additional material such as pericardium or homografts. It has been demonstrated to be effective in our early experience.

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The axillary incision: A cosmetic approach in congenital cardiac surgery

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Surgery for congenital heart disease has made great advances, and the focus has shifted from simply surviving the operation to the quality of life after surgical repair, especially when dealing with simple lesions such as atrial septal defects (ASDs). In children and young women, the appearance of the incision has been a significant issue, with concern that it could have an impact on the patient's psychological wellbeing and self esteem.

Several approaches have been described to avoid a visible midline scar. Most commonly, surgeons have tried using the anterolateral thoracotomy approach, originally described by Lewis and Taufic¹ in 1952. In addition, there have been reports concerning the use of other access sites such as a short right lateral thoracotomy, posterolateral thoracotomy, ministernotomy, a sub-xiphoid approach without sternotomy, and, more recently, an axillary incision.^{2,3} The axillary incision scar is well concealed under the upper arm (Figure 1) and, in prepubescent female patients, poses less potential for subsequent breast tissue distortion.⁴ This article reports the use of the axillary incision at our institution in 34 patients with various congenital cardiac defects.

Patients and Methods

Thirty-four consecutive patients were included in the report. Median age was 5 years, with a range from 5 months to 47 years.

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Median weight was 21 kg, with a range from 5.9 to 72 kg. Clinical and operative data regarding the 34 patients are shown in Table 1.

We opted to evaluate the axillary incision against the commonly used incision, the ministernotomy. A subgroup of patients with secundum ASDs was compared with 14 other recent patients who had a secundum ASD closure through a ministernotomy incision. Their clinical data and the results of statistical analysis of this comparison are shown in Table 2.

Data gathering adhered to Mount Sinai and St Joseph's Medical Center Institutional Review Board guidelines. The protocol was approved by the Institutional Review Board, and specific patient consent was not required.

Surgical Techniques

Ministernotomy. The technique has been well described.⁵ A majority of patients had repair with the heart electrically fibrillated, and the defects were closed primarily. For larger lesions, the defects were closed with an autologous pericardial patch.

Right axillary incision. The patient was placed in the left lateral decubitus position. The right arm was elevated to expose the axilla. The slightly oblique incision was placed between the anterior and posterior axillary lines.

Figure 1. The scar for the axillary incision is positioned under the upper arm.

TABLE 1. Clinical and operative data

Diagnosis	No.	Female	Age (mo)	Weight (kg)	CPB (min)	Crossclamp (min)	Fibrillation (min)
Secundum ASD	16	12	77 (11, 572)	21 (7, 72)	29 (51-9)	16 (9, 25) in 7 patients	9 (4, 16) in 9 patients
Sinus venosus ASD, superior type PAPVR	6	2	52 (14, 145)	15 (8, 55)	71 (50, 90)	43 (27, 53)	
Sinus venosus ASD, inferior type, PAPVR	3	1	135 (118, 220)	37 (27, 58)	65 (30, 84)	33 (16, 66)	
Perimembranous VSD	4	2	17 (6, 23)	8 (6-10)	126 (108, 129)	73 (48, 105)	
Inlet VSD	1	1	5	6	128	85	
Sub AS	3	2	65 (58, 95)	27 (20, 31)	72 (50, 78)	42 (26, 52)	
TV regurgitation	1	1	38	20	233	184	

ASD, Atrial septal defect; PAPVR, partial anomalous pulmonary venous return; VSD, ventricular septal defect; Sub AS, subaortic stenosis; TV, tricuspid valve.

The incisions usually measured about 1.5 inches in a 10-kg infant to almost 3 inches in adults. The serratus anterior muscle was split along its fibers and the latissimus dorsi was retracted posteriorly. The pleural cavity was entered through the fourth intercostal space. Aortic and bicaval cannulations were then achieved, and cardiopulmonary bypass (CPB) was instituted. The conduct of the operation is similar to that of ministernotomy.

Statistical Methods

Data are described as percentages or median and range, as appropriate. Comparisons of categorical factors between the 2 procedures are by exact π^2 tests. Wilcoxon tests were used to compare continuous measures. Data analyses were implemented with SAS software, version 9.1 (SAS Institute Inc, Cary, NC).

Results

There was 1 case of transient and 1 case of permanent atrioventricular block. One patient, who had first-degree heart block preoperatively, required a permanent pacemaker placed after closure of a ventricular septal defect. All but 1 patient were extubated in the operating room. Intraoperative and follow-up echocardiograms showed no residual lesions in any patient.

TABLE 2. Comparison of patients undergoing axillary incision and those undergoing ministernotomy

Variables (median values)	Axillary (n = 16)	Ministernotomy (n = 14)	P values
Age (mo)	77 (11, 572)	59 (14, 191)	.79
Weight (kg)	21.0 (6.8, 72.0)	19 (8, 53)	.72
Time before CPB (min)*	65 (44, 126)	47 (35, 98)	.06
CPB (min)	29 (9, 51)	11 (8, 54)	.0012
Crossclamp time (min)	16 (9, 23) (in 7 patients)	26 in 1 patient	.25
Fibrillation time (min)	10 (4, 16) in 9 patients	5 (3, 10) in 13 patients	.003
Surgery time (min)†	137 (105, 221)	99 (76, 175)	.01
LOS (d)	2.0 (1.0, 4.0)	1.0 (1.0, 3.0)	.07

CPB, Cardiopulmonary bypass; LOS, length of stay. *Time from skin incision to initiation of CPB. †Time from skin incision to skin closure.

Intraoperative data from the patients who had an axillary incision are shown in Table 1. Data and statistical analysis on the 2 groups of patients with secundum ASDs are shown in Table 2. As can be seen from the table, the CPB times and the overall duration of surgery were significantly greater for the patients with axillary incisions.

Discussion

The axillary incision has been commonly used for thoracic operations. Our goal to achieve a cosmetic result in surgery for congenital cardiac lesions had led us to the application of the axillary incision. Our experience showed that repair of certain congenital defects through an axillary incision using central cannulation is possible. Lesions at the atrial level, lesions close to the tricuspid valve, and those that can be visualized and reached from the unique angle dictated by the axillary incision seem amenable to the axillary approach. The smallest patient was 5.9 kg.

When compared with patients with ASD closed via a ministernotomy, there is clearly an increase in CPB and fibrillation times in patients with axillary incision, but the two groups had no differences in postoperative outcomes or length of stay. Because it was a new approach, there was a tendency to use a more complete open heart setup with mild hypothermia and crossclamping in the axillary incision group, as our data noted. Up to 44% of patients in the axillary group had aortic crossclamping, in contrast to 7% in the ministernotomy group, contributing to a longer duration of CPB. In fact, when only normothermia and fibrillation were used in patients with an axillary incision, the CPB and fibrillation times approached those of patients with the ministernotomy approach.

The study sample was small, but it did provide useful data when compared with that of the more commonly performed ministernotomy. The axillary incision is not suitable for many complex congenital cardiac lesions and the sternotomy is still the standard and most effective approach.

In conclusion, the axillary incision provides a superior cosmetic result in repairing a variety of congenital cardiac lesions. We anticipate its wider application in patients with mitral and aortic valve disease, as well as in surgery of the ascending aorta.

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Immediate "total" aortic true lumen expansion in type A and B acute aortic dissection after endovascular aortic endografting and GZSD bare stenting

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Use of bare metal stenting is a novel approach for more complete reconstruction of aortic dissection.¹ Treatment advancement with endografting^{2,3} and bare stenting for total aortic reconstruction has been previously reported.¹ In this article we report our results for complete endovascular aortic stenting in acute dissection for both type A and B cases.

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Deficiencies have persisted with endografts in the treatment of thoracic dissections.⁴ Stent graft closure of the primary entry tear, typically in the proximal descending aorta, results in decompression of the thoracic false lumen with proximal thrombosis and remodeling. However, this technique does not address the need in some cases to more fully remodel the entire aorta and ensure distal branch vessel perfusion.^{2,3} Furthermore, the presence of complex distal re-entries, often related to branch vessels, prohibits extensive treatment with standard tube endografts.

Case reports of Z-stent use for prevention of malperfusion suggest its utility in aortic dissection.⁵ Additionally, we have found bare metal stenting accelerates true lumen remodeling, reduces false lumen volume, and enhances branch vessel perfusion. Our study evaluates quantitatively the postdissection true lumen expansion as a result of Z stenting with or without additional endografting of the primary entry tear.

From 2002 to 2005, 9 patients were treated for acute aortic dissection (3 type A and 6 type B) using Z stenting of the thoracic and abdominal aorta. Patient selection included acute phase false lumen growth (>0.5 cm), malperfusion or mesenteric branch involvement, and true lumen collapse (which did not expand after proximal endograft placement) (Table 1). Initially Gianturco Z stents and subsequently the purpose built Zenith DISSECTION thoracic endovascular

TABLE 1. Procedural and clinical characteristics/outcomes

Patient sex/age (y)	Dissection type	Aortic indication for stenting	Proximal endograft	Stent type	Stent dimensions (mm)
M/60	Acute type B	TLC, high-flow FL	ZTEGA 38–177	GZS	1 × 35–75
M/51	Acute type B	Mesenteric involvement	No endograft	GZS	3 × 35–75
F/54	Acute type B	High-flow FL involving renal artery	ZTEG 42–135	GZS	3 × 35–75
F/48	Acute type B	TLC	ZTEG 30–120	GZS	3 × 35–75
F/48	Acute type B	TLC	ZTEG 30–120	GZSD	46–123, 46–82
M/79	Postop type A repair	Mesenteric involvement	No endograft	GZSD	46–164
M/50	Acute type B	Aorta-infrarenal malperfusion	ZTEG 34–127	GZSD	46–164, 46–123
M/57	Acute type B	Renal malperfusion	ZTEG 34–127	GZSD	46–164, 46–123
M/52	Postop type A repair	Postop type A repair	ZTEG 30–120	GZSD	46–164, 46–82

FL, False lumen; TL, true lumen; SG, stent graft; TLC, symptomatic true lumen collapse; T, total; P, partial; N, no; Y, yes.