Deferent Duct Plasty from Autologous Testicular Vaginal Tunica Propria on an Arteriovenous Pedicle

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Results of plastic replacement of a part of the deferent duct with a tubular prosthesis formed from the testicular vaginal tunica propria on an arteriovenous pedicle under conditions of a chronic experiment on dogs showed that by day 10 postoperation half of the epididymal anastomoses were obstructed, while by days 17-20 obturation of all epididymal anastomoses was observed, which was caused by organization of the intraductal spermatogranuloma mass. The negative effect of spermatogranuloma consisted in detachment of epithelial cells of the deferent duct from the underlying tissues. By days 17-20 postoperation no epithelial cells were left on the internal surface of the duct at the site of the epididymal anastomosis.

Key Words: *testicular vaginal tunic; spermatogranuloma; anastomosis; obturation; neoduct*

Negative results of experiments on replacement of the deferent duct (DD) defects with an autovein [3] and a silicon tubule [2,3] necessitated the development of a new technology (patent of the Russian Federation for invention No. 2181986 of May 10, 2002) making use of the testicular vaginal tunica propria as plastic material. This material was selected because the testicular vaginal tunica propria, as a local tissue of the scrotal organs, had better potentialities for adaptation to a new functional role, and a blood-supplied prosthesis, formed from the common testicular vaginal sheath on an arteriovenous pedicle, was more likely to take in than devascularized prostheses.

We studied the dog DD after plastic repair with a prosthesis formed from the testicular vaginal tunica propria.

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MATERIALS AND METHODS

Healthy dogs (7-17 kg) were taken into experiment after a 2-week quarantine in a vivarium. The animals were subcutaneously injected with 0.5 ml/kg 2% promedol 35-40 min before operation and narcotized with 2.5% hexenal or sodium thiopental.

The skin and subcutaneous fat in the inguinal area were dissected with a vertical incision (5-6 cm). The spermatic cord was mobilized at a length of 5-6 cm and brought into the operation wound. The spermatic cord membranes were opened longitudinally on the anterior surface. The DD was mobilized at a length of 5-6 cm, 3-4 cm were resected with a scalpel or razor. The DD vessels were ligated and crossed at the ends of the resected fragment; thorough hemostasis was carried out.

The anastomoses between the ends of the duct and newly formed prosthesis were sutured by an atraumatic monofilament thread (7/0) by 6 nodular sutures through all layers of the plastic material and

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the adventitial muscular part of the DD wall. Tantalum wire served as the endoprosthesis for more convenient formation of the anastomosis; it was removed directly after the formation of both anastomoses. The spermatic cord tunics were repaired by nodular capron sutures. The operation wound was hermetically sutured layer-by-layer and treated by antiseptic solutions.

Thirty chronic experiments were carried out, 6 per term: days 5-7, 10, 17-20, and 60-120.

The following methods of examination were used: chromoductography, X-ray contrast ductography (injection of methylene blue solution or 3-atom X-ray contrast agent into the DD and neoduct cavities). The macroscopic picture of the site of intervention, including the anastomoses and prosthesis, was described, histological studies of the neoduct and anastomosis zones were carried out (serial 7-8-μ sections, staining by hematoxylin and eosin, by picrofuchsine after Van Gieson, by resorcin-fuchsine after Weigert).

The animals were sacrificed by injections of toxic doses of hexenal or sodium thiopental.

RESULTS

Surgical interventions did not appreciably change animal status. Scrotal edema developing after surgery was arrested on days 2-5 postoperation.

On days 5-7 postoperation the vascular pedicle functioned well, the vessels of newly formed duct were plethoric. No macroscopic changes were seen in the neoduct wall. The diameters of the epididymal and vesical DD portions at the sites of anastomoses coincided. No deformations of anastomoses were detected, the sutures were competent. The

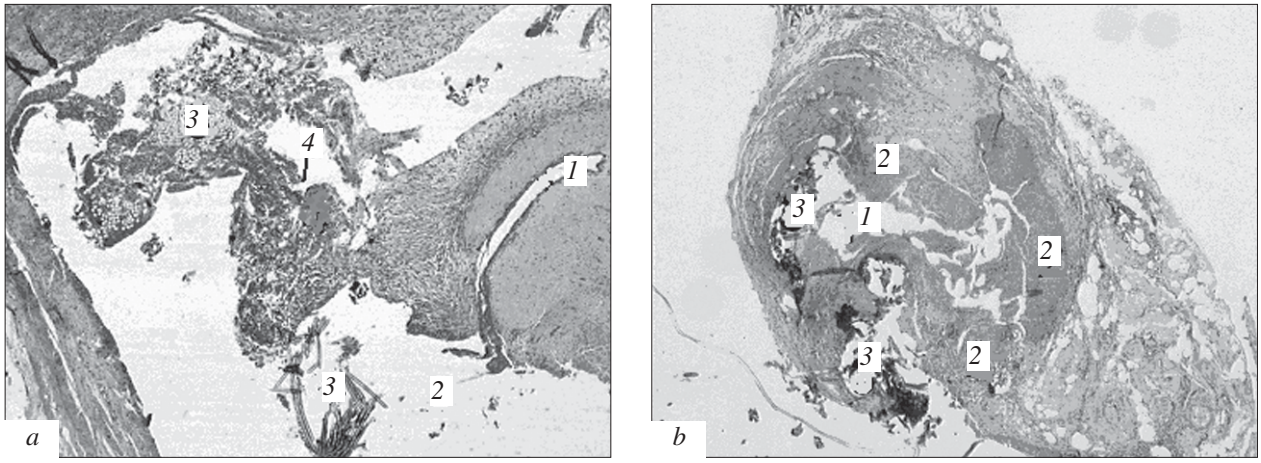

Fig. 1. EA zone on days 5 (*a*) and 10 (*b*) postoperation. *a*) DD lumen (*1*) opens into the prosthesis lumen (*2*); surgical thread cuts into the prosthesis lumen (*3*) and accumulation of spermatozoa (*4*) in it. *b*) neoduct lumen (*1*) filled with SG (*2*). Surgical threads cutting into the lumen and to the surface of the prosthesis (*3*). Hematoxylin and eosin staining, ×105.

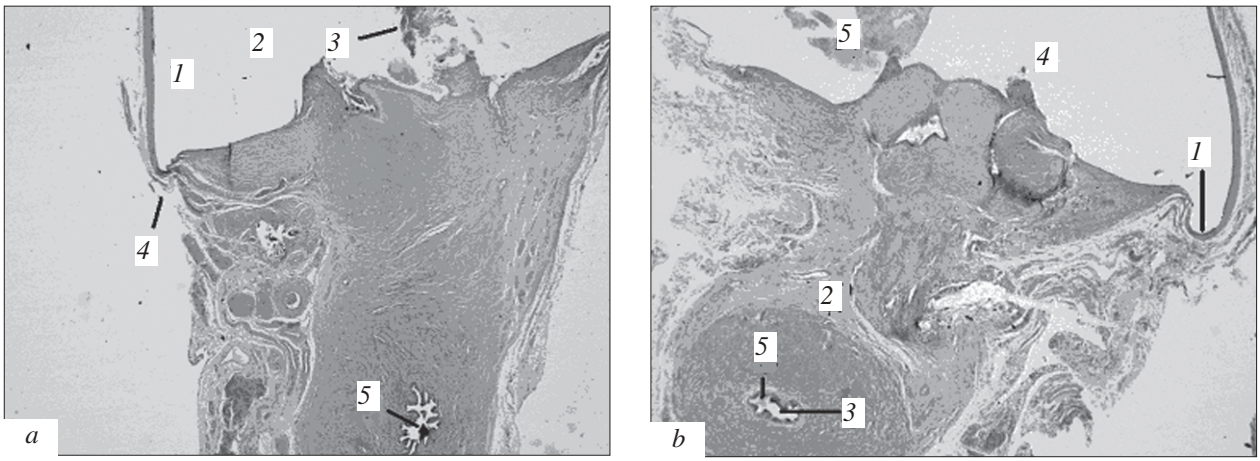

Fig. 2. VA zone on days 30 (*a*) and 60 (*b*) after operation. *a*: *1*) neoduct wall; *2*) neoduct lumen; *3*) accumulation of spermatozoa in the neoduct; *4*) site of DD anastomosis with prosthesis; *5*) DD lumen. *b*: *1*) anastomosis zone; *2*) DD wall; *3*) DD lumen; *4*) neoduct lumen; *5*) accumulation of spermatozoa in the duct and neoduct lumen. Hematoxylin and eosin staining, ×52.

TABLE 1. DD Anastomoses with Neoduct Formed from the Testicular Vaginal Tunica Propria (n=6)

Day of observation	EA				VA			
	patency	obstruction	SG		patency	obstruction	SG	
			outside	inside			outside	inside
5-7	6	—	2	6	6	—	—	—
10	3	3	2	6	4	2	—	1
17-20	—	5	1	6	4	2	—	1
30	—	6	1	6	3	3	—	—
60-120	—	6	—	6	1	5	—	—

anastomoses were patent (Table 1), which was confirmed by X-ray contrast ductography.

The neoduct wall was morphologically unchanged in 3 of 4 cases and in only 1 case the zone of the epididymal anastomosis (EA) presented as a completely necrotic area; significant necrotic foci were seen in the DD wall in the same case. The zone of the duct walls adhesion to the plastic material was clearly discernible.

Transition of the DD adventitium to the neoduct wall was detected in the EA and vesical anastomosis (VA) zones (Fig. 1, *a*). Spermatogranuloma (SG) was detected in the ductal and neoductal channels in the EA zone in all cases. Spermatozoa were also detected in the plethoric neoductal vessels.

On day 10 there were no apparent changes in the neoduct wall. Whitish condensed SG mass was detected in the neoduct lumen. The DD anastomoses with the neoduct were not deformed, the sutures were competent. Three of six EA and four of five VA were patent. Small SG plaques no larger than 1×1.5 mm were detected on the external DD surface in the EA zone in 2 cases (Fig. 1, *b*).

The DD wall adhered to the neoduct wall; no growth of the DD wall muscle elements into the neoduct wall was detected. No DD epitheliocytes were detected on the inner surface of the neoduct. The DD epithelium was detached from the muscle part of the wall by SG in 3 cases; SG was also detected between the tunica vagina leaflets in the zone of the longitudinal suture on the tubule.

On days 17-20 signs of DD obturation were clearly seen. The epididymal end of DD was significantly thicker than the vesical one. The channel of the epididymal portion of the duct and the epididymal tubule were significantly dilated. No deformations were detected in the anastomoses, the sutures remained competent. All EA were obstructed. In one case small SG plaques were detected on the DD surface in the anastomosis zone. The neoduct lumen and DD channel in the EA zone were tightly packed with crumbling yellowing SG. Attempts at antegrade ductography failed: methylene blue solution did not enter the DD lumen. Retrograde chromoductography (the stain was injected into the vesical portion of DD) showed patency of 4 VA (methylene blue entered the neoduct channel adjacent to VA).

The histological picture of anastomosis zones was in general similar to that on day 10. No DD epithelium was seen in the EA zone, while its dilated channel was tightly packed with organizing SG.

On day 30 signs of DD obturation were sharply pronounced. The DD channel and epididymal tubule were significantly dilated. Small SG foci were detected in the EA zone on the external surface in

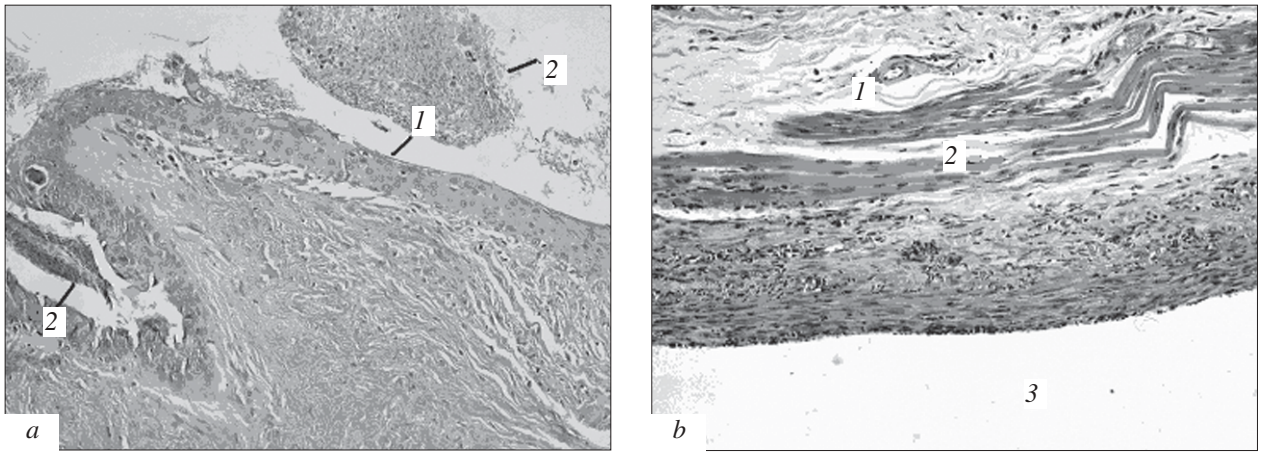

Fig. 3. Neoduct wall near VA on days 30 (*a*) and 72 (*b*) postoperation. *a*: *1*) metaplastic squamous epithelium lining the neoduct lumen; *2*) accumulation of spermatozoa in the neoduct lumen. *b*: structure of prosthesis wall at a site distant from anastomosis with DD is well formed and blood vessels (*1*) and striated muscles (cremasteric muscle; *2*) are seen in it; *3*) neoduct lumen. Hematoxylin and eosin staining, ×420.

one case. The sutures were competent. Antegrade ductography was impossible because of tight packing of the DD epididymal portion and neoduct channels by SG. Retrograde injection of methylene blue solution showed its presence in the neoduct channel in the VA zone in 3 cases. Hence, VA remained patent in all cases.

The histological picture of serial sections through anastomoses coincided with that on days 17-20. The zone of DD wall and neoduct connection in the EA and VA zones was clearly seen (Fig. 2, *a*). No transition of the DD epithelium to the inner surface of the neoduct was detected. The DD and neoduct channel in the EA zone and the neoduct channel (Fig. 3, *a*) were tightly packed with SG along its entire length.

The macroscopic and histological picture on days 60-120 did not change in comparison with day 30 of observation (Fig. 2, *b*; 3, *b*).

Spermatogranuloma formed in the neoduct channel in the zone adjacent to EA in all cases, which determined the unsatisfactory function of the anastomosis. On days 5-7 postoperation the presence of loose mass of SG in the DD and neoduct channel was inessential for the anastomoses patency. On day 10, when still loose SG filled the neoduct and DD channel in the EA zone, half of epididymal anastomoses remained patent, while on days 17-20, when organization of SG started, all EA were no longer patent.

The negative impact of SG on the DD epithelial cells was clearly discernible. On day 10 the duct cells were detached from the underlying tissues in the EA zone in the majority of cases, while on days 17-20 postoperation there were no epithelial cells on the inner surface of DD in the EA zone.

No transition of the DD epithelial cells to the neoduct wall was observed in any of the cases.

The appearance of SG mass on the external surface of DD in the EA zone did not depend on the postoperation period and anastomosis function and was observed in 6 of 30 cases.

Hence, the negative results of experimental plastic replacement of a DD fragment by an autovein segment, silicone tube prosthesis, and prosthesis formed from the testicular vaginal tunica propria indicate that no biological or synthetic material, except the DD proper, can be used for plastic repair of this organ in practical andrology.

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