Pulmonary Artery Banding in Infants with Cardiac Anomalies Other Than Ventricular Septal Defects: Including an Evaluation of a New Technic for Determining a Critical Degree of Banding

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INTRODUCTION

Since the original clinical report of Muller and Dammann in 1952,1 the use of pulmonary artery banding in small infants with congestive heart failure due to large ventricular septal defects has been widely recognized and used as a beneficial, palliative procedure of reasonable risk.1,2 Only limited clinical information is available concerning the use of banding in the treatment of other types of congenital heart disease associated with low vascular resistance and high pulmonary blood flow.1-3 Additionally, the immediate determination of the ideal or even an adequate degree of banding at the surgical table continues to be a serious problem in the uniform success of this procedure.

During the past four years, we have had experience with pulmonary banding in 14 infants with congenital heart disease other than ventricular septal defect and in ten of these infants have had a technic for pulmonary artery banding in which the end point of constriction was based on changes in pulmonary arterial and systemic arterial oxygen saturation. The results of banding of these infants and an evaluation of the accuracy of arterial saturation as an aid in the determination of a critical degree of banding are the subjects of this report.

PATIENTS AND METHODS

1. Patients—The 14 infants treated by pulmonary artery banding ranged in age from six weeks to eight months. There were five girls and nine boys. All were below the third percentile in weight. All patients had evidence of right- and left-sided cardiac decompensation and had been digitalized with digoxin (Lanoxin). All were severely ill and 12 of the 14 had marked dyspnea, auscultatory evidence of pulmonary edema and required continuous oxygen therapy. Operation was carried out as an emergency procedure in three patients and in four others on a semi-emergency basis. It was the opinion of all observers that these infants could not survive for more than a few weeks or months without surgical palliation. The indexed pulmonary blood flow in every case was greater than 15 liters per minute. Three had acyanotic congenital heart disease and 11 cyanotic congenital heart lesions. Of the latter group, two patients had large right-to-left shunts (greater than 40 per cent of the systemic flow) and nine had small right-to-left shunts (20 per cent or less of the systemic flow). The pulmonary systolic pressure was elevated to systemic levels in all except one patient; however, because of the high pulmonary blood flow, the calculated pulmonary vascular resistance was less than four units in all patients. There was markedly increased pulmonary venous admixture (evidenced by low pulmonary venous saturation) in three patients during unassisted 20 per cent oxygen breathing. Pulmonary artery banding was the planned procedure in ten of the 14 patients. Banding was done in five patients with truncus arteriosus (Colletti and three had the Taussig

Table 1—Clinical and Physiologic Findings

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Init.</th>
<th>Implantation</th>
<th>Postop.</th>
<th>Days Postop.</th>
<th>Venous Saturation data</th>
<th>Arterial Saturation data</th>
<th>Pulmonary Pressure data</th>
<th>Pulmonary Vascular Resistance data</th>
<th>Pulmonary Blood Flow data</th>
<th>Pulmonary Artery Banding data</th>
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*SA saturation; **Late op at LLB—Postop at LLSB. Legend: =—No chan.
rioventricular sit; ASD—Cardiac tra

Table 2—Patient Selection

Physiology—Indexed pulmonary resistance; arterial saturation; systemic arterial and venous pressure

Anatomy—Lesion not amenable to surgical or medical therapy.
with Cardiac Anomalies Including an Evaluation of the Degree of Banding*

WILLIAMS, M.D., F.R.C.P.
LARTWRIGHT, M.D., F.C.C.P.
NADL R. CARTER, M.D.

Patients and Methods

The 14 infants treated by pulmonary artery banding ranged in age from 2 weeks to 8 months. There were 8 girls and 6 boys. All were the third percentile in weight. All had evidence of right- and left-sided decompensation and had givalized with digoxin (Lanoxin). Severe heart failure and 12 of the 14 had dyspnea, auscultatory evidence of edema and required continuous therapy. Operation was carried out emergently in three of the four on a semi-urgent basis. It was the opinion of all that these infants could not survive more than six weeks or months of surgical palliation. The indexed 

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...systemic flow) and nine had right-to-left shunts (20 to 100 per cent of the systemic flow). The pulmonary pressure was elevated to systemic level in all except one patient; however, of the high pulmonary blood flow... 

...death and failure to thrive; congestive heart failure with moderate to marked dyspnea. 

... encouraged to maintain the systemic flow... 

...two patients with tricuspid atresia after surgical exploration. Banding was performed in two other patients after exploration of the heart using cardiopulmonary bypass where the pulmonary pressure was normal and the systemic pressure was elevated to systemic level. As a result, the clinical situation was much improved... 

...two, tricuspid atresia (types 1C and 2C of Keith and associates) and one, mitral atresia. Table 1 summarizes the clinical, physiologic, and anatomic criteria used in patient selection.

1. Banding Technique—A cotton umbilical tape was used for banding the first 11 patients, external plicating was used in the twelfth patient, and Dacron bands were used in the last two patients. Changes in pulmonary arterial and systemic arterial oxygen saturation were used as indicators of a critical degree of banding in ten patients (Cases 4-14). Table 3 lists the changes in blood oxygen saturation following pulmonary artery banding which were used for determination of the “end-point” of pulmonary artery constriction. In patients with ayanocyanotic congenital heart disease, an ideal “end-point” of banding would be to increase the pulmonary resistance to a level where pulmonary and systemic...
temic blood flow were equal. At this point, pulmonary artery oxygen saturation would just equal systemic venous saturation. A decrease in pulmonary artery saturation to a level only 5 to 10 per cent greater than systemic venous saturation would indicate a residual but small left-to-right shunt and would result from banding which was adequate. Excess banding would be present when the pulmonary resistance exceeded the systemic and would be evinced by decrease in systemic arterial saturation due to right-to-left shunting. These criteria are not applicable to patients with complicated heart lesions associated with bidirectional shunts, since the pulmonary artery saturation in such patients is always greater than the systemic venous saturation. In patients with large left-to-right shunts and small right-to-left shunts, it was felt that the magnitude of drop in pulmonary arterial oxygen saturation following banding would reflect the magnitude of decrease in pulmonary blood flow. Figure 1 illustrates the calculated changes in indexed pulmonary blood flow for changes in pulmonary artery saturation at two levels of pulmonary venous saturation. Since the relationship of pulmonary artery saturation to pulmonary blood flow is a parabolic curve (Fig. 1), the change in pulmonary blood flow is large in association with initial small changes in saturation. Therefore, it seemed apparent that a decrease in pulmonary artery oxygen saturation of approximately 20 per cent would be associated with a marked reduction in pulmonary blood flow and could be used as an index of adequate banding. The band was loosened if the drop in saturation was in excess of 30 per cent and the banding increased if the difference was less than 15 per cent. It is important to remember that the calculated changes in flow illustrated in Fig. 1 assume that blood oxygen capacity, oxygen consumption, systemic blood flow and pulmonary venous saturation are all constant. We cannot be certain that all of these parameters remained constant in our patients. Blood oxygen capacity should not change unless there is excessive bleeding or transfusion. It seems unlikely that oxygen consumption changed significantly over the sampling period. If the systemic blood flow decreased, pulmonary artery saturation a lesser decrease and the converse if it increased. It is quite possible venous saturation increasing in patients with large since pulmonary congests by the procedure. If the drop in pulmonary arte represent a greater decrease. In patients with shunts as well as left-to-right felt that it was more changes in systemic art the pulmonary artery w to lower the systemic art low 50 per cent since bidirectional shunts, the saturation falls as the flow is decreased. If band a patient who has a syste below 70 per cent desirable that banding conjunction with a second, increase systemic and mixing.

Patients with cyanotic infants with small right-to-left ventilated with 20 per cent minutes prior to banding, large right-to-left shunts breathe 60 to 100 per cent banding since systemic increased only slightly during high tension oxygen surgery was tolerated. A pulmonary or systemic arterial sample drawn and the banding blood oxygen saturation w the indirect spectrophotobony Gordy and Drabkin, who one to two minutes for and could, therefore, be the banding was accomp geon produced pulmonary estimated to reduce the p diameter to one-half to the aorta (area of one-fourth

| Table 3—Changes in Blood Oxygen Saturation Following Pulmonary Artery Banding |
|----------------|----------------|----------------|
|                | "Ideal"        | Adequate       | Excess          |
| I. Cyanotic Lesions | PA=SV          | PA≈SV          | PA=SV; SA>      |
| II. Cyanotic Lesions |                |                |                 |
| A. Large L→R +    | PA>15-30%      |                |                 |
| Small R→L         |                |                |                 |
| B. Large L→R +    | SA> to no less than 50% |     |                 |

Legend: PA—Pulmonary arterial saturation; SV—Systemic venous saturation; SA—Systemic arterial saturation; L→R—Left-to-right shunt; R→L—Right-to-left shunt; >—Decrease.

- Figure 1: The relationship of pulmonary arterial blood oxygen saturation to pulmonary blood flow for two levels of pulmonary venous oxygen saturation. These data are based on the assumption that oxygen capacity, oxygen consumption, systemic blood flow and pulmonary venous saturation remain constant.
PULMONARY ARTERY BANDING

Blood flow decreased, a given decrease in pulmonary artery saturation would represent a lesser decrease in pulmonary flow and the converse if the systemic flow increased. It is quite possible that pulmonary venous saturation increased following banding in patients with large left-to-right shunts since pulmonary congestion is often relieved by the procedure. If this occurred, a given drop in pulmonary artery saturation would represent a greater decrease in pulmonary flow. In patients with large right-to-left shunts as well as left-to-right shunts, we felt that it was more critical to obscure changes in systemic arterial saturation as the pulmonary artery was banded so as not to lower the systemic arterial saturation below 50 per cent; since in patients with bidirectional shunts, the systemic arterial saturation falls as the pulmonary blood flow is decreased. If banding is planned for a patient who has a systemic arterial saturation below 70 per cent, we feel that it is desirable that banding be performed in conjunction with a second procedure to increase systemic and pulmonary venous mixing.

Patients with acyanotic lesions and patients with small right-to-left shunts were ventilated with 20 per cent oxygen for five minutes prior to banding. Patients with large right-to-left shunts were allowed to breathe 60 to 100 per cent oxygen during banding since systemic arterial saturation increased only slightly in these patients during high tension oxygen breathing and surgery was tolerated poorly at lower oxygen tensions. A pulmonary arterial sample or systemic arterial sample was then withdrawn and the banding performed. The blood oxygen saturation was determined by the indirect spectrophotometric method of Gordy and Drabkin, which requires only one to two minutes for a determination, and could, therefore, be completed while the banding was accomplished. The surgeon produced pulmonary artery banding estimated to reduce the pulmonary artery diameter to one-half to one-third that of the aorta (area of one-fourth to one-ninth that of the aorta). He was guided in this initial effort by gross observations of myocardial color and action. The electrocardiograph was monitored constantly during the procedure. The band was promptly loosened when any significant bradycardia occurred. The banding tape was then clamped and a second pulmonary or systemic arterial sample withdrawn. This second sample was analyzed for oxygen saturation while the surgeon sutured the band. If the difference in saturation between the first and second samples was 15 to 30 per cent, the procedure was concluded. The band was loosened if the change in saturation was in excess of 30 per cent and the band tightened if the saturation difference was less than 15 per cent.

In patient 6, only a 10 per cent decrease in saturation was observed even though the band appeared to result in a pulmonary diameter one-third of the aortic diameter. Cardiac action weakened following further banding. It is possible that pulmonary venous saturation increased in this patient. Her postoperative clinical findings and course indicate that the degree of banding is close to ideal. In patient 7, even after the surgeon felt the pulmonary artery was almost completely occluded, the saturation drop was less than 10 per cent. At necropsy, this patient proved to have a large misshapen patent ductus arteriosus and pulmonary artery banding without ligation of the ductus probably did not result in a significant decrease in pulmonary blood flow. In patient 12, the decrease in pulmonary artery diameter was accomplished by the plication technic and resulted in only a five per cent decrease in saturation. It was not technically possible to increase further the pulmonary artery narrowing in this patient. In patient 10, the initial change was 50 per cent; however, cardiac action was good. The band was slightly loosened and the second sample showed a 40 per cent change. The band was not further altered since gross observation indicated that the band was well tolerated. This previously acyanotic patient has grad-
ventricular communis defects had pulmonary artery banding. Two patients survived and are clinically improved; however, both continue to have considerable cardiac enlargement and improvement has not been as marked as is usually seen after successful banding of patients with ventricular septal defect. Both surviving patients have shown less evidence of congestive heart failure following banding and both have begun to gain weight slowly.

Patients with cyanotic congenital heart disease: Large left-to-right shunts, small right-to-left shunts — Nine patients with this type cyanotic congenital heart disease have been banded. Four survived the surgical procedure and three evinced clinical improvement. The three patients who were improved showed changes comparable to the banded patients with atrioventricular communis lesions. Patient 6 who had a single ventricle and transposition of the great vessels showed the most marked change. Preoperative and postoperative roentgenograms of this patient are illustrated in Fig. 2.

Large left-to-right shunts, large right-to-left shunts: Two patients were banded

Table 4—Summary of Results of Pulmonary Artery Banding

<table>
<thead>
<tr>
<th>Procedure</th>
<th>No. of Patients</th>
<th>Survivors</th>
<th>Surgical Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Cyanotic—AV Communis</td>
<td>2</td>
<td>1</td>
<td>50%</td>
</tr>
<tr>
<td>B. Cyanotic—Transposition</td>
<td>3</td>
<td>2</td>
<td>33%</td>
</tr>
<tr>
<td>C. Single Ventricle</td>
<td>3</td>
<td>2</td>
<td>33%</td>
</tr>
<tr>
<td>D. Truncus (Type 1)</td>
<td>2</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>E. T.A. (Types 1C &amp; 2C)</td>
<td>2</td>
<td>1</td>
<td>50%</td>
</tr>
<tr>
<td>F. M.A. (ASD + SV)</td>
<td>1</td>
<td>1</td>
<td>0%</td>
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<tr>
<td>Total</td>
<td>14</td>
<td>8</td>
<td>43%</td>
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usually become cyanotic since surgery, indicating that the banding is excessive. It is our impression from observing changes in the postoperative intensity of the stenotic murmur that the cotton umbilical tape bands tend to loosen somewhat during the first week following surgery. This has not been the case in patients in whom Dacron bands were used.

Results

Clinical Results (Table 4)

Patients with acyanotic congenital heart disease: Three patients with large atrio-

Figure 2: Pre- and postoperative chest roentgenogram of patient 6. This patient’s lesion was single ventricle plus transposition of the great vessels.

An Evaluation of A Saturation as an I Banding (Table 5)

Arterial oxygen saturation performed in ten of our experience, although that change in artery can be simply and easily determined for the determination of the quantity of banding. In some saturation data indicates significantly reduced of these six patients the postoperative clinical picture of pulmonary flow diminished. Two patients five and 18 months other complications after banding showed the pulmonary artery banding to a diameter of half the aortic (Case 8) did not improve, procedure although satisfactory.

Table 5—Accuracy of Oxygen Saturation in Pulmonary Artery

<table>
<thead>
<tr>
<th>No.</th>
<th>Patient Description</th>
<th>Adequate Banding</th>
<th>Inadequate Banding</th>
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<tbody>
<tr>
<td>1</td>
<td>Saturation data indicative of adequate banding</td>
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<tr>
<td>2</td>
<td>Saturation data not indicative of adequate banding</td>
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</table>
lar communis defects had pulmonary banding. Two patients survived clinically improved; however, both had lesions with both large right-to-left as well as left-to-right shunts. Both of these patients had the Taussig-Bing type transposition of the great vessels. Both survived and were moderately improved by the banding. Patient 4 is now three-and-one-half years old, weighs 22 pounds and by chest roentgenogram shows only slight cardiac enlargement and normal pulmonary vascular markings. Patient 5 expired 18 months after surgery from bronchopneumonia.

**An Evaluation of Arterial Oxygen Saturation as an Index of Critical Banding (Table 5)**

Arterial oxygen saturation studies were performed in ten of our 14 cases. Our experience, although limited, has shown that change in arterial oxygen saturation can be simply and rapidly performed and that this information is a helpful adjunct for the determination of an adequate degree of banding. In six of ten patients, the saturation data indicated that the banding significantly reduced pulmonary flow. Five of these six patients survived surgery and the postoperative clinical findings indicated that pulmonary flow was significantly diminished. Two patients (5 and 13) expired five and 18 months postoperatively from other complications and necropsy observations showed the pulmonary artery to be banded to a diameter approximately one-half of the aortic diameter. One baby (Case 8) did not survive the banding procedure although saturation data indicated that there was adequate banding. This was a mongoloid infant with an atroventricular communis who had had excessive bleeding in association with the pulmonary artery dissection for both ductus division and banding. Necropsy examination showed adequate banding.

In four infants, saturation data indicated that the banding had not resulted in a significant decrease in pulmonary blood flow. This proved to be the case in two patients. In one patient (Case 7), the band was quite tight, but the pulmonary flow was probably not diminished since a large ductus arteriosus was present. In another (Case 12), the plication technic had been used and it was not technically possible to achieve safely further banding. In Case 14, cardiac action weakened following banding which was associated with a drop in saturation of only 7 per cent. Postoperative clinical assessment indicates that pulmonary flow is decreased but is still large. In the fourth patient (patient 6), efforts to increase the degree of banding, following only a 10 per cent drop in saturation, resulted in weak heart action and, therefore, the degree of banding was not increased. Postoperative observation indicated that the banding in this patient was adequate. We suspect that the pulmonary venous saturation in the last two patients increased significantly following banding.

**Discussion**

Most previous investigators have determined the adequacy of pulmonary artery banding by gross observations of cardiac action or by measurements of the right ventricular to pulmonary artery systolic pressure gradient. The gross technic has the advantage of keeping the operative time to a minimum which is certainly important in these severely ill infants. We felt that results would be improved if a quick reliable measurement could be used to confirm the gross observations. The pressure gradient technics as described by Morrow and Braunwald and Albert et al. apparently give quite consistent results, but are

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**Table 5—Accuracy of Changes in Blood Oxygen Saturation as an Indicator of Pulmonary Artery Banding**

<table>
<thead>
<tr>
<th>No. Survived Surgery</th>
<th>Clinical or Necropsy Evidence of Adequate Banding</th>
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1. Saturation data indicative of adequate banding
2. Saturation data not indicative of adequate banding
not particularly simple or brief or atraumatic and do not necessarily indicate a decrease in pulmonary blood flow. We decided to use the technic described involving measurement of pulmonary arterial and systemic arterial saturation for the following reasons: (1) simplicity, (2) rapidity and (3) the change in pulmonary arterial oxygen saturation reflects changes in pulmonary blood flow when there is no significant change in blood oxygen capacity, oxygen consumption, pulmonary venous saturation or systemic flow. Because the accuracy of this technic depends on the constancy of variables which cannot be simply or accurately measured, its use must be limited to that of an adjunct in the assessment of adequate banding. As is seen in Table 5, the saturation data correlated with the adequacy of the banding in eight of ten patients. There were two false negatives; that is, patients (Cases 6 and 14) who proved to have adequate banding in whom the saturation change indicated an insufficient degree of banding. There were no false positives; e.g., a significant drop in saturation without a sufficient degree of banding.

The mortality of 43 per cent is high; however, it must be remembered that the criteria for patient selection for operation was the demonstration of large left-to-right shunts in small, extremely ill infants whose clinical condition indicated that survival beyond a few weeks or months was unlikely without surgical palliation. Our experience and that reported by Keith show that the expected natural attrition rate of such infants is greater than 80 per cent. Of the nine patients (Cases 4, 5, 8, 10, 11, 12, 13 and 14) in whom we felt satisfactory banding was accomplished, eight survived and seven (78 per cent) were clinically improved. It is our impression that surgical experience had more to do with the success or failure of the procedure in our patients than did the type of congenital heart defect, patient selection or other factors, since the first three patients of our experience did not survive and additionally two other patients who expired had had excessive bleeding during dissection of the pulmonary artery. The sixth death was probably the result of a faulty preoperative diagnosis. This was a patient (Case 7) with single ventricle in whom the diagnosis of a coexistent large patent ductus arteriosus had been missed. Because of our experience with this latter patient, we feel that it is imperative that exact knowledge of great vessel anatomy and the presence or absence of a significant size ductus be determined and, therefore, not routinely do aortograms as a part of the preoperative workup.

We did not measure changes in pulmonary artery pressure at the time of surgery in any of our patients. There was necropsy evidence of adequate banding in six patients. Postoperative catheterization has been performed in only one patient. His pre-banding pulmonary-to-systemic flow ratio was five to one. The post-banding ratio was one to one and there was a 60 mm. Hg systolic gradient across the band (Case 13).

There is controversy as to the effect of pulmonary artery banding on patients with atrial communications. Morrow and Braunwald have stated that patients with atrial septal defect should not be banded since the magnitude of shunting will decrease only when right ventricular failure is produced. The experimental animal work of deS Amorim, et al., in animals with atrial defects has shown that banding is associated with marked reductions in the magnitude of left-to-right shunting with only minor changes in the right ventricular filling pressure. Young has recently stated that, "Because it appears that the additional presence of pulmonary stenosis has a beneficial effect on the complete form of atrioventricular canal, it seems reasonable to propose that banding the pulmonary artery... might be an effective, at least temporizing, surgical procedure..." Our experience with three patients with atrioventricularis communis lesions and the clinical experience of Dammann, et al., indicates that infants with large atrial left-to-right shunts and c can be improved by pulm. A few technical as procedure merit menti- perience, we feel that incision is the approa- in patients who have a tus arteriosus. In the left anterior incision the ductus can be more to banding the pulmc- tion of the pulmonary done with great care excessive bleeding. Blin the "vascular" space i there may be considered reupr of the large v course close to the bas artery. We feel that a material, such as Dacron preferable to cotton, seem to stretch during placement. The band exceed 1 cm. as it is too cult to control the ar resistance with a wide present experimenting v of belt type design. U. will allow the surgeon curately the degree of diameter and hence the segment would be kno. By use of this type of b possible to make small greater precision.

**Summary**

1. Experience with banding in 14 very ill infants with cyanotic congenital defects shows that this procedure resulted in survival in 78 per cent of patients in whom satisfactory banding was accomplished.

2. Evaluation of changes in pulmonary artery pressure before and after banding to be a safe, simple and determining critical band.
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A few technical aspects of the surgical
procedure merit mention. Based on our
experience, we feel that the sternal splitting
incision is the approach of choice except
in patients who have associated patent ductus
arteriosus. In these latter patients, a
left anterior incision is preferred so that
the ductus can be more easily divided prior
to banding the pulmonary artery. Dissection
of the pulmonary artery should also be
done with great care in order to avoid
excessive bleeding. Blind dissection through
the "avascular" space is not indicated since
there may be considerable bleeding from
rupture of the large venous trunks which
course close to the base of the pulmonary
artery. We feel that use of the synthetic
material, such as Dacron for the band, is
preferable to cotton, since cotton bands
seem to stretch during the first week after
placement. The band width should not
exceed 1 cm. as it is technically more diffi
cult to control the amount of increased
resistance with a wide band. We are at
present experimenting with a Dacron band
of belt type design. Use of such a band
will allow the surgeon to assess more ac
curately the degree of banding since the
diameter and hence the area of the banded
segment would be known more precisely.
By use of this type of band, it will also be
possible to make small adjustments with
greater precision.

SUMMARY

1. Experience with pulmonary artery
bANDING in 14 very ill infants with cyanotic
and acyanotic congenital heart disease oth
ner than ventricular septal defect, reveals
that this procedure resulted in effective
palliation in 78 per cent (seven of nine)
patients in whom satisfactory banding was
achieved.

2. Evaluation of change in pulmonary
arterial and systemic arterial oxygen satu
bation before and after banding proved to
be a safe, simple and rapid adjunct for
determining critical banding and correlat
ed well with the postoperative evaluation
of the adequacy of banding in eight of ten
patients.

3. Our findings suggest that survival
rate and effective banding are probably
associated more with surgical experience
than with patient selection or the type
congenital heart lesion, since our first three
attempts at banding were unsuccessful and
two of the other three deaths occurred in
patients in whom surgical complications
occurred.

4. Our experience indicates that it is
quite important that preoperative laborato
ry evaluation include a careful assessment
of great vessel anatomy in order to be
as certain as possible concerning the exact
position of the great vessels and the presen
tce or absence of a significant size ductus
arteriosus.

RESUMEN

1. La experiencia del vendaje de la arteria
pulmonar en 14 niños muy enfermos con afeccio
nes cianóticas y acianóticas congénitas del
corazón aparte de los que tenían defectos sep
tales ventriculares, revela que este procedimiento
produce paliación efectiva en 78 por ciento (siete de
nueve casos), enfermos en los que le llevó a cabo
el vendaje con éxito.

2. La valoración de los cambios en la satura
ción del oxígeno en la arteria pulmonar y en la
circulación general antes y después del vendaje
demuestra que es un adyuvante seguro, sencillo y
rápido para hacer un vendaje en condiciones
críticas y se correlacionó bien lo adecuado del
vendaje en 8 de 10 enfermos.

3. Nuestros hallazgos llevan a pensar que la
proporción de sobrevida y el vendaje efectivo
están asociados más con la experiencia quirúrgica
que con la selección de enfermos o el tipo de
lesión cardiaca congénita, puesto que nuestros
tres primeros intentos de vendaje no tuvieron
buen resultado y dos de las otras tres muertes
ocurridas fueron en enfermos de los que pre
sentaron complicaciones quirúrgicas.

4. Nuestra experiencia indica que es especial
mente importante que la valoración preope
ratória incluya una cuidadosa estimación de la
anatomía de los grandes vasos para ser tan
cierto como sea posible respecto de la posición
exacta de los vasos y la presencia o no de con
ducto arterioso de tamaño significante.

RESUMÉ

1. L'expérience du "banding" de l'artère pul
monaire chez quatorze nourrissons en trois ma
vatis état, avec cardiopathie congénitale cyanogène ou sans cyanose autre que la communication interventriculaire, montre que ce procédé a amené un effet palliatif dans 78 pour cent (7 sur 9) des malades chez lequel l'opération a été fait de manière satisfaisante.

2. Une évaluation des modifications dans la saturation artérielle oxygénée artérielle pulmonaire et systémique, avant et après l'opération s'est montrée être un test sûr, simple et rapide pour déterminer l'importance à donner au geste opératoire. Ces modifications ont une bonne corrélation avec le résultat post-opératoire sur l'efficacité du "banding" dans 8 malades sur 10.

3. Nos constatations suggèrent que le pourcentage de survie et l'efficacité du "banding" sont sans doute plus en rapport avec l'expérience des chirurgiens qu'avec la sélection ou le type de la cardiopathie congénitale, étant donné que nos trois premiers essais opératoires ont été infructueux et que deux des trois morts ultérieures sont survenues chez des malades qui avaient eu des complications chirurgicales.

4. Notre expérience montre qu'il est très important que les examens pré-opératoires comprennent une évaluation soigneuse de l'état anatomique vasculaire, pour qu'on soit aussi bien renseigné que possible sur la position exacte des gros vaisseaux, et la présence ou l'absence d'un canal artériel.

ZUSAMMENFASSUNG

1. Erfahrungen mit der Pulmonalarterien-Verpflanzung bei 14 kranken Kleinkindern mit Cyanose und ohne Cyanose bei angeborenen Herzfehlern, abgesehen von Kammerseptumdefekten ergaben, daß dieses Vorgehen zu einer wirksamen Besserung in 78% führte (7 von 9), sofern eine befriedigende Vereinigung gelungen war.

2. Eine Auswertung der Veränderungen in der pulmonalarteriellen-Sauerstoffsättigung und der Sauerstoffättigung im großen Kreislauf vor und nach der Verpflanzung erwies sich als eine sichere, einfache und schnelle Methode zur Bestimmung kritischer Phasen der Vereinigung und stimmt sehr gut mit der postoperativen Auswertung einer ausreichenden Vereinigung in 8 von 10 Fällen überein.


REFERENCES


TOBACCO ALLERGY IN CORONARY ARTERY DISEASE

That tobacco hypersensitivity is a factor in cardiovascular disorders in man is supported by the following observations: (1) exposure to tobacco may provoke symptoms in specific shock tissues, that is, the heart and coronary or peripheral vessels; (2) abstention from smoking causes clinical remissions in the functional and organo-vegetative reactions in these shock organs and may arrest the progress of diseases such as thromboangitis obliterans, angina pectoris, and so on; (3) positive skin reactions are correlated with suspected clinical allergy; (4) reagents specific for various types of tobacco are demonstrable by passive-transfer tests.

Since hypertension, generally regarded as one of the major causes in coronary artery disease, was absent in most of the hypersensitive smokers investigated, and other conditions such as obesity and diabetes were negligible, it is possible that tobacco allergy, in addition to other, as yet unknown factors, may play a significant role in the pathogenesis of coronary artery disease in patients sensitive to tobacco.

MUCOID IMPACTION OF THE BRONCHI

Mucoid impaction of the bronchi is a syndrome occurring almost exclusively in asthmatics. These patients secrete a peculiarly viscid mucus, inspissation of which leads to bronchial occlusion and atelectasis, followed in some cases by suppuration and bronchiectasis. The radiologic features are described and three illustrative cases reported.


ANOMALOUS LEFT CORONARY ARTERY

Nine cases of anomalous origin of the left coronary artery from the pulmonary trunk, involving patients ranging in age from two months to seven years, have been reviewed. In six, mitral insufficiency was a prominent feature and, in three of these patients, mitral insufficiency presented the major problem clinically. The clinical picture was that of an acyanotic patient with nonspecific respiratory complaints and retardation of growth. In five patients, there were symptoms (although a presenting complaint in only one) which are considered classic for this anomaly. These symptoms included episodes of pallor, dyspnea, and perspiration. Eight patients experienced cardiac failure in infancy and response to digitals was effective in each.

The vectorcardiogram in the horizontal plane was most helpful in the diagnosis of anomalous origin of the left coronary from the pulmonary trunk. The QRS e loop in the horizontal plane in this anomaly was oriented posteriorly to the left and its direction was clockwise, in contrast to the counterclockwise direction of the loop in endocardial fibroelastosis.

Selective ascending aortography or selective right coronary arteriography established the diagnosis in seven cases.


REFERENCES


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