A New Radiopaque Surgical Suture*

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SUMMARY
We have developed a new X-ray visible suture. It is a polyester suture containing platinum wires.

The radiopaque suture was used clinically in 43 cases, and was useful in the following situations:
(1) as a marker for post-operative angiography (post-operative graft angiography of aorto-coronary bypass or Brockenbrough’s method),
(2) as a marker for evaluation of valve reconstructive surgery or surgery of intracardiac anomalies, and
(3) as a guideline for second radical repair after primary operation.

Additional Indexing Words:
Primary and secondary operation Angiocardiography

ENDOTHORACHEAL tube and drainage tubes used in thoracic and cardiovascular surgery are now partially visible on X-ray films for better clinical care.

On the similar thinking we have developed an X-ray visible suture so that we can see it in the postoperative course.

We have developed a polyester suture containing platinum wires (60μ diameter), and is harmless to human tissue. It has a high X-ray absorptive ratio.

The number of the platinum wires in the suture was 5 (Wadax No. 1) for a patient of less than 15 Kg body weight, 10 (Wadax No. 2) for a patient of 15–40 Kg, and 20 (Wadax No. 3) for a patient of more than 40 Kg. The size of the suture was USP No. 3 (0.56–0.63 mm diameter).

METHODS AND RESULTS

The suture was used in 43 cases consisting of 1 of pulmonary artery banding, 3 of atrial septal defect closure, 4 of endocardial cushion defect repair, 6 of ventricular septal defect repair, 10 of aorto-coronary bypass grafting, 1 of

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shunt operation, 10 of tricuspid valve reconstruction, and 8 of other operations. Some typical cases are described below.

I. Pulmonary artery banding

The X-ray visible suture was used in pulmonary artery banding for pulmonary hypertension in congenital heart anomaly. The size of the banded pulmonary artery could be visually followed up after the operation.

II. As a marker for angiography

A. Aorto-coronary bypass grafting:

The suture was used as a marker at the aortic site of aorto-coronary bypass grafting.¹ It could replace the conventional ring-marker for graft-angiography (Fig. 1).

B. Transseptal left heart catheterization:

The X-ray visible suture was fixed around the foramen ovale during cardiotomy. It made transseptal left heart catheterization² easier and safer. It was especially useful for postoperative hemodynamic studies after aortic valve replacement.

Fig. 1. Marker for postoperative angiography (aorto-coronary bypass grafting).
III. Radical operation after Blalock-Taussig operation
On performing radical operation after the initial Blalock-Taussig operation, ligation of subclavian artery is not always technically easy. At the time of the Blalock-Taussig operation the suture was left as a marker of the site of binding subclavian artery for later radical repair.

IV. Intracardiac anomaly
In the operation of atrial septal defect, ventricular septal defect, endocardial cushion defect, or tetralogy of Fallot, the X-ray visible suture was placed along the interrupted or running suture line on the margin of septal defect; thus, it served for evaluation of post-operative change of patch graft.

Fig. 2 shows a case of VSD with aortic valve regurgitation which was subject of closure of VSD and aortic valve plasty. The anatomical relationship between prolaps of the aortic valve and VSD are well seen by having the special suture in vision.

Fig. 3 shows a case of endocardial cushion defect in which ostium primum defect was treated with patch closure and cleft of the mitral valve was treated with direct closure. The X-ray visible suture was placed along stiches used. Mitral regurgitation which was before the operation disappeared after the operation, and the anatomical relation of cleft of mitral valve to ostium primum defect is well seen by the radiopaque suture along the suture line.

V. Valve reconstruction
A. DeVega’s method
Fig. 4 shows the right ventriculogram after the DeVega’s operation

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Fig. 2. VSD+aortic valve regurgitation. Left panel: pre-operation. Right panel: post-operation, shows the anatomical position of VSD.
Fig. 3. Endocardial cushion defect. Left panels: pre-operation. It shows cleft and regurgitation of the mitral valve. Middle panels: post-operative LV graphy shows no regurgitation of mitral valve. Right panels: post-operative RV graphy.

Fig. 4. De Vega’s method for Tricuspid valve regurgitation. Left panels show pre-operative RV graphy. Middle panels show post-operative RV graphy in diastole and systole (right oblique position). Right panels show post-operative RV graphy (left oblique position).

for tricuspid valve regurgitation.

B. Wada’s tailoring annulo-plasty.4)

Fig. 5 shows a patient who was subjected to the operation with the X-
ray visible suture according to Wada's method in which the full circumference of valvular annulus was reconstructed for tricuspid valve regurgitation.

CONCLUSION

A new radiopaque surgical suture has been developed and was used clinically in 43 cases since December in 1977. No complication has been experienced with this method.

The operation with the suture showed the following merits:
1. It helped to perform precise and safer post-operative angiography.
2. It could serve as a guideline for evaluation of operative outcome and anatomy of the defect corrected surgically.
3. It could serve as a marker for elucidation of anatomy of cardiac anomalies or dynamic functions of valves after surgical treatment.
4. The suture could be used in the primary operation to give a better surgical orientation in the second radical repair.

REFERENCES