Summary

Iatrogenic embolisation of the right ventricle of the heart by a fragment of one of the most basic ICU devices, which has fractured and detached the central vein catheter, is rarely described in subject literature. Removing such an element from the heart is highly risky and requires the use of very modern techniques and equipment. The Atrieve Vascular Snare™ was employed in the described patient. Therefore, it is necessary to present this process and its effectiveness through an evaluation of the health-related quality of life (HRQoL) associated with the perception of health status by those patients. This is a requirement in modern medicine. The main aim of this paper was to evaluate the HRQoL after this embolisation.

A 67-year-old patient was referred to the Vascular Surgery Department with Endovascular Interventions Ward, John Paul II Hospital in Kraków, after the defragmenting of the central vein catheter and replacement to the right ventricle of the heart. An endovascular approach through the right common femoral vein (RCFV) under local anesthesia of the groin was chosen as the preferred method for removing the broken catheter fragment. The right ventricle of the heart was reached using a 18-30mm Atrieve Vascular Snare™. A structure consisting of three loops facilitated the quick grasp and removal of the catheter fragment at the first attempt through the RCFV. Despite the short time needed for the procedure, the patient experienced periprocedural ventricular fibrillation (VF) with the necessity of defibrillation. After one successful defibrillation attempt, sinus rhythm was restored. The post-operative course showed no complications whatsoever, and the patient was sent to the General Surgery Ward in order for a new Hickman catheter to be implemented and further parenteral nutrition treatment to be carried out.

The endovascular technique with the use of Atrieve Vascular Snare™ is an effective method which was used in the case of our patient under local anesthesia. It provides for the fast, safe and convenient removal of a disrupted and dislocated catheter fragment. It allows one to improve the patient’s HRQoL not only in the short term, but also in the longitudinal (6 months after surgery) follow up.

Key words: life-threatening condition, chest pain, parenteral alimentation, endovascular approach, interventional cardiology
INTRODUCTION

Iatrogenic embolisation of the right ventricle of the heart by a fragment of one of the most basic ICU devices, which has fractured and detached the central vein catheter, is rarely described in subject literature [1,2], because in many cases it is asymptomatic [3]. This clinical condition is potentially life threatening, because detached pieces of the catheter might migrate mostly to the pulmonary artery (35%), the right atrium (27.6%), the right ventricle (22%), the superior vena cava or peripheral veins (15.4%), while sometimes (27%) extending through more than one location. The average mortality rate is about 1.8% with the highest rate falling among patients with catheter fragments in the right ventricle [4].

The current gold standard for removing foreign bodies from the cardiovascular system are endovascular techniques [5]. The success rate is estimated at 71-100% [6]. The gooseneck snare is recommended as the first choice, however the multi-loop Atrieve Vascular Snare™ including three interlaced loops can be also successfully used, because it increases the chance of grasping the foreign body. Even though, removing such an element from the heart is extremely risky because is associated with difficult access to the heart ventricle, the risk of the catheter catching the chordae tendineae of the heart and its rupture or ventricle wall perforation, as well as requiring great skills in manipulation.

The patient we described is, according to the latest subject literature, the first case in Poland and the third case in the world among those patients reported with the shortest known latency between diagnosis and catheter removal from the right ventricle [2,6]. He was operated on in accordance with the requirements of an individually selected methodology [7] with the use of the innovative Atrieve Vascular Snare™ technique.

Therefore, as a requirement of modern medicine, it is necessary to present this process and its effectiveness through an evaluation of the HRQoL associated with this patient’s perception of his health status, which constitutes the main aim of this requirement.

CASE REPORT

A 67-year-old patient following extensive intestinal resection performed four years previously as a result of upper mesenteric artery embolisation with subsequent Short Bowel Syndrome (SBS), was fed parenterally through the Hickman’s catheter inserted as a central venous port in the right subclavian vein. He was sent to the hospital for a routine replacement of the catheter. The fluoroscopy examination performed immediately after the replacement procedure showed that a 15-cm long fragment of the catheter was extending from the superior vena cava to the right atrium of the heart. The reason for the catheter fragmentation remains unidentified.

He was referred immediately to the Vascular Surgery Department with Endovascular Interventions Ward, John Paul II Hospital, Kraków, Poland. He was qualified for the endovascular removal procedure with the use of the Atrieve
Vascular Snare™, applying techniques developed at the Department of Vascular Surgery and Endovascular Procedures, of the John Paul II Hospital Krakow, Poland, [2] at the Hybrid Procedures Operating Theatre (see: Fig. 1).

An endovascular approach through the right common femoral vein (RCFV) under local anesthesia of the groin was chosen as the method for removing the broken catheter fragment. The procedure was conducted under ECG and fluoroscopy control, which shows that the fragment had to be moved to the right ventricle (see. Fig 2 a, b), possibly during the transportation of the patient to our hospital.

Fig. 1. Hybrid Procedures Operating Theatre, The John Paul II Hospital Krakow, Poland
Source: Mariusz Trystula

Fig. 2. The patient's heart under fluoroscopy: a) view of the patient’s heart with the broken catheter tip inside; b) closer view of the right ventricle of the heart with catheter embolus
A 10F introducer was inserted in the RCFV. After that a 7F guiding catheter was advanced inside the 10F introducer using glide wire through the inferior vena cava and the right atrium to the right ventricle of the heart. The right ventricle of the heart was reached using a 18-30mm Atrieve Vascular Snare™ (see Fig 3a). The structure of the snare consisting of three loops facilitated the quick grasp and removal of the catheter fragment at the first attempt through the RCFV (see Fig 3b).

The groin was closed by manual compression for 4 hours. The post-operative course showed no complications, the patient was discharged the next day back to the General Surgery Ward in order for a new Hickman catheter to be inserted and further parenteral nutrition treatment to be undertaken (see Fig 4a,b).

Fig. 3. Intraoperative views: a) the Atrieve Vascular Snare™ reaching the right ventricle; b) successful removal of the catheter fragment

Fig. 4. Postoperative pictures of the catheter: a) just after extraction from the femoral vein; b) length compared to a standard 20 ml syringe
METHOD

The Short Form 36 (SF-36) was used to assess the health related quality of life [3]. It includes a 36-item, patient-reported survey of patient health, and their measure of health status. The original SF-36 is available and accessible under the public domain license. The SF-36 consists of eight scaled scores, which are the weighted sums of the questions in their section. Each scale is directly transformed into a 0-100 scale on the assumption that each question carries equal weight. The higher the score, the more disability (more complaints for constrains and limitations). The lower the score, the lower the disability of the patient (fewer complaints for constrains and limitations).

The eight sections are:

- vitality
- physical functioning
- bodily pain
- general health perceptions
- physical role functioning
- emotional role functioning
- social role functioning
- mental health

The patient was tested three times, before the admission of the patient to the Vascular Surgery Department of the John Paul II Hospital in Cracow, one week and half a year after central vein catheter embolisation.

RESULTS

The results of SF-36 are presented in Fig 5. It was found that before the endovascular procedure to remove the fractured catheter from the right ventricle of the heart, the patient had a reduced quality of life as evidenced by the large number of complaints in various quality of life scores. The most significant discomfort occurred in the spheres: role limitations—emotional (78 points), social function (73 points), bodily pain (71 points), role limitations—physical (69 points), vitality (69 points), general health (66 points) and was slightly smaller for the mental health dimension (62 points) and physical function (60 points) (Fig 5).

All differences in the scores between the first and second examination were large and significant at p < 0.001 for the two physical domains of the SF-36 profile role limitations – physical and emotional. The results obtained in study III, half a year after surgery, slightly deteriorated with more complaints about discomfort related to functioning in the various spheres of quality of life appeared, however the differences between the tests I and II are not statistically significant. This indicates that central vein catheter embolisation has the greatest impact on the health related quality of life: especially role limitations – physical and emotional.
DISCUSSION

Health Related Quality of Life (HRQoL) after the ventricle embolisation of our patient was associated not only with his previous medical conditions, but mainly with his full awareness of the life-threatening state associated with the broken catheter during routine replacement as well as its dislocation to the right ventricle. Such a complication during the catheter exchange caused great discomfort for the patient resulting in a huge amount of stress not only because he could not be fed parenterally, but also because of the awareness of having to undergo another operation to remove the detached catheter fragment from the right ventricle of the heart. In addition, during the procedure of removing the catheter fragment severe arrhythmia in the form of ventricular fibrillation occurred, followed by impaired brain perfusion, loss of consciousness and the need to perform defibrillation.

The whole of this procedure negatively changed the perception of the patient’s health status, which is why during the first examination he evaluated his health status as significantly reduced in the majority of the areas studied.

In the second examination using SF-36, after the stabilizing of health after the operation and setting up a catheter for parenteral nutrition in the General Surgery Ward, the patient evaluated the quality of life as much better. During this study, the patient was happy that such a risky procedure had been successful and that he had survived, and this fact most likely influenced his perception of health, which was manifested by a smaller number of complaints in particular spheres of SF-36 than had been the case during the first examination. The obtained difference between the first and the second examination was statistically significant. The difference was significant at the level ($P <0.001$).
This perception of his own health persisted for about 6 months, however in the third examination the patient evaluated his health condition as a little worse. The patient associated it also with a worsening self-acceptance, difficulties in functioning at home and fear of the next catheter exchanges. Calling himself an “unlucky man,” he was afraid that the complication might repeat itself again. Those facts most likely influenced his subjective perception of health, which was manifested by a larger number of complaints in particular spheres of SF-36 than in the third examination in comparison to the second examination. However, the obtained difference between the second and third examination is not statistically significant.

It is worth to emphasize that the SF-36 assesses important health-related areas (including an assessment of health care needs) that are sensitive to at least eight health spheres. Thanks to this, it determines how to cope with a patient with problems related to disease and surgery, and shows the needs that may be included in further therapy to support a patient during the healing process.

The central vein catheter embolisation is a serious condition and should be immediately diagnosed and treated. The endovascular technique with the use of Atrieve Vascular Snare™ turned out to be an effective method under local anesthesia, which may provide for the fast, safe and convenient removal of a disrupted and dislocated catheter fragment. The procedure described here, in our opinion, may be used in similar clinical cases with the same or another embolisation localization.

**CONCLUSIONS**

The endovascular technique with the use of Atrieve Vascular Snare™ is an effective method which was used in the case of our patient under local anesthesia. It provides for the fast, safe and convenient removal of a disrupted and dislocated catheter fragment. It allows one to improve the HRQoL of this patient not only in the short term, but also in the longitudinal (6 months after surgery) follow up.

**REFERENCES**


