ATRIAL SEPTAL DEFECT PREOPERATIVE EVALUATION.
THREE-DIMENSIONAL TRANSESOPHAGEAL ECHOCARDIOGRAPHIC STUDY.

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REZUMAT

Background: The assessment of patients with atrial septal defect for surgical closure requires accurate information regarding the anatomy of the defect, the diameters and the aspects of the circumferential margins. Transthoracic echocardiography provides poor data, while multiplane transesophageal echocardiography offers more but still incomplete anatomic details of atrial septal defects. On the contrary, three-dimensional echocardiography can provide views of the entire atrial septum seen from the right or from the left atrium, allowing its complete assessment. The aim of the study was to evaluate the accuracy of three-dimensional transesophageal echocardiographic reconstruction to appreciate the anatomy and the dimension of atrial septal defects.

Material and methods: Thirty adult patients with atrial septal defect underwent a transesophageal echocardiography with three-dimensional reconstruction, before surgical repair. The location, shape, diameters and circumference of the atrial septal defect were compared to the intraoperative findings.

The results showed an excellent correlation between the echocardiographic localization (r = 0.98), the shape (r = 0.96), the maximum diameter (r = 0.98) and the circumference (r = 0.92) of the atrial septal defect and surgical data.

Conclusion: In patients with atrial septal defect three-dimensional transesophageal echocardiographic reconstruction allowed a precise localization and an accurate quantification of the defect. This method facilitates a better preoperative planning and therefore a safer surgical repair.

Key Words: atrial septal defect, tridimensional transesophageal echocardiography

INTRODUCERE

Evaluarea preoperatorie a pacienților cu defect septal atrial urmărește anatomiile, diametrele și aspectul marginilor defectului. Ecografia tranzitorică este săracă în acest sens, în timp ce ecografia transesofagiană multiplană oferă mult mai multe detalii anatomici, dar uneori și acestea sunt incomplete. În contrast cu acestea, ecografia tridimensională explorează întreg septul interatrial, văzând adâncul atrului drept, cât și adâncul atrului stâng, permițând evaluarea sa completă. Scopul studiului a fost evaluarea acurateței ecocardiografiei tridimensionale transesofagiene în aprecierea anatomicii și dimensiunilor defectelor septale atriale. Material și metodă: Treizeci de pacienți cu defect septal atrial au fost investigați ecocardiografic transesofagian, practicându-se și reconstrucția tridimensională, înainte de intervenția chirurgicală de reparare a defectului. S-au urmărit localizarea, forma, diametrele și circumferința defectului septal atrial, datele posterioare cu datele chirurgicale. Rezultatele au arătat o corelație excelentă pentru localizarea (r = 0.98), forma (r = 0.96), diametrul maxim (r = 0.98) și circumferința (r = 0.92) defectului, determinate ecocardiografic și intraoperator. Concluzie: Reconstrucția tridimensională transesofagiană ecocardiografică permite la pacienții cu defect septal atrial o localizare preciză și o cuantificare acurate a defectului. Această metodă facilitează o mai bună planificare a strategiei chirurgicale.

Cuvinte cheie: defect septal atrial, ecocardiografia tridimensională transesofagiană

BACKGROUND

The atrial septal defect (ASD) is one of the frequently diagnosed congenital malformations in adults.¹ This disease is very well tolerated in many patients and the symptoms appear when the shunt is significant and the pulmonary pressure begins to rise. The optimal moment for surgical intervention is one step earlier. For this reason the correct and complete diagnosis is crucial, and the echocardiography is the elective investigation. In present there are several possibilities for routine echocardiographic study: transthoracic (TTE) and transesophageal (TEE), bidimensional (2D) (for anatomy of the defect) and Doppler measurements (for quantification of the shunt and of the pulmonary pressure). However, in some cases the obtained data are not enough for establishing a surgical strategy.

In the past years, tridimensional (3D) echocardiography has joined these procedures and...
contributes to a better and more complete diagnosis, especially for anatomic details. It has an important role in a large number of diseases where the morphologic data help to better understand the mechanisms and severity of cardiopathies and to correctly analyze the therapeutic solutions. In conclusion 3D echocardiography can and is used in ASD.

The aim of the study was to evaluate the accuracy of three-dimensional transesophageal echocardiographic (3D TEE) reconstruction for a complete description of ASD regarding the size and the aspect of the defect.

**MATERIAL AND METHOD**

Thirty adult patients, twenty two women and eight men, aged between 20 and 67 years, underwent complete echocardiographic investigation for an ASD and subsequently all of them underwent corrective surgery.

The echocardiographic studies were performed with an ultrasound imaging system Sonos 5500, Agilent Technologies.

The conventional TTE and TEE described the location and the diameters of ASD, calculated the shunt and the pulmonary pressure and looked after associated defects. In all patients a 3D TEE reconstruction was performed and the location, the shape, the maximum diameter and circumference of the ASD were recorded and then compared with the intraoperative findings.

For statistical correlation of 3D TEE characteristics and surgical data, the findings were coded as follows:
- For ASD localization: ostium primum ASD–1, ostium secundum ASD-2, venous sinus–3 (near superior vena cava), 4 (near inferior vena cava) and 5 for coronary sinus type;
- The same for the shape of ASD: round-1, oval–2 and irregular-3; the color Doppler flow helped for a better visualization of the ASD in some patients; (Fig. 1)
- The ASD maximum diameter was measured in the systole;
- The ASD circumference was measured in the systole.

**RESULTS**

The study has revealed an excellent correlation of the 3D echocardiographic ASD characteristics with the surgical data:
- For the echocardiographic localization (r = 0.98); there were no patients with venous sinus or coronary sinus type ASD; in two patients 3D TEE reconstruction revealed an ostium secundum ASD that was found intraoperatively to be venous sinus ASD near the superior vena cava;
For the ASD shape (r = 0.96); the shapes of ASD appear variable on 3D views: round, oval, but in most of the patients ASD shape was irregular; (Fig. 2,3)
- For the maximum diameter (r = 0.98);
- For the circumference (r = 0.92). (Fig. 4,5)

**DISCUSSION AND LIMITS**

The assessment of patients with ASD for surgical closure requires accurate information regarding the anatomy of the defect, the diameters and the aspects of the circumferential margins.\(^2,3\)

While TTE and TEE show incomplete anatomic details, 3D echo can provide views of the entire atrial septum allowing for a comprehensive assessment of the defect. The ASD morphology varies with the view, i.e., is different when viewed from the right atrium versus left atrium.\(^4\) Another important issue is that ASD, especially ostium secundum, is a dynamic structure which changes in size during the cardiac cycle. A 30 to 70% reduction of ASD size in mid to end-systole has been reported.\(^5\) In this study the measurements of diameters and circumferences were performed in early systole, or when the dimension of ASD reached a maximum. The size and the shape of ASD are essential parameters for the selection of the optimal therapeutic strategy. For device closure a very important parameter is the dimension of the septal rims, but this was not measured in this study.\(^4,6\) Live 3D TEE also describes all these parameters, and the method is more rapid.\(^5,6\)

**CONCLUSION**

In patients with atrial septal defect, 3D echocardiographic reconstruction allowed a precise localization and an accurate quantification of the defect.

This method facilitates a better preoperative planning and therefore a safer surgical repair.

**REFERENCES**


