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# Collective Review of Superior Vena Cavo-Right Pulmonary Arterial (SVC-RPA) Anastomosis

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As regards to surgical methods to increase the pulmonary arterial circulation and to increase oxygenated blood into the left atrium, a great number of operative procedures have been tried and attempted. Some of them are palliative operative procedures, of which the best palliative procedure to improve pulmonary circulatory hemodynamics is SVC-RPA anastomosis. This procedure has been widely studied throughout the world at different centers regarding various clinical and hemodynamic factors toward the best. Historically, in 1947 Ray and Burch[26] did experimental studies on the hemodynamics of the pulmonary and systemic circulation following inferior vena caval ligation. In 1949, Rodbard and Wagner[29] did experimental study of RA(Right Atrium) appendage-right PA anastomosis in five dogs, bypassing R.V. (Right Ventricle). In 1950, Blalock and Hanlon[4] studied experimentally the extracardial venous-arterial shunting for hemodynamic correction of transposition of aorta and PA (Pulmonary Artery), and concluded that the most satisfactory procedure is subclavian-PA anastomosis. In 1954, Warden, DeWall and Varco[34] used the RA as a pump of pulmonary arterial circulation experimentally, doing RA-main PA anastomosis, bypassing the R.V. Dr. Shumacker discussed this problem and presented his laboratory work on the vena cava-PA anastomosis.

Donovan and Donovan, in 1955[10] did experimental studies on RV-main PA anastomosis with homograft bypassing pulmonary valve in eight dogs(vein graft).

For the first time in history Hurwitt, Young and Escher, in 1955, did RA appendage-main PA anastomosis on a cyanotic, nine-pound, four-month-old infant in order to correct a tricuspid atresia. He died with autopsy finding of Cor Triloculare. They then concluded that the importance of RA-PA pressure gradient is the key to success to increase the pulmonary circulation.

In 1954, Glenn and Patino[26] and in 1956, Patino and Glenn[23] did extensive experimental studies and research on the subject of bypass of the right heart in order to increase the pulmonary circulation and decrease, or not advance, the right heart strain. They conclu-

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ded that the SVC-RPA anastomosis would be favorable procedure than anything else to increase the pulmonary circulation and decrease, or not advance, the right heart strain for such congenital heart diseases, as tricuspid atresia or stenosis. Ebstein's anomaly, Eisenmenger syndrome with irreversible hypertension, transposition of the great vessels with pulmonary stenosis, and SVC anomalies.

Robicsek[26], Robicsek, Timeslvari and Kader[27] in 1956 also experimented with SVC-RPA anastomosis in Europe.

In 1958, Nuland, Glenn and Guilfoil[21] studied the experimental work on SVC-RPA anastomosis, including the RPA for study. They commented on chylous pleural effusion. Sixty-five per cent of dogs had pleural effusion and chylous effusion with partial or complete thrombosis of anastomosis. Ascites with hypoproteinemia in IVC-RPA (inferior vena cava-right pulmonary artery) was treated with high protein low salt diet. Hepatic damage was also noted in IVC-RPA anastomosis (cirrhotic type lesion).

In 1958, Robicsek, Magistro, Foti Robicsek and Sanger[15] studied 30 dogs on the pulmonary blood flow following SVC-RPA anastomosis and followed them up to two years. They had a high rate of patency 72%. In 1958 Glenn[15] did the first successful case of SVC-RPA side-to-end anastomosis on a seven-year old boy, who had a single ventricle with tricuspid atresia, transposition of aorta and PA with PS (Pulmonic Stenosis).

Rasmussen, in 1959[24], performed a SVC-RPA anastomosis (end-to-end) for transpoistion of the great vessels with P.S. and noted great improvement of the arterial oxygenation. Brechner, Kovan and Dillon[5] studied the EEG changes on the SVC compression in the operating room and commented on the importance of cerebral arteriovenous pressure gradient and EEG wave changes.

In the U.S.S.R. in 1959, Bakulev and Kolesnilov[1] reported 41 cases of SVC-RPA end-to-end anatomosis, with 34% operative mortality and 34% satisfactory results up to two years. Most of the cases were tetralogy of Fallot, and they used tantalum staples for transection of SVC and blood vessel stitcher for end-to-end anastomosis.

In 1959, Sanger, Pawl, Robicsek and Taylor[30] reported a successful case of SVC-RPA anastomosis for the transposition of the great vessels with P.S. and ASD.

In 1959, Gasul and Weinberg[14] reported five cases of SVC-RPA anastomosis for Ebstein's anomaly and congenital hypoplasia of the right ventricle.

In France in 1959, Santy, Marion, Bret and Estanove[31] did a successful case of SVC-RPA anastomosis for tricuspid atresia.

In 1960 in Canada, Cumming and Ferguson[6] did four cases of SVC-RPA anastomosis for tricuspid atresia with three cases of survival.

In 1960 Weinberg, Bicoff and Juan[35] reported two additional cases of Ebstein's anomaly and tricuspid atresia and follow-up of three cases[14]. Dr. Glenn[35] added five more cases of SVC-RPA anastomosis for two cases of tetralogy of Fallot, two cases of tricuspid atresia and a case of Ebstein's anomaly.

In England, Bickford and Edward, in 1960[3] reported two cases of tricuspid atresia in which Blalock procedure was performed previously and had SVC-RPA anastomosis, and followed up to three years with improvement of cyanosis.

In 1960 in Italy, Martelli[19] did experimental study on SVC-RPA anastomosis using a bypass Sigmamotor Pump from SVC to IVC to prevent temporary decrease of cerebral arteriovenous pressure gradient, and had 14 successful cases out of cases.

In Czechoslovakia in 1960, Visnevskij, Galankin and Darbinan[33] reported 22 cases of

SVC-RPA anastomosis, four cases of tricuspid atresia and 18 cases of tetralogy of Fallot. They stated that the improvement of polycythemia is an important clinical indication for follow-up.

In 1960, Darbiman and al[7] wrote about vascular suture technique of the anastomosis and Fitilena, in 1960[13] did phonocardiographic studies in patients with tetralogy of Fallot before and after SVC-RPA anastomosis.

In France, Soulie, Servalle, Vernant and Cornu[32] reported 13 cases of SVC-RPA anastomosis for nine cases of tetralogy of Fallot, two cases of tricuspid atresia, and one Ebstein's anomaly and one transposition of great vessels, and had eight cases of satisfactory results.

Also, Edward and Bargeson[11] reported a successful case of SVC-RPA anastomosis in a 14-week old infant with tricuspid atresia.

In Mexico, Palacios-Macedo and al[22] did some experimental studies on the anastomosis in 12 dogs.

Moss, Maloney and Adams[20] reported six azygos-RPA anastomosis for transposition of aorta and PA.

## Material of Study

**Table I.** 70 Mongol dogs between 15 to 25 pounds were used.

| | |
|---|---|
| Blalock procedure-lt subclavian-pulmonary arterial anastomosis | 9 |
| SVC-RPA anastomosis side to end...with graft | 3 |
| SVC-RPA anastomosis side to end without graft | 8 |
| Blalock procedure with ligation of lt pulmonary artery or end to end anastomosis | 14 |
| SVC-RPA anastomosis side to end.....group 1 | 17 |
| group 2 | 19 |
| Total cases | 70 |

## Operative Procedures of SVC-RPA Anastomosis

Under general anesthesia with endotracheal intubation, the dog was placed in the left lateral position and a right thoracotomy was performed through 4th intercostal space.

The superior vena cava was isolated satisfactorily down to pericardial reflection with effort not to enter the pericardium.

Then the azygos vein was isolated and transsected. The vena cava was completely cleaned from surrounding fatty structures. In same manner the right pulmonary artery was isolated removing most of adventitia down to the margin of bifurcation of main pulmonary artery, and the right pulmonary artery was ligated doubly with one suture ligature. Then 10mg of heparin was injected into distal right pulmonary artery. A straight Bulldog clamp was applied on the right pulmonary artery and transsect the right pulmonary artery. A Satinsky clamp was applied to the area of azygos bifurcation blocking 50% of the superior vena cava and windowed the SVC removing the azygos remnant. Anastomosis was performed with Six O atraumatic black silk, continuous everting mattress suture posteriorly and interrupted everting mattress sutures anteriorly. Then the base of SVC was either suture-ligated the base of SVC extrapericardially or suture-ligated in mattress fashion. After careful observation of the anastomotic area the thoracotomy wound was closed in the usual fashion.

## Review of World Literatures

Extensive experimental research and clinical followup has been done on the hemodynamics, electrocardiogram, electroencephalogram, hemoglobin and red blood cell count change and angiogram of the lung following right heart bypass anastomosis.

### A. Review of the animal research

Hemodynamics following SVC-RPA anastomosis was studied extensively by Glenn's group[15] and also the post-operative complica-

**Table II.**

| Authors | Year | Type of Anastomosis | Number | References |
|---|---|---|---|---|
| Rodbard & Wagner | 1949 | RA-RPA anaatomosis | 5 cases | 29) |
| Glenn | 1954 | Azygos-RPA anastomosis | 6 cases | 16) |
| | | IVC-RPA anastomosis | 1 cases | |
| Nuland & Glenn | 1958 | SVC-RPA anastomosis | 75 cases | 21) |
| | | IVC-RPA anastomosis | 46 cases | |
| Robicsek | 1958 | SVC-RPA anastomosis | 30 cases | 28) |
| Martelli | 1960 | SVC-RPA anastomosis under bypass pump | 15 cases | 19) |
| Palacias-Macedo | 1961 | SVC-RPA anastomosis | 12 cases | 22) |

tions, especially on the subject of pleural effusion and chylothorax[21].

There was definite increase of arterial oxygen saturation following the anastomosis[15,22]. In the end-to-end SVC-RPA anastomosis, the period of occlusion was an important factor on the success[22,28]. Palacias-Macedo mentioned the importance of the electroencephalographic monitoring during anastomosis, especially in the end-to-end SVC-RPA anastomosis[2]. Martelli used a Sigmamotor Pump as a bypass from SVC to IVC in order to decrease the risk of cerebral congestion[19].

**B. Clinical case review**

Since the first successful case of the SVC-RPA anastomosis by Dr. Glenn[15], 98 cases of SVC-RPA anastomosis have been reported throughout the world.

**1. First Series**

Nine cases of the left subclavian-left pulmonary arterial anastomosis without ligation of proximal pulmonary artery did not have satisfactory anastomotic stomas and most of them were thrombosed, most probably due to the inadequate pressure gradient across the anastomotic stoma.

**2. Second Series**

Fourteen cases of left subclavian-left pulmonary arterial anastomosis with ligation of the proximal pulmonary artery showed satisfactory patency of the anastomotic stomas. Most of them were side-to-end anastomosis, but some had end-to-end anastomosis.

**3. Third Series:**

Eight cases of SVC-RPA side-to-end anastomosis without obstruction of proximal SVC showed thrombosis in 90%. Most of the cases were operated with poor surgical skill, so-called "our first group of operative cases", and some of the anastomosis were done with 3-0 silk. In other words, the anastomosis was done with some degree of operative trauma, either by forceps or silk suture material.

**4. Fourth Series**

Three cases of SVC-RPA anastomosis with Teflon graft revealed complete thrombosis within two weeks.

**5. Fifth Series**

These cases are our actual cases for study, because all of those previously mentioned were prelimonary experiments.

**Group 1**— These 17 cases had SVC-RPA side-to-end anastomosis above the azygos branch. There were many cases which had some degree of tension over the upper part of the anastomosis area. In this group, the patency was 60%.

**Group 2**— Nineteen[19] cases of this group had anastomosis at the level of azygos branch with 6-0 arterial silk and double suture ligature or mattress sutures for SVC to have the best angle of the SVC blood flow

**Table III.**

| Authors | Year | Diagnosis, Age of Patient | No. of Cases | Followup |
|---|---|---|---|---|
| Glenn [15] | 1958 | Single ventricle, transposition, P.S., 7. yrs. old | 1 | Arterial oxygenation improv. |
| Gasul & Weinberg [14] | 1959 | Congenital hypoplasia of RV, LASD, 4 yrs. old | 1 | BA $O_2$ 84-86% |
| | | Ebstein's anomaly & patent foramen ovale, 14 yrs. old | 1 | Died with SVC obstruction. |
| | | Ebstein's anomaly & LASDD, 8 yrs. old | 1 | LASD repair suggested. |
| Sanger & Robicsek [30] | 1959 | Transposition, P.S. & LASD, 11 yrs. old | 1 | Cyanosis disappeared & physical activity improved. |
| Rasmussen [24] | 1959 | Transposition & P.S., 17 mos. old | 1 | Significant improvement of arterial oxygenation. |
| Santy [31] | 1959 | Tricuspid atresia | 1 | |
| Bakulev [1] | 1959 | Tetralogy of Fallot | 41 | 34% mortality; 34% improvement. |
| Cumming [6] | 1960 | Tricuspid atresia, small P.A., P.F.O. & small IVSD, 7 wks. old | 1 | Elevated V.P. |
| | | Tricuspid atresia, 5 mos. & 10 mos. old | 2 | Elevated V.P. |
| | | Tricuspid atresia, 8 days old | 1 | Died. |
| Weinberg [35] | 1960 | Ebstein's anomaly & LASD, 18 yrs. old | 1 | |
| | | Tricuspid atresia, 7 mos. old | 1 | Progressive SVC obstruction |
| Taylor & Robicsek [35] | 1960 | Transposition & P.S., 1 yr. old | 1 | Cerebral damage. |
| Glenn [35] | 1960 | Tricuspid atresia, infants | 2 | |
| | | Tetralogy of Fallot, 6 yrs. & 41 yrs. old | 2 | Corrective procedure was considered. |
| | | Ebstein's anomaly & LASD | 1 | |
| Bickford [3] | 1960 | Tricuspid atresia (had Blaolock procedure), 6 yrs. old and 7 yrs. old | 2 | Cyanosis improved. |
| Visnevskij [33] | 1960 | Tetralogy of Fallot, 1 | 18 | |
| | | Tricuspid atresia | 4 | |
| Edward [11] | 1961 | Tricuspid atresia, 14 wks. old | 1 | Improvement of BA $O_2$ |
| Soúlie [32] | 1961 | Tetralogy of Fallot | 9) | |
| | | Tricuspid atresia | 2) | |
| | | Ebstein's anomaly | 1) | 8 good results |
| | | Transposition of great vessels | 1) | |
| | | | Total=98 | |

**Table IV.**

| Diagnosis | Number of Cases |
|---|---|
| Tricuspid atresia [15, 31, 33, 3, 11, 35, 6] | 18 |
| Ebstein's anomaly & hypoplasia of right ventricle [14, 32, 35] | 6 |
| Transposition of great vessels [24, 30, 32, 31] | 4 |
| Tetralogy of Fallot Total [32, 33, 35] | 29 |
| | Total=57 |

Bakulev (1)-cases not included

## Results and Discussion of our Research on Patency

Seventy dogs were used for the study.

**Table V.**

| Series | Type of Procedure | No. of Cases | Remarks |
|---|---|---|---|
| 1 | Left subclavian artery-left pulmonary arterial anastomosis without ligation of proximal pulmonary artery | 1 | Thrombosed |
| 2 | Left subclavian artery-left pulmonary arterial anastomosis with ligation of proximal pulmonary artery | 14 | Patent |
| 3 | SVC-RPA side-to-end anastomosis without obstruction of proximal SVC | 8 | Thrombosed |
| 4 | SVC-RPA anastomosis with Teflon graft and ligation of proximal SVC | 3 | Thrombosed |
| 5 | SVC-RPA anastomosis | 36 | |
| | Group 1: SVC-RPA anastomosis above the azygos branch | 17 | 60% patency |
| | Group 2: SVC-RPA anastomosis at the azygos branch | 19 | 95% patency |

without any bulging area around the anastomosis, or the ligature close to the inferior edge of the anastomosis. In this group, the patency was 95%. One case had thrombus in the proximal stump of the right pulmonary artery, blocking the left pulmonary artery. Another case had thrombus in the right atrium around the area of the proximal stump of the superior vena cava.

### Discussion and Comment

The SVC-RPA anastomosis is definitely a superior procedure for the congenital heart disease with decreased pulmonary circulation and also, it might be helpful in certain congenital heart diseases to increase the oxygenated blood into the left atrium.

**1. Technique**

If we could create end-to-end anastomosis without any venous pressure change, it would be the best procedure. There are many techniques for anastomosis, as shown in the following drawings:

**a) Side-to-end anastomosts**

1. RPA to azygos vein with ligature of SVC.
2. RPA to above the level of azygos vein.
3. RPA to SVC removing the window of SVC including azygos vein.
4. Transverse stoma of SVC to RPA.

**b) End-to-end anastomosis**

1. Large SVC stoma to RPA.
2. Large SVC stoma was shaved with tantalum stapple or mattress sutures to fit to the RPA stoma.
3. As #1 and #2 with temporary bypass from SVC to IVC[19] or SVC to RA.
4. Left subclavian vein to left pulmonary artery anastomosis.

As we know, there are many variations of the level of azygos branch. Therefore, every case must be individualized in selecting the type of anastomosis. We believe that the ideal technique is the end-to-end anastomosis under the temporary bypass from SVC to RA through the proximal SVC stump.

In side-to-end SVC-RPA anastomosis, there are a few different techniques, for obstructing superior vena cava :

**a**) Simple ligature or suture ligature with silk.

**b**) Tantalum stapling[33]

**c**) Use of mattress sutures with silk to have best angle of blood flow.

An important point in end-to-end anastomosis without any temporary bypass circulation is the venous pressure before and after clamping of SVC. Consequently one must check for the collateral circulation of SVC. Bickford and

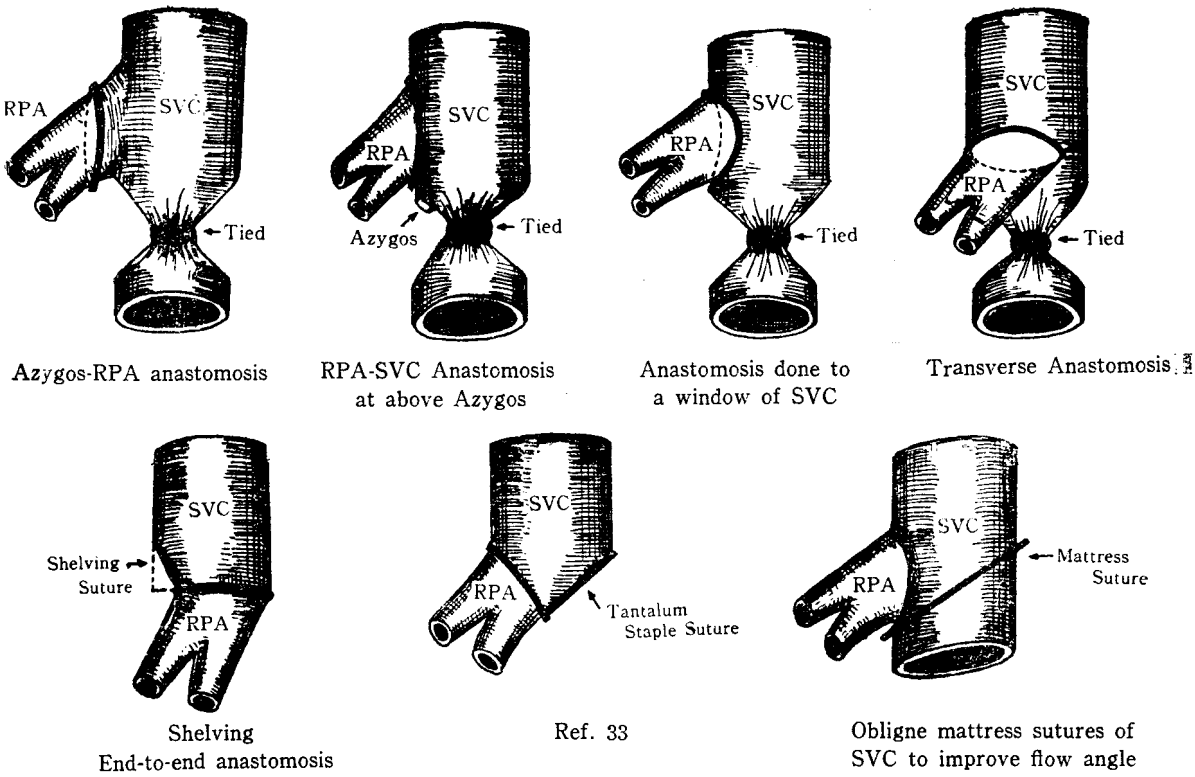


**Fig. 1**

Edward[3] stated that over 50 mmHg. of SVC after clamping of SVC means no collateral circulation and below 25 mmHg. suggests collateral circulation. A Sigmamotor Pump temporary bypass from SVC-to IVC was used with satisfactory results[19]. We used simple temporary bypass cannula from SVC to the stump of the transected proximal SVC during end-to-end anastomosis. Tantalum staple is convenient to obstruct the SVC in order to have the best angle of SVC blood flow into the RPA[33].

Double mattress sutures was employed after applying two crushing clamps to have the best angle of blood flow and not to have any bulging. The transection of the RPA is also important not to have any kinking or bulging. These are the mechanical factors to form thrombus.

Left subclavian vein—left pulmonary arterial anastomosis has also been done[33]. Speed of end-to-end anastomosis without any temporary bypass is an essential factor not to get permanent cerebral damage. Bakulev and Kolesnikov used tantalum staple and blood vessel stitcher for this purpose[1], but the blood vessel stitcher did not shorten the period of the anastomosis than without stitcher. If the RPA stoma is smaller than two third of the SVC, the choice of procedure would be either side-to-end SVC-RPA anastomosis, or the SVC stoma must be deminished to fit the RPA stoma.(Figure 1).

A Satinsky clamp was used for the superior vena cava not to occlude completely and a straight Bulldog clamp for the right pulmonary artery in side-to-end SVC-RPA anastomosis, but in end-to-end anastomosis two straight vascular clamps were satisfactory.

6-0 atraumatic arterial silk was used for everting mattress sutures, continuous posteriorly and interrupted anteriorly.

An important factor to decrease the operative risk is not to make any hole into the pericardium. We experienced one case of pericardial tamponade and on autopsy it was

found to have a small hole over the superior vena cava, measuring 1 mm. in diameter. The size of the anastmotic stoma is not related to the complications.

**II. Venous Pressure**

The increasing venous pressure level in Superior vena cava does not always mean bad prognostic signs, because this increased venous pressure gives the increased of pressure gradient across the anastomotic stoma to increase pulmonary circulation. The bronchial blood supply into the right pulmonary circulation might increase the venous pressure because of the retrograde flow of bronchial blood into the superior vena cava.

In end-to-end anastomosis if there is no collateral circulation there will be elevation of venous pressure. One of our research cases had venous pressure up to 600 mm. normal saline solution during anastomosis, but in side-to-end anastomosis there was no elevation of venous pressure. The post-operative venous pressure usually rose to 150% in most of the cases using the following formula :

$$\frac{\text{Post-operative venous pressure}}{\text{Pre-operative venous pressure}} \times 100$$

There was no change of venous pressure in the inferior vena cava pre and post-operatively.

**III. Electroencephalographic Change**

Certainly, there is a decrease of the cerebral arterio-venous pressure gradient due to the increased venous pressure of SVC in the presence of no collateral circulation of the SVC system. Therefore, the cerebral circulation will be decreased. The reasonable temporary complete blockage of the SVC can be compensated completely after the reasonable period of occlusion during anastomosis, but post-operatively the usual increase of venous pressure of the SVC system does not always show electroencephalographic changes. Bakulev and Kolesnikov[1] observed cerebral hypoxic picture on electroencephalogram during the procedure. This electroencephalographic change can be corrected by side-to-end type of anastomosis. The electroencephalographic monitorinig in the SVC-RPA anastomosis is essential and important.

**IV. Oxymetric Study**

The oxygen content in SVC will decrease as the SVC occludes, but it will return to normal range when the SVC blood flows into the right pulmonary arterial system. The arterial saturation usually increases in most of cases because 25% to 40% of the systemic blood passes through the right pulmonary artery system. Even though the oxygen content of the superior vena cava is on the lower side of normal range, the arterial oxygen content will not decrease but will increase somewhat. In other words, the pulmonary circulation increases and more oxygenated blood will be distributed into the systemic system.

**V. Flow Study**

The Right pulmonary arterial flow studies have been done in different centers, but the right pulmonary arterial flow can be indirectly estimated by the speed of disappearance of dye in the right lung during angiogram. There are several factors to increase right pulmonary blood flow :

1. Gravitational factor—Fowler's position or standing position will improve the flow.
2. Deep respiration will increase the negative pressure in the chest and will increase the blood flow in the pulmonary alveolary capillary bed. The pleural effusion must be treated promptly.
3. Increased venous pressure in the SVC system-150% increase of the pre-operative venous pressure will increase the pressure gradient across the SVC-RPA stoma.
4. Bronchial blood supply—The bronchial blood supply to right lung will decrease the pressure gradient across the SVC-RPA stoma.

**VI. Electrocardiograhic Change**

Electrocardiographic change is not significant in animal research, but in the clinical cases there are changes of right heart strain before and after surgery. Of course, the electrocardiographic change is an essential part of the follow-up.

**VII. Angiographic Study**

Cine-angiograms were taken and all of them showed the slowing of right pulmonary circulation. In the case of anatomotic stricture of partial thrombosis there was definite slowing and retention of cardiographin.

**VIII. Thrombosis**

In the immediate post-operative period, the prevention of thrombosisis essential as stated on flow study. Post-operative anticoagulation might help 48 hours after surgery, but as long as there is intimal trauma of vessel, the thrombus will form. There are several points to prevent the thrombosis:

1. Do not traumatize the vessel by either forceps, suture exposure in the intima, or large needle hole.
2. Minimize the period of occlusion of right pulmonary artery.
3. Direction of blood flow must be natural angle of anastomosis; not to angle or kink.
4. Perfect control of bleeding around the anastomotic area.
5. The gradual thrombosis or stricture might be prevented by removing periarterial loose tissue and adventitia from SVC and RPA.
6. The pleural effusion must be treated promptly.
7. As stated on Flow Study.

The prevention of respiratory tract infection is essential. When there is a progressive occlusion or stricture with clinical manifestation, one must strongly consider the surgical management.

**IX. Pleural Effusion**

Pleural effusion is the most common complication. One must treat this complication promptly. Nuland, Glenn and Guilfoil[21] stated that 65% of their experimental dogs had some degree of pleural effusion with chylous content. We had less than 30% of pleural effusion and 20% of chylothorax. Most of the chylothorax cases were combined with infection. The ligation of thoracic duct did not help to decrease the instance of chylothorax[23].

**X. Pulmonary Change**

Ferencz[12] reported pulmonary vascular changes on Blalock procedure. We observed some degree of pulmonary congestion and one of them had severe congestion superimposed with infection.

**XI. Clinical Evaluation**

Up to August, 1961, there are 89 case reports throughout the world. It is impossible to evaluate all of these cases for definite conclusion. The operative mortality has been high[1] and the long follow-up cases are minimal:

**a.** Hemodynamic study—To measure the right pulmonary circulation or right pulmonary blood flow, the oxygen content and pressure of the SVC and righ lung vessels are an essential part of the study. Then we could calculate the right pulmonary blood flow.

**b.** Clinical manifestation—Cyanosis and edema of the face and neck following surgery is not uncommon[1]. Sometimes there will be murmurs over the area of anastomosis. Hemoglobin and red blood cell count should be done periodically to see the improvement of polycythemia.

**c.** Indications-The SVC-RPA anastomosis is a palliative procedure in such poor risk cases, as follows. Every effort must be made to try to shorten the period of operation.

1. Tricuspid atresia with LASD or patent foramen ovale the LASD might be

corrected later.

2. Tricuspid atresia with large IVSD and pulmonary stenosis.
3. Single ventricle with tricuspid atresia.
4. Ebstein's anomaly with or without IASD or patent foramen ovale.
5. Congenital hypoplasia of right ventricle.
6. Transposition of great vessels with pulmonary stenosis.
7. Obstruction of SVC; congenital type.
8. Eisenmenger syndrome with irreversible hypertension.
9. Tetralogy of Fallot.

Hypothermia might decrease the operative risk.

## Conclusion

1. The world literatures have been reviewed on the subject of the SVC-RPA anastomosis.

2. The followup study of 89 cases showed high operative mortality.

3. Seventy[70] dog research have been reviewed.

4. The clinical problem was discussed.

5. The SVC-RPA anastomosis is a satisfactory sub-urgent palliative procedure in such poor risk cases as mentioned to minimize the operative mortality in sick patients.

6. Various complications were discussed.

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