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Features of the installation of a suprapubic cystostomy for laparoscopic treatment of patients with intraperitoneal bladder rupture

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INTRODUCTION: In closed intraperitoneal bladder trauma, an alternative to laparotomy is laparoscopy. The rupture is closed with endoscopic sutures, and the bladder is drained with a urethral catheter. In the literature, the issue of the placement of a trocar cystostomy during laparoscopic treatment of patients with intraperitoneal bladder ruptures requiring prolonged drainage is insufficiently covered.

PURPOSE OF THE STUDY: Determination of the optimal trocar cystostomy method during laparoscopic treatment of intraperitoneal bladder rupture.

MATERIALS AND METHODS: Trocar cystostomy was performed in 8 patients with intraperitoneal bladder ruptures, among whom 7 had concomitant diseases of the prostate gland, and 1 had urethral stricture. Trocar cystostomy during laparoscopic surgery was performed in three different ways.

RESULTS: In the first method, the rupture of the bladder was initially sutured. Then, through the urethral catheter, the bladder was filled with saline. A trocar cystostomy was inserted through the suprapubic region. The second method consisted in the installation of a trocar cystostomy under the control of a laparoscope even before the suturing of the bladder rupture. In the third method proposed by us (patent No. 2592023), a Foley-type catheter with a balloon capacity of at least 200 ml was inserted into the abdominal cavity through the laparoscopic port. A catheter was inserted from the abdomen through an intraperitoneal rupture into the bladder. Inside the bladder, the catheter balloon was filled with saline. Then, through the suprapubic region, the anterior abdominal wall, the bladder and the inflated balloon of the catheter were pierced layer by layer with a trocar. Another catheter was inserted through the trocar into the bladder. After removal of the catheter with a ruptured balloon, the intraperitoneal rupture of the bladder was sutured.

FINDINGS: According to the results of the study, the third method of inserting a trocar cystostomy turned out to be the most optimal and safe.

Keywords: laparoscopy; intraperitoneal rupture bladder; trocar cystostomy.

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Особенности установки надлобковой цистостомы при лапароскопическом лечении пациентов с внутрибрюшинным разрывом мочевого пузыря

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Введение. При закрытой внутрибрюшинной травме мочевого пузыря альтернативой лапаротомии является лапароскопия. Разрыв ушивается эндоскопическими швами, а мочевой пузырь дренируется уретральным катетером. В литературе недостаточно освещен вопрос относительно установки троакарной цистостомы при лапароскопическом лечении пациентов с внутрибрюшинными разрывами мочевого пузыря, которым требуется его длительное дренирование.

Цель исследования. Определение оптимального способа троакарной цистостомии при лапароскопическом лечении пациентов с внутрибрюшинным разрывом мочевого пузыря.

Материалы и методы. Троакарную цистостомию выполняли 8 пациентам с внутрибрюшинными разрывами мочевого пузыря, среди которых 7 имели сопутствующие заболевания предстательной железы, а 1 — стриктуру уретры. Троакарную цистостомию во время лапароскопической операции выполняли тремя разными способами.

Результаты. При первом способе вначале ушивали разрыв мочевого пузыря. Затем по уретральному катетеру мочевой пузырь заполняли физиологическим раствором. Через надлобковую область устанавливали троакарную цистостому. Второй способ заключался в установке троакарной цистостомы под контролем лапараскопа еще до ушивания разрыва мочевого пузыря. При третьем способе, предложенном нами (патент № 2592023), через лапароскопический порт в брюшную полость заводили катетер типа Фолея с емкостью баллона не менее 200 мл. Катетер из живота через внутрибрюшинный разрыв проводили в мочевой пузырь. Внутри мочевого пузыря баллон катетера наполняли физиологическим раствором. Затем через надлобковую область послойно прокалывали троакаром переднюю брюшную стенку, мочевой пузырь и раздутый баллон катетера. По троакару в мочевой пузырь устанавливали другой катетер. После удаления катетера с разорванным баллоном внутрибрюшинный разрыв мочевого пузыря ушивали.

Выводы. По результатам исследования третий способ установки троакарной цистостомы оказался наиболее оптимальным и безопасным.

Ключевые слова: лапароскопия; внутрибрюшинный разрыв мочевого пузыря; троакарная цистостомия.

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INTRODUCTION

With a closed intra-abdominal injury, intraperitoneal bladder ruptures account for 2% of cases [1]. They can be either combined or isolated. Combined injuries of the bladder caused by road traffic accidents, falls from a height, and home injuries are most often observed. Isolated injuries of the bladder are less common, mainly represented by spontaneous ruptures. The mechanism of spontaneous rupture is presented by a sharp increase in the intravesical pressure in the overfull bladder at the time of injury, which results in a hydrodynamic effect in the place of least resistance in the apex of the bladder, leading to intraperitoneal rupture [2–5].

In all cases, intraperitoneal bladder injuries require surgical intervention. Laparotomy is traditionally performed [2, 6, 7]. In recent decades, the laparoscopic method of treatment has been increasingly used as an alternative to laparotomy for isolated intraperitoneal ruptures of the bladder [1, 3, 4, 7–9]. During laparoscopic surgery, the ruptured bladder is sutured hermetically with absorbable sutures [7, 10]. The bladder cavity in most cases is drained using a urethral catheter [2, 3, 8]. However, patients who had lower urinary tract diseases before the injury require prolonged drainage of the bladder. For such patients, the optimal method of drainage is the installation of a suprapubic trocar cystostomy [7, 10].

Despite the urgency of this problem, the literature presents insufficiently the issues of installing a suprapubic cystostomy during laparoscopic treatment of patients with bladder injury.

This study aimed to determine the optimal method for inserting a trocar cystostomy during laparoscopic treatment of patients with intraperitoneal bladder rupture.

MATERIALS AND METHODS

Over the period from 2012 to 2019, at the St. Petersburg I.I. Janelidze Research Institute of Emergency Medicine, suprapubic trocar cystostomy for laparoscopic treatment of isolated bladder injuries was performed in eight patients. All patients were middle-aged and elderly men. As regards the mechanism of trauma, 4 (50%) patients were injuried in a state of alcoholic intoxication. One patient fell out of bed. In 3 (37.5%) patients, bladder ruptures were associated with domestic conflicts. The duration of admission to hospital from the moment of injury ranged from 8 to 27 hours.

All patients indicated that they had urinary disorders even before the injury. Five of them had lower urinary tract diseases and were previously monitored by a urologist. Preoperative examination revealed prostatic hyperplasia in 7 (87.5%) patients, and stricture of the suspending part of the urethra in one patient.

After receiving the results of the examination, the patients were informed about the course of the upcoming surgery and the need to install a suprapubic trocar cystostomy. All eight patients underwent laparoscopic intervention. During surgery, the ruptured bladder was sutured endoscopically with absorbable sutures.

During laparoscopy, three methods of installation of a trocar cystostomy were employed. Method 1 consisted of traditional catheterization of the bladder with a urethral catheter through the urethra. The ruptured bladder was sutured hermetically with endoscopic sutures. Then, through the urethral catheter, the bladder was filled with 300 ml of saline solution. A trocar cystostomy was inserted into the filled bladder through the suprapubic region. At the same time, a laparoscope was used for the visual control of the extraperitoneal installation of a trocar cystostomy from the abdominal cavity (Fig. 1). Method 2 involved installation of a suprapubic trocar cystostomy even before suturing the intraperitoneal bladder rupture. During the laparoscopic surgery, visual control of the extraperitoneal passage of the trocar was also performed (Fig. 2). We proposed method 3 of suprapubic installation of a trocar cystostomy (Patent No. 2592023). For this method, a Foley-type catheter was

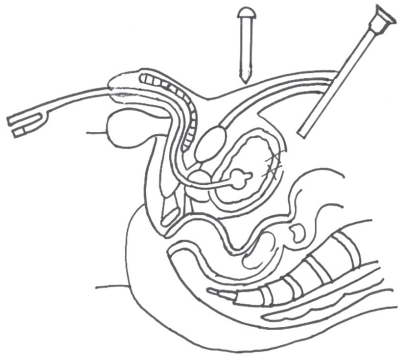

Fig. 1. Trocar cystostomy after suturing the intraperitoneal rupture. The bladder is filled with saline
Рис. 1. Троакарная цистостомия, после ушивания внутрибрюшинного разрыва. Мочевой пузырь заполнен физиологическим раствором

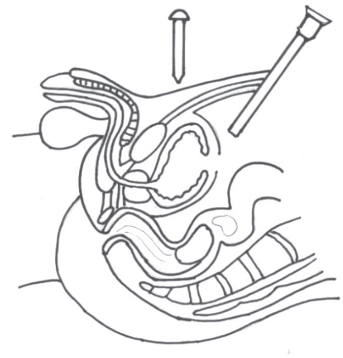

Fig. 2. Conducting a trocar cystostomy in case of non-sutured intraperitoneal rupture of an urinary bladder
Рис. 2. Проведение троакарной цистостомы при неушитом внутрибрюшинном разрыве мочевого пузыря

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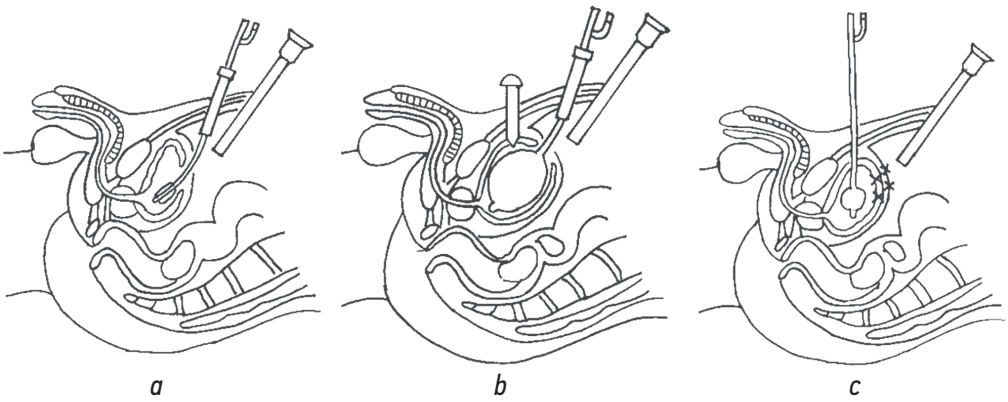

Fig. 3. Stages of suprapubic trocar cystostomy: *a* – antegrade placement of a Foley catheter into a urinary bladder through an intraperitoneal rupture; *b* – puncture of an anterior abdominal wall, urinary bladder and inflated balloon with a trocar; *c* – installation of a suprapubic cystostomy, intraperitoneal rupture of the bladder is hermetically sutured

Рис. 3. Этапы надлобковой троакарной цистостомии: *a* — антеградное заведение катетера Фолея в мочевой пузырь через внутрибрюшинный разрыв; *b* — прокол троакаром передней брюшной стенки, мочевого пузыря и раздутого баллона; *c* — установка надлобковой цистостомы, внутрибрюшинный разрыв мочевого пузыря герметично ушит

inserted into the abdominal cavity through the laparoscopic port, with a balloon capacity of at least 200 ml when filled. The distal end of the Foley catheter with a balloon was antegradely passed through the intraperitoneal rupture into the bladder cavity (Fig. 3). Inside the bladder, the balloon was tightly filled with saline solution. The filled balloon stretched the bladder walls from inside, displacing the transitional fold of the peritoneum cranially. A trocar puncture was made through the anterior abdominal wall in the suprapubic region above the extraperitoneal part of the bladder. The trocar was used to puncture in layers the anterior abdominal wall, bladder, and inflated balloon of a Foley catheter and was inserted in the bladder cavity. Another catheter was inserted through the hollow trocar tube into the bladder. The catheter with the ruptured Foley-type balloon was then removed from the bladder and the abdominal cavity through the laparoscopic port. Intraperitoneal bladder rupture was sutured hermetically with endoscopic sutures.

RESULTS

After sanitation of the abdominal cavity, the bladder was examined in all patients. Ruptures in all cases were localized on the intraperitoneal part of the bladder. The bladder cavity was also examined during laparoscopy to rule out combined injuries (Fig. 4). The size of the rupture ranged from 2 to 8 cm. The sequence of suturing the bladder rupture and insertion of the suprapubic cystostomy was different in all three cases.

Installation of a suprapubic cystostomy by method 1, which involved suturing the bladder rupture and subsequent filling of its cavity with saline solution through a urethral catheter, was performed in 2 (25%) patients. Two main disadvantages of this method were identified during cystostomy. One of them was leakage of saline solution between the sutures into the abdominal cavity during the bladder filling. Therefore, it was technically difficult to create a sealed bladder vessel for safe extraperitoneal placement of a trocar cystostomy. Another disadvantage was the divergence of the sutured wound edges of the bladder with intravesical administration of saline solution. Therefore, depressurization and bladder wound dehiscence required additional imposition of endoscopic sutures. As a result, the surgery time increased.

Suprapubic drainage of the urinary bladder by method 2 was performed in 3 (37.5%) patients. The drawback of this method was the nearly complete absence of the extraperitoneal part of the anterior wall of the bladder for safe trocar cystostomy. Thus, in two patients, the trocar passed into the bladder through the abdominal cavity, causing a risk of intestinal damage. Both patients required repeated insertion of the trocar for suprapubic cystostomy. After suprapubic drainage, the bladder was hermetically sutured.

Drainage of the urinary bladder using method 3 with a Foley-type catheter inserted antegradely into the bladder cavity through the intraperitoneal rupture was also performed in 3 (37.5%) patients. With tight filling of the Foley-type catheter balloon, the capacity of the bladder increased. As a result, the inflated balloon of the Foley catheter inside the bladder provided cranial displacement of the transitional fold of the peritoneum. This surgical technique helped establish a trocar cystostomy for all three patients without unnecessary punctures and risk of intestinal damage. After removal of the Foley-type catheter with a ruptured balloon, the bladder was sutured (Fig. 5).

During drainage of the urinary bladder by method 3, no intraoperative and postoperative complications were recorded. No additional surgery time was required.

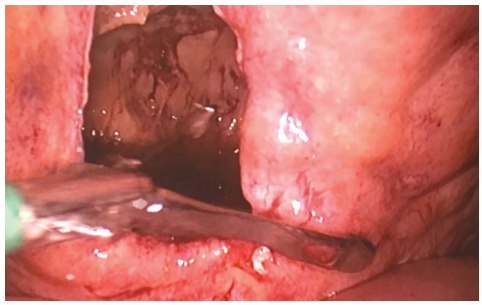

Fig. 4. Checkup of the bladder through the intraperitoneal rupture
Рис. 4. Осмотр мочевого пузыря через внутрибрюшинный разрыв

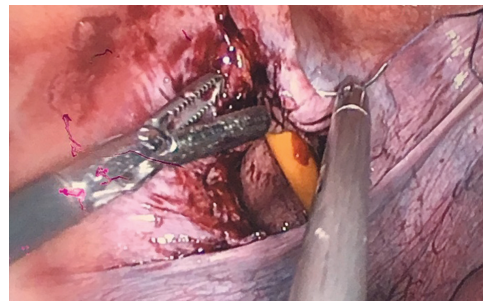

Fig. 5. Suturing of the bladder after trocar cystostomy
Рис. 5. Ушивание мочевого пузыря после троакарной цистостомии

DISCUSSION

Spontaneous intraperitoneal injury is recorded in patients with overfull bladders. These patients are often middle-aged and elderly men with pre-existing lower urinary tract symptoms. Some of them do not undergo timely treatment of prostate and urethral diseases, despite having persistent urinary disorders. If intraperitoneal rupture occurs in such patients, choosing a method for draining the bladder is always a concern. In most cases, studies have described a method of urine diversion from a sutured bladder using a urethral catheter [2, 3, 8]. However, no data are available on the condition of the lower urinary tract in patients with trauma. Several studies have described installation of a trocar cystostomy after suturing an intraperitoneal rupture of the bladder; however, indications for such a method of drainage are not provided [7, 10].

When selecting a method for draining the bladder in case of intraperitoneal injury, we approach each patient individually. Drainage of the bladder using a urethral catheter is undoubtedly a priority. This drainage method is applicable to most patients. However, men with lower urinary tract diseases and dysuria experiencing intraperitoneal rupture often require longer bladder drainage. Installing a urethral catheter for a long period of time is at risk of various complications [11]. Therefore, for patients with lower urinary tract symptoms, the temporary placement of a trocar cystostomy appears to be the only possible solution.

In our study, we employed three methods to determine the optimal one for inserting a trocar cystostomy in case of intraperitoneal rupture of the bladder. Methods 1 and 2 have certain disadvantages, as they require additional endo-videosurgical manipulations associated with depressurization, bladder wound dehiscence, or repeated installation of the trocar for cystostomy. With method 3, the only difficulty was the absence of common application of Foley catheters with a large balloon capacity.

CONCLUSIONS

In the laparoscopic treatment of patients with intraperitoneal rupture of the bladder, trocar cystostomy can be technically performed in several methods. The most optimal method was the insertion of a Foley-type catheter through the abdomen and the existing intraperitoneal rupture into the bladder cavity. Filling the Foley-type catheter balloon inside the bladder creates an airtight vessel necessary for the safe extraperitoneal placement of a trocar cystostomy.

ADDITIONAL INFORMATION

Conflict of interest. The authors declare no conflict of interest.

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