

ORIGINAL ARTICLE

Experience in the Hospital General de Mexico 'Dr. Eduardo Liceaga' in the surgical management of patent ductus arteriosus in a population older than 18 years.

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Objective. To present the long-term outcomes of double ligation management (simple ligation plus transfixative stitch) of patent ductus arteriosus (PDA) in adults at the General Hospital of Mexico. **Material.** Retrospective, observational and descriptive study, in which all patients with a diagnosis of PDA in adults undergoing surgical treatment by the Cardiothoracic Surgery Department Staff at the General Hospital de Mexico between 2010 and 2020 were included. **Results.** A total of 33 patients with a diagnosis of PDA in adults were included. 74.19% of the techniques were ligation with a transfixative stitch. The main complications were thoracic duct injury with presentation of chylothorax in one case (3.2%), recurrent laryngeal nerve injury manifested as dysphonia in 2 patients (6.5%). They were presented in the cut and suture technique. Early (30 days) and late (6-24 months) mortality was 0%. **Conclusions.** Double ligation plus transfixative stitch of the ductus is still a safe and effective option for the treatment of PDA in adults.

Key words: Congenital heart disease in the adult; Patent ductus arteriosus; Surgery.

Objetivo. Dar a conocer los resultados a largo plazo del manejo mediante doble ligadura (ligadura simple más punto transfixativo) del conducto arterioso persistente en adultos en el Hospital General de México. **Material.** Este es un estudio, retrospectivo, observacional y descriptivo, en el que se incluyeron a todos los pacientes con diagnóstico de PCA en el adulto con tratamiento quirúrgico por el servicio de Cirugía Cardiorádica en el Hospital General de México en el periodo comprendido de 2010-2020. **Resultados:** Se incluyeron un total de 33 pacientes con diagnóstico de PCA en el adulto. El 74.19% de las técnicas fueron ligadura con punto transfixativo. Las complicaciones más notorias; lesión de conducto torácico con presentación de quilotorax en un caso (3.2%), lesión de nervio laríngeo recurrente manifestado como disfonía 2 pacientes (6.5%). estas se presentaron en la técnica de corte y sutura. Hubo una mortalidad de 0% en seguimiento temprano (30 días) y tardío (6-24 meses). **Conclusiones.** La doble ligadura con punto transfixativo del conducto arterioso constituye aún una opción segura y eficaz para el tratamiento de la PCA en adultos.

Palabras clave: Cardiopatía congénita en el adulto; Conducto arterioso persistente; Cirugía.

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Patent ductus arteriosus (PDA) is the most frequently congenital acyanotic heart disease seen in our adult cardiac population at our institution. Despite the most innovative techniques for diagnosis and management such as endovascular treatment, in our institution, it still represents an indication for classic open chest operation due to a lack of economic resources of our entitled population.

The first surgical technique for the management of this pathology in neonates was firstly performed in 1938 by Robert Gross. A transpleural left posterolateral thoracotomy approach, dissection and clipping of the aortic end of the conduit established the gold standard of surgical treatment for PDA closure for years [1]. In 1999, ligation of the DPA through an extrapleural subaxillary mini-incision was reported by Yan et al. [2]. Thoracoscopic approaches to close by clipping the PDA began in 1993 with the video-assisted technique (VATS) [3].

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In adult patients, since the PDA can become fibrous and/or calcified, some special considerations to the tradition-

al surgical technique must be taken into account, such as the use of cardiopulmonary bypass, systemic hypothermia, among others [4]. In general terms, regardless the approach, there are different options for the surgical management of the PDA, such as simple ligation, double ligation, occlusion with titanium clips and section plus suture; the latter is the current preferred by us given the low recurrence rate.

On the other hand, with the emergence of endovascular interventionism in 1967, percutaneous closure arose, with the evolution of the device to be used. In 2003, the FDA approved occluders with coils for PDA smaller than 3 mm and with Amplatzer between 3 and 12 mm [5].

We present herein a retrospective, observational and descriptive study to analyze the long-term results of management by means of a conventional surgical approach with a double ligation technique (simple ligation plus transfixative stitch) of the PDA in adults at the Hospital General de Mexico.

MATERIAL

This is an observational, retrospective and descriptive study including all patients diagnosed with PDA in adults underwent surgical treatment by the Cardiothoracic Surgery Department Staff at the Hospital General de México from 2010 to 2020. All cases with incomplete records or due to non-compliance with follow-up were excluded, defining this non-compliance as the absence of a postoperative echocardiogram within 6 months after procedure. The information was collected from the clinical records. Collected variables included age, gender, weight, height, echocardiographic findings, approach, utilized technique and surgical complications. The severity of the presentation of disease was evaluated by means of the classification of symptoms and echocardiogram findings described in the Adult Congenital Heart Disease in the Netherlands guidelines 2000[6].

All information was collected, gathered and processed by the IBM SPSS Statistics program; descriptive data were expressed as percentages, ranges and means with two standard deviations.

Surgical technique

The standard technique was performed through a left posterolateral thoracotomy in the 3rd intercostal space. After opening the mediastinal pleura, and careful dissection of the anatomical structures involved, one of these two techniques was used: a) PDA ligation, using 3/0 silk to ligate both ends of the PDA, as well as a transfixative suture between both sutures with polypropylene 5/0; b) Section and suture of the PDA, suturing both sectioned ends using 5/0 polypropylene suture. In both techniques, a 36Fr chest tube was placed [7].

For a transpulmonary closure of the PDA by median sternotomy, cardiopulmonary bypass was used with conventional bicaval cannulation. Pulmonary arteriotomy is performed, identification of the ductal orifice and closure with 4-0 polypropylene suture, without the need for a patch [4]. This tech-

nique was used to approach a patient in whom, due to the complications of the pathology, other simultaneous procedures were required.

RESULTS

A total of 33 patients with diagnosis of PDA older than 18 years underwent surgical treatment were included. Out of them, 2 patients were excluded because they did not have a complete clinical file. Twenty-seven were women (87.1%) and 4 men (12.9%), corresponding to a ratio of 2.8:1; mean age of 29.6, mean BMI of 23.35. Demographic data are described in **Table 1**. There were 30 elective operations, but one emergency secondary to endocarditis associated with PDA.

According to the severity, classification was based on the Adult Congenital Heart Disease in the Netherlands guidelines 2000 [6], and the results obtained in our study, most patients were diagnosed as a type of moderate PDA [8]. The probability of pulmonary arterial hypertension based on the PSAP criteria defined as unlikely (>36 mmHg) 9 cases (29.0%), possible (37-50 mmHg) 12 (38.7%), probable (>51 mmHg) 10 (32.3%) [9] (**Fig. 1**).

Thirty transpleural left posterolateral thoracotomies were performed (96.7%), of which ligation plus transfixative suture was the most frequent duct management corresponding to 74.2% of cases. Cut and suture was used in 7 occasions (22.6%), while sternotomy with transpulmonary closure of the PDA was in 1 patient (3.22%).

The morbidity for the 3 groups, depending on the technique used, is described in **Fig. 2**. The morbidities were directly associated with the surgical approach; thoracic duct injury with presentation of chylothorax in one case (3.2%), recurrent laryngeal nerve injury manifested as dysphonia in 2 patients (6.5%), were presented in the cut and suture technique.

Other complications were identified such as pneumonia in one case (3.2%), hemopericardium in one case (3.2%) and wound dehiscence in another case (3.2%). Operative mortality was 0% in early follow-up (30 days). Patients were followed up for an average of 24 months after surgical treatment. No case for late mortality (6-24 month-follow-up) were present.

DISCUSSION

PDA in the adult population is usually diagnosed incidentally after a medical examination, or an ECG taken for some other reason [6]. In our population, the main cause of late treatment of the disease is due to the lack of follow-up ever since childhood related to a lower socioeconomic and educational level.

The definitive treatment of PDA is represented by the closure, either through an endovascular approach or surgery. It has been established that closure through this method is

TABLE 1. Demographic data

Surgical technique	Double ligation (n= 23)	Cut and Suture (n= 07)	CPB (n= 01)
Age (years) ± standard deviation	29.1 ± 8.9	31 ± 8.2	30
Gender			
Male	3 (13.1%)	1 (14.3%)	0
Female	20 (86.9%)	6 (85.7%)	1 (100%)
Reason for Diagnosis			
Dyspnea	9 (39.1%)	3 (42.9%)	-
Murmur	13 (56.5%)	4 (57.1%)	-
Endocarditis	-	-	1 (100%)
Fatigue	1 (4.34%)	-	-

CPB: Cardiopulmonary bypass.

the first choice to treat PDA in adults with very good results. However, surgical closure remains the option of choice for the treatment of very large or calcified duct that cannot be approached for catheter-based interventions [6].

Due to the aforementioned with respect to the type of population treated at the Hospital General de Mexico, open surgical approaches are chosen as the first choice of treatment in over 18-year-old patients, despite not being the gold standard reported in the current literature.

Recurrence after PDA ligation has been described up to 22% in pediatric population [10]. The difficulty of performing this technique in adults due to age-related structural changes in the duct should be considered. However, in our institution it continues to be the main technique used due to its ease, reproducibility and good results, with no relapses or complications directly associated with the technique, in contrast to what has been previously published.

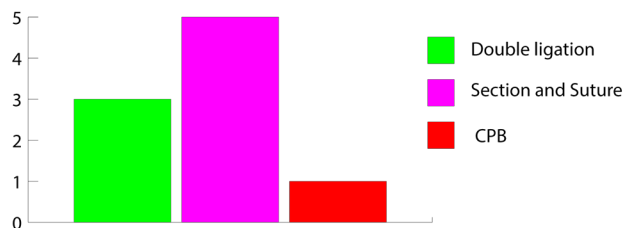


Figure 2. Complications related to the technique employed. CPB: Cardiopulmonary bypass.

In conclusion, double ligation with transfixative stitch of the PDA is still a safe and effective option for treatment in adult patients. Despite not being the best technique for the management of this pathology in patients over 18 years of age, double ligation of the PDA has acceptable results at our institution.

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Pulmonary Hypertension

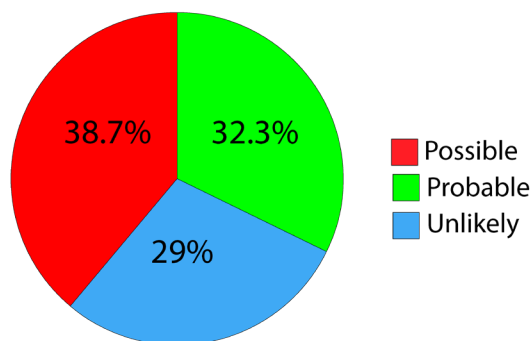


Figure 1. Percentage of patients with possible pulmonary hypertension at the time of diagnosis.

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