Intracardiac embolization of inferior vena cava filter associated with right atrium perforation and cardiac tamponade

Emboliização de filtro de veia cava associado à perfuração de átrio direito e tamponamento cardíaco

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INTRODUCTION
The treatment of choice for prevention of pulmonary embolism (PE) secondary to deep vein thrombosis (DVT) is anticoagulation; however, some patients may have contraindications to it. Without treatment, the chance of developing PE after an episode of DVT is approximately 40%[1]. Thus, for patients with contraindications to anticoagulation, there is the option of placing an Inferior Vena Cava Filter (ICVF) in an attempt to prevent PE[2]. The idea of implementing a filter to prevent clots reaching the pulmonary arteries was first described in 1958 by Hunter and DeWeese[3]. From this time until the present day, the models and placement techniques have evolved considerably, however the ICVF is not free of risks, and device-related complications can occur, e.g. in situ thrombosis (0-25%), occlusion of the ICVF (2-30%), recurrence of PE (0.5-6%), filter fracture (2-10%) and vena cava filter embolization (< 1%)[4,5].

Embolization of the filter to the heart or pulmonary artery is an extremely rare complication that can lead to symptoms...
ranging from hypotension, syncope, dyspnea or even cardiac arrest as the first manifestation. The cause of embolization of the ICVF can vary greatly, and includes: placing the device in an unsuitable location, device failure and a vena cava with an enlarged diameter (>28 mm).

In case of intracardiac embolization, therapeutic options involve surgical or endovascular removal or even maintenance of the vena cava filter in the same place, however the best treatment option is under discussion. Many authors suggested that the removal by open thoracotomy would be the best option.

Below we report a case of embolization of a vena cava filter in a patient treated at the Heart Institute in Sao Paulo.

**CASE REPORT**

A 47-years-old male who had a history of epilepsy was admitted to our service due to dyspnea and chest pain, that was worse during inspiration. Forty-five days prior to this admission he had been submitted to a subdural hematoma surgical drainage secondary to a same height fall. Following the procedure the patient developed DVT. Since he had clinical contraindication to anticoagulation, insertion of an ICVF was performed.

At entrance physical examination he was prostrated, pale and disoriented. Had a heart rate of 114 bpm, blood pressure of 108/80mmHg, weak pulse and capillary refill of less than 3 seconds. Cardiac examination showed hypophonetic and rhythmic heart sounds without murmurs. Pulmonary examination had diminished breath sounds at lung bases, a respiratory rate of 16 breaths per minute and an oxygen saturation of 94%. Extremities examination demonstrated an asymmetrical bilateral edema, that was larger in the left limb.

Electrocardiogram was normal. At initial laboratory studies he had hemoglobin of 9.7 g/dL, hematocrit of 31%, leukocytes 10.360/mm³, 351.000 platelets, CK-MB 1.12 ng/mL, troponin I 0.288 ng/mL, urea 19mg/dL, creatinine 0.86 mg/dL, C-reactive protein (CRP) 272.22 mg/dL.

As the initial hypothesis was PE, the patient underwent CT angiography of the pulmonary arteries. Instead of showing signs of PE, CT showed an ICVF dislocation. It had moved to the right atrium. There was also right-sided pleural effusion and pericardial effusion (Figure 1).

Transthoracic echocardiogram showed signs of cardiac tamponade. In such way, emergent surgical pleural and pericardial drainage was performed.

After the procedure, CT and echocardiogram still showed moderate pericardial effusion, now with no signs of cardiac tamponade and a foreign body into the right atrium. In this moment the patient developed an early nosocomial infection thereby delaying the withdrawal of ICVF performed by open thoracotomy. During the procedure we observed that the ICVF had perforated the free wall of the right atrium (Figure 2).
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Fig. 2 - Inferior vena cava filter perforating the free wall of the right atrium

Postoperatively, the patient developed septic shock, res-
solved after 33 days of antibiotics (Meropenem, Colistimethate, Linezolid, Fluconazole and amikacin at different
times). He was discharged in good general condition, with-
out anticoagulation due to the poor patient compliance and
because the risk factor for DVT and PE, that was immobili-
ization, had been resolved. After two months, he presented a
new episode of DVT in the left medial gastrocnemius vein,
at this time the anticoagulation therapy with warfarin was
introduced.

DISCUSSION

Embolization of the ICVF to the heart or pulmonary ar-
tery is an extremely rare complication that can lead to symp-
toms ranging from hypotension, syncope, dyspnea or even
heart arrest as the first manifestation[2,6]. The cause of em-
bolization of the ICVF can vary greatly, and includes: plac-
ing the device in an unsuitable location, device failure and a
vena cava with an enlarged diameter (>28 mm)[4-14].

In a series published by Ferris et al.[9], in which 324 pa-
tients had undergone to ICVF implantation, there were  no
cases of distal embolization. Similarly, another published
case series with respect to 26 years of ICVF implants in 1731
patients at a center in the United States showed a complica-
tion rate of 0.3%, a rate of PE after the procedure of only
5.6% and no heart embolization.

The first description of cardiac tamponade associated
with ICVF embolization was performed by Lahey et al.[13]
in 1991. In this first published report, the authors associate
the displacement of ICVF to its improper placement, with no
evidence of fracture. As in our case, the patient had the IVCF
removed by open surgery.

Differently to this first description and our case, the ma-
jority of reports in the literature with cardiac tamponade
described the presence of fractured IVCF and intracardiac
embolization of only parts of the filter[7-10]. Chandra et al.[8]
reported there was no any well-defined correlation or factor
associated with increased likelihood of intracardiac device
embolization. Furthermore, the IVCF brands are variable and
not necessarily associated with this complication[8,14].

Nicholson et al.[12] performed a single-center study in 2004,
in which they published a series of 80 cases of patients who
had IVCF placed. There were 5 cases of intracardiacembo-
lization after filter fracture, and they were associated to two
brands: BARD RECOVERY and BARD G2. Three of those
patients had cardiac tamponade and one resulted in death. In
all cases, the extraction was performed by open surgery[14].

Regarding the observed time between the IVCF place-
ment and embolization, the literature is also inconclusive.
Hussain et al.[11] described a case of embolization and cardiac
tamponade after only four hours of filter implantation. How-
ever, the placement was performed in the subclavian vein,
unlike our case. In another hand, most of the published series
showed cases where embolization occurred months after the
filter placement, usually associated with device fracture[7-10].

The therapeutic options in cases of cardiac emboliza-
tion involve surgical removal, endovascular treatment or
even conservative approach[3,7-14]. Many authors suggest that
the withdrawal by open thoracotomy would be the best op-
tion[1,7,8,10-14]. Controversially, Vergara et al.[9] described a case
of embolization associated with cardiac tamponade, in which
the ICVF was removed percutaneously, suggesting that in se-
lected patients, this is a plausible alternative to open surgery.

In our case, we opted for open surgical removal due to as-
soiation with perforation and cardiac tamponade. However,
the best treatment option is still uncertain due to the rarity of
cases and it should be individualized[1].

We could not find in Brazilian literature descriptions of
cases of IVCF embolization associated with cardiac tampon-
ade. This makes this case unique nationwide, inferring the
clinician to consider this adverse outcome in the indication
of the procedure and as a complication of its placement[2,3].

CONCLUSION

Although embolization of the IVCF to the heart or pul-
monary artery is an extremely rare complication (0.1-1.2%),
clinicians should be aware of IVCF complications, in order
to optimize the time-to-diagnosis and prevent further de-
vice-related complications[7-8].
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