Cardiol Young 2000; 10: 462–463

ISSN 1047-9511

Editorial Comment

Transcatheter closure of atrial septal defects demands co-operation between the interventionist and the echocardiographer

Per G. Bjørnstad

Rikshospitalet, The National Hospital, Oslo, Norway

DEVELOPMENT OF MEDICINE NEEDS INNOvative pioneers, along with courageous patients agreeing to submit to a non-established therapy. In this light, we should remember that the pioneers for closure of shunts by interventional catheterisation, from King, Porstmann and Rashkind onwards, sooner or later had to realise that their techniques did not survive. But, extending the lines of their innovative thinking, it proved possible to develop new devices based on modern technology. In this issue of the Journal, we are presented with a series of articles outlining the existing "state of the art" for transcatheter closure of holes within the oval fossa. We can be quite confident that the devices described do not mark the end of this development. Without question, these devices will be modified and improved. New devices,[1] and probably completely new methods, will be developed. We have already seen the birth of several ingeniously engineered devices that have had a shorter or longer life span but have now disappeared. This process will continue. To take but one example, the experience of Godart and his colleagues[2] with the buttoned device has shown it no longer to be on the level of modern requirements, nor to be a match for the competition. Thus, Godart's institution, along with a number of others, have changed to other techniques. We have to be open-minded in our choice of device, and be able and willing to change should our data tell us that our current method is no longer up to date.

We have now advanced beyond the era of the pioneers. But, thanks to them, transcatheter closure of atrial septal defects has become an established procedure. The articles presented in this issue show that, presently, there are but two competitive devices. These are the umbrella in the CardioSEAL or Starflex version, and the Amplatzer plug. They are based on different concepts, and have different capacities. The results obtained with either device are comparable, although the number of patients with residual shunting, albeit small, seems to be higher after closure using the umbrellas (20 % after one year) than the plug (5 and 10 % after one year), especially in the immediate period after implantation. Both devices can be used to close defects in patients of markedly different size. There may, though, be some concern about using 11 French sheaths for the CardioSEAL, and 10 French for Starflex implantation, in small patients when a 7 French sheath will suffice for placement of an Amplatzer plug. The Amplatzer plug can also be used to close much bigger defects, up to 34 mm stretched diameter, but then again with much larger introducers.

From the anatomical and echocardiographic studies presented in this issue, we learn that the defects almost uniformly are not circular. After implantation of an Amplatzer device, nonetheless, they are! Concerns may arise from this reshaping of the defect. We have also learned that the shape and size of the defect is not constant during the cardiac cycle. A defect stented with an Amplatzer plug will not change its shape. We do not know what that may imply in the future. Atrial dysfunction? Disturbances of rhythm? Impact on the atrioventricular valves? But the rim of the left-sided disc reaches only 7 mm outside the stent. The right-sided rim even less. The rest of the septum is not touched. So maybe nothing will happen? The size of the CardioSEAL or Starflex devices is measured along the *sides* of the square. When Carminati and

Correspondence to: Per G. Bjørnstad, MD, Paediatric Cardiology, Green Lane Hospital, Green Lane, Auckland, New Zealand. Tel: 64 9 630 9944; Fax: 64 9 631 0785; E-mail: perb@ahsl.co.nz

Accepted for publication 30 June 2000

his colleagues[3] report a ratio of device to defect of about 2: 1, it reflects the *shortest* distance from the centre of the device to the margins of the fabric. The points farthest away from the centre of the device are the eight *corners* of the device, at the insertion of the arms. This diagonal distance along the arms is 1.4 times longer than the side of the device. This fact has often not received attention when the size of the device has been related to the size of the defect.

For comparison, let us take the biggest defect that presently can be closed with umbrellas, a 20 mm defect. If closed with a 20 mm Amplatzer device, we would have a maximal ratio of diameter of device to defect of 1.7: 1. The diameter of the left-sided disc would measure 34 mm. The defect, of 314 mm^2, will be covered with a left-sided disc having an area of 907 mm^2, or approximately 2.9 times the size of the defect. The same defect closed with one of the umbrellas would require a device of approximately 40mm. Its longest axis from corner to corner would be 56mm, with a maximal ratio of device to defect of 2.8: 1. The left-sided umbrella covers 1600 mm^2, with 1344 mm^2 covered on both sides of the septum, and 512 mm^2 on one side only. The area of atrial walls covered on one or two sides is 5.9 times the size of the defect, more than twice that of the Amplatzer. The size may cause a problem, and the steel arms ending at the corners create a potential for mechanical injury. The much bigger part of the atrial walls covered implies a potential for impairment of movement and conduction, along with the processes of fibrosis and endothelialisation of the device. Development of new devices will have to aim for less and less overlap of device and atrial walls, and less and less infliction upon the rims of the oval fossa itself.

In the umbrellas, we have seen fractured arms, but these are probably not of any concern. Fractures of the nitinol threads of the Amplatzer plug would be difficult both to define and to exclude. To my knowledge, they have never been reported.

It is obvious from ongoing experience, and from the articles contained in this issue, that closure of atrial septal defects using catheters is an issue both of sublime interventional technique and advanced echocardiography. The articles on echocardiography in this issue demonstrate the importance of morphologic examinations in such procedures. For the selection of patients, for the implantation procedure itself, and for the follow-up, detailed echocardiographic examinations are crucial. The interventional cardiologists have shown that they rely more and more on transoesophageal echo during the process of measurement and implantation, and that they use less and less fluoroscopy. It has already been shown[4] that implantation is feasible with echocardiography alone. Three-dimensional echo now requires shorter and shorter times for processing the data and displaying the picture. Without question, the time is nearly upon us when we will have real-time three-dimensional display at our disposal for use in the closure of these defects.

References

1. Sideris E, Sideris S, Pousanov M, Toumanides S, Stamatelopoulos S, Moulopoulos S. Transcatheter patch correction of atrial septal defects: experimental validation and early clinical experience. Cardiology in the Young 2000; 10(Suppl. 2): 13.
2. Richens T, Houston AB, Hillis WS, Sievert H, Wilson N. Early clinical experience with a novel nitinol/ePTFE based double disc atrial septal occlusion device (HELEX!™). Cardiology in the Young 2000;10(Suppl. 2): 13–14.
3. Godart F, Rey C, Francart C, Cajot MA, Brevière GM, Vaksmann G, Devos P, Coullet JM, Vincentelli A. Experience in one centre using the buttoned device for occlusion of atrial septal defect – comparison with the Amplatzer septal occluder. Cardiology in the Young 2000;10: 527–533.
4. Carminati M, Hausdorf G, Qureshi S, Tynan M, Witsenburg M, Hess J, Piechaud JF, Bonhoeffer P, Donti A, Ovaert C, Sievert H, Elzenga N, Talsma M, van Oort A, Ernst J, Gewillig M, De Geeter B. A European multicentric experience using the CardioSEAL and Starflex double umbrella devices to close interatrial communications holes within the oval fossa. Cardiology in the Young 2000;10: 519–526.
5. Ewert P, Daehnert I, Berger F, Kaestner A, Krings G, Vogel M, Lange PE. Transcatheter closure of atrial septal defect under echocardiographic guidance without X-ray: initial experiences. Cardiology in the Young 1999;9: 136–140.