REVIEW ARTICLE

Urolithiasis in military personnel: diagnosis, endourological treatment and return to duty

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Abstract

Background. Urolithiasis is common and frequently recurs; military personnel serving in hot climates under heavy physical load are at increased risk.

Aim. To summarise current evidence on risk factors, diagnosis, surgical treatment and metaphylaxis of urolithiasis from the perspective of restoring fitness for duty in military personnel.

Methods. Review of publications indexed in PubMed/MEDLINE, the Cochrane Library and eLIBRARY, prioritising randomised trials, systematic reviews and clinical guidelines.

Results. The prevalence of urolithiasis ranges from 1% to 13% across world regions, and about half of patients have a recurrence within 5–10 years. In troops deployed to a hot region, symptomatic stones developed on average 93 ± 42 days after arrival. Initial ultrasonography is non-inferior to computed tomography for clinical outcomes with lower radiation exposure. Compared with open surgery, percutaneous nephrolithotomy was associated with fewer intraoperative complications (16.3% vs. 37.8%), shorter hospital stay (6.4 vs. 10 days) and earlier return to work (2.5 vs. 4.1 weeks). Maintaining urine output above 2 L/day reduced 5-year recurrence from 27.0% to 12.1%. Studies comparing treatment methods by time to return to duty and occupational fitness are scarce; a set of criteria for assessing the recovery of servicemen is proposed.

Conclusion. Prospective studies of urolithiasis treatment outcomes in servicemen using service-related criteria, and an algorithm for treatment selection and a metaphylaxis programme for military medical facilities, are needed.

Keywords: *urolithiasis; military personnel; percutaneous nephrolithotomy; ureteroscopy; return to duty; metaphylaxis.*

MAIN TEXT

Introduction

Urolithiasis is one of the most common urological diseases. Its prevalence is 7–13% in North America, 5–9% in Europe and 1–5% in Asia, reaching 14.8% in some populations, and continues to increase [1, 2]; the disease imposes a considerable economic burden [3]. About half of patients have a recurrence within 5–10 years after the first episode [4, 5]. In the United States,

according to the 2007–2010 national survey, kidney stones were present in 8.8% of the population [6], and in China, according to ultrasound screening, in 6.4% of adults [7].

Central Asia, including the Republic of Uzbekistan, is a high-risk region for stone formation because of its hot and dry climate; higher ambient temperature increases the risk of urolithiasis, and climate warming may expand areas of increased incidence [8–10].

The aim of this review was to summarise current evidence on risk factors, diagnosis, surgical treatment and metaphylaxis of urolithiasis from the perspective of restoring fitness for duty in military personnel.

Methods

Publications were searched in PubMed/MEDLINE, the Cochrane Library and eLIBRARY using the keywords “urolithiasis”, “kidney stones”, “military personnel”, “percutaneous nephrolithotomy”, “ureteroscopy” and “return to work”. Priority was given to randomised trials, systematic reviews and clinical guidelines.

Risk factors in military personnel

Military personnel constitute a specific risk group. Hot climate, heavy physical load, disrupted drinking regimen in field conditions and dietary features accelerate stone formation. In troops deployed to a hot region (Kuwait), 218 symptomatic stones were found in 182 patients, and the mean time from arrival to clinical presentation was 93 ± 42 days [11]. The disease leads to prolonged absence from duty and may reduce occupational fitness; for some specialties (aircrew, personnel deployed to remote areas), even an asymptomatic stone may restrict fitness for service.

Diagnosis

In a multicentre randomised trial, initial ultrasonography for suspected renal colic was associated with lower radiation exposure than computed tomography without an increase in missed complicated diagnoses, serious adverse events or return visits [12]. This supports ultrasonography as the first-line method at unit and hospital level, followed by low-dose computed tomography for treatment planning. After an episode, stone analysis and metabolic evaluation, including 24-hour urine analysis in high-risk patients, are recommended [13, 14].

Conservative and surgical treatment

In the randomised SUSPEND trial, tamsulosin and nifedipine did not increase the overall rate of spontaneous passage of ureteral stones up to 10 mm [15]; according to a meta-analysis, α-blockers are effective mainly for stones of 5–10 mm [16]. According to the American Urological

Association and Endourological Society guidelines, ureteroscopy is the method of choice for ureteral stones and percutaneous nephrolithotomy for large (>20 mm) renal stones [17, 18].

Since the first description of percutaneous pyelolithotomy [19], the treatment of urolithiasis has shifted from open surgery to minimally invasive endourological procedures. In a randomised trial of complete staghorn stones, percutaneous nephrolithotomy compared with open surgery was associated with fewer intraoperative complications (16.3% vs. 37.8%), shorter hospital stay (6.4 vs. 10 days) and earlier return to work (2.5 vs. 4.1 weeks), with comparable stone-free rates (Figure 1) [20]. According to a meta-analysis, percutaneous nephrolithotomy provides higher stone-free rates than retrograde intrarenal surgery, whereas the latter is associated with less blood loss and shorter hospital stay [21]; miniaturised access provides comparable efficacy with less invasiveness, although the quality of evidence remains low [22]. The main characteristics of the methods are summarised in Table 1.

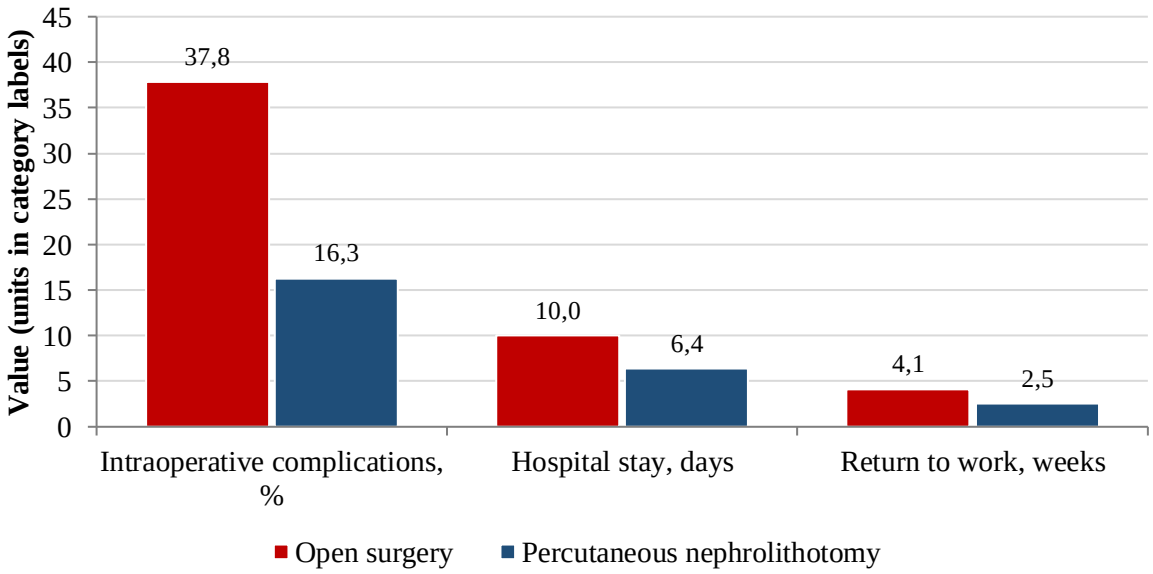


Figure 1. Comparison of open surgery and percutaneous nephrolithotomy for complete staghorn stones according to a randomised trial [20].

Table 1. Characteristics of the main methods of urinary stone removal

Method	Main indications	Features and typical complications
Shock wave lithotripsy	Small renal and upper ureteral stones	Non-invasive; Clavien–Dindo grade I–II complications about 18%, grade III–IV about 2.5% [23, 24]
Ureteroscopic lithotripsy	Ureteral stones	Method of choice for ureteral stones [17]
Retrograde intrarenal surgery	Renal stones up to 20 mm; contraindications to percutaneous access	Fever or urinary tract infection in 0.2–15%, urosepsis in 0.1–4.3% [24]; less blood loss and shorter

Method	Main indications	Features and typical complications
		hospital stay [21]
Percutaneous (mini-) nephrolithotomy	Renal stones >20 mm, staghorn stones	Highest stone-free rate [21]; transfusion in 2–7%, urosepsis in 1–2% [24]
Open surgery (pyelo-, uretero-, nephrolithotomy)	Failure or impossibility of endourological treatment	More complications, longer hospital stay and recovery [20]

Complications are classified according to Clavien–Dindo [23].

Recovery and return to duty

Most studies evaluate treatment results by stone-free rates and complications, whereas for a serviceman the key outcome is full return to duty, tolerance of physical load and preservation of occupational fitness. Data from civilian populations concern mainly length of hospital stay and return to work [20, 21] and do not take into account physical fitness requirements and service conditions. Comparative studies of conventional and endourological operations in servicemen using these outcomes are scarce, and a uniform algorithm for diagnosis, treatment selection and metaphylaxis in military medical facilities has not been developed. A proposed set of criteria for assessing recovery is given in Table 2.

Table 2. Proposed criteria for assessing the recovery of servicemen after surgery for urolithiasis

Criterion	Assessment
Stone-free status	Ultrasonography or low-dose computed tomography after the procedure
Complications	Clavien–Dindo classification [23]
Pain	Visual analogue scale
Length of hospital stay	Bed-days
Time to return to duty	Days from surgery to clearance for full duty
Occupational fitness	Conclusion of the military medical board
Quality of life	SF-36 questionnaire

The criteria were formulated by the author for a prospective study and are subject to evaluation.

Metaphylaxis

In a randomised trial in patients with idiopathic calcium nephrolithiasis, increased fluid intake maintaining urine output above 2 L/day reduced the 5-year recurrence rate from 27.0% to 12.1% [25]; guidelines recommend a urine volume of at least 2.5 L/day and correction of metabolic abnormalities according to the results of evaluation [13]. The ROKS nomogram has been proposed to estimate the risk of a second symptomatic episode [26]. In service conditions, implementation of

these measures requires organisational solutions: access to drinking water in the field, control of the drinking regimen in high temperature and heavy physical load, and follow-up of servicemen after an episode of the disease.

Conclusion

Military personnel, especially those serving in hot climates, are at increased risk of urolithiasis. Compared with open surgery, endourological methods are associated with fewer complications, shorter hospital stay and faster recovery, but their advantages for service-related outcomes in servicemen have been insufficiently studied. Studies comparing treatment methods by time to return to duty and occupational fitness are needed, as well as an algorithm for treatment selection and a metaphylaxis programme for military medical facilities.

Additional information

Author contributions. The author performed the compilation and layout of this material.

Acknowledgements. This review was prepared within the dissertation research “Improving the diagnosis and treatment of urolithiasis in military personnel: comparative assessment of recovery after conventional and endourological operations” (specialty 14.00.40 — Urology).

Generative artificial intelligence. Translation of the dissertation abstract, drafting of the review from the cited sources and translation of the abstract were performed using Claude (Anthropic, https://claude.ai).

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