

# Restenosis Subsequent to Inflate Valvuloplasty in Dogs with Inherited Pulmonary Stenosis

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**Abstract:** The aspire of this learning were to expose the pervasiveness of complications connected with PBV in excess of a long-term follow-up, and to examine the factors interrelated to those complications, particularly pulmonary Restenosis. Forty dogs that undergo PBV were with the benefit of hindsight reviewed. Long-term follow-up was available in 26 dogs. Exacerbation of PI and TR after PBV was observed in some dogs; however, right-sided heart failure due to PI or TR was not observed in any of them. During long-term follow up, Restenosis developed in 7 dogs (7/25). Restenosis was noticed 5.5 after successful PBV. Numerous regression analyses recognized atenolol administration proceeding to PBV as the autonomous predictor of Restenosis all through long-term follow-up. Supplementary search is defensible to investigate the apparatus of Restenosis and to conclude an approach to thwart complications.

**Key Words:** Pulmonary valve stenosis, Long-term follow-up, Atenolol.

## I. INTRODUCTION

Pulmonary stenosis is an energetic or fixed impediment of stream from the right ventricle of the heart to the pulmonary blood vessel. It is regularly first diagnosed in babyhood. Pulmonic stenosis is typically due to inaccessible valvular obstruction be due to subvalvular or supralvalvular impediment. It may transpire in organization with more convoluted hereditary heart disorders. Pulmonary stenosis (PS) is solitary of the most frequent congenital heart defects (CHD) in dogs. Pulmonary valvular stenosis (PVS) is the majority familiar form of PS. When PS is severe, the unwearied may enlarge syncope, right-sided congestive heart failures, or unexpected death. Pulmonary balloon Valvuloplasty (PBV) is a congenital defect involving the pulmonic valve. The valves normally open and close to allow blood to flow in one direction. In pulmonic stenosis the valves are usually fused. Blood then has to squeeze all through a much slighter area than regular, which causes pressure surplus in the right side of the heart and the heart ought to get bigger and work harder to

maintain to pump blood all the way through this narrowing (stenosis). In excess of instance arrhythmias can happen, as well as congestive heart failure. (PBV) has been distinguished to be successful for valvular stenosis, and is calculated the first-line management for relentless PVS in humans and dogs. According to foregoing journalism of human and dogs, complications of PBV subsequent to flourishing lessening of PG incorporated Restenosis of pulmonary valve, tricuspid valve regurgitation (TR), and pulmonary valve deficiency (PI).

Restenosis was noticed in a quantity of patients throughout long term follow-up subsequent to PBV despite diminishing of the peak instantaneous heaviness gradient across the pulmonary valve (PG) at instantaneous follow-up after PBV. To the best of author's acquaintance, there has been no statement in veterinary medicine focusing on the complications of PBV, Specially Restenosis, for the duration of long-term follow-up.

## II. MATERIALS AND METHODS

Dogs who underwent successful PBV due to severe PVS, and whose long-term follow-up was available, were included in the study. A diagnosis of PVS was established by physical examination, thoracic radiography and echocardiography. Dogs with synchronized heart disease that was not hemodynamically noteworthy were included, but dogs with hemodynamically important concurrent heart disease were disqualified from the study. The result of acquired surrounded by one month after PBV was definite as the short-term follow-up.

Severity and localization of stenosis were evaluated using echocardiography before PBV. All echo cardio graphic images were acquired using ultrasound unit equipped with 4, 7, and 10 MHz transducers. Pulmonic blood flow velocity was assessed by continuous-wave Doppler using the right parasternal small axis +/- left cranial parasternal views, and advanced velocity was new to compute PG by customized Bernoulli equation. Severe PVS was diagnosed when PG was 80 mmHg or more. Strictness of PI was confidential as mild, reasonable or severe according to the degree of the rehearse jet

substantial the right ventricle: the jet extending only into the outflow territory was “mild,” the jet happening to the tricuspid valve was “severe,” and anywhere among the two was “moderate.” TR severities were assessed by color Doppler jet area to the right atrial area ratio:

- placid, less than 20%
- reasonable, 20% to 50%
- strict, greater than 50%

The interventional procedures were performed under common anesthesia maintained with isoflurane and fentanyl. The jugular vein was surgically uncovered in left imaginative recumbence, and a catheter introducer was inserted. When the jugular vein is hypo plastic, the femoral vein was worn for vascular right of entry as an alternative. After measuring the right ventricular and pulmonary artery pressures using multipurpose catheter, the pulmonary annulus diameter was measured by performing right ventricular angiography. The diameter of the balloon catheter was selected based on it being approximately 1.2 times the diameter of the pulmonary artery annulus. Successful inflation was achieved when a loss of the waist was visualized during balloon inflation. When ventricular arrhythmia was observed during the procedure, lidocaine was administered. PG was again assessed by measuring the peak pulmonary artery and right ventricle pressure after inflation, to confirm the effectiveness of the procedure.

The assessment of variables connecting the success group and the Restenosis assembly was performed. In order to examine the factors associated with Restenosis, multiple deterioration analysis was performed with the subsequent variables:

- age (months) at the time of PBV
- weight (kg)
- PG prior to PBV
- PG at short-term follow-up

- the number of balloon inflations
- Balloon Annulus Rate (BAR)
- concurrent congenital heart disease
- atenolol administration prior to PBV, and
- Candesartan administration prior to PBV.

Dissimilarity with  $P < 0.05$  was measured considerable.

### III. RESULTS

A total of 40 dogs underwent PBV throughout the study period. Two cases were unproductive and disqualified from the study--one of them died for the duration of the practice due to puncture of pulmonary artery, and the supplementary did not accomplish assistance of stenosis. Consequently, the immediate success rate was 95% (38/40). The characteristics and quantifiable features of cases were summarized. The mean PG of 38 dogs proceeding to PBV was 138.5 mmHg. PG was significantly decreased to 42.7 mmHg postoperatively ( $P < 0.001$ ). The signify numbers of balloon inflations and the efficient BAR.

The median follow-up period was 37.8 months (ranging from 10.3 to 73.9 months). Fourteen diverse breeds were represented in this assemblage of dogs. The common breeds incorporated Chihuahua (n=5), mixed breed dogs (n=3), French bulldogs (n=2), and miniature pinschers (n=2).

In 26 dogs for which long-term follow up was accessible, there was a momentous lessening in mean PG from 149.8 mmHg (ranging from 80.9 to 267.9 mmHg) to 43.7 mmHg (range 16.1 to 74.9 mmHg) subsequent to PBV ( $P < 0.001$ ) at short-term follow-up. Restenosis was experimental in 7 out of 24 dogs throughout long-term follow-up (Table 1). The medium time when Restenosis was exposed was 5.5 months (ranging from 1.5 to 68.2 months) after PBV.

*Table 1: Characteristics and clinical findings of success group and Restenosis group*

Variables	Success group (n = 16)	Restenosis group (n = 6)	P value
Sex (male/female)	7/10	7/2	
Age (months)	29.8±37.9 (4.0-127.7)	20.9±27.0 (3.3-68.8)	0.86
Weight (kg)	7.4±5.7 (3.8-15.1)	10.6± 8.3 (2.5-18.9)	0.44
Pre-PBV PG (mmHg)	150.1±63.8 (82.9-269.9)	156.4±58.8 (92.8-247.2)	1.03
PG in short-term follow-up (mmHg)	41.3 (18.1-68.1)	54.2±16.7 (43.8-76.9)	0.30
Numbers of balloon inflation	5.3±3.5 (3.0-8.0)	6.3±3.6 (4.0-8.0)	0.36
BAR	3.4±2.2 (3.1-3.8)	3.4±2.3 (3.3-4.0)	0.38

All dogs were prearranged one or more medications previous to PBV. Fourteen dogs were on beta-blockers, 15 dogs were on candesartan, and 2 dogs were on enalapril. Compound deterioration analysis acknowledged atenolol administration proceeding to PBV as the independent predictors of Restenosis all through long-term follow-up (Table 2). For the reason that all dogs except for one were on atenolol and candesartan subsequent to PBV, medication after PBV was not incorporated in multiple deterioration analysis.

Five out of 26 dogs were classified as having mild PI; seven dogs had moderate PI, and no

dogs had severe PI before PBV. PI in four dogs worsened after PBV in short expression follow-up, even though the strictness of PI in two dogs was enhanced during long-term follow-up. TR was revealed in four dogs previous to PBV. Two of them had mild TR and the other two had severe TR. Although deterioration of TR severity was observed in 14 dogs at short-term follow-up, TR improved at long-term follow-up in 12 dogs. None of the dogs was considered to have severe TR at the latest follow-up. The right-sided heart failure due to PI and/or TR was not developed in any dogs during the observation period.

**Table 2: Results of multiple regression analysis.**

Variables	95% Confidence interval	P value
Age (months)	-0.007 to 0.015	0.21
Weight (kg)	-0.076 to 0.058	0.82
Pre-PBV PG (mmHg)	-0.005 to 0.012	0.24
Short-term follow-up PG (mmHg)	-0.022 to 0.022	1.50
Numbers of balloon inflation	-0.288 to 0.034	0.15
Balloon annulus ratio (BAR)	-1.463 to 0.366	0.27
Pre-PBV beta-blocker	0.177 to 1.076	0.06
Pre-PBV candesartan	-0.150 to 0.946	0.19

#### IV. DISCUSSION AND CONCLUSION

Previous studies reported that Restenosis after PBV was noticed in long-term follow-up and that it progressed over time. In the present study, 7 out of 26 dogs (29.3%) developed Restenosis after successful PBV at medium to long-term follow-up (1.5 to 68.2 months). The incidence of Restenosis in this study appeared to be about the same as those of previous veterinary reports (11-33%).

BAR < 1.2 and instantaneous post Valvuloplasty gradient > 30 mmHg.15 No dogs in the Restenosis collection had BAR < 1.2 in our study. In adding together, post PBV PG was not statistically dissimilar connecting the Restenosis group and accomplishment group. BAR or PG position PBV did not appear to be related to the happening of Restenosis moreover.

Our present study revealed that our present study revealed that beta-blocker administration prior to PBV was associated with incidence of Restenosis. Beta blockers have negative chronotropic and isotropic effects, which could

Possibly reduce the mechanical stress to the heart valve. The mechanical stretch to cardiac fibroblasts increased collagen. The mechanical

stretch to cardiac fibroblasts increased collagen and glycol saminoglycan in vitro.<sup>16</sup> a human pulmonary valve consists of endothelial cell, fibroblast, glycol saminoglycan, and collagen, <sup>17</sup> as in dogs. Although degeneration of the pulmonary valve after PBV was not pathohistologically investigated at this time, pathological changes due to mechanical stress could possibly be related to Restenosis. Diminution of mechanical stress could be one of the approaches for preventing Restenosis, even though a potential study is needed. Furthermore, carvedilol afforded superb profound protection against balloon angioplasty-induced neointimal smooth muscle cell proliferation, migration, and vascular stenosis in an animal model.

Exacerbation of PI and TR was observed in some dogs after PBV; however, right-sided heart failure due to PI or TR was not experiential in any of our dogs. The same propensity was experiential in previous veterinary studies as well. In human patients, prevalence of right-sided heart failure due to PI was reportedly low among those who underwent PBV compared with those who underwent surgery. It was suggested that PI was related to a large BAR, and that the severity of PI was associated also with the dysfunction of the right ventricular. Selection of an appropriate balloon size on the basis of accurate measurement of pulmonary artery annulus is required

in order to prevent right-sided congestive heart failure.

Even though none of our patients urbanized heart failure in this reading, dogs with Restenosis and valvular regurgitation are supposed to be measured high-risk patients to expand heart malfunction. Boundaries to this study were principally associated with its demonstration nature. The numeral of dogs at long-term follow-up was diminutive, and this could have prejudiced our outcome.

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