

The role of preoperative pulmonary arterial compliance in cardiac outcomes after bidirectional Glenn procedure

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Abstract

Background:

Pulmonary arterial compliance (PAC) reflects vascular distensibility. Although pulmonary vascular resistance index (PVRI) is routinely used to assess surgical suitability, the clinical relevance of PAC in infants with single-ventricle physiology is not well defined. We evaluated the association between preoperative PAC and postoperative morbidity following BDG surgery.

Methods:

We performed a retrospective cohort study of infants with single-ventricle congenital heart disease who underwent pre-BDG cardiac catheterization at UTHealth Houston between 2018-2025. PAC was calculated as stroke volume divided by pulmonary pulse pressure and analyzed both continuously and in tertiles. The primary outcome was composite postoperative morbidity, including pleural effusion, postoperative pulmonary vasodilator use, oxygen requirement at discharge, or length of stay greater than 7 days. Associations were examined using Spearman correlations and logistic regressions. Receiver operating characteristic analyses compared discrimination between PVRI alone and models incorporating PAC and mean pulmonary artery pressure (mPAP).

Results:

Seventy-three infants met the inclusion criteria. PAC demonstrated a moderate inverse correlation with mean pulmonary artery pressure ($\rho = -0.45$, $p < 0.001$) but was not associated with PVRI or early postoperative Glenn pressure. Low PAC was significantly associated with increased composite morbidity (OR 6.9, 95% CI 1.31–36.45, $p = 0.023$), whereas PVRI alone was not. Adding PAC tertiles to a model with PVRI and mPAP improved discrimination from AUC of 0.59 to 0.73 ($\Delta\text{AUC } p = 0.032$).

Conclusions:

Lower pulmonary arterial compliance is associated with higher postoperative morbidity after BDG surgery and may serve as an additional preoperative marker to refine hemodynamic assessment in single-ventricle patients.

Background

The bidirectional Glenn (BDG) procedure is a critical stage in the surgical palliation of children with congenital heart disease, particularly those with single ventricle physiology such as hypoplastic left heart syndrome[1]. As part of the multistage palliative strategy, BDG involves an anastomosis between the superior vena cava and the pulmonary arteries to provide passive pulmonary blood flow[2, 3]. Because of the success of this circulation depends heavily on the pulmonary vasculature, preoperative pulmonary vascular resistance (PVR) has been the current standard in measuring pulmonary hemodynamics and predicting postoperative outcomes of the surgery[3].

However, recent studies have highlighted limitations in the use of PVR for such predictions[4, 5]. Measurement of PVR challenges includes difficulty estimating pulmonary blood flow in the presence of

aortopulmonary collaterals and poor reliability of pressure measurements in nonpulsatile systems[6]. Due to the imprecision in the current PVR measurement and calculations, the predictive accuracy of PVR for BDG outcomes remains suboptimal[4]. In the evaluation of pulmonary hypertension and right ventricular function, studies have demonstrated the potential advantages of pulmonary arterial compliance (PAC) over the traditional PVR[7, 8]. PAC, calculated as stroke volume divided by pulmonary pulse pressure, reflects the elastic properties of the pulmonary vasculature and captures the pulsatile component of the right ventricular afterload [7, 9]. In contrast to PVR, which measures only steady-state resistance to flow, PAC provides more physiologically relevant information about distensibility and elasticity of the pulmonary arteries[10].

PAC and PVR are inversely related through a hyperbolic relationship, with compliance falling precipitously even with a mild increase in resistance[11]. In pediatric populations with pulmonary arterial hypertension and congenital heart disease, lower PAC independently predicts mortality and adverse outcomes, with evidence suggesting this relationship is independent of PVR in the adult population [12, 13]. Given that BDG outcomes depend heavily on the quality of the pulmonary vasculature, PAC may serve as an additional preoperative marker to refine hemodynamic assessment[6, 14]. However, the specific role of preoperative PAC in cardiac outcomes after BDG has not been systematically studied. In particular, the predictive value of PAC compared to traditional PVR measurements remains unclear.

We hypothesize that preoperative pulmonary artery compliance (PAC) more accurately predicts postoperative morbidity than pulmonary vascular resistance (PVR) in children undergoing the bidirectional Glenn (BDG) procedure.

METHODS

Study Design

This was a retrospective cohort study of children with single-ventricle physiology who underwent superior cavopulmonary anastomosis (Glenn procedure) at UTHealth Houston. The study was reviewed and approved by the University of Texas Health Science Center at Houston Institutional Review Board (IRB). Because many patients underwent surgery years before data collection, and all analyses used de-identified data, the IRB granted a waiver of informed consent and assent.

Study Population

We identified all patients who underwent a bidirectional Glenn (BDG) procedure between January 2018 and May,2025.

Patients were included if they had a diagnosis consistent with single-ventricle physiology and a preoperative cardiac catheterization before Glenn surgery. Patients with missing hemodynamic variables needed to calculate pulmonary arterial compliance were excluded.

Data Collection and Variables

Demographic, anatomic, surgical, hemodynamic, and postoperative data were obtained from the institutional clinical database. Only de-identified records were analyzed.

Hemodynamic Variables

Hemodynamic variables abstracted from catheterization reports included systolic, diastolic, and mean pulmonary artery pressures, right atrial pressure, pulmonary capillary wedge or left atrial pressure, cardiac index, heart rate, and pulmonary vascular resistance index. The size of the pulmonary arteries obtained from angiograms during the same cardiac catheterization was used to estimate the Nakata index. Stroke volume was derived by dividing cardiac output by heart rate, with cardiac output calculated as the cardiac index multiplied by body surface area. Pulmonary arterial compliance was calculated using the standard formula: $PAC = \text{Stroke Volume} / (sPAP - dPAP)$

Echocardiographic Variables

Echocardiograms performed preoperatively and before hospital discharge were reviewed for ventricular systolic function, ventricular size, and atrioventricular valve regurgitation (AVVR). For comparative analyses, ventricular systolic function and AVVR variables were collapsed into clinically meaningful binary categories: normal function versus any dysfunction and none or mild regurgitation versus moderate or severe regurgitation, respectively.

Postoperative Outcomes

The primary outcome was a composite morbidity, defined a priori as the presence of one or more clinically relevant postoperative complications. These included pleural effusion, postoperative pulmonary vasodilator use, oxygen requirement at discharge, or length of stay greater than 7 days. Because these variables defined the outcome itself, they were not included as predictors in any regression models.

Statistical Analysis

Continuous variables were summarized using the median and interquartile range (IQR). Categorical variables were summarized using counts and percentages. Pulmonary arterial compliance was examined both as a continuous measure and in tertiles, which were defined to allow detection of non-linear associations and to create clinically interpretable groups representing low, mid, and high compliance. Comparisons across pulmonary compliance tertiles were performed using Kruskal–Wallis testing for continuous variables and chi-square testing for categorical variables. Correlations between continuous compliance values and other hemodynamic measures were assessed using Spearman rank correlation. Logistic regression was used to evaluate associations between predictors and the

composite morbidity outcome. Firth penalized logistic regression was performed as a sensitivity analysis to mitigate small-sample and separation bias.

To assess the incremental predictive value of pulmonary arterial compliance, predicted probabilities from a model containing PVRI alone were compared with those from a model containing both PVRI, main PAP, and pulmonary compliance tertiles. Receiver operating characteristic curves were constructed, and areas under the curve were compared using DeLong's method. All analyses were performed using Stata (StataCorp, College Station, Texas).

RESULTS

Baseline Characteristics

A total of 73 patients undergoing superior cavopulmonary connection were included and stratified by pulmonary arterial compliance (PAC) tertiles: (Low PAC (T1): $n = 25$ (34.2%), Mid PAC (T2): $n = 24$ (32.8%), High PAC (T3): $n = 24$ (32.8%)).

Table 1 summarizes patient, anatomic, and hemodynamic characteristics of the patient. The median age at the time of Glenn surgery was 6 months (IQR 4–8). There were more males ($n = 41$, 56.2%). Fourteen (19.2%) had a form of genetic syndrome. Diagnoses were heterogeneous and included hypoplastic left heart syndrome ($n = 19$, 26%), atrioventricular septal defects ($n = 15$, 20.5%), tricuspid atresia ($n = 11$, 15.1%), and other single-ventricle variants ($n = 28$, 38.4%). Most of the patients were palliated with a Sano conduit ($n = 28$, 38.4%). Age, sex, diagnosis distribution, shunt type, and genetic syndromes were similar across tertiles.

Several hemodynamic variables differed meaningfully by the PAC group. Median mean pulmonary artery pressure (mPAP) decreased across tertiles (T1: 16 mmHg vs. T3: 12.5 mmHg; $p = 0.001$), while other preoperative measures (right atrial pressure, pulmonary vascular resistance index (PVRI), cardiac index, and Nakata index) did not differ significantly. Echocardiographic measures (pre- and postdischarge atrioventricular valve regurgitation and ventricular function) were similar across groups as well.

Postoperative outcomes demonstrated clear gradients by PAC tertile.

Lower PAC was associated with higher frequency of postoperative vasodilator use (T1: 57% vs. T3: 20%; $p = 0.001$), greater pleural effusion (T1: 57.9% vs. T3: 5.3%; $p = 0.006$) and more frequent discharge on home oxygen (T1: 56.3% vs. T3: 6.3%; $p = 0.024$). Low PAC tertile was more associated with the composite early morbidity (T1: 43.4% vs. T3: 28.3%; $p = 0.027$).

Correlation Between PAC and Hemodynamic Measures

Spearman correlation analyses assessed relationships between continuous PAC and three key hemodynamic parameters. There was no meaningful correlation between PAC and pulmonary vascular resistance index ($\rho = -0.06$, $p = 0.64$). Compliance demonstrated a moderate inverse association with

mean pulmonary artery pressure ($p = -0.45, p < 0.001$). No association was observed between compliance and the immediate mean Glenn pressure ($p = -0.01, p = 0.92$). Corresponding scatterplots with fitted lines are shown in Fig. 1.

Associations of PAC with Composite Morbidity

On univariable analysis (Table 2), PVRI was not associated with the risk of composite morbidity (OR = 0.62; 95% CI 0.30–1.28, $p = 0.20$). When modeled as a continuous variable, PAC was not significantly associated with postoperative morbidity (OR = 0.87; 95% CI 0.72–1.06; $p = 0.17$). Similarly, mean pulmonary artery pressure was not independently associated with composite morbidity (OR = 1.06; 95% CI 0.96–1.18; $p = 0.26$). In contrast, pulmonary arterial compliance tertiles demonstrated a significant association with postoperative morbidity. Infants in the lowest compliance tertile had nearly seven-fold higher odds of experiencing composite morbidity compared with those in the highest tertile (OR = 6.90; 95% CI 1.31–36.45; $p = 0.023$). The mid-compliance tertile did not differ from the high-compliance group.

In a combined PVRI and compliance tertiles model, whereas low compliance continued to show markedly elevated odds of morbidity (OR = 8.83; 95% CI 1.52–51.26; $p = 0.015$), PVRI again did not contribute meaningfully to the model (OR = 0.5; 95% CI 0.22–1.15; $p = 0.105$). When PAC was modeled continuously alongside PVRI, neither variable reached statistical significance. In additional exploratory models incorporating mean pulmonary artery pressure, mPAP was not independently associated with morbidity and did not materially alter the relationship between compliance and outcomes. In a model including PVRI, mPAP, and PAC tertiles, low compliance remained significantly associated with increased morbidity (OR = 10.75; 95% CI 1.37–84.49; $p = 0.024$), whereas neither PVRI nor mPAP were significant predictors.

In a univariate fifth penalized logistic regression, low PAC was associated with higher odds of composite morbidity compared with high PAC (OR = 5.8, 95% CI 1.2–26.7, $p = 0.025$). In adjusted penalized logistic regression, low pulmonary arterial compliance remained independently associated with increased postoperative morbidity (adjusted OR 5.95, 95% CI 1.13–31.2, $p = 0.035$), after accounting for PVRI and preoperative atrioventricular valve regurgitation.

Model Comparison Using ROC Analysis

Figure 2 demonstrates modest discrimination for the PVRI-only model, with an area under the curve of 0.59. Addition of mean pulmonary artery pressure modestly improved discrimination (AUC 0.65). Incorporation of PAC as a continuous variable resulted in a similar incremental increase (AUC 0.67), although these models remained limited in discriminatory performance.

In contrast, the model incorporating PVRI, mean pulmonary artery pressure, and PAC tertiles achieved substantially higher discrimination, with an area under the curve of 0.73. The improvement in AUC compared with the PVRI-only model was statistically significant ($\Delta\text{AUC } p = 0.032$), indicating that

categorical pulmonary arterial compliance meaningfully enhances postoperative risk classification beyond traditional resistance and pressure-based metrics.

Discussion

In this study, we evaluated the role of PAC as a preoperative hemodynamic marker of postoperative morbidity in infants with single-ventricle physiology undergoing BDG. The key findings can be summarized into the following three. First, there is a significant association between decreased PAC and increased composite postoperative morbidity, while PVR alone does not. Second, PAC demonstrated a moderate inverse correlation with mPAP, but no significant relationship with PVR or early postoperative Glenn pressure. Third, adding PAC tertiles to the existing model with the PVR index and the main pulmonary artery improved the predictive accuracy for postoperative morbidity. Combined, these findings indicate that PAC provides clinically relevant pulmonary vascular properties that were formerly not fully reflected in resistance-based metrics.

This study shows a statistically significant relationship between PAC and composite postoperative morbidity after BDG. While PVR is the traditional standard for hemodynamic characterization in Glenn patients and surgical candidacy in Glenn physiology, recent studies have shown that PVR is not associated with morbidity or mortality, indicating its limitation as a surgical prognostic tool [15]. Our study established an association between PAC and post-BDG morbidity, supporting its use for preoperative risk stratification.

In our cohort, infants in the lowest compliance tertile showed substantially higher levels of morbidity compared to those in the highest tertile. The importance of pulmonary vascular pulsatility and compliance in single-ventricle circulation in Fontan patients is currently well established. Previous studies have demonstrated that reduced PAC is associated with elevated venous pressures, impaired cardiac output, and adverse postoperative outcomes in Fontan and pre-Fontan populations[7]. In contrast to resistance-based measures, compliance reflects the ability of the pulmonary vasculature to buffer pulsatile flow, a property that may be particularly critical in passive pulmonary blood flow states such as the Glenn circulation [11, 16]. Our findings enable this correlation to be applied to the pre-Glenn population, suggesting that compliance-based metrics have prognostic value and can improve surgical risk stratification.

The improvement in model discrimination observed in our study when PAC tertiles were added to a model with PVRi and mPAP is an important finding in this study. The model with only PVRi showed an AUC of 59%, reflecting poor discrimination [17]. The combined model improved to an AUC of 73%, a threshold considered possibly meaningful for clinical discrimination [17]. The net increase of 14% in AUC was statistically significant. While the AUC in receiver operator characteristic has been criticized for its insensitivity in model comparison [18], the significant incremental increase observed in our study suggests that PAC may play a meaningful incremental role in risk stratification beyond resistance-based metrics alone. Future studies employing integrated discrimination improvement or the continuous net

reclassification improvement models may better characterize the role of PAC in preoperative risk assessment in children undergoing BDG[18].

Several observations beyond the significant relationship between PAC and composite postoperative morbidity after BDG merit discussion. Within this cohort, PAC demonstrates a moderate inverse correlation with mPAP. This finding is consistent with the known pathophysiology of vascular stiffening, resulting in elevated pressures [8]. Elevated pre-BDG mPAP (≥ 16 mmHg) has shown to be a significant risk factor for postoperative adverse events, with Tran et al. demonstrating that mPAP >16 mmHg was independently associated with morbidity (OR 4.1) while PVRi was not [15]. Therefore, the significant association between PAC and mPAP suggests that PAC reflects the underlying pulmonary vascular stiffness that contributes to elevated mPAP, supporting PAC as a physiologically grounded marker for risk stratification.

More importantly, PAC showed no correlation with PVR in this study. This highlights PAC's independence in capturing pulmonary vascular physiology from PVR, a historically used metric in pre-Glenn populations. This dissociation is consistent with prior work demonstrating that the resistance-compliance relationship shifts depending on pulmonary vasculature and blood flow, and each may independently assess the pulmonary vascular health [19]. This finding is particularly relevant in the present cohort, as all patients met conventional resistance-based criteria for Glenn candidacy. Thus, PAC may reveal meaningful hemodynamic differences despite uniformly acceptable PVR.

Lastly, PAC showed no association with early postoperative Glenn pressure. Early postoperative hemodynamics are heavily influenced by transient perioperative factors, especially ventilation strategies, as they directly affect pulmonary vascular physiology [20, 21]. The absence of an association between PAC and early Glenn pressure is therefore consistent with PAC being relatively independent of immediate postoperative hemodynamic conditions. This suggests that the prognostic value of PAC may relate more to intrinsic pulmonary vascular properties and downstream morbidity, supporting its potential utility in identifying patients at risk for adverse longer-term outcomes despite acceptable early postoperative metrics.

This study has several important limitations. Its retrospective design introduces the potential for selection bias and unmeasured confounding. Additionally, the cohort size was relatively small, limiting statistical power and contributing to wide confidence intervals, particularly in the multivariable regression analyses. Because only patients who proceeded to Glenn surgery were included, the range of PVR values was truncated, potentially attenuating its observed association with outcomes. PAC was calculated using catheterization-derived measures and may be influenced by measurement variability and loading conditions. Finally, the composite outcome, while clinically meaningful, combines heterogeneous postoperative events that may not share identical mechanistic pathways.

In infants with single-ventricle physiology undergoing BDG surgery, low PAC was associated with increased postoperative morbidity, whereas PVR alone was not. PAC may therefore serve as an additional preoperative hemodynamic tool that captures clinically relevant pulmonary vascular

properties beyond resistance-based metrics. These findings support further prospective investigation of compliance-based assessment and raise the possibility that incorporating PAC into preoperative evaluation may improve risk stratification in single-ventricle palliation pathways.

Declarations

Author Contribution

E. A conceptualization, data extraction, analysis, writing, editing and submission
S.K- data extraction, writing, DL-mentorship, design
K.M- mentorship, editing, reviewing cath tracing
H.B-mentorship, design
A.P.R- mentorship, design, editing

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Data Availability

Data used in this study is available upon request.

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Tables

Table 1. Baseline Characteristics Stratified by Pulmonary Arterial Compliance Tertiles					
Variable	Total	T1: Low PAC	T2: Mid PAC	T3: High PAC	p-value
Age, months	6 [4–8], n=73	5 [3–6]	6 [4–7]	6.5 [5–8]	0.099
Gender (Male)	41 (56.2%)	14 (34.1%)	13 (31.7%)	14 (34.1%)	0.958
Genetic syndrome (Yes)	14 (19.2%)	6 (42.9%)	5 (35.7%)	3 (21.4%)	0.575
Diagnosis group	—	—	—	—	0.862
• AVSD	15 (20.5%)	5 (33.3%)	4 (26.7%)	6 (40.0%)	—
• HLHS	19 (26.0%)	7 (36.8%)	7 (36.8%)	5 (26.3%)	—
• Other SV	28 (38.4%)	11 (39.3%)	8 (28.6%)	9 (32.1%)	—
• Tricuspid atresia	11 (15.1%)	2 (18.2%)	5 (45.5%)	4 (36.4%)	—
Shunt type group	—	—	—	—	0.056
• Non-shunt	11 (15.1%)	5 (45.5%)	4 (36.4%)	2 (18.2%)	—
• Other shunt	13 (17.8%)	1 (7.7%)	3 (23.1%)	9 (69.2%)	—
• PA band	21 (28.8%)	6 (28.6%)	9 (42.9%)	6 (28.6%)	—
• Sano	28 (38.4%)	13 (46.4%)	8 (28.6%)	7 (25.0%)	—
Hemodynamics variables	Total	T1	T2	T3	p-value
mPAP (mmHg)	13.5 [12–16], n=73	16 [14–23]	13 [11.5–15]	12.5 [11.5–14.5]	0.001
RAP (mmHg)	6 [5–8], n=73	7 [5–8]	6 [5–7]	6 [4.5–8]	0.478
LAP/PCWP (mmHg)	7 [5–8], n=70	8 [7–9]	6 [5–7]	7 [5–8]	0.069
Cardiac index (L/min/m ²)	4.0 [3.29–5.05], n=73	4.0 [3.44–4.77]	3.87 [3.03–4.70]	4.36 [3.55–5.99]	0.201
PVRi (WU·m ²)	1.75 [1.21–2.17], n=73	1.77 [1.05–2.33]	1.77 [1.38–2.13]	1.66 [0.97–2.09]	0.595
Pulse pressure (PP)	6 [3–9], n=73	13 [9–23]	5.5 [3–7]	2 [2–4]	<0.001
Pulmonary arterial compliance (PAC)	1.75 [0.93–3.77], n=73	0.50 [0.35–0.93]	1.79 [1.48–2.22]	4.70 [3.81–5.76]	<0.001
Nakata index (mm ² /m ²)	180.9 [105.9–268.4], n=70	188.8 [79–306]	173.8 [122–274]	180.9 [114–252]	0.899
Echocardiographic Variable	Total	T1	T2	T3	p-value

Preop SV function	—	—	—	—	0.604
• Normal	52 (76.5%)	20 (38.5%)	15 (28.9%)	17 (32.7%)	—
• Any dysfunction	16 (23.5%)	4 (25.0%)	6 (37.5%)	6 (37.5%)	—
Preop AVVR	—	—	—	—	0.465
• None/Mild	46 (68.7%)	18 (39.1%)	13 (28.3%)	15 (32.6%)	—
• Moderate/Severe	21 (31.3%)	5 (23.8%)	7 (33.3%)	9 (42.9%)	—
Predisch SV function	—	—	—	—	0.446
• Normal	45 (65.2%)	18 (40.0%)	13 (28.9%)	14 (31.1%)	—
• Any dysfunction	24 (34.8%)	6 (25.0%)	8 (33.3%)	10 (41.7%)	—
Predisch AVVR	—	—	—	—	0.157
• None/Mild	46 (68.7%)	18 (39.1%)	15 (32.6%)	13 (28.3%)	—
• Moderate/Severe	21 (31.3%)	5 (23.8%)	5 (23.8%)	11 (52.4%)	—
Postoperative Outcomes	Total	T1	T2	T3	p-value
Length of stay (days)	12 [7–24], n=73	18 [13–33]	9 [6–19.5]	10 [6.5–19]	0.014
Delayed sternal closure (Yes)	28 (38.4%)	16 (57.1%)	8 (28.6%)	4 (14.3%)	0.002
Pleural effusion (Yes)	19 (26.0%)	11 (57.9%)	7 (36.8%)	1 (5.3%)	0.006
Any postop vasodilator	35 (48.6%)	20 (57.1%)	8 (22.9%)	7 (20.0%)	0.001
Discharged on oxygen	16 (21.9%)	9 (56.3%)	6 (37.5%)	1 (6.3%)	0.024
Composite early morbidity	53 (72.6%)	23 (43.4%)	15 (28.3%)	15 (28.3%)	0.027

Table 2. Univariable and Multivariable Associations with Composite Morbidity

Predictor	OR	95% CI	p-value
Univariable Models			
PVRi (continuous)	0.62	0.30–1.28	0.198
PAC (continuous)	0.87	0.72–1.06	0.167
PAC tertiles (ref = High PAC)			
Low PAC (T1)	6.90	1.31–36.45	0.023
Mid PAC (T2)	1.00	0.31–3.22	1.000
Multivariable Logistic Models			
PVRi + PAC tertiles			
PVRi	0.50	0.22–1.15	0.105
Low PAC (T1)	8.83	1.52–51.26	0.015
Mid PAC (T2)	1.12	0.34–3.73	0.852
PVRi + mPAP + PAC tertiles			
PVRi	0.53	0.22–1.27	0.156
mPAP	0.98	0.87–1.10	0.686
Low PAC (T1)	10.75	1.37–84.49	0.024
Mid PAC (T2)	1.13	0.34–3.75	0.843
Penalized Logistic Regression (Firth)			
Low PAC (T1) vs High	5.76	1.24–26.74	0.025
Adjusted (PVRi + AVVR)	5.95	1.13–31.2	0.035

Figures

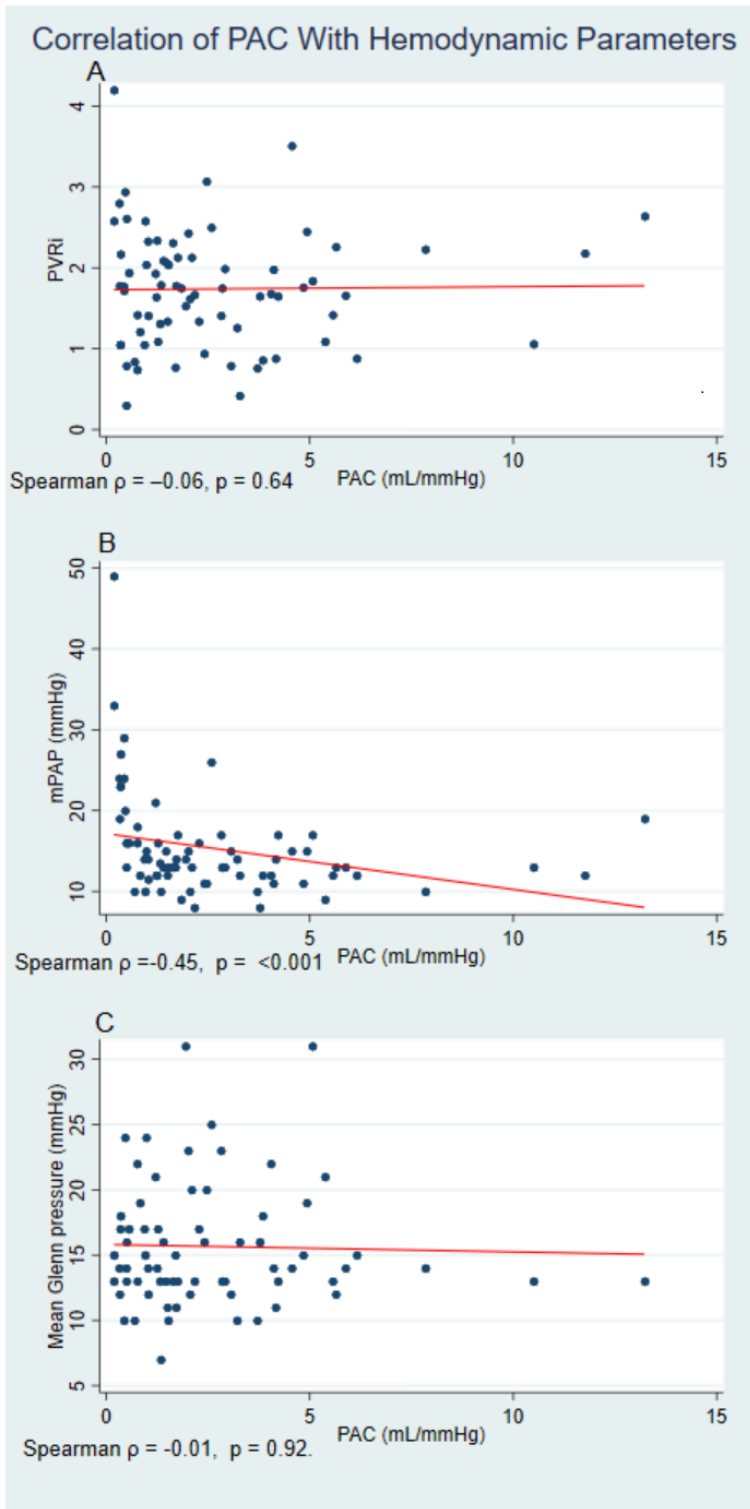


Figure 1

Correlation of Pulmonary Arterial Compliance (PAC) With Hemodynamic Parameters

Panel A: Scatter plot demonstrating the relationship between pulmonary arterial compliance (PAC) and indexed pulmonary vascular resistance (PVRi). A fitted linear trend line is shown. PAC was not significantly correlated with PVRi (Spearman $\rho = -0.06$, $p = 0.64$).

Panel B: Scatter plot illustrating the association between PAC and mean pulmonary arterial pressure (mPAP). Increasing PAC was moderately and significantly associated with lower mPAP (Spearman $\rho = -0.45, p < 0.001$), indicating an inverse relationship between pulmonary compliance and pulmonary arterial pressure.

Panel C: Scatter plot assessing the relationship between PAC and mean Glenn pressure on postoperative day 1. PAC showed no meaningful correlation with Glenn pressures (Spearman $\rho = -0.01, p = 0.92$).

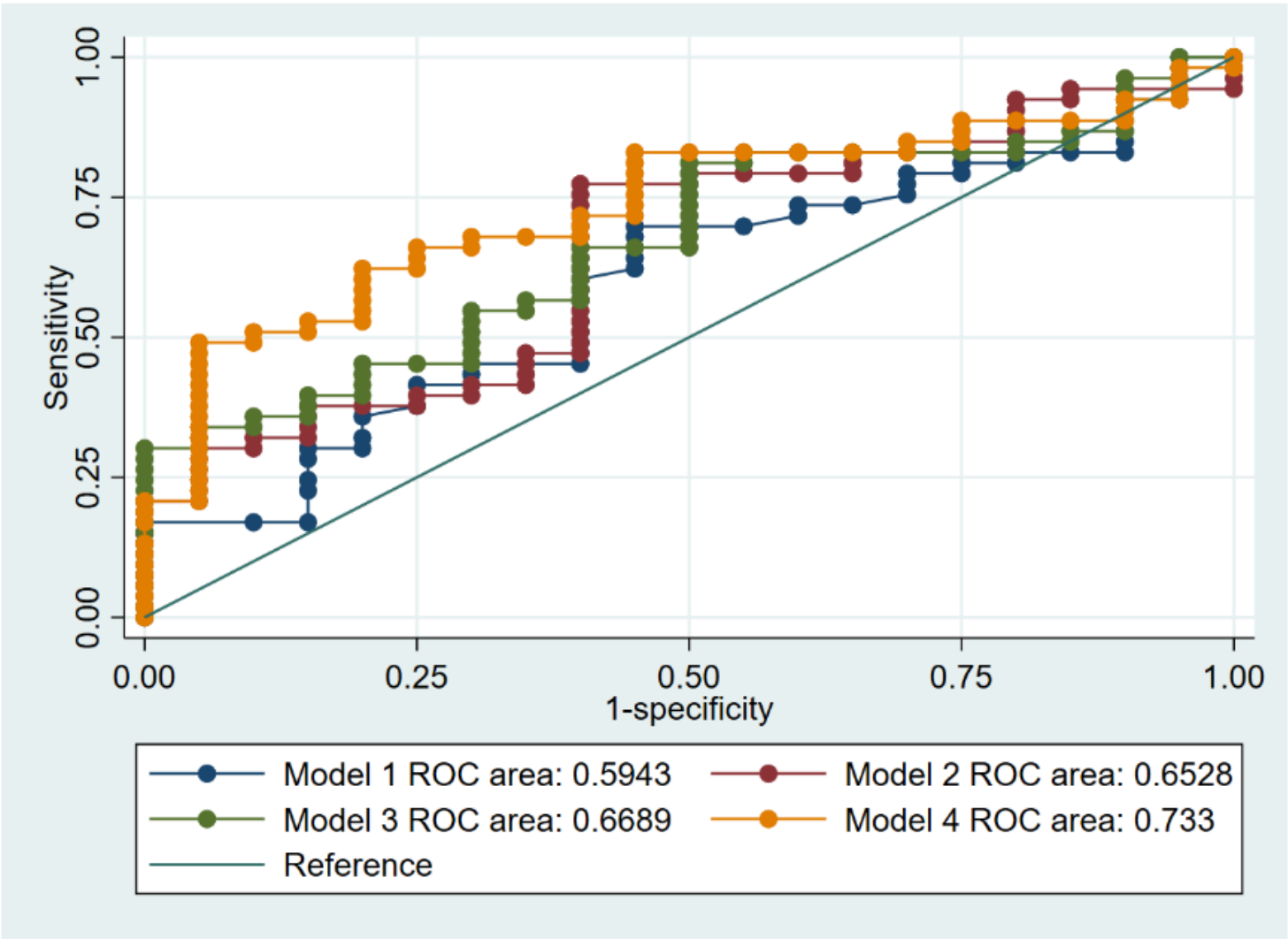


Figure 2

Receiver operating characteristic curves comparing model discrimination for postoperative composite morbidity. Model 1 includes PVRI alone (AUC 0.59). Model 2 includes PVRI and mean pulmonary artery pressure (AUC 0.65). Model 3 includes PVRI, mean pulmonary artery pressure, and PAC as a continuous variable (AUC 0.67). Model 4 includes PVRI, mean pulmonary artery pressure, and PAC tertiles (AUC 0.73). The improvement in discrimination for Model 4 compared with the PVRI-only model was statistically significant ($\Delta AUC p = 0.032$).