prior to her admission. Under generalized hypertensive the patient was operated upon five years ago at which time six pairs of intercostal artery were ligated and severed extending from the take-off of the subclavian artery down to 4cm. above the diaphragma. The aneurysmal lesion was dissected out and this was replaced with an artificial vessel. Her post-operative course has been uneventful and no neurological deficit was detected on the latest follow-up study. Neither phlebograms showed no abnormality. Only abnormality found was low voltage EMG activity appeared in the lower limbs.

CONCLUSION

Above mentioned subjects in the field of aortic surgery seemed extremely interesting to us. Problems raised in the surgery of the aorta were quite different from ones in the peripheral

vascular surgery in which the prevention of the post-operative thrombus formation is most problematical.

Protection of the various organs, located below the lesion, from the ischemic change should rather call our attention in the case of aortic surgery in which post-operative thrombus formation can be considered minor.

Problems of declamping shock are also remained unsolved. Associated generalized arteriosclerosis in the most cases of aortic diseases makes their long-term follow-up results rather poor. Further detailed clinicopathological consideration in avoiding any ischemic lesion in the spinal cord has to be made in near future when more accurate diagnosis of the aortic disease could be established and more extensive operative procedures would become feasible.

4. Graft Replacements in Venous System[†]

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EXPERIMENT STUDIES

Through our extensive experimental studies on venous grafting major obstacles to successful grafting have been the incidence of early thrombotic occlusion and late constrictive obstruction of implanted grafts. Every effort has been made to eliminate these two impeding factors.

The author and associates have carried out experimental replacement of canine superior vena cava (SVC) with a variety of materials. As a result, of the synthetic tubes tested, the most successful patency rate of 70% was achieved with Teflon tube. On the other hand, patch grafting repair of defect in SVC has resulted in 100% patency rate with any synthetic materials or autogenous vein patch.

It is generally accepted that venous replace-

ment by synthetics is not carried out with equal likelihood of success in all areas. This difference in maintenance of patency in different parts of venous system suggests that it might result from hemodynamic characteristics at a site of graft placement.

Some interesting findings were obtained from blood flow and pressure measurements in SVC, intrathoracic inferior vena cava (IVC) and infrarenal IVC. The rate of blood flow in intrathoracic IVC was determined the highest of all and slightly higher than those in SVC. In the area of infrarenal IVC, rate of blood flow was found markedly decreased.

Tracing of venous pressure curve in the area of SVC and intrathoracic IVC has revealed the pulsatile pattern of flow which occurs in accordance with cardiac contraction. Whereas, flat pressure curve was obtained in intraabdominal

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IVC.

These findings from hemodynamic studies appear to offer evidence of difficulties with grafting in the area of infrarenal IVC.

In arterial grafting, high internal pressure and pulsatile pattern of blood flow seem to contribute to high rate of success. In this connection, it is presumable that generally accepted high rate of patency in SVC and intrathoracic IVC grafting might be due to the existence of pulsatile flow and also to relatively high rate of blood flow.

Although autogenous vein is clearly the best graft material for use in venous replacement, the most practical solution to the problem of large venous grafting lies in the use of synthetic tubes. As we have already reported, the best results with synthetic grafts have been obtained with Teflon. On the other hand, autogenous vein patch grafts or Teflon patch grafts have been implanted with complete patency. Based on these experimental results, we devised "compilation graft" made of Teflon tube of which part was replaced with autogenous vein, and applied it to SVC in dogs. Usefulness of this compilation graft was evidenced by rare incidence of early thrombotic occlusion. In addition, autogenous vein appeared to be contributory to neointimization of the synthetic tube. However, follow-up observation demonstrated relatively high incidence of late constrictive occlusion of the graft. This experience led us to employing more rigid synthetic tube. In subsequent studies, compilation graft made of autogenous vein and Darcon or Tetron tube which was made more rigid with polyurethane coating was tested. As a result, narrowing of the lumen due to excessive coagulum formation on a inner surface of the synthetic tube was noted to occur. In long term, however, many of them remained patent. This result seems to indicate that external support which does not reduce the porosity of the synthetics would be more advisable.

An attempt was made to investigate the adequacy of external splinting or reinforcement of compilation graft with half-moon shaped SMO steel ring. In a follow-up of more than 10 months, the site of anastomosis which was

externally reinforced was found void of deformity or constriction. But, the anastomotic site which was not reinforced was uniformly associated with constriction. All of 5 animals have remained patent 15-32 weeks after implantation of compilation graft of which both sites of anastomosis or whole length was externally reinforced.

The evidence at hand, though limited, suggests that a higher incidence of successful grafting in the venous system may be achieved by the use of externally supported compilation graft.

Further evaluation was made of placement of this compilation graft in canine infrarenal IVC. The results obtained, however, were distinctly inferior to those obtained in SVC. It appears that hemodynamics in this area of venous system provide particular hindrance to patency of the implanted synthetic grafts.

CLINICAL STUDIES

To date, 8 clinical cases of venous grafting have been experienced. In each case of them, we were confronted with difficult problems. End results of bypass grafting or replacement for venous obstruction were discouraging even when Teflon tubes were employed in some cases. When a venous obstruction is relatively localized patch grafting may be preferred. A case will be presented briefly.

A man with clinical manifestations of superior vena caval obstruction was admitted. Exploration revealed mediastinal granuloma which affected SVC. Dissecting the scar, resultant wound of SVC was repaired with Teflon patch. The brachial venous pressure promptly fell from 340 mm of saline to 110 mm with complete relief of symptoms. Postoperative patency was evidenced by venography. However, symptoms of superior vena caval obstruction became gradually apparent 3 months later and venography taken 11 months after operation could hardly demonstrate the patency. Although recurrence of inflammation was suspected as a possible cause of failure in this case, necessity of obtaining more reliable reconstructive method for venous obstruction was keenly felt. Clinical trial of the suitability of compilation

graft would appear to be worth while.

SUMMARY

1. Correlation between hemodynamics in different parts of venous system and difference in graft patency was discussed.

2. Feasibility of compilation graft made of autogenous vein and Teflon tube with external support was evaluated in experimental replacement of canine superior vena cava.

3. Clinical trial of this compilation graft would appear to be worth while.