348

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STANDARDIZATION OF LAPAROSCOPIC BLADDER AUTOAUGMENTATION IN DOGS

Hypothesis / aims of study

Enterocystoplasty is an option for neurogenic urinary dysfunctions refractaries to clinical treatment. In 1989, Cartwright and Snow described bladder autoaugmentation as another alternative.Other studies obtained positive results with autoaugmentation and the success was attributed to the maintenance of the bladder partially distended in the post operative period. With these observations as a basis, a silicone modeling balloon was developed to be inserted into the bladder with the purpose of maintaining the diverticulum distended and, thus, avoiding cicatricial shrinkage.

Due to the apparent advantage using the silicone balloon, this study was developed to standardize the surgical technique of laparoscopic bladder autoaugmentation with and without the use of an intravesical silicone balloon in dogs so that future experiments can better evaluate this promising procedure.

Study design, materials and methods

Seven male mongrel dogs, weighing between 15 and 20 kg were used. Three were necessary to standardize the surgical technique of laparoscopic bladder autoaugmentation and the others to standardize the technique using the silicone modeling balloon.

In all the experiments, an urodynamic evaluation was performed immediately before beginning the surgery.The urodynamic evaluations were performed using Life-Tech model Janus IV equipment, Houston, TX, USA. The evaluations were done with the animal in supine position under intravenous anesthesia with thiopental sodium 12.5mg/kg. Bladder catheterization was performed using a 7 F double lumen catheter which allowed the bladder to be filled while registering pressure simultaneously.

Results

Standardization of Laparoscopic Bladder Autoaugmentation:

The animals were all fasting from the previous evening and submited to intravenous general anesthesia .An intravenous prophylaxis of 1g cephalothin was given. The animals were placed in the Trendelenburg position at 30^{o}. After the placement of the sterile drapes a Veress needle was introduced exactly under the umbilical scar and through it carbon dioxide (CO2) was insufflated until the intra-abdominal pressure reached 12mmHg. A 10mm trocar was inserted at the umbilicus and a rigid zero degree video-laparoscope was placed. Three more punctures were made under laparoscopic vision: one at the external edge of the rectus abdominis muscle with the insertion of a 10mm trocar, another at the external edge of the rectus abdominis muscle on the left side and the last one in left iliac fossa, both for insertion of a 5mm trocar.

The dissection began at the bladder dome and continued on the anterior wall, parallel to the urachus, all the way to the lowest part of the anterior wall, near the bladder neck. Blunt dissection was performed, holding the musculature with parallel forceps that pulled simultaneously in opposite directions. The dissection forceps were inserted through the trocars located at the external edges of rectus abdominis muscle bilaterally. Through the trocar located at the left iliac fossa, a grasper was introduced which produced a slight antero-posterior rotation of the bladder.In this manner a large diverticulum was made in the anterior wall of the bladder, extending to the dome. Bleeding was minimum and electrocautery was not necessary. After making the diverticulum, the bladder was catheterized using an 8 F urethral catheter.The urethral catheter was fixed to the penis with a 3.0 Nylon suture and the bladder was drained for seven days. The dog received cephalothin l g intravenously for 24h and then cephalexin l g daily by mouth was given until the urethral catheter was removed.

Standardization of Laparoscopic Bladder Autoaugmentation Using the Intravesical Balloon:

For the first two cases, the technique was identical to that of the surgery without the balloon. After making the diverticulum, the bladder was emptied through a urethral catheter and a hole in the posterior wall of the bladder was made using Maryland forceps. The 10mm trocar on the right side was removed and the silicon balloon was inserted, empty, through the opening of the skin. The trocar was reinserted and the pneumoperitoneum redone.The balloon was inserted into the bladder, leaving the tube through the hole in the posterior bladder wall to fill it. The hole was sutured closed so that there was no free space between its edges and the tube, in order to avoid the exit of the balloon and urine.The tube was then passed through the hole to the 10mm trocar located on the right side and the balloon was filled with 60ml of 0.9% saline solution. The tube was stopped up and reinserted into the abdominal cavity, the trocar was reinserted and the pneumoperitoneum redone in order to verify the correct position of the balloon. The tube of the balloon was left free inside the abdominal cavity as described by Ikonomidis. On the second post operative day abdominal distension was observed, pain upon touching it, loss of appetite and vomiting. Exploratory surgery revealed that mucosa had ruptured provoking urine leakage into the abdominal cavity and peritonitis, thus, the animals had to be put down. It was presumed that mucosa rupture occurred due to the weight of the balloon full of saline, since it is a four legged animal, when it stands the balloon is over the diverticulum made in the anterior bladder wall.

For the following surgery, it was decided to fill the balloon with air. On the third post operative day the animal presented loss of appetite and on the fourth the abdomen was distended and painful. Exploratory surgery was performed and a great quantity of urine was found in the abdominal cavity. The bladder mucosa was intact. The silicon balloon, which was almost empty, was removed from the bladder and filled with saline to test it but presented no defects. The abdominal cavity was washed with saline and the balloon was reinserted into the bladder, filled once again with air and the surgical incision closed. After two days the animal died despite broad-spectrum intravenous antibiotic treatment. With this case, it was learned that silicon is not air proof. It was also observed that the tube to fill the balloon had a cylindrical wrapping on it in order to facilitate the balloon's removal. This permitted the passage of liquid between the tube and the wrapping and explained the presence of urine in the abdominal cavity despite the bladder being intact.

It was then decided to fill the balloon with saline solution and make the diverticulum on the posterior wall of the bladder so that the balloon would not exert pressure on the mucosa when the animal stands up. After filling the balloon, the tube was placed through the incision made for the insertion of the left iliac fossa trocar. This allowed the urine to be drained through the existing space between the tube and its wrapping. On the seventh post operative day, the balloon was emptied and withdrawn through the incision. It was necessary to sedate the animal with 25mg/kg thiopental sodium for this procedure. The urethral catheter was left in place for 5 more days to allow proper closure of bladder hole.

Interpretation of results

Some technical aspects must be considered. The urodynamic evaluations were performed without registering the abdominal pressure with a rectal catheter. The animals were sedated during examination, so abdominal contractions did not occurs and registering the intravesical pressure was sufficient since any increase of the vesical pressure would be caused by an increase of the detrusor pressure.

In the group without the balloon, the diverticulum was made in the anterior wall of the bladder, in contrast to the other group in which the posterior wall was used. The initial purpose was to create the diverticulum in the anterior wall of both groups, but since the weight of the balloon caused rupture of the mucosa when the animal stood up, we had to look for alternative solutions. Since the muscle fibers of a dog's bladder, as well as the human's, are randomly arranged and the anterior and posterior bladder walls have similar thickness, there appears to be no difference in making the diverticulum on the anterior or posterior wall.

The development of this experimental model can be of great importance for future experiments. During development of this study we could identify restricting factors for performing surgeries with and without the balloon and we found solutions that allowed us to perform surgeries successfully.

Concluding message

Laparoscopic bladder autoaugmentation is feasible in dogs and the use of an intravesical silicon balloon requires making a diverticulum in the posterior bladder wall. Bladder drainage is of great importance since the intraperitoneal extravasation of urine produces serious consequences.

The standardization of laparoscopic bladder autoaugmentation was successfully obtained, with and without the use of intravesical silicon balloon.

Specify source of funding or grant	**FAPESP**
Is this a clinical trial?	**No**
What were the subjects in the study?	**ANIMAL**
Were guidelines for care and use of laboratory animals followed or ethical committee approval obtained?	**Yes**
Name of ethics committee	**Ethical Commission of Animal Experimentation (CEEA) – Biology Institute (IB) – UNICAMP,**