

Hemolysis after PDA Umbrella Occlusion : Surgical Treatment

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The first successful percutaneous transcatheter occlusion technique for patent ductus arteriosus achieved by Rashkind in 1977.

Transcatheter occlusion with the Rashkind double umbrella device is now widely accepted as treatment for patent ductus arteriosus. The reported complications include embolization of the device, pseudocoarctation left pulmonary artery stenosis, residual shunts, and mechanical hemolysis^{1,3)}.

We report two cases of severe hemolysis after occlusion of PDA with Rashkind occluder.

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Key words : Hemolysis, Patent ductus arteriosus, Umbrella.

Case 1

A 22 years old female was admitted for known patent ductus arteriosus. She was diagnosed at four month ago on echocardiogram, cardiac catheterization and angiogram. On echocardiogram, length of PDA was 20mm and diameter of aortic, pulmonic end were 10,9mm respectively.

On cardiac catheterization, O₂ step up between RV and PA was 14.7%, pressure in RV, PA was no significant elevated and pressure gradient, Qp/Qs was about 3.14.

Parents and patient agreed to have defect occlusion by percutaneous technique. Occlusion technique was carried out by the method of Mullins. A 17mm Rashkind double umbrella prosthesis was passed through a Rashkind delivery catheter into the Mullins sheath. The device was advanced to distal umbrella opened in the aorta. And then, sheath and delivery system were slowly pulled back until

the distal umbrella was well positioned in the PDA aortic end.

The sheath was retreated further so that the proximal umbrella could spring open and secure the device at pulmonary end of PDA. After PDA occlusion, repeated aortogram revealed considerable leakage through ductus around device (Fig. 1). Echocardiogram show considerable leakage (Fig. 2).

At preocclusion, hemoglobin, hematocrit were 12.9 gm %, 38 % respectively. After 3 days later, patient complained dizziness and dark urine. Microscopic examination of urine showed hemoglobin but no red blood cell, the blood hemoglobin fell 6.8 gm % at 4 days after occlusion, and transfused packed red cell. She was transfused 2 pints of packed red cell per week due to hemolytic anemia.

After 3 weeks later, operation was done due to no decreased in red cell destruction. Operation was done under the partial cardiopulmonary bypass with left thoracotomy incision, aortic cannulation at distal part of PDA at descending aorta, venous cannulation at main pulmonary artery through left pulmonary artery.

During bypass, heart was continuously beated and main-

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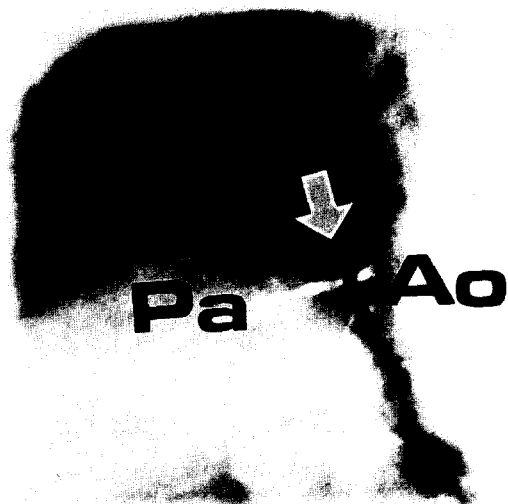


Fig. 1. After PDA occlusion, repeat aortogram reveal considerable leakage through ductus around device (arrow indicate umbrella device).

(Pa : pulmonary artery, Ao : aorta, PDA : patent ductus arteriosus)

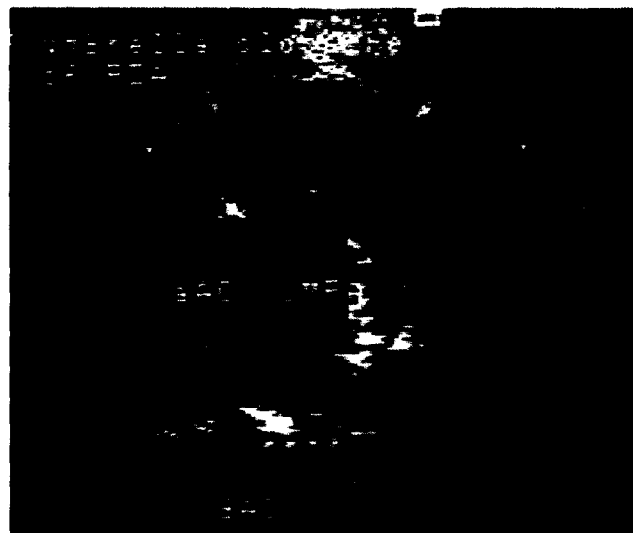


Fig. 2. After patent ductus arteriosus occlusion, echocardiogram show considerable leakage.

tain of blood pressure with 80~100mmHg on upper and lower extremity artery blood pressure for hypoxic damage without hypothermia. At operation the left pulmonary artery was clamped and descending aorta was clamped above and below at origin of ductus, head and upper extremities were perfused by beating heart. The ductus was incised longitudinally after aortic side and the occluder device removed (Fig. 3). The prosthesis had not been damaged and no evidence of infection. The ductus was divided and primary closed. Postoperative recovery was uneventful with no further hemolysis, blood hemoglobin was maintained at 12 gm %.

Case 2

A 2 years and 9 months old female patient was admitted for known patent ductus arteriosus.

On echocardiogram, PDA was short length with window type and diameter of pulmonic end was 3.6mm.

On cardiac catheterization, O₂ step up between right ventricle and pulmonary artery was 18%, pressure in right ventricle and pulmonary artery was no significant elevated

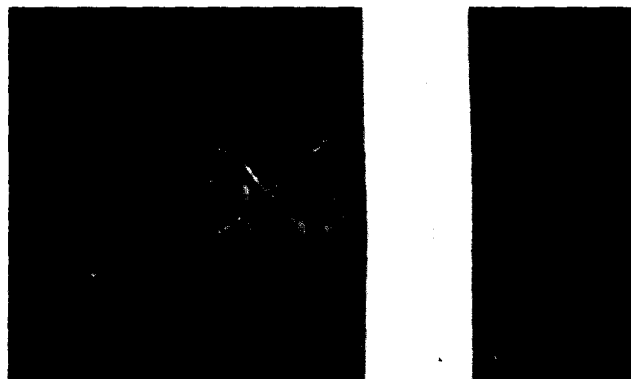


Fig. 3. A 17mm Rashkind double umbrella prosthesis (The prosthesis was not damaged or infected).

and pressure gradient. Qp/Qs was about 2.3.

PDA occlusion was carried with a 12mm Rashkind double umbrella prosthesis. After PDA occlusion, aortogram revealed considerable leakage through ductus around device (Fig. 4).

Echocardiogram show also considerable leakage (Fig. 5). At preocclusion, hemoglobin was 12.5 gm %.

One day after PDA occlusion, microscopic examination of urine showed hemoglobin, but no red blood cell. Four days later, microscopic examination of urine showed many red blood cell, the blood hemoglobin fell 6.2gm % and

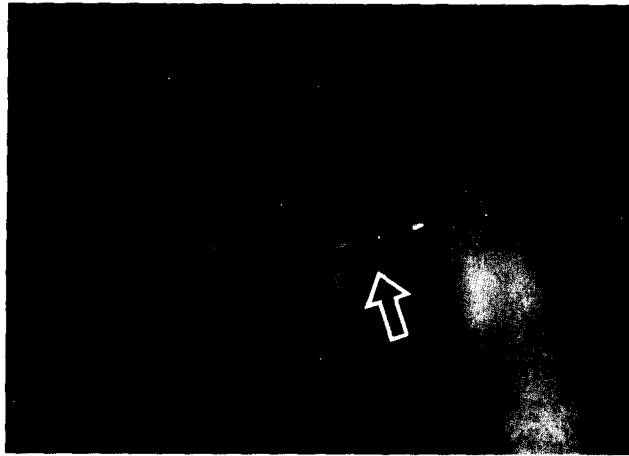


Fig. 4. After PDA occlusion, aortogram show considerable leakage though ductus around device (arrow indicate umbrella device).
(PDA : patent ductus arteriosus, Pa : pulmonary artery, Ao : aorta)

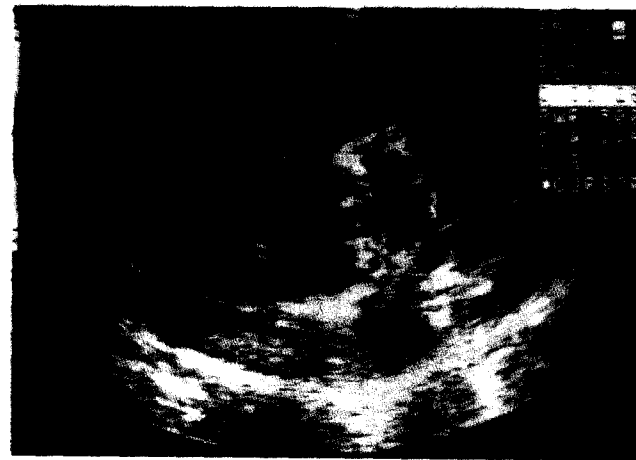


Fig. 5. After patent ductus arteriosus occlusion, echocardiogram show leakage.

transfused packed red cell.

She was three times transfused 200ml packed red cell during four weeks. After four weeks later, PDA occluder was removed (Fig. 6) and PDA was divided by surgically without cardiopulmonary bypass.

The region of the ductus is exposed by a wide incision of the pleura through the left fourth intercostal space.

The perivascular sheath over the aorta is incised, and the fibrous tissue and pericardium are dissected off the ductus into pulmonary artery.

The recurrent nerve was carefully exposed.

After PDA snaring at the pulmonic end, Potts ductus clamps are applied into descending aorta at the above and below of the ductus.

After PDA transection, at the aortic side, PDA occluder was not found in ductus and palpated at pulmonic side.

Aortic strump was primary closed and longitudinal incision of ductus including left pulmonary artery. PDA occluder was remained and pulmonary artery was closed with primary suture.

Postoperative recovery was uneventful with no further hemolysis, blood hemoglobin was maintained at 12 gm %.

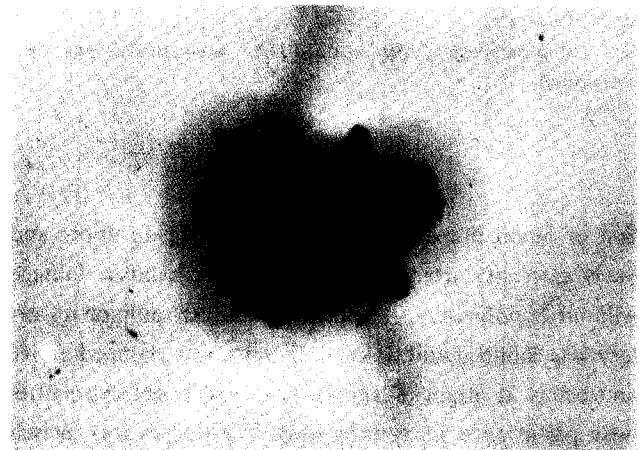


Fig. 6. A 12mm Rashkind double umbrella prosthesis.

The first successful application of a transcatheter occlusion technique for patent ductus arteriosus suitable for use in child and adult by Rashkind in 1977¹⁾.

The Rashkind occluder consists of two disc mounted on two opposing three arm spring assemblies. The whole device resembles two connected umbrellas. Each disc is constructed from open-pore polyurethane foam and though initially blood can leak through this mesh. They are eventually covered with tissue and incorporated into the arterial walls¹⁾.

Ali Khan MA et al²⁾ reported that results of 43 nonsurgical ductal closure using the Rashkind device. Successful

Discussion

implantation was achieved in 98% (42 patients). In 25 patients a residual shunt was seen on angiography immediate after implantation.

On 6 week follow up study show a small residual shunt in only 3 patients. 2 patients was implantated a second occluder device. But, in one patient, the occluder device embolized to the left pulmonary artery and removed by surgically.

Ladusans EJ et al³⁾ surgically removed of the device and ligated the ductus. Hayes AM et al⁴⁾ managed with nonsurgically successfully use of a second umbrella to severe mechanical hemolysis after transcatheter ductal occlusion.

Hosking MC et al⁵⁾ revealed 5.7% of patients required a second 12mm double umbrella because of residual flow after the initial procedure.

=국문초록=

경피적 카테타 동맥관폐쇄술후 발생한 용혈

나 찬 영 · 유재 현 · 이 원 용 · 김 혁 · 서 필 원 · 정 윤 섭 · 백 완 기 ·
한 재 진 · 박 국 양 · 이 영 탁 · 박 영 관 · 홍 승 록 · 이 영 균

1977년 Rashkind에 의해 개발된 경피적 카테타 동맥관폐쇄술은 그동안 선천성 심장병 영역에 괄목할 변화를 가져왔다. 그러나 경피적 카테타 동맥관폐쇄술의 합병증으로 폐쇄장치의 색전증, 대동맥가성축착증, 좌측폐동맥협착, 잔여단락 및 기계적 용혈 등의 보고가 있어왔다.

저자들은 22세된 여자 환자와 2년 9개월된 여자 환자에서 경피적 동맥관폐쇄술후 발생한 심한 용혈 현상을 보여온 환자를 외과적 치험하였기에 보고하는 바이다.

Key words : Hemolysis, Patent ductus arteriosus, Umbrella.

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