**Supplemental Appendix**

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| **Table S1. Types and Sites of Index Thromboembolism** | | | |
|  | **ATE**  **n=111** | **ATE and VTE n=95** | **All TE**  **n=206** |
| **Arterial, n (%)** | | | |
| Upper extremity and/or thoracic aorta | 10 (9.0) | 10 (10.5) | 20 (9.7) |
| Lower extremity and/or iliac artery, abdominal aorta | 77 (69.4) | 64 (67.4) | 141 (68.4) |
| Unspecified/other | 28 (25.2) | 21 (22.1) | 49 (23.8) |
| **Venous, n (%)** | | | |
| Upper extremity |  |  |  |
| *Axillary* | - | 10 (10.5) | 10 (4.9) |
| *Internal jugular* | - | 10 (10.5) | 10 (4.9) |
| *Subclavian* | - | 10 (10.5) | 10 (4.9) |
| *Superior vena cava* | - | 4 (4.2) | 4 (1.9) |
| *Unspecified/other* | - | 10 (10.5) | 10 (4.9) |
| Lower extremity |  |  |  |
| *Femoral* | - | 30 (31.6) | 30 (14.6) |
| *Iliac* | - | 19 (20.0) | 19 (9.2) |
| *Popliteal* | - | 10 (10.5) | 10 (4.9) |
| *Tibial vein* | - | 0 (0) | 0 (0) |
| *Inferior vena cava* | - | 5 (5.3) | 5 (2.4) |
| *Unspecified/other* | - | 20 (21.1) | 20 (9.7) |
| **Other, n (%)** | | | |
| Pulmonary embolism | - | 10 (10.5) | 10 (4.9) |
| Portal | - | 10 (10.5) | 10 (4.9) |
| Cerebral sinovenous thrombosis (CSVT) | - | 10 (10.5) | 10 (4.9) |
| Renal | - | 10 (10.5) | 10 (4.9) |
| Other thoracic veins | - | 5 (5.3) | 5 (2.4) |

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| **Table S2. Types of Congenital Cardiac Surgery** | | | |
|  | **ATE**  **n=111** | **ATE and VTE**  **n=95** | **All Events**  **n=206** |
| **Pulmonary Artery,** n (%) |  |  | 52 (25.2) |
| Pulmonary artery stenosis | 18 (16.2) | 11 (11.6) | 29 (14.1) |
| Pulmonary artery atresia | 13 (11.7) | 10 (10.5) | 23 (11.1) |
| **Shunts,** n (%) |  |  | 61 (29.6) |
| Superior vena cava to pulmonary artery (Bi-directional and Classic Glenn) | 23 (20.7) | 12 (12.6) | 35 (17.0) |
| Subclavian to pulmonary artery (Blalock-Taussig) | 10 (9.0) | 3 (3.2) | 13 (6.3) |
| Central | 10 (9.0) | 2 (2.1) | 12 (5.8) |
| Ascending aorta to pulmonary artery (Waterston) | 0 (0) | 1 (1.1) | 1 (0.5) |
| **Septal Defects,** n (%) |  |  | 84 (40.8) |
| Atrial septal defect (secundum) | 25 (22.5) | 5 (5.3) | 30 (14.6) |
| Tetralogy of Fallot (with/without pulmonary atresia) | 10 (9.0) | 3 (3.2) | 13 (6.3) |
| Ventricular septal defect (single and multiple) | 16 (14.4) | 3 (3.2) | 19 (9.2) |
| Atrioventricular canal (complete) | 17 (15.3) | 2 (2.1) | 19 (9.2) |
| Atrial septal defect and ventricular septal defect | 0 (0) | 2 (2.1) | 2 (1) |
| Atrioventricular canal (incomplete, partial, intermediate, transitional) | 0 (0) | 1 (1.3) | 1 (0.5) |
| **Single Ventricle and Other Complex Cardiac Anomalies,** n (%) |  |  | 28 (13.6) |
| Fontan | 5 (4.5) | 2 (2.1) | 7 (3.4) |
| Right or left ventricle to pulmonary artery conduit | 2 (1.8) | 3 (3.2) | 5 (2.4) |
| Aortic outflow obstruction and aortic arch hypoplasia | 2 (1.8) | 5 (5.3) | 7 (3.4) |
| Double outlet right ventricle | 2 (1.8) | 3 (3.2) | 5 (2.4) |
| Pulmonary artery bands | 0 (0) | 2 (2.1) | 2 (1.0) |
| Atrioventricular valve closure | 0 (0) | 2 (2.1) | 2 (1.0) |
| Subaortic obstruction | 0 (0) | 0 (0) | 0 (0) |
| **Cardiac Valves,** n (%) |  |  | 22 (10.7) |
| Mitral valve | 12 (10.8) | 0 (0) | 12 (5.8) |
| Tricuspid valve | 0 (0) | 0 (0) | 0 (0) |
| Aortic valve | 10 (9.0) | 0 (0) | 10 (4.9) |
| Ventriculomyotomy/ventriculomyectomy | 0 (0) | 0 (0) | 0 (0) |
| **Aortic anomalies,** n (%) |  |  | 25 (12.1) |
| Hypoplastic or interrupted aortic arch | 10 (9.0) | 10 (10.5) | 20 (9.7) |
| Coarctation of the aorta | 10 (9.0) | 5 (5.3) | 15 (7.3) |
| **Venous anomalies,** n (%) |  |  | 20 (12.1) |
| Anomalous pulmonary venous return, complete and incomplete | 0 (0) | 0 (0) | 0 (0) |
| Pulmonary venous stenosis | 5 (4.5) | 10 (10.5) | 15 (7.3) |
| Cor triatriatum | 5 (4.5) | 0 (0) | 5 (2.4) |
| **Great Vessels,** n (%) |  |  | 10 (4.9) |
| Transposition of the great arteries | 0 (0) | 10 (10.5) | 10 (4.9) |
| Aortic root translocation with ventricular septal defect/pulmonary stenosis | 0 (0) | 0 (0) | 0 (0) |
| **Other,** n (%) |  |  | 10 (4.9) |
| Anomalous coronary artery | 10 (9.0) | 0 (0) | 10 (4.9) |
| Anomalous pulmonary artery | 0 (0) | 0 (0) | 0 (0) |
| Truncus Arteriosus | 0 (0) | 0 (0) | 0 (0) |
| Sinus of Valsalva | 0 (0) | 0 (0) | 0 (0) |

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| **Appendix A. Thromboembolism ICD10 Codes** | |
| Code | Location |
| I74 | Arterial thromboembolism and thrombosis |
| I74.0 | Arterial thromboembolism of abdominal aorta |
| I74.09 | Other arterial thromboembolism of the abdominal aorta |
| I74.1 | Arterial thromboembolism of aorta |
| I74.10 | Unspecified parts of the aorta |
| I74.11 | Arterial thromboembolism thoracic aorta |
| I74.19 | Arterial thromboembolism other parts of the aorta |
| I74.3 | Arterial thromboembolism of lower extremities |
| I74.4 | Arterial thromboembolism of extremities, unspecified |
| I74.5 | Arterial thromboembolism of iliac artery |
| I74.8 | Arterial thromboembolism of other artery |
| I74.9 | Arterial thromboembolism of unspecified artery |
| I82 | Other VTE |
| I82.2 | Vena cava and thoracic veins |
| I82.21 | SVC |
| I82.210 | Acute SVC |
| I82.22 | IVC |
| I82.220 | Acute IVC |
| I82.29 | VTE thoracic veins |
| I82.290 | Acute thoracic veins |
| I82.3 | Renal vein |
| I82.4 | Acute DVT LE |
| I82.40 | Acute DVT unspecified LE |
| I82.401 | Acute DVT unspecified RLE |
| I82.402 | Acute DVT unspecified LLE |
| I82.403 | Acute DVT unspecified Bilateral |
| I82.409 | Acute unspecified DVT unspecified LE |
| I82.41 | Acute femoral vein |
| I82.411 | Acute RFV |
| I82.412 | Acute LFV |
| I82.413 | Acute bilateral FV |
| I82.419 | Acute unspecified FV |
| I82.42 | Acute iliac vein |
| I82.421 | Acute R iliac vein |
| I82.422 | Acute L iliac vein |
| I82.423 | Acute bilateral iliac vein |
| I82.429 | Acute unspecified iliac vein |
| I82.43 | Acute popliteal vein |
| I82.431 | Acute R popliteal vein |
| I82.432 | Acute L popliteal vein |
| I82.433 | Acute bilateral popliteal vein |
| I82.439 | Acute unspecified popliteal vein |
| I82.44 | Acute tibial vein |
| I82.441 | Acute R tibial vein |
| I82.442 | Acute L tibial vein |
| I82.443 | Acute bilateral tibial vein |
| I82.449 | Acute unspecified tibial vein |
| I82.45 | Acute peroneal vein |
| I82.451 | Acute R peroneal vein |
| I82.452 | Acute L peroneal vein |
| I82.453 | Acute bilateral peroneal vein |
| I82.459 | Acute unspecified peroneal vein |
| I82.46 | Acute calf vein |
| I82.461 | Acute R calf vein |
| I82.462 | Acute L calf vein |
| I82.463 | Acute bilateral calf vein |
| I82.469 | Acute unspecified calf vein |
| I82.49 | Acute other DVT LE |
| I82.491 | Acute other DVT RLE |
| I82.492 | Acute other DVT LLE |
| I82.493 | Acute other DVT bilateral LE |
| I82.499 | Acute other DVT unspecified LE |
| I82.4Y | Acute unspecified DVT proximal LE |
| I82.4Y1 | Acute unspecified DVT proximal RLE |
| I82.4Y2 | Acute unspecified DVT proximal LLE |
| I82.4Y3 | Acute unspecified DVT proximal bilateral LE |
| I82.4Y9 | Acute unspecified DVT proximal unspecified LE |
| I82.4Z | Acute unspecified DVT distal LE |
| I82.4Z1 | Acute unspecified DVT distal RLE |
| I82.4Z2 | Acute unspecified DVT distal LLE |
| I82.4Z3 | Acute unspecified DVT distal bilateral LE |
| I82.4Z9 | Acute unspecified DVT distal unspecified LE |
| I82.6 | Acute UE |
| I82.60 | Acute unspecified UE |
| I82.601 | Acute unspecified RUE |
| I82.602 | Acute unspecified LUE |
| I82.603 | Acute unspecified bilateral UE |
| I82.609 | Acute unspecified veins unspecified UE |
| I82.62 | Acute DVT UE |
| I82.621 | Acute DVT RUE |
| I82.622 | Acute DVT LUE |
| I82.623 | Acute DVT bilateral UE |
| I82.629 | Acute DVT unspecified UE |
| I82.A | VTE axillary vein |
| I82.A1 | Acute axillary vein |
| I82.A11 | Acute R axillary vein |
| I82.A12 | Acute L axillary vein |
| I82.A13 | Acute bilateral axillary vein |
| I82.A19 | Acute unspecified axillary vein |
| I82.B | VTE subclavian vein |
| I82.B1 | Acute subclavian vein |
| I82.B11 | Acute R subclavian vein |
| I82.B12 | Acute L subclavian vein |
| I82.B13 | Acute bilateral subclavian vein |
| I82.B19 | Acute unspecified subclavian vein |
| I82.C | VTE IJV |
| I82.C1 | Acute IJV |
| I82.C11 | Acute R IJV |
| I82.C12 | Acute L IJV |
| I82.C13 | Acute bilateral IJV |
| I82.C19 | Acute unspecified IJV |
| I82.890 | Paget-Schroetter |
| I26 | PE |
| I26.0 | PE with acute cor pulmonale |
| I26.01 | Septic pulmonary embolism with acute cor pulmonale |
| I26.02 | Saddle embolus of the pulmonary artery with acute cor pulmonale |
| I26.09 | Other pulmonary embolism with acute cor pulmonale |
| I26.9 | Pulmonary embolism without acute cor pulmonale |
| I26.90 | Septic pulmonary embolism without acute cor pulmonale |
| I26.92 | Saddle embolus of the pulmonary artery without acute cor pulmonale |
| I26.93 | Single subsegmental PE w/o acute cor pulmonale |
| I26.94 | Multiple subsegmental pulmonary emboli without acute cor pulmonale |
| I26.99 | Other pulmonary embolism without acute cor pulmonale |
| I81 | Portal vein thrombosis |
| I82 | Other VTE |
| I51.3 | Intracardiac thrombosis |
| I67.6 | CSVT |
| I63.6 | CSVT |
| G0.8 | CSVT |
| I74 | Arterial thrombosis |
| I74.01 | Saddle embolus of abdominal aorta |
| I74.09 | Other arterial embolism and thrombosis of the abdominal aorta |
| I74.1 | Thrombosis of other and unspecified parts of the aorta |
| I74.10 | Thrombosis of unspecified parts of the aorta |
| I74.11 | Thrombosis of thoracic aorta |
| I74.19 | Thrombosis of other parts of the aorta |
| I74.2 | Thrombosis of arteries of the upper extremities |
| I74.3 | Thrombosis of arteries of the lower extremities |
| I74.4 | Thrombosis of arteries of extremities, unspecified |
| I74.5 | Thrombosis of the iliac artery |
| I74.8 | Thrombosis of other arteries |
| I74.9 | Thrombosis of unspecified artery |

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| **Appendix B. Cardiac Surgery Procedural Codes** | |
| CPT Code | Procedure |
| 1006321 | Surgical Procedures on the Pulmonary Artery |
| 33917 | Repair of pulmonary artery stenosis by reconstruction with patch or graft |
| 33920 | Repair of pulmonary atresia with ventricular septal defect, by construction or replacement of conduit from right or left ventricle to pulmonary artery |
| 33922 | Transection of pulmonary artery with cardiopulmonary bypass |
| 1006330 | Repair of pulmonary artery arborization anomalies by unifocalization |
| 1006322 | Pulmonary artery embolectomy |
| 33910 | Pulmonary artery embolectomy, with cardiopulmonary bypass |
| 1006238 | Repair Procedures for Septal Defects |
| 33641 | Repair atrial septal defect, secundum, with cardiopulmonary bypass, with or without patch |
| 1014133 | Closure of single ventricular septal defect, with or without patch |
| 33681 | Closure of single ventricular septal defect, with or without patch |
| 33684 | Closure of single ventricular septal defect, with or without patch; with pulmonary valvotomy or infundibular resection (acyanotic) |
| 33688 | Closure of single ventricular septal defect, with or without patch; with removal of pulmonary artery band, with or without gusset |
| 33670 | Repair of complete atrioventricular canal, with or without prosthetic valve |
| 1014135 | Complete repair tetralogy of Fallot without pulmonary atresia |
| 33692 | Complete repair tetralogy of Fallot without pulmonary atresia |
| 33694 | Complete repair tetralogy of Fallot without pulmonary atresia; with transannular patch |
| 33690 | Banding of pulmonary artery |
| 33647 | Repair of atrial septal defect and ventricular septal defect, with direct or patch closure |
| 33697 | Complete repair tetralogy of Fallot with pulmonary atresia including construction of conduit from right ventricle to pulmonary artery and closure of ventricular septal defect |
| 1014755 | Closure of multiple ventricular septal defects |
| 33675 | Closure of multiple ventricular septal defects |
| 33676 | Closure of multiple ventricular septal defects; with pulmonary valvotomy or infundibular resection |
| 33677 | Closure of multiple ventricular septal defects; with removal of pulmonary artery band, with or without gusset |
| 33660 | Repair of incomplete or partial atrioventricular canal (ostium primum atrial septal defect), with or without atrioventricular valve repair |
| 33665 | Repair of intermediate or transitional atrioventricular canal, with or without atrioventricular valve repair |
| 1006260 | Shunting procedures on the heart and pericardium |
| 1006265 | Shunts |
| 33767 | Shunt; superior vena cava to pulmonary artery for flow to both lungs (bidirectional Glenn procedure) |
| 33750 | Shunt; subclavian to pulmonary artery (Blalock-Taussig type operation) |
| 33764 | Shunt; central, with prosthetic graft |
| 33766 | Shunt; superior vena cava to pulmonary artery for flow to 1 lung (classical Glenn procedure) |
| 33755 | Shunt; ascending aorta to pulmonary artery (Waterston type operation) |
| 1006227 | Repair Procedures for Single Ventricle and Other Complex Cardiac Anomalies |
| 33617 | Repair of complex cardiac anomalies (e.g., single ventricle) by modified Fontan procedure |
| 33608 | Repair of complex cardiac anomaly other than pulmonary atresia with ventricular septal defect by construction or replacement of conduit from right or left ventricle to pulmonary artery |
| 33619 | Repair of single ventricle with aortic outflow obstruction and aortic arch hypoplasia (hypoplastic left heart syndrome) (e.g., Norwood procedure) |
| 1014132 | Repair of double outlet right ventricle with intraventricular tunnel repair |
| 33612 | Repair of double outlet right ventricle with intraventricular tunnel repair; with repair of right ventricular outflow tract obstruction |
| 33611 | Repair of double outlet right ventricle with intraventricular tunnel repair |
| 33622 | Reconstruction of complex cardiac anomaly (e.g., single ventricle or hypoplastic left heart) with palliation of single ventricle with aortic outflow obstruction and aortic arch hypoplasia, creation of cavopulmonary anastomosis, and removal of the right and left pulmonary bands (e.g., hybrid approach stage 2, Norwood, bidirectional Glenn, pulmonary artery debanding) |
| 33606 | Anastomosis of the pulmonary artery to aorta (Damus-Kaye-Stansel procedure) |
| 33615 | Repair of complex cardiac anomalies (e.g., tricuspid atresia) by closure of atrial septal defect and anastomosis of atria or vena cava to pulmonary artery (simple Fontan procedure) |
| 33600 | Closure of atrioventricular valve (mitral or tricuspid) by suture or patch |
| 33602 | Closure of semilunar valve (aortic or pulmonary) by suture or patch |
| 33620 | Application of right and left pulmonary artery bands (e.g., hybrid approach stage 1) |
| 33610 | Repair of complex cardiac anomalies (e.g., single ventricle with subaortic obstruction) by surgical enlargement of ventricular septal defect |
| 1006140 | Surgical procedures on the cardiac valve |
| 33463 | Valvuloplasty, tricuspid valve, without ring insertion |
| 33464 | Valvuloplasty, tricuspid valve, with ring insertion |
| 33465 | Replacement, tricuspid valve, with cardiopulmonary bypass |
| 33460 | Valvectomy, tricuspid valve, with cardiopulmonary bypass |
| 33468 | Tricuspid valve repositioning and plication for Ebstein anomaly |
| 1006174 | Surgical procedures on the pulmonary valve |
| 1006141 | Surgical Procedures on the Aortic Valve |
| 33413 | Replacement, aortic valve, by translocation of autologous pulmonary valve with allograft replacement of pulmonary valve (Ross) |
| 33412 | Replacement, aortic valve; with transventricular aortic annulus enlargement (Konno procedure) |
| 33411 | Replacement, aortic valve; with aortic annulus enlargement, noncoronary sinus |
| 33440 | Replacement pulmonary valve; by translocation of autologous pulmonary valve and transventricular aortic annulus enlargement of the left ventricular outflow tract |
| 33416 | Ventriculomyotomy (-myectomy) for idiopathic hypertrophic subaortic stenosis (e.g., asymmetric septal hypertrophy) |
| 1029692 | Valvuloplasty, aortic valve, open with cardiopulmonary bypass |
| 33417 | Aortoplasty (gusset) for supravalvular stenosis |
| 1006147 | Replacement, aortic valve, with cardiopulmonary bypass |
| 1029693 | Replacement, aortic valve, open, with cardiopulmonary bypass |
| 33414 | Repair of left ventricular outflow tract obstruction by patch enlargement of the outflow tract |
| 1006159 | Surgical procedures on the mitral valve |
| 1014130 | Valvuloplasty, mitral valve, with cardiopulmonary bypass |
| 33425 | Valvuloplasty, mitral valve, with cardiopulmonary bypass |
| 33426 | Valvuloplasty, mitral valve, with cardiopulmonary bypass; with prosthetic ring |
| 33430 | Replacement, mitral valve, with cardiopulmonary bypass |
| 1006160 | Valvotomy, mitral valve |
| 33422 | Valvotomy, mitral valve; open heart, with cardiopulmonary bypass |
| 1006288 | Repair procedures for aortic anomalies |
| 1006303 | Repair of hypoplastic or interrupted aortic arch using autogenous or prosthetic material |
| 1006299 | Excision of coarctation of aorta, with or without associated patent ductus arteriosus |
| 33840 | Excision of coarctation of aorta, with or without associated patent ductus arteriosus; with direct anastomosis |
| 33845 | Excision of coarctation of aorta, with or without associated patent ductus arteriosus; with graft |
| 33851 | Excision of coarctation of aorta, with or without associated patent ductus arteriosus; repair using either left subclavian artery or prosthetic material as gusset for enlargement |
| 1015064 | Repair procedures for venous anomalies |
| 33726 | Repair of pulmonary venous stenosis |
| 33730 | Complete repair of anomalous pulmonary venous return (supracardiac, intracardiac, or infracardiac types) |
| 33724 | Repair of isolated partial anomalous pulmonary venous return (e.g., Scimitar Syndrome) |
| 33732 | Repair of cor triatriatum or supravalvular mitral ring by resection of left atrial membrane |
| 1006273 | Repair procedures for transposition of the great vessels |
| 1014617 | Repair of transposition of the great arteries, aortic pulmonary reconstruction |
| 33778 | Repair of transposition of the great arteries, aortic pulmonary artery reconstruction (e.g., Jatene type) |
| 33779 | Repair of transposition of the great arteries, aortic pulmonary artery reconstruction (e.g., Jatene type); with removal of pulmonary band |
| 33780 | Repair of transposition of the great arteries, aortic pulmonary artery reconstruction (e.g., Jatene type); with closure of ventricular septal defect |
| 33781 | Repair of transposition of the great arteries, aortic pulmonary artery reconstruction (e.g., Jatene type); with repair of subpulmonic obstruction |
| 1014614 | Repair of transposition of the great arteries, atrial baffle procedure (e.g., Mustard or Senning type) with cardiopulmonary bypass |
| 33774 | Repair of transposition of the great arteries, atrial baffle procedure (e.g., Mustard or Senning type) with cardiopulmonary bypass |
| 33775 | Repair of transposition of the great arteries, atrial baffle procedure (e.g., Mustard or Senning type) with cardiopulmonary bypass; with removal of pulmonary band |
| 33776 | Repair of transposition of the great arteries, atrial baffle procedure (e.g., Mustard or Senning type) with cardiopulmonary bypass; with closure of ventricular septal defect |
| 33777 | Repair of transposition of the great arteries, atrial baffle procedure (e.g., Mustard or Senning type) with cardiopulmonary bypass; with repair of subpulmonic obstruction |
| 1006274 | Repair of transposition of the great arteries with ventricular septal defect and subpulonary stenosis |
| 1020205 | Aortic root translocation with ventricular septal defect and pulmonary stenosis repair (Nikaidoh) |
| 1006186 | Coronary artery anomaly procedures |
| 33502 | Repair of anomalous coronary artery from pulmonary artery origin; by ligation |
| 33504 | Repair of anomalous coronary artery from pulmonary artery origin; by graft, with cardiopulmonary bypass |
| 33505 | Repair of anomalous coronary artery from pulmonary artery origin; with construction of intrapulmonary artery tunnel (Takeuchi procedure) |
| 33506 | Repair of anomalous coronary artery from pulmonary artery origin; by translocation from pulmonary artery to aorta |
| 33507 | Repair of anomalous (e.g., intramural) aortic origin of coronary artery by unroofing or translocation |
| 33641 | Repair atrial septal defect, secundum, with cardiopulmonary bypass, with or without patch |
| 1006285 | Repair Procedures for Truncus Arteriosus |
| 33786 | Total repair, truncus arteriosus (Rastelli type operation) |
| 33788 | Reimplantation of an anomalous pulmonary artery |
| 1006252 | Repair procedure for the Sinus of Valsalva |
| 33720 | Repair sinus of Valsalva aneurysm, with cardiopulmonary bypass |
| 1035630 | Tricuspid Valve Repair |
| 1036591 | Tricuspid Valve Implantation/Replacement |
| 1006190 | Repair of anomalous coronary artery from pulmonary artery origin |
| 33782 | Aortic root translocation with ventricular septal defect and pulmonary stenosis repair (i.e., Nikaidoh procedure); without coronary ostium reimplantation |
| 33783 | Aortic root translocation with ventricular septal defect and pulmonary stenosis repair (i.e., Nikaidoh procedure); with reimplantation of 1 or both coronary ostia |
| 1035167 | Replacement, aortic valve |