the medical waiver shall not be granted to the pilots with distant metastasis, residual tumors, and treatment-related side effects. There is also a rule stating that the pilots with CRC or histories of CRC are not eligible for flight.
All the 3 cases reported here had passed the high-risk period of recurrence and metastasis for 2 years after surgical operations\(^{13-15}\). With reference to relevant foreign guidelines and the latest evidence-based guidelines at home and abroad, also considering the types of aircrafts, the flight posts, personal willingness, organizational opinions and psychosomatic tests, the individualized flight qualification assessment shall be conducted for these pilots and they will also undergo rigorous follow-up medical observation. It is the responsibility of military surgeons to maintain the health of the pilots and maintain their combat effectiveness. It is their duty to provide the sick pilots with the right treatment so they can have the largest chance to resume flying. However, whether the pilots who resumed flying can fit with the combat requirements is still an important issue to be resolved. The current case studies showed that pilots who resumed flight only satisfied the flight time requirement for training.

**CONCLUSION**

Based on the routine diagnosis and treatment criteria, the exploratory experience indicated that the flight function of pilots diagnosed with CRC shall be protected. It is safe for a pilot who was diagnosed with CRC but who has passed through the high-risk period of recurrence and metastasis to fly aircrafts again under strict medical observation.
Figure 4 Recent reexamination colonoscopy. A: Recent reexamination colonoscopy of Case 1 (white arrow shows the anastomotic stoma, 2018/12/13); B: Recent reexamination colonoscopy of Case 2 (white arrow shows the anastomotic stoma, 2018/11/19).

Figure 5 Recent reexamination of Case 3. A: Recent abdominal computed tomography reexamination of Case 3 (white arrow shows the anastomotic stoma, 2018/01/03); B: Recent reexamination colonoscopy of Case 3 (white arrow shows the anastomotic stoma, 2018/01/04).

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