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# EFFECT OF NUMBER OF SUTURES ON MICROVASCULAR VENOUS ANASTOMOSIS IN EXPERIMENTAL RATS

D. C. Srivastava, J. K. Sinha, S. Khanna, F. M. Tripathi and V. Bhattacharya

## SUMMARY

*In this experimental study better patency rates (80 percent) were achieved when 8 to 9 sutures were used for anastomosis. Accurate edge to edge approximation and minimal medial damage were found to be prime factors in the success of venous anastomosis. Use of less number of sutures (4-6) resulted in significant leakage and early occlusion of the veins.*

(*Key Words* : Microsurgery, Femoral Vein, Suture Techniques, Rats, Platelet Aggregation)

Advancement in microsurgical techniques and instrumentation have enabled the surgeon to repair vessels of 1mm (Jacobson et al., 1960; Seaber, 1985). Various studies in the past have revealed a success rate of 50% to 90% patency after anastomosis (Duspiva et al., 1976; O'Brien, 1977). Establishing and maintaining vascular patency are particularly difficult with regard to small veins because of the increased technical difficulty, modest venous blood flow favouring post-operative thrombosis and the tendency for prolonged venospasm to occur (Hayhurst and O'Brien, 1975).

Microsurgical techniques are exacting and often time consuming. Interest is always generated in techniques which can simplify or accelerate the procedure. Since the veins are thin walled, low pressure venous system, we used 4 to 6 sutures for end to end anastomosis of femoral vein in a group of 20 rats. We compared this with end to end anastomosis of 1 mm veins using 8 to 9 sutures in other group of 20 rats and have noted the duration of operation, patency rates and histological differences post-operatively during the 2nd week.

## Materials and Methods

Forty femoral vein microanastomosis were performed on 40 adult Chales-Foster strain of rats (weight 250-300 gms) anaesthetised with intraperitoneal chloral hydrate 4% (4 gm/100 ml). The rats were divided into two groups, in one group of 20 rats we used 8 to 9 sutures and in other group of 20 rats 4 to 6 sutures were used for end to end anastomosis. The femoral vein was exposed in one leg of each animal through an inguinal incision. The mean femoral vein diameter measured was 1.1mm (Fig. 1a). An 8 mm Acland's double approximating clamp was used for anastomosis. Warm normal saline was applied continually for irrigation and 0.5% marcaine was used to reduce the spasm. All vein anastomoses were performed as described by Acland (1980), using 10/0 Ethilon on 4 mm needle. Completed anastomosis using 9 sutures is shown in (Fig. 1b.) The appearance of the vein before and after anastomosis using 6 sutures is shown in (Fig. 2a, 2b.

Fifteen minutes after anastomosis an uplift test and double clamp milking test (Acland, 1980) were carried out to assess the immediate patency. The wound was then closed. Patency tests and macroscopic examination were carried out during 2nd week post-operatively. An ex-vivo fixation procedure (Mazer et al., 1986) was used to prepare vessels for histopathology. Representative specimens of end to end anastomosis were taken and serially sectioned after fixation in formal saline (10%). Observations were made under light microscopy.

**Table 1. Patency rates following end to end femoral vein anastomosis**

| No. of suture used | Immediate post-op. (%) | 7-10 day post-op. (%) |
|---|---|---|
| 8-9 | 80 | 80 |
| 4-6 | 70 | 60 |

## Results

The operation time for end to end femoral vein anastomosis using 8 to 9 sutures was 15 ± 5 minutes while it was 10 ± 5 minutes when 4 to 6 sutures were used. The patency rates immediately post-operatively and at 7-10 day are shown in Table 1. No statistical difference in operation time between two groups was noted ($P > .05$). The patency rates obtained at the end of 1 week was 80% in the group where 8 to 9 suture were used. It was only 60% when only 4 to 6 sutures were used which is statistically significant ($P < .05$).

Patent anastomoses showed accurate apposition of cut vein ends in the microscopic examination (Fig. 3). Extensive thrombosis was present where accurate apposition of vessel end was not achieved and vein showed partial or

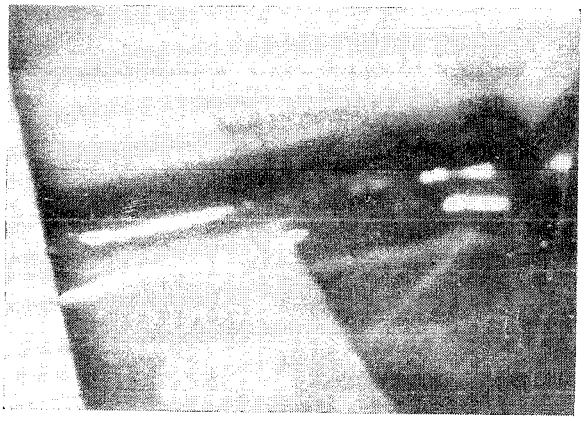

Fig. 1a. Photograph showing dissected femoral vein of the rat with background material for contrast and millimeter scale in place to measure external diameter of the vein.

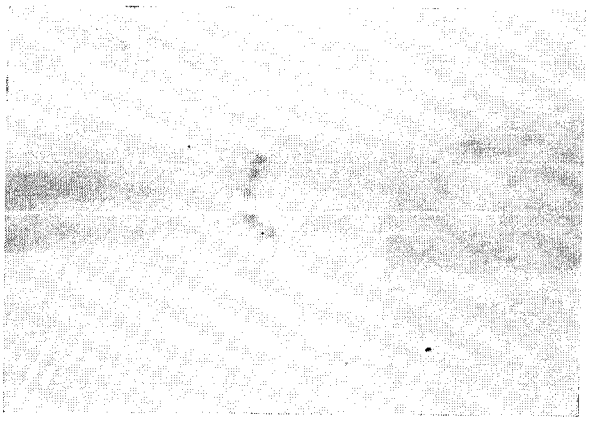

Fig. 1b. Completed end to end vein anastomosis using 9 sutures after release of the clamp. Vein is full, no constriction at the anastomosis site, colour of the vein both proximal and distal to anastomosis is same showing adequate patency.

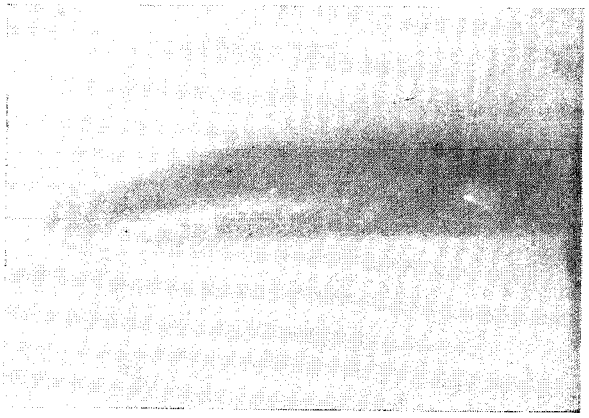

Fig. 2a. Dissected rat femoral vein against background material before anastomosis.

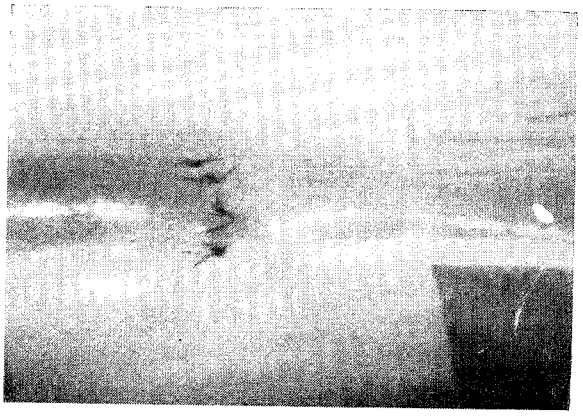

Fig. 2b. Completed vein anastomosis using 6 suture after release of the clamp. Blood in the vein is little darker distal to the anastomosis with doubtful patency.

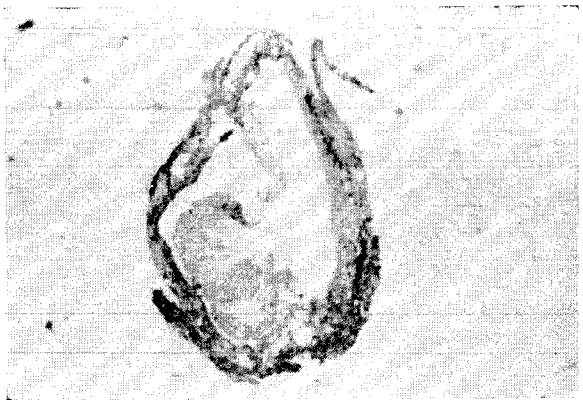

Fig. 3. Transverse section of a patent vein shows good apposition of cut vein ends at the anastomosis. The wall shows areas of necrosis. Biopsied at 10th day (Magnification 50 X).

Fig. 4. Transverse section of femoral vein showing complete blockage of the lumen and inaccurate apposition. Vein ends biopsied at 10th day (Magnification 50 X).

complete blockage of lumen (Fig. 4). This was much more evident where less number of sutures were used for anastomosis. Similar patterns of disruption of media and elastic lamina, subintimal hyperplasia and surrounding adventitial hyperplasia were observed in both the groups but these were less marked where less number of sutures were used.

## Discussion

Veins are technically more difficult to repair because of their flimsy wall structure and this has been suggested as the primary reason for the lower patency rates in microvenous repairs (Hayhurst, 1976a). In a histopathologic study of microvascular repairs the most common accompaniment of venous occlusion was the inaccurate apposition of the vein edges (Baxter and Coworkers, 1972).

Venous thrombosis after anastomosis is primarily caused by platelet aggregation and the formation of an occluding platelet thrombus leading to vascular stasis, simultaneous activation of the coagulation cascade and the formation of permanent clot (Hardisty, 1977). It has been suggested that the high rate of blood flow and higher pressure present in the arteries may inhibit thrombosis whereas an anastomotic mural thrombus may form and propagate in the low flow, low pressure venous environment (May and Coworkers, 1984). Each suture causes damage to the vascular wall and contributes to the potential for the occlusion of the anastomosis. Considering these facts it would seem wise to use as few suture as possible to avoid disruption of the normal vascular physiology and damage to the vessel particularly in thin walled low pressure venous system. In our study this was not found to be a good technique, eventhough anastomosis became leak free in a matter of few minutes, the gaps between the widely spaced sutures rapidly became filled with platelet thrombus and clots in the low pressure system. These occluding plugs narrowed the effective lumen of the vein leading to early occlusion and lowered patency rates.

Inaccurate apposition of vein ends was more common in the anastomoses where less number of sutures were used. Improvement in the patency rates of venous repairs have been obtained by a careful attention to the end to end approximation of the vein edges and by addition of a few sutures to each anastomosis as has been shown in our study and by other workers also (Hayhurst and O'Brien, 1975). There should be no hesitation in using an adequate number of sutures, e.g. 8 to 9 sutures for

1 mm vein to achieve accurate edge to edge approximation. The fear of suture crowding and the avoidance of suture tension are of secondary importance in venous repairs.

## Conclusion

We conclude from our study that accurate edge to edge approximation is of prime importance in venous repairs. It may be advantageous to use eight or nine sutures to achieve this objective as the use of less number of sutures was frequently associated with inaccurate apposition of vein ends and lowered patency rates.

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