Review Article

Pain management strategies in urethral reconstruction: a narrative review

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Background and Objective: Few investigations explore pain recovery comprehensively following urethral reconstruction, and understanding pain pathways that lead to discomfort following reconstruction has posed challenges. Options for pain control aside from opioids continue to be in the early forms of investigation, and remain an important strategy to combat the well-documented burden of the opioid epidemic. We conduct a detailed assessment of pain pathways in patients undergoing urethral reconstruction and further outline non-narcotic based pain management strategies in those undergoing urethroplasty.

Methods: We performed a literature review to describe pain pathways involved in urethral reconstruction with buccal graft, and postoperative pain recovery. We searched for pain management techniques performed by fields similar to urology, and those being utilized in urethroplasty with buccal graft.

Key Content and Findings: Innervation of the penoscrotal areas and mouth are well-defined, but understanding postoperative pain after urethroplasty remains a challenge. Preventative analgesia, nerve blocks, and multimodal analgesia have been employed by colorectal and gynecological surgeons. Urologists have utilized similar techniques for patients undergoing urethral reconstruction with buccal graft.

Conclusions: Few investigations explore pain recovery comprehensively following urethral reconstruction, but we believe that utilizing a combination of preventative analgesia, nerve blocks, and multimodal analgesia will have acceptable outcomes in post-surgical patients undergoing recovery. Additional work is required to further explore how combined pain management strategies can optimally reduce postoperative pain.

Keywords: Postoperative pain management; urethroplasty with buccal graft; multimodal therapy; preventative analgesia

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Introduction

Rationale and background

Male urethral strictures can cause lower urinary tract pain and significantly diminish quality of life. Most patients reassuringly report improved pain relief following urethral reconstruction, as well as resolution from irritative lower urinary tract symptoms that affect quality of life prior to surgery (1). Although the high success rates and tolerance of urethroplasty allows for a successful outcome following repair, possible post-surgical complications may include perineal and scrotal pain, as well as persistent oral

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Table 1 Search strategy summary

Items	Specification
Date of search	March 3, 2022 to May 11, 2022
Databases and other sources searched	PubMed
Search terms used	Urethroplasty pain management, perineal and pudendal nerve block, multimodal analgesia, opioid epidemic, buccal graft
Timeframe	1987–2022
Inclusion criteria	Randomized control trials, retrospective studies
Selection process (who conducted the selection, whether it was conducted independently, how consensus was obtained, etc.)	The authors conducted the selection and all were in agreement about which studies were to be included. Abstracts were screened, and we included systemic reviews, meta-analyses, retrospective case series, prospective case series, and review articles. Articles published in a language besides English were eliminated, as well as editorial comments

discomfort in patients who undergo harvest of buccal mucosa grafts. Few investigations explore pain recovery comprehensively following urethral reconstruction and understanding pain pathways that lead to discomfort following reconstruction has posed challenges. Importantly, understanding such modulation pathways may provide a guide for minimization of narcotic-based pain control following surgery since opioids remain a mainstay of treatment for patients with discomfort in the postoperative setting. Further, options for pain control aside from opioids continue to be in the early forms of investigation and remain an important strategy to combat the well-documented burden of the opioid epidemic (2).

Objectives

Here, we conduct a detailed assessment of pain pathways in patients undergoing urethral reconstruction and further outline non-narcotic based pain management strategies in those undergoing urethroplasty. We present the following article in accordance with the Narrative Review reporting checklist (available at https://tau.amegroups.com/article/view/10.21037/tau-22-363/rc).

Methods

To perform this narrative review, we performed a comprehensive literature review using PubMed from inception in March 2022 to project endpoint in May 2022. The search keywords included "urethroplasty pain management", "perineal and pudendal nerve block", "multimodal analgesia", "opioid epidemic", and "buccal graft". We also reviewed the references in those studies to include other studies that may be relevant to our review. We included full-text English articles that were published in peer-reviewed journals between 1987 and 2022 (see *Table 1*).

Discussion

Nerve distributions involved in urethroplasty and buccal graft harvest

There are two main pathways for pain sensation: the direct lateral spinothalamic pathway and an indirect medial spinoreticulothalamic pathway, with the lateral pathway from the spinal cord to the ventrocaudal thalamus and to the cortex responsible primarily for sharp, well-localized pains that arise near the body surface (3). Action potentials are then propagated from neurons to transmit pain signals.

Most urethroplasties are performed through perineal or penile incisions and these areas are innervated by perineal and dorsal penile nerves, which are branches of the pudendal nerve. The pudendal nerve is a key anatomical factor that warrants understanding to help clarify pain management in urethral reconstruction recipients. This nerve contains three branches: the dorsal nerve of the penis, the inferior rectal nerve, and the perineal nerve. The largest branch of the pudendal nerve is the perineal nerve, which contains superficial and deep branches. The superficial perineal nerves carry sensory information from the perineum, scrotum, and ventral penis, whereas the deep branches provide somatic innervation to the perineal musculature (4). Perineal nerves travel alongside the ischiocavernosus and bulbospongiosus muscles towards the

penoscrotal area. The perineal nerve gives branches to the scrotum and continues over to the ventral side of penis (5). Branches of the dorsal nerve of the penis at the junction of corpus cavernosum and corpus spongiosum assemble into a network with the perineal nerves. In addition to the pudendal nerve, the lateral femoral nerve overlaps with some of the distribution of the pudendal nerve and further provides sensory innervation to the perineum. For those undergoing buccal mucosa graft harvest, innervations of the inner mouth have to be considered. The inner mouth is innervated by branches of the infraorbital nerve (6), with contributions to the mucosa of the inner cheek and inner lip from the mandibular nerve and from the lingual nerve, one of the mandibular nerve's branches (7).

There are several pharmacological mechanisms to inhibit pain signals along the aforementioned pathways including local analgesics, opioids, non-steroidal anti-inflammatory medications (NSAIDs), and gabapentinoids. Local analgesics such as lidocaine work by altering signal conduction in neurons by prolonging inactivation of sodium-gated channels on the internal surface of nerve cell membranes responsible for action potential propagation (8). Opioids exert their main analgesic effect by binding to G-protein coupled mu opioid receptors, causing cellular hyperpolarization and inhibiting nociceptive signaling throughout the central nervous system and peripheral tissues (9). Non-selective NSAIDs such as Ketorolac block both COX-1 and COX-2 enzymes responsible for the peripheral production of prostaglandins thus reducing pain, fever, and inflammation (10). Evidence also shows that NSAIDs may work through the endocannabinoid system, increasing levels of endocannabinoids through a multitude of proposed mechanisms, contributing to its systematic analgesic effects (11). Gabapentinoids, another class of drugs which has seen increased use in management of perioperative pain, act as calcium channel blockers that inhibit release of excitatory neurotransmitters in neuronal tissues and decrease calcium-mediated neuronal excitability pathways, although exact analgesic mechanisms are still poorly understood (12). Gabapentinoids have been approved for a wide array of conditions, including seizures, restless leg syndrome and chronic or post-herpetic pain; its approval for post-herpetic pain is what promoted interest in use for post-operative pain (13).

Pain management options used by fields similar to urology

Fields similar to urology that perform surgical manipulation in the pelvic, perineal and genital domains have explored various approaches to reduce postoperative pain, including preoperative, intraoperative, local, and multimodal analgesia. Due to the limited work done in understanding non-narcotic based approaches in urethral reconstruction, we review the investigative work of other such surgical disciplines to characterize successful non-opioid based strategies.

Preemptively blocking pain pathways prior to incision is known to sensitize pain receptors and reduce postoperative pain while decreasing the potential use of opioids (14). To evaluate the role of preventative analgesia, colorectal surgeons conducted a double-blinded trial for patients undergoing outpatient colorectal surgeries such as anal fissures, hemorrhoids, condyloma, and fistula (14). In this investigation of 61 patients by Van Backer and associates, patients were randomized to receive ibuprofen and acetaminophen preoperatively as well as ketamine and dexamethasone intraoperatively (n=31 patients) against placebo (n=30 patients). Those who received preventative analgesia reported lower pain scores early postoperatively [pain score 0.8 with interquartile range (IQR 0–1)] and less opioid use up to 8 hours postoperatively compared with the control group's [pain score 1.6 (IQR 0–2), $P<0.05$]. However, there was no difference noted in opioid consumption at 24 hours postoperatively.

Local anesthesia combined with nerve blocks have been utilized to help reduce postoperative pain and use of additional pain medications. Within gynecology, pudendal nerve blocks have been employed successfully in different patient populations, ranging from those with chronic severe pelvic pain due to pudendal neuropathy (15), to those in labor (16), and for those undergoing procedures such as anterior and posterior vaginal repair (17). Ismail and colleagues randomly allocated patients undergoing posterior colpoperineorrhaphy to two groups of 65 patients each; one that received general anesthesia alone and one that received general anesthesia combined with preemptive nerve stimulator-guided pudendal nerve block. Ten mL of 0.25% bupivacaine was administered on each side to perform the pudendal nerve block. Postoperative visual analog pain scores, pethidine and paracetamol consumption during the first 24 hours were significantly lower with patients who received a pudendal nerve block in addition to general anesthesia *vs.* those that did not receive blockade (23.5 *vs.* 51.1 mg/24 hours, 239.4 *vs.* 278.3 mg/24 hours, 2.0 *vs.* 2.6 g/24 hours respectively, all $P<0.0001$) (18).

Multimodal analgesia involves combining various

groups of pain medications for pain relief. A randomized controlled trial conducted by Xiromeritis and colleagues demonstrated that a multimodal perioperative analgesia regimen improved pain control in 92 women undergoing minimally invasive myomectomies (19). Forty-seven women were randomized to receive dexamethasone, ondansetron, diclofenac, and paracetamol *vs.* 45 women who received placebo, with significantly lower pain scores and duration of hospitalization for those that received the pain reduction protocol (pain score 4.7 *vs.* 7.1 at 2 hours postoperatively, 2 *vs.* 4.5 at 8 hours postoperatively, respectively, with P<0.01). In another study, Reagan and colleagues employed multimodal analgesia to decrease postoperative opioid use while providing adequate pain control in female patients undergoing pelvic reconstructive surgery, randomizing 70 patients to the usual care arm and 68 patients to multimodal analgesia (20). They included patients who underwent sacrocolpopexy, and vaginal hysterectomy with vaginal vault suspension, anterior and/or posterior repair, plus or minus a midurethral sling. Their multimodal pain regimen included a preoperative dose of celecoxib and gabapentin, intraoperative IV dexamethasone and acetaminophen, and immediate postoperative ondansetron prior to leaving the operating room. Postoperatively, IV acetaminophen was continued for 4 doses and then transitioned to oral acetaminophen (1,000 mg by mouth every 6 hours). In addition, patients received scheduled oral celecoxib and gabapentin starting in the evening of postoperative day 0 and continuing until discharge. Multimodal pain regimen recipients used significantly fewer intravenous narcotics while in the hospital (10.8±15.1 *vs.* 31.2±29.6 mg; P<0.001) and were more likely not to use any narcotics following discharge (34.8% of patients *vs.* 10.6%; P=0.001). Multimodal pain regimens have shown notable promise in reducing postoperative opioid use and even better pain control.

Current investigations in postoperative pain after urethroplasty with buccal graft

Perineo-genital pain

There have been few investigations into the characterization of postoperative pain following urethral reconstruction. Evans and associates reported significant improvement in pain frequency of the bladder and urethra postoperatively in their prospective study on patient-reported pain after bulbar urethroplasty in 35 patients (P<0.001) (21). Preoperatively, 29 patients (83%) reported some lower urinary tract pain (bladder, penile or urethral, or perineal) with pain frequency reported as "sometimes" or "often" in 22 patients (63%); and, 12 men (34.3%) reported having some degree of perineal or scrotal pain where the preoperative reported pain intensity (rated on a 0–10 visual analog pain scale) was a median of 4.0. Postoperatively, only 1 patient (3%) reported worsening pain frequency in the bladder, and 2 patients (6%) in the urethra or penis; 12 patients (34%) reported perineal pain even at a median follow-up of 483 days. Although 2 of these patients had improved pain compared to preoperatively, 6 patients developed persistent pain after urethroplasty. This investigation is one of few studies to include a thorough preoperative pain assessment and did not demonstrate any improvement of perineal or scrotal pain intensity following reconstruction (P=0.98). Of patients who had complete resolution of lower urinary tract pain, there was no apparent return of pain with a median follow-up of 483 days. Nevertheless, patients still reported high satisfaction rates from the reconstruction (P<0.001) and improvement in quality of life after urethroplasty despite continuing to have perineal discomfort.

Very few reports have described the incidence of perineal pain after urethroplasty. Granieri and associates reported roughly 14% of patients experienced postoperative scrotal or perineal neuralgia after bulbar urethroplasty, but also suggested that this neuralgia resolved within 1 year following surgery (4). The authors hypothesized that perineal nerves may be injured during a non-nerve sparing bulbar urethroplasty because of the dissection of the central tendon, splitting or retraction of the bulbospongiosus muscle, and/or the use of cautery. Routine splitting of the bulbospongiosus muscle may damage the superficial perineal nerves, contributing to the neuralgia (4). Perineo-genital pain intensity and quality subscales decreased over time, reaching the minimum at 6 months postoperatively.

A longitudinal study examining postoperative pain in 135 patients undergoing urethroplasty with buccal graft demonstrated that pain was no more than "mild to moderate", with highest pain intensity being reported on postoperative day one and decreasing over time (22). The investigators followed patients rigorously and reported no difference in perineo-genital pain intensity between patients with later stricture recurrence and those with ordinary follow-up. Patients also tended to characterize the perineo-genital pain as "tender, aching, sharp, and stabbing" in nature.

Oral pain and buccal graft considerations

Buccal graft harvest is overall well tolerated but it is not without risks. Patients may experience numbness, tightness of the mouth, and oral pain. The pain from the buccal graft harvest site contributes greatly to postoperative pain after buccal graft urethroplasty and has been shown to result in significant increase in narcotic use thus limiting oral activities (23). However, by postoperative day 6, a prior investigation reported that 90% of patients had little or no oral pain and all were able to eat and drink with only 10 percent having moderate-to-severe pain (24). A few reports have been conducted exploring pain management techniques for patients' oral pain from buccal graft harvest sites. If closure is performed, oral pain following graft harvest can also be related to how tightly the harvest site itself is closed. Accordingly, the pain may be less intense in the early postoperative period when the donor area is closed. In other investigations subsequently, patients have previously reported significantly less postoperative pain following closure of the donor site, and closure was only performed when it could be done without tension (25). Lumen and associates described how 3 days postoperatively, compared to those that underwent buccal mucosa graft, significantly more patients in the lingual mucosa graft group had severe difficulties with eating and drinking (62.1% *vs.* 24.1%, P=0.004) and speaking (93.1% *vs.* 55.2%, P=0.001). Excessive tension can lead to more postoperative pain and contracture. However, others such as Wood and colleagues, have believed that closure may worsen postprocedural oral pain, create problems with mouth opening and contribute to perioral numbness, thus recommending leaving the harvest site open to avoid these sequelae (26). Forty-nine men returned questionnaires relating to 57 buccal mucosal graft harvests; 39 patients (68%) reported perioral numbness postoperatively, with 15 (26%) having residual numbness after 6 months. Thirty-eight patients (67%) reported initial difficulty with mouth opening, with 5 (9%) having persistent problems. Mean pain score for patients with donor site closure was significantly higher than that for patients without closure (3.68 *vs.* 2.26 respectively, P<0.01).

Currently, there is no consensus on closure *vs.* non-closure of the buccal graft donor site. Chua and colleagues performed a meta-analysis of comparative studies to evaluate postprocedural oral pain scale and other patient reported oral morbidities for nonclosure *vs.* closure of buccal mucosal graft donor site, including 269 patients (139 nonclosure and 130 closure) from 4 randomized controlled trials (27). Overall pooled effect estimates from the 4 randomized controlled trial studies showed no significant difference in oral pain perception with nonclosure or closure of the BMG harvest site for postoperative day 1 [standardized mean difference (SMD) –0.47; 95% confidence interval (CI): –1.01 to 0.07], day 3–7 (SMD 0.16; 95% CI: –0.23 to 0.54) and 6-month follow-up (SMD –0.04; 95% CI: –0.28 to 0.20). However, subgroup analysis demonstrated that rectangular buccal mucosal graft harvest sites that were not closed had lower pain scores on postoperative day 1 (SMD –0.90; 95% CI: –1.70 to –1.10). In addition to considerations regarding closure or nonclosure and postoperative pain, Barbagli and colleagues have suggested harvesting a buccal graft no larger than 4 cm × 2.5 cm to reduce risk of postoperative complications including pain (28). They also found that the number of buccal grafts was the only significant predictor of patient dissatisfaction. Another report by Bozkurt and colleagues also supports that harvesting bilateral buccal grafts results in higher morbidity compared to a single graft especially in the short-term; but with comparable satisfaction after 6 months of follow-up (29). In this investigation, researchers compared 19 patients who had bilateral buccal graft harvest for strictures 7 cm or longer, to 23 patients who had single buccal graft harvest for strictures shorter than 7 cm. Postoperative pain was significantly higher between postoperative day 2 and 7 for the patients who underwent bilateral buccal graft harvest compared to single graft (5.5 *vs.* 4.2, P=0.006).

When infiltrating the harvest site, different local anesthetics have been used, such as lidocaine and epinephrine. However, the pain control normally has worn off prior to completion of urethroplasty. Chua and colleagues randomized 43 patients to a control group (n=22) which had no further local anesthetic infiltration aside from that used in the hydrodissection for buccal graft harvest (2% Lidocaine with epinephrine) and to an intervention group (n=21) receiving an additional 20 mL infiltration of 1.3% liposomal bupivacaine (liposomal bupivacaine is available in 96-hour delayed release form) (30). A significantly lower narcotic use was noticed among the treatment group on postoperative day 1 (P=0.017), while no durable difference was noticed on postoperative day 2.

In addition to the use of local anesthetics at the graft site, these agents can also be used to perform infraorbital nerve blocks. Infraorbital nerve blocks were previously performed for analgesia after cleft palate, midface, and transsphenoidal surgeries. Since innervation of the buccal mucosa is through branches of the same nerve, a block by its foramen via an

intraoral approach should provide acceptable analgesia to the donor site. A randomized controlled trial demonstrated median time to pain-free oral intake for liquids and solids was earlier for patients who received an infraorbital nerve block *vs.* those that did not (1 day *vs.* 2–5 days, P<0.001 for liquids and 4 *vs.* 2 days, P<0.001 for solids) (6). The reduction in postoperative pain allowed patients to have better oral intake sooner. Urologist acceptance of the incorporation of infraorbital nerve blocks may remain limited due to the learning curve required to undertake this adjunctive maneuver.

Postoperative pain management for urethroplasty without opiates

While post-urethroplasty pain management most commonly consists of opioid analgesics, a handful of reports have examined different methods to reduce postoperative pain without opioid use. A randomized clinical trial by Ghiasy and associates demonstrated the utility of Gabapentin in managing postoperative pain in patients undergoing posterior urethroplasty (31). These investigators randomized 50 patients each to either receive placebo or Gabapentin 600 mg, with results of decreased postoperative pain and less need for opioid consumption after end-to-end urethroplasty. Another benefit reported was that there were less adverse effects such as nausea, vomiting, and drowsiness with patients who received Gabapentin before surgery compared to those who did not.

Nerve blocks have also been utilized for patients undergoing urethroplasty, as described in a few case series. Pudendal nerve blocks are routinely performed in women via a transvaginal approach using well-defined anatomic landmarks such as the ischial spines. This nerve block is more technically challenging in men, requiring approaches such as transperineal, transrectal, or transgluteal techniques but have been shown to consistently provide up to 12–18 hours of postoperative analgesia (32). The performance of pudendal nerve blocks in men depends on surgeon comfort and may require multiple injections. Some reconstructionists may elect to utilize special equipment including C-arm fluoroscopy, nerve stimulators, and ultrasonography. Although the amount of equipment needed may deter some urologists, other investigations performed in penile prosthesis implantation have alternatively demonstrated the feasibility and success of pudendal nerve blocks in perioperative pain control without the need for any specialized equipment (33).

Only few reports have assessed the utility of nerve blocks in urethroplasty recipients. Gong and colleagues used a combined nerve block of the spermatic cord in addition to the pudendal nerve, as the ilioinguinal nerve and the genital branch of the genitofemoral nerve contained in the spermatic cord innervate the scrotum and the penile root (34). The researchers injected 5 mL of 0.5% ropivacaine to both sides of the pudendal nerve and spermatic cord for 20 mL in total; 40 mg of parecoxib was then administered every 12 hours after surgery for a total of two doses, and no patient received opioids postoperatively. To date, these remain the only two studies exploring use of nerve blocks for urethroplasty.

Although the efficacy of pudendal nerve blocks in urology is not well established, existing studies have shown promising results with use in procedures such as transrectal ultrasound (TRUS)-guided prostate biopsies (35) and transurethral resection of prostates (TURP) (36). Adsan and collaborators randomized 51 patients to receive 10 mg of 1% Prilocaine for unilateral pudendal nerve blockade (n=26) or placebo (n=25), and found that patients who received the block had at least a two point improvement in visual analog scale (VAS) for the biopsy procedure (P<0.01) and probe discomfort (P<0.05) (35). This is another study where pudendal nerve blocks were performed without extra equipment, as unilateral pudendal nerve block were undertaken without ultrasound guidance. The researchers percutaneously injected posterior to the ischial spine at the attachment of the sacrospinous ligament, as the ischial spine can be palpated transrectally. Akkaya and colleagues described pudendal nerve blocks via the perineal approach utilizing ultrasound guidance and nerve stimulator for patients undergoing TURP, and randomized 40 patients to receive block *vs.* placebo (36). The incidence of catheter-related discomfort and the VAS scores were higher in the control group than in the pudendal block group (P<0.05). Total tramadol consumption was 213.5±44.5 mg in the control group and 103.8±26.8 mg in the pudendal block group (P<0.001). Although there are not many studies on use of pudendal nerve blocks in urologic procedures, these investigations demonstrate promising efficacy and a potential solution for pain mitigation in urologic reconstruction recipients.

In pediatric reconstruction populations, caudal blocks have been utilized more liberally in children undergoing hypospadias repair. Wang and collaborators divided a large hypospadias cohort of 160 patients into four groups of n=40 patients each: mixed solution of 1 μg/kg

of dexmedetomidine plus 0.25% ropivacaine, 1.5 μg/kg of dexmedetomidine plus 0.25% ropivacaine, 2 μg/kg of dexmedetomidine plus 0.25% ropivacaine, or just 0.25% ropivacaine into the sacral canal. The authors found that 1.5 μg/kg of dexmedetomidine accelerates the onset of the caudal block, reduces stress and inflammation, stabilizes the circulation, increases the duration of postoperative analgesia, and reduces anesthesia- and procedure-associated adverse events (37). Another report of children undergoing primary hypospadias repair compared penile blocks to caudal epidurals and reported improved analgesia in penile block recipients (38).

Future directions in postoperative pain control after urethroplasty

Narcotics are still a predominant pain medication prescribed for postoperative analgesia, and are unfortunately prescribed excessively throughout the field of urology. Theisen and colleagues found that urologists prescribed opioids to an excess of 6.8-fold to patient use with 60 percent of prescribed opioids being unused (39). The median number of oxycodone-equivalents prescribed at discharge was 27 for all procedures, and median use was 4–14 pills. This is especially alarming given that the 6% of opioid naïve postsurgical patients can develop chronic opioid use after a single prescription (40). Opioid dependence and overdose is a complication after urological procedures, which also contribute to the overall opioid epidemic and elevated health expenditures (2). In 2019, approximately 10.1 million people aged 12 and older misused opioids, and over 48,000 people died from overdose of synthetic opioids (41). The estimated cost of the opioid epidemic was about 1 trillion dollars in 2017, with more than one-half being related to fatal overdoses (42). The costs encompass loss of benefits from a person's lifetime earnings, health care expenses, loss of productivity, criminal justice fees, and reduced quality of life. Control of acute postoperative pain can reduce the risk of patients developing chronic postsurgical pain, which ultimately worsens quality of life and productivity, and adds to aforementioned costs (43). There will likely be a trend towards increased utilization of multimodal and preventative analgesia in the future as urologists try to limit prescribing narcotics for postoperative analgesia. Preventative analgesia helps to dampen peripheral and central nervous system sensitization, resulting in improved pain control and reduced narcotic usage (44). Medications that can be given preoperatively that have shown promising results include Pregabalin, sometimes with Ibuprofen, and other regimens as described earlier (14,19,45,46).

Multimodal analgesia involves administering combinations of analgesics with different mechanisms of action to improve pain control, reduce opioid requirements, and lessen side effects (44). There may also be increased utilization of nerve blocks being performed for patients undergoing urethroplasty with buccal graft harvest. There are only a few studies regarding nerve blocks in urology, but these suggest that they are efficacious and could further reduce opioid requirements. More work is needed to elucidate pain pathways involved with postoperative pain following urethral reconstruction. Implementation of preventative and multimodal analgesia, combined with nerve blocks may prove quite useful in alleviating acute surgical pain which reduces risk of chronic postsurgical pain.

Our recommendations for pain management in urethroplasty

We take this opportunity to provide the reader with our collective strategy to manage pain control in urethral reconstruction recipients. Due to the limited work done specifically in urethroplasty recipients, our strategies utilize the work summarized in this review to arrive at the recommendations below.

Urethra and penile pain

We recommend preventative and multimodal analgesia, with preoperative Acetaminophen, NSAID, and Gabapentin, combined with pudendal nerve and penile nerve block with liposomal bupivacaine. Efforts should be taken to minimize the size of the perineal incision and tissue handling. We utilize such maneuvers including the unilateral dissection of the urethra, sparing of bulbospongiosus muscle if feasible, and non-transection of urethra when possible. Decreasing tension on the tissue by retractors should also help to reduce postoperative pain. After the wound is closed, we recommend local infiltration with mixed local analgesia of lidocaine and bupivacaine. Postoperatively, we recommend immediate selective COX-2 inhibitors with continuation for roughly 1 week postoperative along with docusate to avoid constipation. Ideally, patients would not need narcotics postoperatively but if necessary, we suggest several days

of opioids and then conducting a repeat assessment of the patient's pain control.

Oral pain

When harvesting buccal grafts, we recommend infiltrating with a combination of either lidocaine or bupivacaine with epinephrine. We do not suggest use of cautery, and recommend an ellipsoid incision instead of a rectangle, as this facilitates closure of the site if a tension-free closure is feasible. If closing the donor site, we recommend imbricating the edges with figure-of-8 sutures. At the end of the procedure, we recommend repeat infiltration of the donor site with liposomal bupivacaine. Postoperatively, we recommend an oral mix of lidocaine and aluminum hydroxide and a magnesium hydroxide suspension.

Patients with history of addiction, chronic pain, or on methadone

We recommend working with a pain management team for perioperative, operative, and postoperative regimens. It would be ideal for them to follow the patient if they remain an inpatient following reconstruction and to help devise reasonable expectations with them regarding goals of pain management. There may possibly be a need for a "pain contract" with the patient as well.

Summary

Few investigations explore pain recovery comprehensively following urethral reconstruction, but we believe that utilizing a combination of preventative analgesia, nerve blocks, and multimodal analgesia will have acceptable outcomes in post-surgical patients undergoing recovery. Additional work is required to further explore how combined pain management strategies can optimally reduce postoperative pain.

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Footnote

Reporting Checklist: The authors have completed the Narrative Review reporting checklist. Available at https://tau.amegroups.com/article/view/10.21037/tau-22-363/rc

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://tau.amegroups.com/article/view/10.21037/tau-22-363/coif). JS reports that he has received the consulting fees from Coloplast and Boston Scientific. The other authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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