Editorial comment

Severe intraprosthetic regurgitation following trans-catheter aortic valve implantation-to crimp or not to crimp? This might be the problem

Keywords: Stent valves; Trans-catheter aortic valve implantation; High-risk patients

Since few years, we have been dealing with a new generation of trans-catheter aortic valve prostheses implanted through a trans-apical or a transfemoral access [1]. Unfortunately, advanced technologies and innovative surgical techniques can be at the origin of unknown complications that affect negatively patient outcome.

In this evolving scenario, we all know that one of the main complications that occurs immediately after the deployment of the stent valve is a severe paravalvular leak due to the valve malpositioning, incomplete valve deployment, presence of heavily asymmetric calcifications in the aortic annulus or due to an error in the stent-valve sizing [2]. However, it is quite obvious that this is not the only form of stent-valve leak a surgeon or an interventional cardiologist can face during standard transcatheter aortic valve implantation (TAVI) procedures.

In fact, as well underlined by Al-Attar and colleagues in their case report [3], not only the paravalvular leak but also the intraprosthetic regurgitation is a potentially life-threatening complication that may affect any trans-catheter aortic valve procedure, regardless of the way of introduction. In their reported case, the major intravalvular regurgitation due to one leaflet immobility, rapidly and severely affected the left ventricular function and all attempts to recover the hemodynamic status failed (in particular, the positioning of a second stent valve within the first one and the use of a femorofemoral extracorporeal membrane oxygenation (ECMO)).

In our center and during my personal activity as proctor for trans-apical TAVI procedures (62 trans-apical TAVI in 2 years), I have also experienced the onset of this complication two times: in one case (in our institute), the immobility of the stent-valve leaflet was transient and the cusp motion restored few minutes after the valve deployment, when our anesthesiology team increased the patient's systolic blood pressure above 130 mm Hg: the transesophageal echocardiographic evaluation confirmed the restoration of the valve hemodynamic and the postoperative recovery was uneventful. To what may concern the second trans-apical patient (a proctoring case), the cusp immobility was irreversible and all attempts to solve the problem failed: in this critical scenario, we urgently implanted a second stent valve within the first one and the hemodynamic status ameliorated consequently, with no need for cardiopulmonary assistance.

Hence, I surmise that this complication occurs more often than expected and further investigations are mandatory. In particular, one of the most critical phases in TAVI procedures remains the crimping process (for balloon-expandable stent valves) and it is plausible that leaflets might be damaged during this process (crimping with high strength is never recommended): as suggested by Al-Attar and colleagues, the hooking of the leaflet on the stent during the crimping phase can be at the origin of its transient or irreversible immobility [3].

Another hypothesis is that broken calcifications in the aortic annulus might determine cusp immobility during the valve deployment, following a nonclear mechanism (anchoring of the leaflet through the stent? Microfractures within the stent hooking the cusp?).

Moreover, the asymmetrical stent-valve deployment may be a (rare) cause of limited cusp motion; however, in this situation, the echocardiographic evaluation will guide for a valve re-ballooning.

However, the mechanism behind the intraprosthetic regurgitation remains mostly unknown and we can only suggest expedients to manage the complication. The following conjectures may be considered.

During a standard TAVI and after the stent-valve deployment, presence of severe central regurgitation caused by a frozen cusp:

1. The hemodynamic status is stable or can be stabilized with acceptable doses of inotropic drugs.
   - Control the position of the stiff guidewire (it can be at the origin of temporary leaflet immobilization). Try to place the guidewire in the valve orifice to evaluate the leaflet motion.
   - Verify the stent-valve shape and re-balloon in case of distortion.
   - Increase the systolic pressure (above 120 mm Hg) to mobilize the frozen leaflet from the stent. (When the leaflet moves and the valve is competent, a second stent valve is not necessary. However, if the leaflet seems damaged we recommend a second valve.)
   - Consider employing the pigtail placed into the ascending aorta to carefully mobilize the fixed cusp (it might be dangerous for the valve integrity).
2. The hemodynamic status is critical and it cannot be ameliorated with high doses of inotropic drugs (dangerous scenario).
   - Urgent implantation of a second stent valve within the first one seems to be the salvage procedure, regardless of the cause; and
   - Consider an ECMO or a femorofemoral cardiopulmonary bypass to stabilize the hemodynamic.

Following these reflections, I strongly advocate the presence of a cardiac surgery team with available cardiopulmonary bypass equipment during all TAVI procedures. Moreover, I surmise that, when this complication occurs during

percutaneous TAVI under local anesthesia and in the absence of transesophageal echocardiographic control, angiographic imaging alone is inadequate to evaluate the severity of the intraprosthetic regurgitation and the mechanism behind it [4].

In conclusion, further clinical reports are welcome and, in particular, the crimping system for balloon-expandable stent valves should be compared with the self-expandable stent-valve system, with particular regard to cusp damages and to stent integrity.

References

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31 August 2010

doi:10.1016/j.ejcts.2010.08.049