The transapical approach has emerged as an alternative access site with multiple benefits, including easier defect crossing, easier device manipulation, and the avoidance of trans-septal puncture and its associated complications. Some groups have reported positive results using this technique [4, 5]. Some drawbacks also have to be reported, such as apical closure. Fortunately, the small introducer sheath required for device placement avoids most of the problems associated with apical closure that have been reported for transcatheter valve implantation. It is possible that closure devices could be used, and closed chest techniques could also be considered in these situations.

In the reported case, the time from apical puncture to defect crossing was low, possibly reflecting the ease of the access. In addition, deployment of the second device was also easy, being aided by tridimensional transoesophageal echocardiography, which is, in our opinion, fundamental for correct assessment of the guidewire position and defect measurement.

The final result and follow-up echocardiogram confirmed the sustained result and usefulness of the technique in allowing high-risk reoperated patients to be treated in a less invasive manner. Multiple other combination techniques could also be accomplished, such as simultaneous transcatheter valve-in-valve mitral implantation and perivalvular leak closure, further extending the range of possibilities for transcatheter techniques.

Certainly, the devices have to be improved for this kind of procedure. A custom-designed prosthesis based on preoperative imaging studies using computed tomography and tridimensional echocardiography might possibly improve results and reduce the need for multiple devices. In addition, a custom-designed device would probably reduce valve inflow interference and the risk of dislodgement. An ideal device would probably have an oval-shaped disc, allowing a single device to occlude the perivalvular leak completely.

This case also demonstrates that crossing times can be dramatically reduced using an apical approach, decreasing radiation exposure and total procedure time, especially compared with the usual trans-septal approach. There was no need for considerable experience with the technique in order to achieve a satisfactory result in a relatively simple procedure.

Conflict of interest: none declared.

REFERENCES

[1] Binder RK, Webb JG. Percutaneous mitral and aortic paravalvular leak repair: indications, current application, and future directions. Curr Cardiol Rep 2013;15:342.
[2] Webb JG, Wood DA, Ye J, Gurvitch R, Masson JB, Rodes-Cabau J *et al*. Transcatheter valve-in-valve implantation for failed bioprosthetic heart valves. Circulation 2010;121:1848–57.
[3] Gaia DF, Palma JH, de Souza JA, Ferreira CB, Macedo MT, Gimenes MV *et al*. Transapical mitral valve-in-valve implant: an alternative for high risk and multiple reoperative rheumatic patients. Int J Cardiol 2012;154:e6–7.
[4] Guler A, Tavlasoglu M, Kadan M, Barcin C. Transapical closure of mitral paravalvular leakage. Eur J Cardiothorac Surg 2013;43:861–3.
[5] Thourani VH, Smith CM, Guyton RA, Block P, Liff D, Willis P *et al*. Repair of prosthetic mitral valve paravalvular leak using an off-pump transapical approach. Ann Thorac Surg 2012;94:275–8.

eComment. Three-dimensional printers remodelling cardiac interventions

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We read the recent case report by Gaia *et al.* with great interest [1]. In their paper the authors reported off-label use Amplatzer Vascular Plug II device for closure of a prosthetic mitral valve perivalvular leak [1].

Due to the lack of commercially available devices customized for different cardiac lesions, interventionalists use the most appropriate/potentially suitable ones already labelled for other indications. But results are not always encouraging as reported by the authors and sometimes because of device-lesion mismatch, patient loses the chance of a percutaneous treatment.

At this point three-dimensional (3D) printers remodel our future practice. Today 3D printers are being used by surgeons to simulate analogue 3D anatomical models of complex heart diseases to facilitate the planning and execution of the surgical procedure. Individual dental implants produced by 3D printers have been used by dentists nearly for a decade. Use of 3D printers during catheter-based interventions is also promising. Sodian *et al.* reported a case of 3D-printing model to fabricate a custom-made occlusion device for coil embolization of an anastomotic leak after aortic arch replacement [2]. There are reports in the literature describing the use of models in the treatment of valve diseases [3].

In conclusion 3D printers can assist with diagnosis, surgical and catheter-based intervention planning, patient communication, and prosthesis design in fields ranging from maxillofacial surgery to cardiology. With this technology the off-label term will leave its place to the term 'individualized medicine'; a concept implying diagnosis and treatment tailored according to the patient's unique features and requirements.

Conflict of interest: none declared.

References

[1] Gaia DF, Breda JR, Fischer CH, Palma JH. Off-pump transapical closure of a mitral periprosthetic leak: a new approach to a difficult problem. Interact CardioVasc Thorac 2013;17:1048–50.
[2] Sodian R, Schmauss D, Schmitz C, Bigdeli A, Haeberle S, Schmoeckel M *et al*. 3-Dimensional printing of models to create custom-made devices for coil embolization of an anastomotic leak after aortic arch replacement. Ann Thorac Surg 2009;88:974–8.
[3] Schievano S, Migliavacca F, Coats L, Khambadkone S, Carminati M, Wilson N *et al*. Percutaneous pulmonary valve implantation based on rapid prototyping of right ventricular outflow tract and pulmonary trunk from MR data. Radiology 2007;242:490–7.