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Vasovasostomy Suture Technique
An Experimental Study in the Dog

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Summary. The conditions for healing of the vas deferens have been studied in the dog. A length of twisted steel wire or nylon 4/0 inserted into the lumen of the duct gave rise to considerable histological changes after ten days. Obstruction developed in four out of ten anastomoses in which such suture material was used as a splint. A method of nonsplinted anastomosis is described. Nine out of ten anastomoses using this technique exhibited patency with a very limited histological reaction after the procedure.

Key words: Male sterility, Vas deferens, reanastomosis, experimental model, dogs

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During the last few years vasectomy has come into wider use as a method of voluntary birth control. Even if the indications for vasectomy are construed restrictively, it is inevitable that some of these patients will later desire to have their fertility restored. In addition, vasovasostomy is sometimes required in the treatment of male sterility of other origin.

Different techniques of anastomosis have been used (1, 4, 5, 9, 15, 16). Clinical reports indicate that it has been possible to detect spermatozoa in the ejaculate of about 60% of the patients undergoing reanastomosis (6). The number of pregnancies achieved is considerably lower - 20-40% at the most. Opinion is divided as to whether a splint should be used in the lumen of the vas (3, 11, 12) or whether such a procedure should be avoided (7, 10, 14). Recently a microsurgical technique employing an operating microscope (2) has been proposed.

The present report gives an account of a study of the conditions for healing of the vas deferens in the dog. The investigation has been made with a view to elaborating a simple and reliable technique for vasovasostomy.

Material and Methods

Twelve adult mongrel dogs weighing 16-29 kg were used. After an initial hypnotic dose of pentobarbitone (Pentobarbitalum INN; Mebumal sodium, ACO, Sweden) anaesthesia was maintained with halothane - nitrous oxide using endotracheal intubation.

Binocular magnifying glasses and microsurgical instruments (straight and curved iris forceps, straight iris scissors and microsurgery needle holder) were used. Either 8/0 or 9/0 monofil nylon (Ethilon^{R}) was used for the anastomoses and 4/0 twisted steel wire or 4/0 monofil nylon was used as splint material.

The following three types of experiment were performed:

I. A splint measuring about 2 cm was inserted into the lumen of the vas deferens through a transverse incision. The vas was not divided. The material used for the splint was twisted steel wire in two cases and monfil nylon thread in two cases.
II. Reanastomosis using a twisted steel wire splint (5 cases) or monofil nylon (5 cases).
III. Reanastomosis without splint (10 cases).

Surgical technique. The vas deferens was exposed on both sides via inguinal incisions. About 1/2 cm of the duct was resected 2 or 3 cm above the epididymis prior to anastomosis. When inserting the splint, use was made of a hypodermic needle (outer diameter 0.7 mm), the hub of which had been sawn off. The needle was inserted about 1 cm into the lumen and the point was then pushed through the wall. After the splint wire or thread had been

inserted in the needle, the latter was removed, leaving the splint inside the lumen. The same procedure was followed when inserting the splint in the opposite direction.

The transversely cut ends of the vas were apposed and united with six or seven isolated sutures in the outer layers of the duct. The vasa of both sides were anastomosed during the same operation. Steel wire was used as splint material on one side and monofil nylon on the other. The ends of the wire and thread were pulled out through the skin. The splints were removed after nine days.

Nonsplinted anastomoses were done with the aid of a specially designed transecting device (Fig. 1a). Both disengaged ends of the vas were placed in the grooves of the device and cut by a knife blade so as to obtain congruent cut ends at an angle of 45° to the long axis. The cut ends were then apposed with the aid of a straight needle (outer diameter, 0.7 mm) introduced into the lumen (Fig. 1b). With the needle serving as a support, the ends were united with eight or nine isolated sutures in the outer layers of the vas, after which the needle was removed.

In group I the vas deferens was removed bilaterally on the tenth day for histological examination.

All anastomoses (group II and group III) were checked by vasography and histological examination after one to two months.

Results

The results of the vasographic examinations are shown in Table I. Four of the anastomoses in group II and one in group III were occluded. Postoperative infection of the wound had occurred in two of the occluded cases in group II. In all cases employing splints, vasography revealed changes in the lumen in the immediate vicinity of the anastomosis. The changes were in the form of irregularities or local dilatation of the lumen (Fig. 2a). Slight changes were also observed in two cases in group III at the site of the anastomosis. Four vasographic examinations in this group revealed small diverticula opening from the lumen despite the fact that patency was good at the site of the anastomosis. In at least one instance (Fig. 2b) the diverticulum was located at a distance of about 1 cm from the site of the anastomosis, probably at the point where the needle used during the operation was pulled out.

Microscopy in group I revealed considerable changes, including fibrous thickening of the wall and ulceration and squamous metaplasia of the epithelium. There was a slight to moderate inflammatory reaction in the subepithelial region. The changes were somewhat more pronounced in the cases employing steel wire (Fig. 3) than in those in which nylon thread was used (Fig. 4).

In group II there was marked fibrosis in the subepithelial region and the epithelium was flattened. A mild inflammatory reaction with round cells in the wall persisted in several cases (Fig. 5).

In group III the tissue reaction was considerably less marked. A slight dilatation of the lumen with a slight flattening of the epithelium was the rule (Fig. 6). Around the thin monofil nylon sutures there was no appreciable inflammation and only an occasional giant cell.

Discussion

After occlusion of the vas deferens for a certain length of time dilatation of the lumen in the portion of the vas near the testis may occur, while the lumen in the distal portion is collapsed (17). The basic technical conditions for good results following vasoresection and immediate reanastomosis as

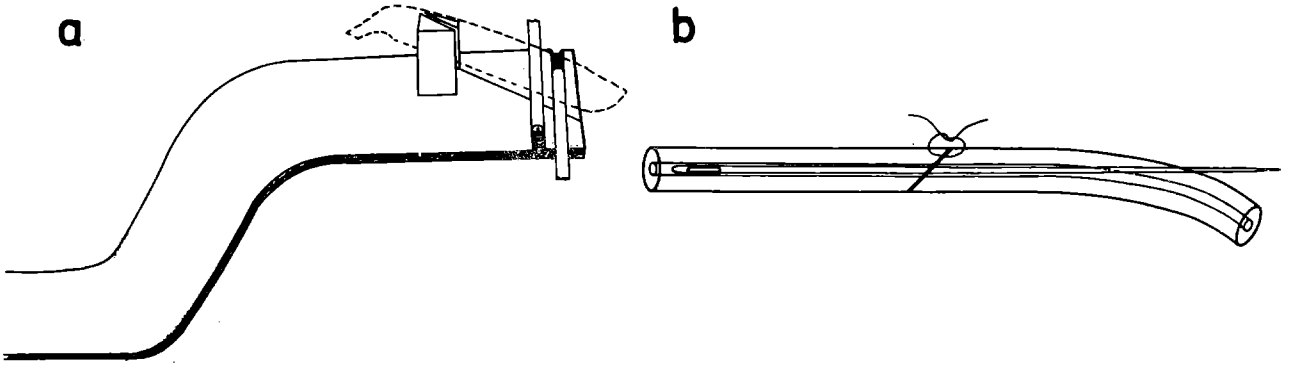

Fig. 1a. Transecting device. The disengaged ends of the vas deferens have been placed in the grooves of the device and are cut simultaneously by a knife blade mounted in the block
Fig. 1b. The two ends of the vas deferens are fixed in position during suturing by means of a straight needle in the lumen. The needle is removed upon completion of the anastomosis

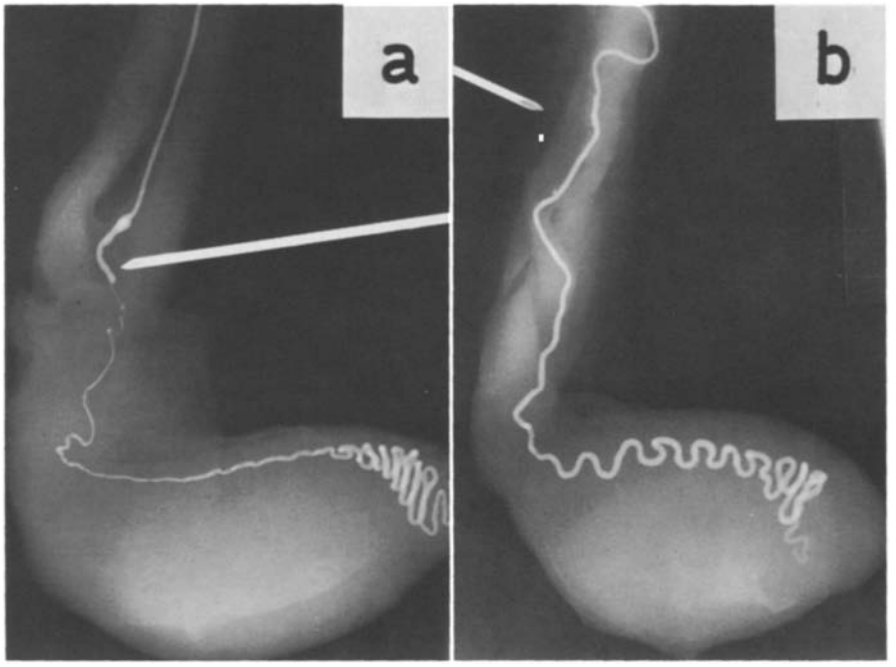

Fig. 2a. Vasography. Vasovasostomy with splint consisting of 4/0 twisted steel wire performed two months earlier. Splint removed ten days after reanastomosis procedure. The lumen is dilated and irregular in shape around the site of the anstomosis (indicated by needle)
Fig. 2b. Vasography six weeks after nonsplinted vasovasostomy. Slightly irregular lumen at site of anastomosis (indicated by needle point). Small diverticulum opening from lumen about 1 cm from anastomosis

Table 1. Vasographic check after vasovasostomy

Group	Number	Splint	Patency	Irregular lumen	Diverticulum
II	5	Nylon 4/0	3	3	
II	5	Steel wire 4/0	3	3	
III	10	-	9	(2)+	4

+ Only slight changes. Cf. Figs. 2a and 2b.

in our experiments may therefore be more favourable than can be expected in most clinical situations.

Although patency of the vas deferens may be restored spontaneously after vasectomy (8, 13), careful adaptation of the lumina of both ends when the anastomosis is performed will probably facilitate healing. The adaptation of the lumen can be maintained with the aid of a splint that remains in place after the operation. Even when inert material, such as twisted steel wire or monofil nylon thread, was used, we found considerable changes in the epithelium around the lumen. In all probability the splint gave rise to oedema in the epithelium and the loose subepithelial connective tissue due to mechanical irritation. Since the vas deferens is a relatively thick-walled fibromuscular tube, it is possible that, owing to the inelasticity of the tube, oedema elicited in this manner in the part of the

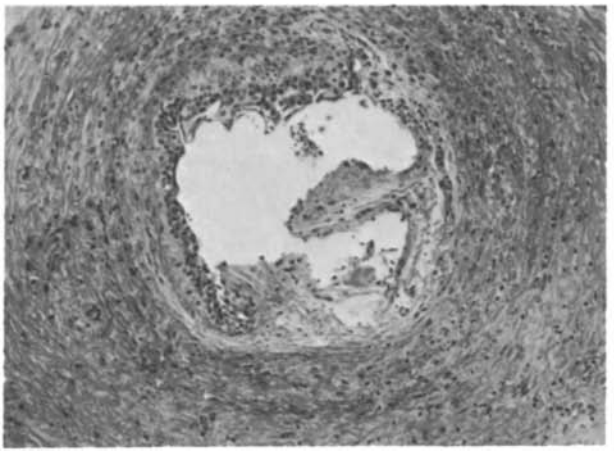

Fig. 3. Vas deferens. Twisted steel wire 4/0 has been inserted in the lumen for ten days (Group I). The epithelium is ulcerated. Slight inflammation of subepithelial tissue. Plastic embedding medium. Haematoxylin-eosin x 130

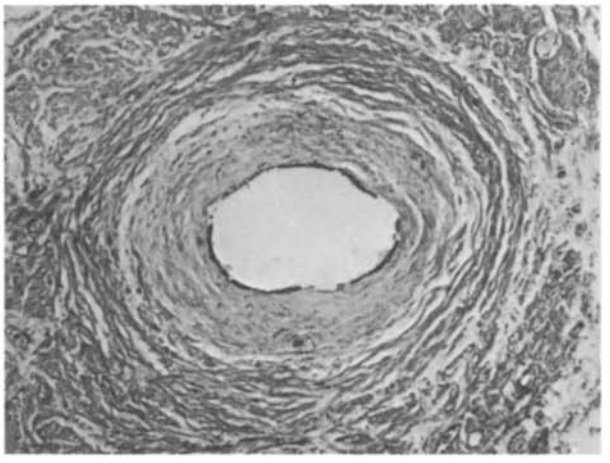

Fig. 5. Vas deferens two months after removal of steel wire splint (Group II). Atrophic, flattened epithelium. Fibrosis in subepithelial tissue with occasional round cells. Embedded in paraffin. van Gieson x 90

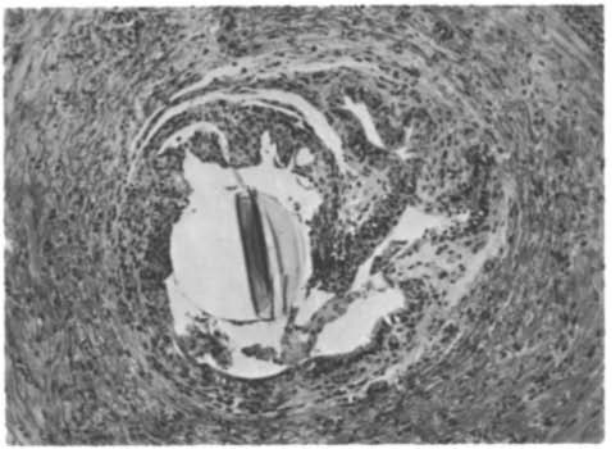

Fig. 4. Vas deferens with retained 4/0 nylon splint in lumen (Group I). Epithelial changes with erosions and squamous metaplasia. Some round cells and a few granulocytes in subepithelial tissue. Plastic embedding medium. Haematoxylin-eosin x 130

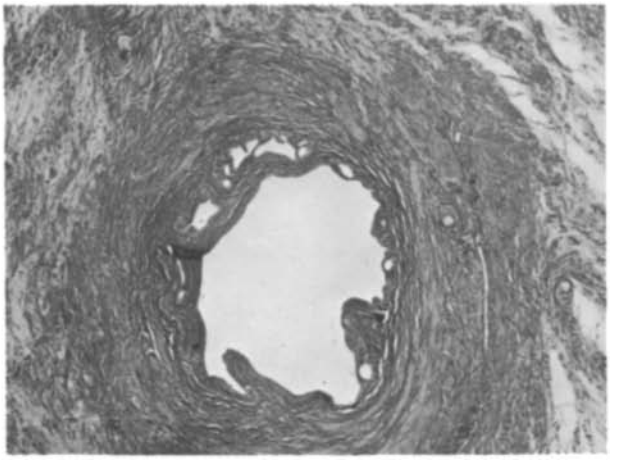

Fig. 6. Vas deferens, anastomosed without splint 8 weeks earlier (Group III). Somewhat dilated lumen with a simple layer of intact slightly flattened epithelium. No inflammation. A few monofil nylon anastomosis sutures in the wall. Embedded in paraffin. Haematoxylin-eosin x 80

vas nearest the lumen may result in nutritional damage to the epithelium with subsequent epithelial atrophy or a tendency to adhesions. If the splint is pulled out through the skin for later removal, there is, in addition, a greater risk of postoperative infection in the area of the anastomosis, as was seen in two of our cases. Consequently, vasovasostomy should be performed without leaving the splint in.

Because of the delicate structures involved, an atraumatic surgical technique, with careful positioning of the sutures so as to engage only the outer layers of the vas, should be employed with the aid of some form of magnifying device. The operating microscope has been suggested, but the majority of doctors working in urology probably do not have the surgical training needed to use the operating

microscope. We have therefore chosen to do the anastomoses under magnifying glasses with two-fold magnification. Despite the fact that the calibre of the vas deferens in the dog is smaller than in humans, the cut ends could be positioned as desired without difficulty. The histological examinations generally showed satisfactory depths of sutures.

Anastomoses with bevelled ends provide a larger surface for adaptation of the lumen and reduce the risk of postoperative dislocation with inadequate union of the two portions of the vas as a result. As an aid to suturing, we have employed a straight needle inserted into the lumen and removed through the wall of the vas. After completion of the anastomosis the cut ends could be held in place quite adequately with the eight or nine sutures applied around the anastomosis. Using this technique, patency was restored in nine out of ten anastomoses. Vasography revealed that small diverticula had developed in four cases. They did not affect passage through the lumen of the duct appreciably, however (Fig. 2b). In one case the diverticulum was obviously situated at some distance from the anastomosis. It is possible that the diverticula developed at the point at which the needle was pulled out through the wall of the vas. In this case, a finer needle may be preferable.

Persistent changes in the lumen of the type demonstrated after splinted anastomoses may conceivably have an adverse effect on the transport of spermatozoa even in cases where the passage is not obliterated. If this is true, a technique of anastomosis entailing minimal tissue reaction may help to increase the number of successful anastomotic operations also in regard to the numer of resultant pregnancies.

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