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Review – Pediatric Urology – Editor's choice

European Association of Urology/European Society for Paediatric Urology Guidelines on Paediatric Urology: Summary of the 2024 Updates

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Abstract

Background and objective: We present an overview of the 2024 updates for the European Association of Urology (EAU)/European Society for Paediatric Urology (ESPU) guidelines on paediatric urology to offer evidence-based standards for perioperative management, minimally invasive surgery (MIS), hydrocele, congenital lower urinary tract obstruction (CLUTO), trauma/emergencies, and fertility preservation.
Methods: A broad literature search was performed for each condition. Recommendations were developed and rated as strong or weak on the basis of the quality of the evidence, the benefit/harm ratio, and potential patient preferences.
Key findings and limitations: Recommendations for perioperative management include points related to fasting, premedication, antibiotic prophylaxis, pain control, and thromboprophylaxis in patients requiring general anaesthesia. MIS use is increasing in paediatric urology, with no major differences observed among different MIS approaches. For hydrocele, observation is the initial approach recommended. For persistent cases, treatment varies according to the type of hydrocele. CLUTO cases should be managed in tertiary centres with multidisciplinary expertise in prenatal and postnatal management. Neonatal valve ablation remains the mainstay of treatment, but associated bladder dysfunction requires continuous treatment. Among urological traumas and emergencies, renal trauma is still an important cause of morbidity and mortality. Conservative management has become the standard approach in haemodynamically stable children.

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Ischaemic priapism is a medical emergency and requires stepwise management. Initial management of nonischaemic priapism is conservative. Fertility preservation in prepubertal children and adolescents has become an increasingly relevant issue owing to the ever-increasing number of cancer survivors receiving gonadotoxic therapies. A major limitation is the scarcity of relevant literature.

Conclusions and clinical implications: This summary of the 2024 EAU/ESPU guidelines provides updated guidance for evidence-based management of some paediatric urological conditions.

Patient summary: We provide a summary of the updated European Association of Urology/European Society for Paediatric Urology guidelines on paediatric urology. There are recommendations on steps to take before and immediately after surgery, management of hydrocele, congenital lower urinary tract obstruction, and urological trauma/emergencies, as well as preservation of fertility. Recommendations are based on a comprehensive review of recent studies.

1. Introduction

The aim of the European Association of Urology (EAU)/European Association for Paediatric Urology guidelines on paediatric urology is to offer evidence-based standards for the management of urological conditions in children. As for any guideline, they cannot replace clinical expertise in the decision-making process.

The guideline panel is an international group. The panel composition and conflicts of interest of members can be reviewed on the EAU website (https://uroweb.org/guidelines/paediatric-urology/panel).

The paediatric urology guidelines are unique among guidelines in that they include all paediatric urology conditions subdivided into chapters. In general, five or six chapters are updated every year, so that every chapter is generally updated every 3 yr, unless significant or groundbreaking studies are published in the interim.

The guideline chapters updated in 2024 include perioperative management, minimally invasive surgery (MIS) in paediatric urology, hydrocele, congenital lower urinary tract obstruction (CLUTO), trauma/emergencies, and fertility preservation in children and adolescents. The chapter on fertility preservation and the subchapter on paediatric emergencies are new. The subchapter on emergencies focuses solely on priapism, as other emergencies, such as acute scrotum and paraphimosis, are addressed in other specific chapters. The full-text version of the guidelines with a full list of references is available at https://uroweb.org/guidelines/paediatric-urology.

2. Methods

For each topic of interest, a broad literature search was performed for studies published since the last update of the same chapter. Data were extracted in a structured fashion as detailed on the EAU website (https://uroweb.org/guidelines/paediatric-urology/chapter/methods).

Recommendations for diagnosis and/or treatment were developed and rated as strong or weak on the basis of the quality of the evidence and the benefit/harm ratio, taking into account possible patient preferences [1].

3. Results

3.1. Perioperative management

Perioperative management recommendations were developed for children undergoing general anaesthesia, which is the most common scenario for paediatric patients. The metabolic response to anaesthesia and surgery in infants and children is related to the severity of the operation.

Fasting should ideally be as short as possible. Recommended preoperative fasting periods are 1 h for clear liquids, 3 h for breast milk, 4 h for formula milk–based products, and 6 h for a light meal (Table 1) [2,3]. The presence of type 1 diabetes does not change the recommended fasting period [2,3].

Fluid intake should be restored early after minor or nonabdominal procedures, as this reduces postoperative vomiting and a need for opioid use [4]. Implementation of an enhanced recovery after surgery protocol is recommended after abdominal surgery in children with pre-existing normal bowel function to reduce the need for postoperative opioids and promote faster bowel recovery and shorter hospital stays [5,6].

Preventative measures can be used to alleviate patients' anxiety and facilitate patient-caregiver separation. This goal can be achieved by admitting caregivers into the operating room and using distraction techniques (eg, play therapy, toys, storybooks, videos, tablets, or mobile phones) and/or providing premedication. The latter has to be given in a timely manner preoperatively; suitable agents include midazolam, clonidine, ketamine, and dexmedetomidine. There is currently no consensus on the optimal medication [7].

It is well established that perioperative antibiotics prevent infections following surgery, but limited data are available for paediatric genitourinary procedures [8].

Postoperative pain should be assessed using age-appropriate tools, and age, physical condition, and type of surgery and anaesthesia should be taken into consideration for pain management [9]. Intraoperative administration of regional anaesthesia reduces the need for postoperative analgesia [10]. Postoperatively, paracetamol and nonsteroidal anti-inflammatory drugs are the first choice for

Table 1 – Recommendations for perioperative management

Recommendation	Strengthrating
Ensure shorter preoperative fasting periods for elective surgeries (1 h for clear liquids, 3 h for breast milk, 4 h for formula milk–based products, and 6 h for a light meal).	Strong
Start early postoperative oral fluid intake in all patients scheduled for minor surgical procedures.	Strong
Use enhanced recovery after surgery protocols for abdominal surgery in children with pre-existing normal bowel function.	Strong
Prevent/treat pain in children of all ages.	Strong
Evaluate pain using age-appropriate assessment tools.	Strong
Use pre-emptive and balanced analgesia to reduce opioid requirements.	Strong
Use physical methods to reduce VTE risk in older children and adolescents who are at higher risk of VTE.	Strong
Consider low-molecular-weight heparin for VTE prophylaxis in children, particularly adolescents, with additional risk factors.	Strong
Use nonpharmacological age-appropriate premedication methods to decrease anxiety levels in children before surgery.	Weak
Use pharmacological premedication to decrease anxiety levels in children and monitor for potential side effects.	Strong

VTE = venous thromboembolism.

analgesia. If these are insufficient to prevent pain, weak and strong opioids are added to achieve balanced analgesia. Continuous local infusion (pain catheter) reduces the need for postoperative opioids, as well as systemic (intravenous) administration of analgesics [11]. Ketorolac is an effective agent that reduces the frequency and severity of bladder spasms, length of postoperative hospital stay, and costs [12].

The incidence of postoperative venous thromboembolism is low in the paediatric population. General preventive measures include adequate perioperative and postoperative hydration, and early mobilisation and removal of central venous catheters.

Thromboprophylaxis should be considered only when immobilisation for >48 h is expected in children aged >13 yr with risk factors for thrombosis, such as sepsis, congenital haematological disorders, malignancies, smoking, obesity, pregnancy, and use of oestrogen-containing oral contraceptives [13]. No anticoagulant agents are licensed for children. Low-molecular-weight heparins have become the mainstay of treatment. Physical preventive measures, such as graduated compression stockings, intermittent pneumatic compression devices, and venous foot-pumps, can also be considered, but the supportive data available are scant [14].

3.2. *Minimally invasive surgery*

The use of MIS in paediatric urology is rapidly increasing [15]. Laparoscopy is commonly performed for nonpalpable testis, nephrectomy, heminephrectomy, varicocelectomy, pyeloplasty, and ureteral reimplantation. Generally accepted benefits of MIS in comparison to open surgery include less pain, shorter convalescence, and better cosmetic results [16].

As most of the complications of laparoscopy are associated with gaining access to the abdomen, the open access technique is recommended, particularly in smaller children (Table 2). Abdominal insufflation is the main principle of laparoscopic surgery. CO_2 is considered to be the optimal insufflation gas of choice [17]. Laparoscopy in children requires specific anaesthetic precautions considering effects of CO_2 pneumoperitoneum on the cardiac and pulmonary systems [18]. After intra-abdominal insufflation, the diaphragm is pushed cranially, which leads to a decrease in total pulmonary compliance. Intra-abdominal pressure, CO_2 absorption, and positioning may also affect the cardiovascular system. Pneumoperitoneum may also have a negative effect on renal oxygenation and may increase intracranial pressure [19]. However, both of these phenomena completely resolve after abdominal desufflation.

Overall, higher intra-abdominal pressures have been associated with more pronounced respiratory and haemodynamic changes, higher postoperative pain scores, and longer time to resumption of feeding [20]. Use of as low an intra-abdominal pressure as possible to provide adequate visualisation of structures during surgery is recommended.

Comparison of transperitoneal and retroperitoneal approaches revealed no difference in recovery of bowel function [21]. In older children, operative success and revision rates seem to be comparable between robot-assisted laparoscopic pyeloplasty and conventional laparoscopy [22]. With respect to operative time, total hospital length of stay, and complication rates, the robotic approach appears to be slightly superior in the paediatric population [23,24]. In the infant population, operative time was longer with the robot-assisted approach and a higher complication rate has been reported, mainly because of a higher rate of port-site hernias [25].

3.3. *Hydrocele*

The most common form of congenital hydrocele is due to the persistence of a patent processus vaginalis (PPV), which allows passage of abdominal fluid into the scrotal tunica vaginalis (communicating hydrocele). This differs from a congenital inguinal hernia, as the PPV in hydrocele is not wide enough to allow passage of bowel and omentum. PPVs tends to close spontaneously, and is present in 80–94% of newborns and 20% of adults [26]. Hydroceles without PPV (noncommunicating) may be acquired and secondary to scrotal pathologies or trauma. Abdominoscrotal hydrocele (ASH) is a rare variant with an intra-abdominal extension via the internal inguinal ring [27].

Hydrocele diagnosis is made via thorough history-taking, physical examination, and transillumination of the scrotum. Scrotal ultrasound with the aid of a Doppler scan may be considered if doubts persist (Table 3) [28].

Observation is recommended in infants, as spontaneous resolution occurs in as many as 92% of cases within the first year [29]. A 6- to 9-mo period of observation is also recommended for noncommunicating hydroceles, for which the spontaneous resolution rate is 75% [30]. Spontaneous resolution is uncommon in ASH [31]. In cases with suspicion of

Table 2 – Recommendations for minimally invasive surgery

Recommendation	Strengthrating
Use open access for laparoscopy in infants and smaller children.	Strong
Use lower intra-abdominal pressure (6–8 mm Hg) during laparoscopic surgery in infants and smaller children.	Strong
Monitor for laparoscopy-related cardiac, pulmonary, and diuretic responses.	Strong

Table 3 – Recommendations for hydrocele

Recommendation	Strengthrating
Perform ultrasound in cases of doubt about the nature of an intrascrotal mass or suspicion of an abdominoscrotal hydrocele.	Strong
Observe hydrocele for 12 mo before considering surgical treatment.	Strong
Perform early surgery if there is suspicion of a concomitant inguinal hernia or underlying testicular pathology.	Strong
Close the processus vaginalis at the inguinal ring.	Strong
Do not use sclerosing agents in children with hydroceles because of the risk of chemical peritonitis.	Strong

concomitant inguinal or testicular pathology, surgery should not be deferred.

The use of therapeutic sclerosing agents is not recommended. For communicating hydrocele, inguinal or laparoscopic ligation of the PPV is performed. Laparoscopy possibly allows for pre-emptive correction of a contralateral PPV. Nevertheless, a recent meta-analysis in patients with hernias, did not support this practice, as a contralateral PPV is detected in 63% of cases, whereas a metachronous hernia is expected to develop in only 8% of patients [26]. For acquired, non-communicating hydroceles, the scrotal approach is used. In ASH cases, the abdominal component is generally resected, but some have questioned this practice since it increases morbidity and can result in testicular atrophy [27].

3.4. CLUTO

CLUTO is a rare foetal condition marked by dilatation of the bladder and/or the upper urinary tract. CLUTO can have several causes and includes a spectrum of clinical manifestations. Posterior urethral valves (PUVs) in male foetuses account for approximately 60% of CLUTO cases. Up to 65% of PUV patients develop chronic kidney disease and 20% progress towards end-stage renal disease [32].

Owing to the rarity and heterogeneity of CLUTO, it is recommended that cases be referred to tertiary centres with multidisciplinary expertise in prenatal and postnatal management (Table 4) [33]. Prenatal assessment is based on (serial) ultrasound evaluation of the urinary tract to assess the degree of dilatation, the kidney appearance, and the amount of amniotic fluid. Major genetic abnormalities should be ruled out. Prenatal interventions are aimed at restoring amniotic fluid volume to attenuate the risk of pulmonary hypoplasia and further renal damage [34,35].

Table 4 – Recommendations for congenital lower urinary tract obstruction

Recommendation	Strengthrating
Drain the bladder in newborn infants with a suspected diagnosis of infravesical obstruction and place on antibiotic prophylaxis.	Strong
Perform a voiding cystourethrogram in patients in whom a diagnosis of PUV is suspected.	Strong
Attempt endoscopic valve ablation after bladder drainage and stabilisation of the child.	Strong
Consider neonatal circumcision as an adjunct to antibiotic prophylaxis to decrease the risk of urinary tract infection in PUV cases, especially in the presence of high-grade vesicoureteral reflux.	Strong
Offer prolonged urinary diversion (suprapubic/transurethral) for bladder drainage if the child is too small for valve ablation.	Strong
Use serum creatinine nadir as a prognostic marker.	Strong
Assess split renal function via a dimercaptosuccinic acid scan or mercaptoacetyltriglycine clearance.	Strong
Consider high urinary diversion if bladder drainage is insufficient to drain the upper urinary tract, or in the absence of clinicobiochemical improvement.	Strong
Monitor and manage bladder and renal function on a lifelong basis.	Strong

PUV = posterior urethral valve.

Postnatal management (Fig. 1) is initially aimed at early bladder drainage via a transurethral or suprapubic catheter, through which voiding cystourethrography can be performed to confirm the diagnosis. As soon as the neonate is stable, endoscopic valve ablation can be performed. Circumcision can be performed at the same time and seems to reduce the risk of subsequently developing febrile urinary tract infections (UTIs) [36]. If the neonate is too small to undergo endoscopic surgery, a vesicostomy can be considered. A vesicostomy can also be considered in the absence of clinical or biochemical improvement following valve ablation. After primary treatment, patients should be followed clinically and with serial assessments of upper tract dilatation and kidney function. The serum creatinine nadir in the first year of life is the most predictive prognosticator for future renal function. Parenchymal status and the functional contribution of each kidney can be assessed via renal scintigraphy.

During follow-up, urodynamic studies play an important role in the management of patients with valve bladder, but there is no consensus on the optimal timing or frequency of such studies.

Antibiotic prophylaxis should be considered in patients with high-grade vesicoureteral reflux, as it is an independent risk factor for febrile UTIs, especially in the first 9 mo of life [37].

In PUV patients with bladder overactivity, anticholinergic therapy may improve bladder function, but early administration has no discernible effect on renal function or the risk of UTI [38]. For patients with poor bladder emptying, α-blockers may play a role in reducing the postvoid residual volume (PVR) [39]. Bladder neck incision has been suggested as a means of managing secondary bladder-neck obstruction, but no strong evidence is currently available [40].

In cases in which bladder drainage is insufficient to preserve renal function, prevent recurrent UTIs, and/or

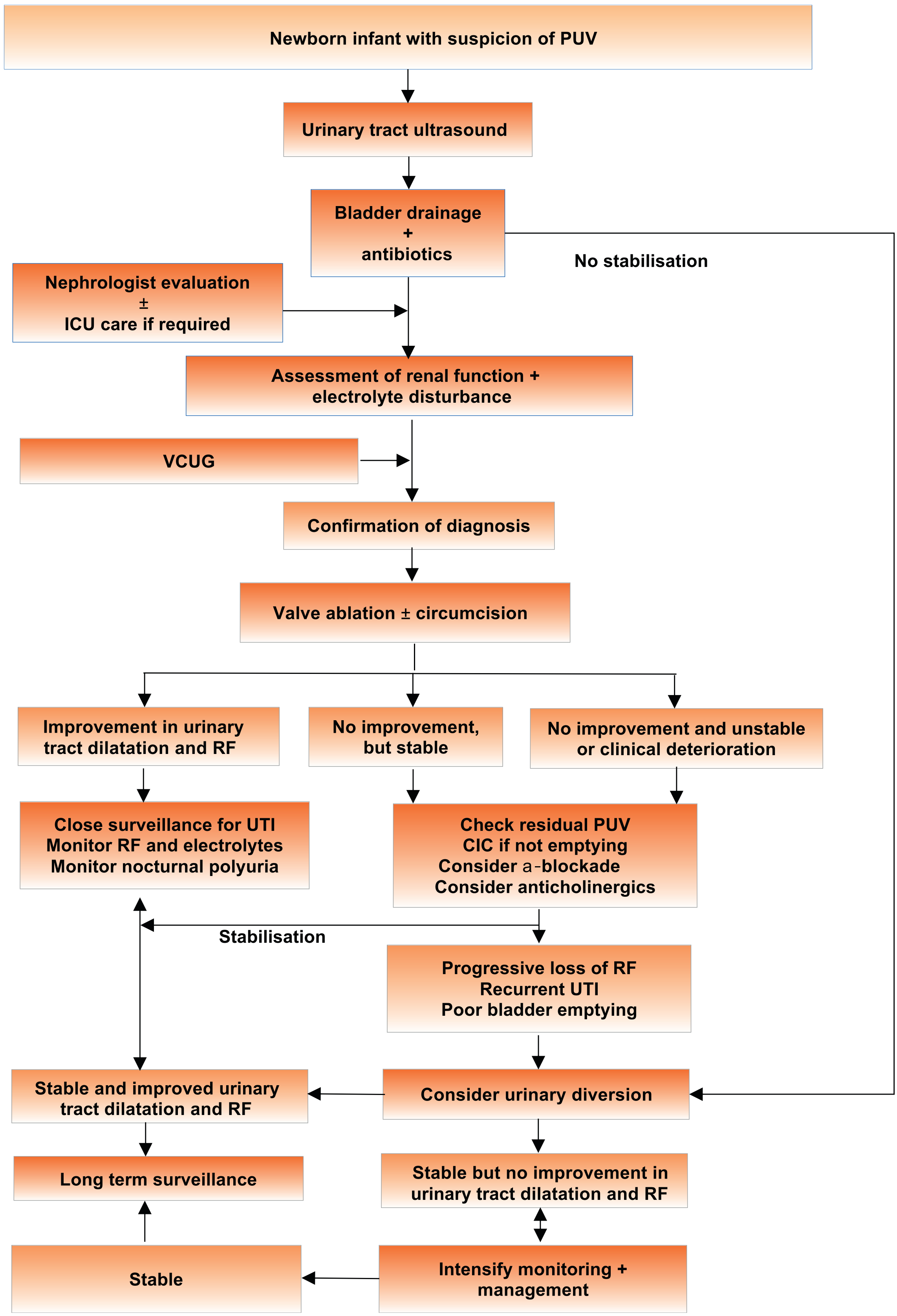

Fig. 1 – Flow chart for the management of posterior urethral valve (PUV). CIC = clean intermittent catheterisation; ICU = intensive care unit; RF = renal function; UTI = urinary tract infection; VCUG = voiding cystourethrogram.

decrease upper tract dilatation, a high urinary diversion should be considered [37].

Patients with high daytime PVR may benefit from clean intermittent catheterisation (CIC). It has been shown that institution of CIC can delay the onset of dialysis and resulted in significantly better 10-yr graft survival rates in transplant patients with PUV [41]. The creation of continent catheterisable channels is a good alternative to CIC via the urethra in PUV patients, who usually have a sensate urethra [41]. Overnight bladder drainage may also be beneficial for hydronephrosis and renal function in patients with preserved daytime micturition. Effective bladder management is an essential prerequisite for successful renal transplantation. Life-long monitoring of these patients is mandatory.

3.5. *Paediatric urological trauma and emergencies*

3.5.1. Trauma

Trauma is the leading cause of morbidity and mortality in children [42]. Of all renal injuries, 25% occur in children, of which 79% are of low grade. The most common cause is blunt abdominal trauma (90%). Renal injuries are classified according to the kidney injury scale of the American Association for the Surgery of Trauma (updated in 2018) [43]. Following blunt abdominal trauma, renal injury can be suspected from the history, physical examination, and laboratory tests (Table 5). Vital signs should be monitored during evaluation, and indicate the urgency of the situation. This, in addition to results for laboratory tests, determines the need for further imaging studies. In patients with high-grade trauma or haemodynamic instability, focused assessment with sonography for trauma (FAST) can be used to identify haemoperitoneum, but the current sensitivity and specificity for renal injury and retroperitoneal haemorrhage are low. Computed tomography (CT) is the imaging modality of choice as it is widely available and quick and provides accurate grading. Ideally, CT imaging is performed in three phases: arterial, nephrographic, and delayed. It is essential to rule out any urine leak, which increases morbidity [44]. Ultrasound (with or without contrast enhancement) can be considered as the sole investigation in patients with mild symptoms and no outstanding indications for CT imaging [45]. Ultrasound can be performed for follow-up; however, routine repeat imaging may be avoidable in asymptomatic patients who are stable [46].

Conservative management with bed rest, fluids, and close monitoring has become the standard approach for blunt renal traumas in haemodynamically stable children, as well as for high-grade traumas [47]. Early urinary-tract drainage does not seem to prevent persistent urinary extravasation or complications [48]. Therefore, stenting and/or percutaneous drainage should be limited to symptomatic patients. Absolute indications for emergent intervention include bleeding into an expanding/unconfined haematoma with haemodynamic instability. Relative indications for surgery are massive urinary extravasation and extensive nonviable renal tissue. If available, angioembolisation is preferred to open surgery. Routine blood-pressure checks are recommended over the long term to monitor for the development of hypertension [47].

Table 5 – Recommendations for urological traumas

Recommendation	Strengthrating
Use imaging in all children who have sustained a blunt or penetrating trauma with any level of haematuria, especially when the history reveals a deceleration trauma, direct flank trauma, or a fall from a height.	Strong
Use contrast-enhanced computed tomography with delayed images for diagnostic and staging purposes.	Strong
Manage most injured kidneys conservatively.	Strong
Offer surgical intervention in cases of haemodynamic instability and a grade V renal injury.	Strong
Diagnose suspected ureteral injuries via a retrograde pyelogram.	Strong
Manage ureteral injuries endoscopically using internal stenting or drainage of an urinoma, either percutaneously or via a nephrostomy tube.	Weak
Use retrograde cystography to diagnose suspected bladder injuries.	Strong
Ensure that the bladder has been filled to its full capacity and an additional scan is acquired after drainage.	Strong
Manage extraperitoneal bladder ruptures conservatively with a transurethral catheter left in place for 7–10 d.	Strong
Perform surgical exploration in cases of intraperitoneal bladder rupture.	Strong
Assess the urethra via a retrograde urethrogram in cases of suspected urethral trauma.	Strong
Perform a rectal examination to determine the position of the prostate.	Strong
Manage urethral injuries conservatively initially if a transurethral catheter can be inserted.	Strong
Manage posterior urethral injuries via either:• Primary drainage with a suprapubic catheter alone and delayed repair; or• Primary realignment with a transurethral catheter.	Weak

Ureteral trauma should be assessed via retrograde pyelography and managed endoscopically with concomitant drainage of any large urinoma, if present. Bladder injuries should be assessed via cystography, taking care to fill the bladder to maximum expected capacity, with acquisition of additional scans after bladder emptying. Extraperitoneal ruptures can be managed conservatively initially, while intraperitoneal ruptures require surgical management.

Urethral injury should be suspected in any patient with a pelvic fracture or perineal trauma. Signs of urethral injury include blood at the meatus, haematuria, dysuria, or an inability to void. Radiographic evaluation of the urethra requires a retrograde urethrogram. For anterior urethral injuries, small lacerations can be repaired via simple closure. Complete ruptures are treated with anastomotic repair. For children with posterior urethral injuries, primary realignment with a transurethral catheter or a staged approach with delayed repair may be more appropriate than immediate surgical repair. For posterior urethral injuries, a large study demonstrated that a transperineal approach resulted in long-term success for >80% of patients [49].

3.5.2. Emergencies: priapism in children

Priapism is a prolonged full or partial erection of the penis unrelated to sexual stimuli that lasts for $\geq$4 h; it is rare among children. In 65% of paediatric cases, priapism is related to sickle cell disease [50]. Priapism in children can

Table 6 – Recommendations for priapism

Recommendation	Strengthrating
Perform Doppler ultrasonography in all patients presenting with priapism.	Strong
In children with ischaemic (low-flow) priapism, perform a full blood count and haemoglobinopathy screen to exclude sickle cell disease and other haematological disorders.	Strong
Adopt a multidisciplinary approach when managing patients with sickle cell disease–associated priapism.	Strong
Use a stepwise approach starting with the least invasive therapy in patients with ischaemic (low-flow) priapism.	Strong
Manage neonatal and non-ischaemic (high-flow) priapism conservatively in the initial management period.	Strong

be divided into four groups: ischaemic (or low-flow), stuttering (intermittent), nonischaemic (or high-flow), and neonatal priapism (Table 6).

Ischaemic priapism is the most common variant (95% of cases) and is caused by decreased or absent intracavernous flow. Ischaemic priapism is a medical emergency, since a duration of $\geq$4 h can result in irreversible tissue damage and erectile dysfunction. Stuttering priapism is a priapism with intervening periods of detumescence, and often precedes an episode of ischaemic priapism. Nonischaemic priapism is caused by increased blood flow into the corpora, most commonly due to the formation of an arteriosinusoidal or arteriocavernous fistula after perineal trauma. Neonatal priapism is extremely rare, is almost invariably self-limiting, and reportedly is without consequences [51].

Priapism diagnosis requires comprehensive assessment of potential risk factors and can help in defining the priapism subtype. Detumescence after perineal compression is suggestive of a nonischaemic priapism. Colour Doppler ultrasound of the penis and perineum should be performed in all patients. This can support clinical differentiation between ischaemic and nonischaemic priapism with 100% sensitivity and 73% specificity in adults. Laboratory testing with a complete blood count and specific tests for sickle cell disease and other haemoglobinopathies should be performed. Penile blood-gas analysis should not be the first-line diagnostic tool because of its invasive nature and the need for anaesthesia in children.

Ischaemic priapism is a medical emergency and requires stepwise management, as in adults [52]. If conservative treatment fails, anaesthesia should be given to favour detumescence. This includes the use of local anaesthesia, dissociative sedation, or general anaesthesia, depending on local availability and expertise, as well as the age and condition of the child. Subsequently, a step-up approach should be used, as detailed in Figure 2.

The initial management of nonischaemic priapism is conservative, as perineal compression or application of ice to the perineum can be successful. If nonischaemic priapism is persistent, superselective angioembolisation can be performed; however, this is technically challenging in children [53]. Neonatal priapism is usually self-limiting and rarely requires treatment.

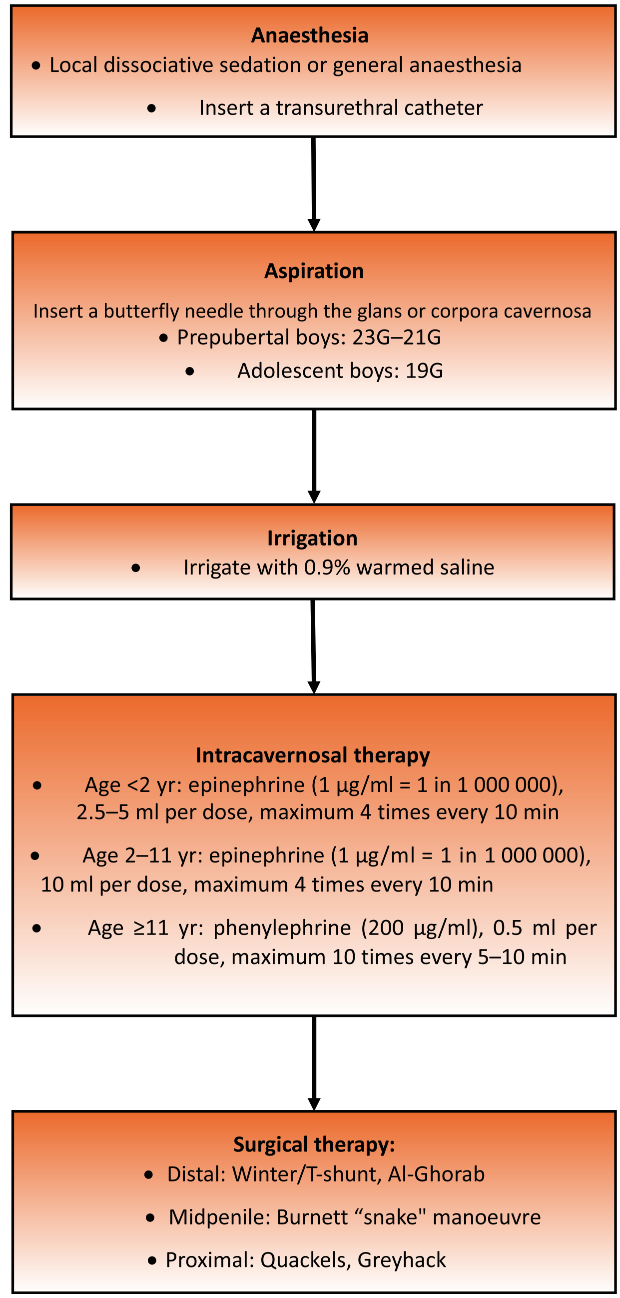

Fig. 2 – Flowchart for stepwise management of ischaemic (low-flow) priapism in children.

3.6. *Fertility preservation in children and adolescents*

The growing number of cancer survivors and the potential gonadotoxic effect of many therapies has made fertility preservation and patient/family counselling about possible options an increasingly relevant issue for prepubertal children and adolescents [54]. Fertility preservation should be managed in a multidisciplinary team setting and should consider the toxicity of the planned therapy, overall prognosis, the patient's age and developmental status, and ethical and financial issues (Table 7).

Table 7 – Recommendations for fertility preservation

Recommendation	Strengthrating
Inform patients and caregivers about the impact of gonadotoxic treatments on future fertility and about fertility preservation options and their risk-benefit balance.	Strong
Discuss the indications and options for fertility preservation in a paediatric multidisciplinary fertility preservation team and consider the toxicity of the planned therapy, the age and pubertal status of the patient, and ethical and financial issues.	Strong

3.6.1. Female-specific considerations

For postpubertal female patients with benign diseases, oocyte retrieval following ovarian stimulation can be considered [55]. Alternatively, ovarian tissue can be retrieved via partial or total ovariectomy performed laparoscopically or via laparotomy [56]. The procedure should possibly be combined with other medically indicated procedures to minimise any additional anaesthetic risk and contain costs. Ovarian tissue can be reimplanted orthotopically or heterotopically either for fertility purposes or for recovery of endocrine function. The rate of ovarian tissue utilisation for ovarian cortex autotransplantation in the paediatric population is low [55]. In a few reported cases, transplantation of prepubertal cryopreserved ovarian tissue resulted in induction of spontaneous puberty and pregnancies [57].

3.6.2. Male-specific considerations

Gonadoprotective measures should be the first aim for prepubertal boys [58]. Gonadal shielding and temporary testicular transposition have been effective in patients undergoing radiotherapy and pelvic brachytherapy, respectively.

Sperm cryopreservation via masturbation or penile vibration should be the first option for non-azoospermic postpubertal boys. Cryopreservation of immature testicular tissue in prepubertal boys is a potential option, but this currently remains experimental [58]. The same procedure has also been proposed for benign conditions with potential risk of germ cell loss before puberty, such as Klinefelter syndrome and bilateral undescended testes; however, this is also experimental and controversial [59].

4. Discussion

This article provides readers with updates on the management of some paediatric urology conditions. While the data supporting these recommendations were retrieved using a standard and solid methodology developed by the EAU Guidelines Office, the strength of the recommendations is somewhat limited by the paucity and quality of the literature available. Moreover, recommendations cannot replace expertise and clinical judgment in routine decision-making.

5. Conclusions

Recommendations regarding perioperative management were developed in relation to fasting, premedication, antibiotic prophylaxis, pain control, and thromboprophylaxis in patients undergoing general anaesthesia. MIS use is increasing in paediatric urology, with no major differences observed among the MIS approaches used. For hydrocele, observation is the initial approach recommended. For persistent cases, treatment varies according to the type of hydrocele. CLUTO cases should be managed in tertiary centres with multidisciplinary expertise in prenatal and postnatal management. Neonatal valve ablation remains the mainstay of treatment, but associated bladder dysfunction requires continuous treatment. Among urological traumas and emergencies, renal trauma is still an important cause of morbidity and mortality. Conservative management has become the standard approach for haemodynamically stable children. Ischaemic priapism is a medical emergency and its management is stepwise. Initial management of nonischaemic priapism is conservative. Fertility preservation in prepubertal children and adolescents has become an increasingly relevant issue owing to the ever-increasing number of cancer survivors receiving gonadotoxic therapies.

Author contributions: Marco Castagnetti had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Castagnetti, Radmayr, Burgu.
Acquisition of data: Gnech, Kennedy, Skott, van Uitert.
Analysis and interpretation of data: Gnech, Kennedy, Skott, van Uitert, Castagnetti, 't Hoen, Rawashdeh, Silay, Quaedackers.
Drafting of the manuscript: Castagnetti, Gnech, Kennedy, Skott, van Uitert, Burgu.
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