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EXPERIMENTAL STUDY REGARDING PROSTHETIC BYPASS ON PIGS

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Abstract
This study describes the possibility of restoring blood flow by a bypass, in a segment which is disrupted or blocked. Our study presents such a possibility and was performed on five pigs weighing 50 kg who underwent aortal bypass at the infrarenal segment and monitored for 30 days postoperatively. The section has been replaced by a length of 5 cm by arteriotomy and closed by suture. The bypass prosthesis used was Dacron and has been properly placed between the two ends and fixed by continuous suture. Anastomosis was performed end-to-side at both ends, between the ends a 5 cm part of aorta was replaced with the prosthesis. Pigs were monitored hemodynamic in terms of physiological constants and general status, postsurgical, received adequate treatment. Aortic bypass has been shown to be effective without postoperative complications noted.

Key words: bypass, aorta, pigs, prostesis

INTRODUCTION

Removal of a vascular portion is required in many different diseases (septic processes, necrosis, tumors). Until the circulation is restored some tissues can suffer irreversible changes. In addition, there are other situations which do not involve septic processes,that can be risk factors for the animales such as occlusive disease, aneurysms, atherosclerotic wounds.

In this context, the by-pass is an effective option for creating a new circuit that avoids the obstructed segment, using for this purpose established vascular prostheses.

The vascular substituent must have some essential properties such as biocompatibility with the new body, to be resistant to infection, to have properties similar to natural vessels. Our research and observations were conducted in 2011-2012 on a total of five pigs, that were used with the aim of highlighting the by-pass technique, using Dacron prosthesis.

MATERIALS AND METHODS

Our research and observations were conducted at the Surgical Clinic Faculty of Veterinary Medicine Cluj-Napoca in the period 2011-2012, on a total of five pigs, Large White, clinically healthy, weighing 50 kg each. To assess the behavior of the graft we used braided polyethylene terephthalate (Dacron). For anastomosis we used nonabsorbable suture, Prolene 4-0, monofilament. The surgical instruments used were the clasical ones but also specific instrument used in vascular surgery.

For surgery the subjects were prepared, by dietfor 12 hours and 30 minutes before surgery they received atropine 0.2 ml sc administration, diazepam 2 mg / kg iv and ketamine 2 mg / kg i.v., through a cannula placed in the external ear. The next step was to introduce the the endotracheal tube for general anesthesia using Isofuran 2% (Fig. 1).

Fig. 1. Narcosis

The animals were heparinized, by intravenous heparin administration, 30 i.u. / kg m.C. The abdomen is prepared for surgery under the rules of asepsis and antisepsis (trimming, washing, disinfection). The subject is placed in dorsal position and isolated by the sterile field. Laparotomy is done and the organs of the abdominal cavity are protected by sterile fields, and the infrarenal abdominal aorta is identified. With care we do the incision and isolated the aorta (fig.2). Before clamping the artery and performing the arteriotomy we need to prepare the prothesis by purging it with heparinized blood. This is followed by clamping of the aorta using vascular forceps , the arteriotomy is performed using Potts scissors, (Fig.3) over a length of 1-2 mm, before the obstructive process.

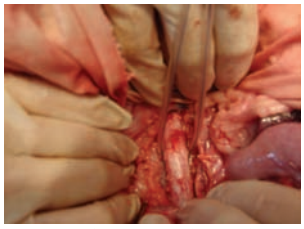

Fig. 2. Isolation of infrarenal aorta

Fig. 3. Aortic clamping and arteriotomy

After hemic preparation, vascular prostheses have been adjusted at both ends in such way that the angle between them and the aorta is between 30-40 degrees. Between the aorta and the graft was performed latero-terminal anastomosis, which always starts from proximal end of prosthesis (Fig.4). The suture was continuously in such way that one of the two needles at the ends of the thread passing in one direction (half) and then continue the suture in the opposite direction until the two needle meet. The suture is performed using more knots (5-7), to prevent slippage of the suture. After this is need to check the sealing of the portion by carefully removing the proximal forceps to see any blood leakage from the anastomosis. Then proceed to the latero-terminal anastomosis of the distal aorta, following the same steps described above. After the two anastomoses are performed (proximal, distal) and removing the Satinski forceps, blood circulation is establish (Fig.5), highlighted by the presence of pulse wave. Between the two anastomosis we proceeded to substitute (removal) a portion of 5 cm from the aorta through arteriotomy and closing the ends by double suture in continuous patern. This way vascular prosthesis assumed full role of the aorta. Is practiced local hemostasis, retroperitoneum sutures and abdominal cavity in reverse order, ending with skin suture in separate points. Operated animals were monitored for 30 days post-operatively in terms of physiological parameters.

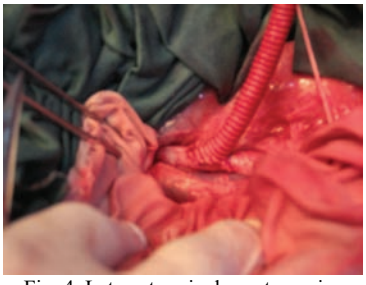

Fig. 4. Latero-terminal anastomosis

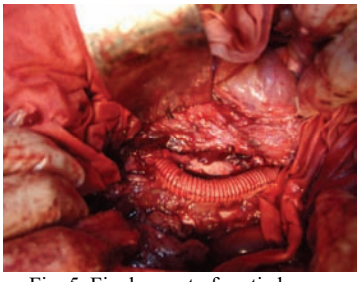

Fig. 5. Final aspect of aortic bypass

RESULTS AND DISCUSSIONS

Body response, after by-pass induction, occurs immediately after blood flow is restored and interference highlighting tissue-prosthesis and blood-prosthesis. This created interface is responsible for the permeability of the graft, because it represents complex microenvironments in which physico-chemical properties form a safety and stability at this level. Acceptance of this prosthesis by the body should be understood by several phenomena including plasma protein binding phenomenon, filing of platelets, white cells, migration of endothelial cells and smooth muscle cells the presence of fibrin network that are inserted in the mesh graft.

In the study the results were good by the fact that the blood flow was not affected, because we used prosthesis of the same size and appropriate elasticity as the blood vessel and the sutures sealed. For proper tightness is very important to follow certain rules and a particular conduct, in the sense that the wall of anastomosed vessel should be handled by applying the forceps only on periarterial wall or on adventitial tissue. In the event that direct manipulation is inevitable, the arterial wall should not be fixed between the arms of the forceps to avoid damage to the intima or to the entire arterial wall with the advent of local necrosis, issues that would compromise the vessel sealing on short and medium term. Another aspect to take into account is that the arterial wall suture needle should pass from inside out (from intima to adventitia) to prevent the formation of intimal fringes that can mobilize and cause embolism or thrombosis. The line of suture need to be made smooth, otherwise, it may facilitate platelets aggregation and compromising the anastomosis. To avoid adhesions and increased pressure the implemented portion is left free, and because its elasticity could take and alleviate inflections coming from the vicinity organs. Postoperatively, the were monitored internal temperature, heart and respiratory rate, arterial pulse, mucosal aspect, bleeding, clotting times and local changes. Postoperative care are extremely important especially those related to prevention of vascular collapse, cardiac arrhythmias, ventricular tachycardia, prevention of thrombosis, inflammation or sero-hemorrhagic collections. For this purpose, Dextran 40 was administered at 5 ml /kg/day, Ringer's lactate 50 ml / kg / day, 0.6 mEq sodium bicarbonate / kg, while for attenuation of the inflammatory phenomena Flumixin meglumine 20 mg / kg iv twice daily at 12 hour intervals for 3 days. Thrombosis has been avoided by use of heparin administered IV, 1 ml (50 mg = 5000U) within 6 hours, and continued for 7 days with oral Trombostop 1 tb / day for 10 days. After the surgery, during the first three days heart and respiratory rate are increased while the body temperature is increased. These changes were registered in the first 3-4 days, as is gradually return to normal. Regarding general condition, operated pigs prefer sterno-abdominal or lateral decubitus, forced to stand up and move, they did so with difficulty, animals showing a transient paresis.

The hind limbs at the level of the knee and fetlock were found subcutaneous edema resolved in 7 days after surgery. Food intake decreased by half after the surgery for a period of five days with progressive recovery after. In our cases we did not found any local or general complications within a period of 30 days, interval in which subjects undergoing surgery were monitored in terms of physiological and haematological status. Physical and chemical properties, elasticity and flexibility of the prosthesis induce an great bio tolerance without complications or side effects.

CONCLUSIONS

1. Aortic bypass is a great solution for restoring circulation in vascular stenosis.
2. Prosthesis behavior for a period of 30 days is very good, tolerance and bio integration is uncomplicated.

3. Preparing prosthetic ends, aortic wall, must be performed carefully to avoid pressure on a particular area which could cause partial stenosis and hemodynamic disorders.

4. Duration of the surgery is very important in the sense that, as the time of the intervention is shorter, recovery after surgery is briefly.

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