IMMEDIATE CLOSURE OF NEPHROSTOMY TUBE WOUNDS USING A TISSUE ADHESIVE: A NOVEL APPROACH FOLLOWING PERCUTANEOUS ENDOUROLOGICAL PROCEDURES

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ABSTRACT

Purpose: We assessed the feasibility of immediate sealing of nephrostomy tube wounds after percutaneous surgery using a tissue adhesive.

Materials and Methods: The study represents a prospective series of 27 consecutive percutaneous procedures. After nephrostographic exclusion of infrarenal urinary obstruction the nephrostomy tubes were removed and the wound edges were glued together using 2-octyl cyanoacrylate. The wound was covered by gauze to assess the efficiency of sealing and the patients were followed clinically. Another consecutive series of 20 patients who had been treated during 6 months before the current study were used for comparison. The nephrostomy wound in this group was dressed and left to close spontaneously.

Results: A total of 27 percutaneous procedures were performed in 25 patients with a median age of 51 years (range 9 to 77). There were 26 cases of percutaneous nephrolithotomy for an average stone burden of 32.6 mm. (range 16 to 70) and 1 pediatric case of percutaneous antegrade balloon dilation of ureteral stricture related to Cohen reimplantation. Median size of the nephrostomy tubes was 16Fr (range 12Fr to 24Fr) and they were maintained a median of 4 days (range 1 to 16) postoperatively. Urinary leakage ceased immediately after tissue adhesive application in all cases. One patient in whom renal colic developed secondary to edema of the ureteral orifice underwent temporary stenting in retrograde fashion. There were no additional complications at a median followup of 5 months (range 3 to 7). The study group had a significantly shorter hospital stay than the wound dressing group (p <0.001).

Conclusions: Wound sealing following nephrostomy tube removal using 2-octyl cyanoacrylate appears to be a safe, simple and efficient method for immediate abolishment of urinary leakage. This novel approach avoids patient and medical personnel inconvenience, permitting early release from the hospital without physical and social limitations related to persistent wound urinary discharge.

KEY WORDS: kidney; kidney calculi; cyanoacrylates; nephrostomy, percutaneous; tissue adhesive

In the last 2 decades percutaneous surgery has become a well established treatment method in endourology. Clinical experience gained with large series of patients as well as refinements in techniques and instrumentation have increased the indications for percutaneous surgery, an approach that has by now evolved to the point where it can be applied successfully in various cases in the most difficult patient population. The most common indications are large and difficult calculi situations, ureteropelvic junction obstruction, large renal pelvis tumors in patients with limited renal functional resources and ureterointestinal anastomotic strictures.1–6 Complication rates and hospital stay related to this approach have been considerably decreased since its adoption.6 However, the postoperative temporary nephrostomy tube and urinary leakage persisting up to 24 hours after its removal remain a significant bother for patient and medical personnel. To overcome this inconvenience we addressed the question whether the nephrostomy tract can be immediately sealed using tissue adhesive.

MATERIALS AND METHODS

A consecutive series of 25 patients who underwent percutaneous endourological procedures was included in the study. The procedures were performed during a 6-month period starting from December 2001. Data on demographics, clinical presentation, indications, urinary tract anatomical abnormalities, urinary culture status, stone size and location, nephrostomy tube size and the timing of its removal, and postoperative complications were prospectively entered into a computerized database. Prophylactic perioperative broad-spectrum antibiotics were administered in cases with sterile urine, while those with bacteriuria were treated according to the antibiogram. An antibiotic agent, usually from the quinolones group, was continued postoperatively for 5 days.

Access was achieved in the operating room by the endourological team. The tract was dilated up to 30Fr using Amplatz dilators. At the end of the procedure a Foley catheter was used as the nephrostomy tube. The catheter was passed through the access sheath into the renal pelvis under fluoroscopic guidance. The tube was secured to the skin after inflation of the balloon with 2 to 3 ml. diluted contrast material. On postoperative day 3 the patency of the upper urinary tract was assessed by antegrade nephrostography. After ruling out infrarenal obstruction and/or extrarenal urinary leakage the nephrostomy tube was removed. When imaging revealed residual fragments, percutaneous second look nephrolithotomy was performed immediately with a flexible 15.5Fr instrument in the endoscopic suite using the preexisting tract and without anesthesia. At completion the edges
of the tract were approached and glued together using 2-octyl cyanoacrylate. A gauze pad was applied locally to assess the efficiency of sealing.

Followup evaluation 2 to 3 months after the operation consisted of symptomatology assessment, clinical examination, evaluation of stone-free status, renal functionality, urinary tract patency, urine culture and cosmetic outcome. The results were compared with those of a group of 20 consecutive patients who were treated during the 6 months preceding the current study. They were treated similarly to the study group except the nephrostomy wound was dressed and left to close spontaneously. The criteria for comparison included demographic data as well as stone burden, nephrostomy tube size, complications, period of urinary leakage after removal of nephrostomy tube, total hospitalization and hospitalization after nephrostomy tube removal. Statistical analysis was done using statistical software. Continuous data were compared by ANOVA, while discrete variables were assessed using Fisher’s exact test. A telephone survey was performed in the 2 groups to rate the most troublesome postoperative condition among pain, nephrostomy tube presence or urinary leakage. During the same interview the patient was asked to for an opinion regarding the cosmetic result of the procedure.

RESULTS

The study group comprised 25 patients who underwent a total of 27 percutaneous procedures. Six patients (24%) were female and 19 (76%) were male. Median patient age was 51 years (range 9 to 77). We performed percutaneous nephrolithotomy to treat an average stone burden of 32.6 ± 14.7 mm. (range 16 to 70) in 26 cases. Two patients underwent bilateral procedures during the same session. Second look nephrostomy for residual fragment extraction was done in 8 cases (31%). An additional pediatric patient underwent percutaneous antegrade ureteroscopy and balloon dilation of a mid ureteral stricture. In this case the percutaneuos approach was chosen due to previous Cohen ureteral reimplantation.

The median size of the nephrostomy tubes was 16 Fr (range 12 to 24) and they were maintained for a median of 4 days (range 1 to 16) postoperatively. Urinary leakage ceased immediately after the tissue adhesive application in all cases. None of the patients had urinary tract or wound infection. In 1 male patient renal colic developed secondary to edema of the ureteral orifice. Antegrade nephrostography prior to nephrostomy tube removal revealed complete obstruction at the level of the ureteral orifice. The whole ureter was inspected antegrade using a flexible, actively deflectable 8Fr ureteroscope but no pathological findings were identified, and so the wound was glued in the usual manner. The patient was treated with temporary retrograde internal stenting. All except this patient were discharged from the hospital within 3 hours following nephrostomy tube removal. There were no additional complications at a median followup of 5 months (range 3 to 7).

The comparison group that was demographically and clinically similar to the study group included 20 cases of percutaneous nephrolithotomy. The table lists the results of the statistical comparison. The study group had statistically significant shorter hospitalization than the group treated traditionally with compressive dressing (p <0.001). The complication rate in the 2 groups was similar.

The telephone survey revealed that the most bothersome condition was postoperative pain in 19 patients (76%) in the study group, while it was a flank tube in the other 6 (24%). This group of patients was not queried on urinary leakage. The patient was glued in the usual manner. The patient was discharged from the hospital within 3 days. Leakage may persist up to 24 hours and sometimes it lasts longer. None of the patients had urinary tract or wound infection. In 12 to 24) and they were maintained for a median of 4 days (range 1 to 16) postoperatively. Urinary leakage ceased immediately after the tissue adhesive application in all cases. None of the patients had urinary tract or wound infection. In 12 to 24) and they were maintained for a median of 4 days (range 1 to 16) postoperatively. Urinary leakage ceased immediately after the tissue adhesive application in all cases. None of the patients had urinary tract or wound infection. In 12 to 24) and they were maintained for a median of 4 days (range 1 to 16) postoperatively. Urinary leakage ceased immediately after the tissue adhesive application in all cases. None of the patients had urinary tract or wound infection. In 12 to 24) and they were maintained for a median of 4 days (range 1 to 16) postoperatively. Urinary leakage ceased immediately after the tissue adhesive application in all cases. None of the patients had urinary tract or wound infection. In 12 to 24) and they were maintained for a median of 4 days (range 1 to 16) postoperatively. Urinary leakage ceased immediately after the tissue adhesive application in all cases. None of the patients had urinary tract or wound infection. In 24 hours rated it as the most inconvenient postoperative condition. The patients in each groups expressed satisfaction with the cosmetic results of the procedure.

DISCUSSION

In recent years there has been evolving interest in the search for refinements in percutaneous procedures. Research has focused on decreasing trauma to the kidney and the percutaneous tract as well as on decreasing postoperative analgesia requirements, hospital stay and cost. A clinically tested modification is the minipercutaneous approach, which was developed to minimize postoperative morbidity. Chan and Jurrett reported their experience with 17 patients in whom the tract was dilated to only 13Fr and the collecting system was left with an internal stent and an 8Fr nephrostomy tube following the procedure. In another series of 21 patients Monga and Oglevie successfully performed minipercutaneous nephrolithotomies through 20Fr tracts and noted minimal morbidity. Another interesting new concept is the tubeless operation. Goh and Wolf reported decreased hospital stay in a tubeless percutaneous nephrolithotomy series. They recommended this approach for a stone burden of less than 3 cm., unique access, no distal obstruction, no significant bleeding or perforation and no need for secondary percutaneous nephrolithotomy. However, to date neither the minipercutaneous nor the tubeless approach has been widely adopted by endourologists, probably because of the relative lack of clinical experience with these techniques.

Our study represents an additional step toward minimizing patient postoperative discomfort. Urinary leakage following nephrostomy tube removal represents a significant inconvenience, not only for patients, but also for the medical team. Leakage may persist up to 24 hours and sometimes it lasts longer. Today the most common approach for treating a leaking nephrostomy wound is the application of a pressure dressing or stomahesive device while waiting for spontaneous termination of the urinary leak.

The idea of immediately sealing the wound was based on 2 clinical observations. Patients with obstructed or displaced nephrostomy tubes do not have complications when there is no distal obstruction. Also, injecting contrast material through a 2-day matured tract reveals that the tract is connected to the intrarenal collecting system and the ureter without any retroperitoneal leakage (see figure). In essence the 2-day tract represents a controlled renocutaneous fistula. As such, if there is no distal obstruction, there is no damage from trying actively to stop extracorporeal urinary leakage. It could be done simply by suturing the wound. However, this operation necessitates local anesthesia, sterile suturing instruments and the need to remove the sutures after the wound has healed. For those reasons we chose wound sealing by 2-octyl cyanoacrylate, a tissue adhesive, which is widely used for gluing small wounds at our emergency department. This preparation is Food and Drug Administration approved and...
belongs to the cyanoacrylate group of tissue adhesives. Its mechanism of action consists of polymerization in an exothermic reaction when contacting a fluid or basic medium, forming a strong bond when applied on the tissue.\(^{11}\) Cyanoacrylates and their derivatives are bactericidal, bacteriostatic, chemically stable and easily stored.\(^{12}\) There have been no reports of toxicity or carcinogenicity related to topical use.\(^{11}\)

Cyanoacrylate derivatives have been successfully used in urology to treat posttraumatic high flow priapism, high output post-nephrectomy aorticaval fistula, erectile dysfunction due to veno-occlusive dysfunction, pelvic arteriovenous aneurysm caused by transurethral resection of prostate, percutaneous fistula after partial nephrectomy and chyluria after radical nephrectomy.\(^{13-18}\) Experimentally 2-octyl cyanoacrylate was tested with good results for gluing open cystotomy and closing the wound after circumcision.\(^{19, 20}\)

Using tissue adhesive in our series of patients we were able to avoid patient discomfort related to urinary discharge without adverse events. The lack of wound infections after sealing is probably due to the bacteriostatic and bactericidal properties of 2-octyl cyanoacrylate as well as to oral antibiotics that were continued postoperatively. Retrospectively we suspect that the single patient with renal colic secondary to ureteral orifice edema was under diagnosed despite negative findings on antegrade endoscopic inspection. The consecutive character of this series and its categorical results support the concept of immediate tract sealing. This method permits early recovery and release from the hospital, overcoming significant bother related to percutaneous surgery.

CONCLUSIONS

Wound sealing following nephrostomy tube removal using 2-octyl cyanoacrylate appears to be a safe, simple and efficient method of immediately terminating urinary leakage. This novel approach avoids inconvenience to the patient and medical personnel, permitting early release from the hospital without the physical and social limitations related to persistent wound urinary discharge.

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REFERENCES


Antegrade injection of contrast material through 2-day nephrostomy tract (arrow) connected to intrarenal collecting system without evidence of retroperitoneal extravasation.