

Systematic Review

Emergency Urological Surgery Performed by General Surgeons: A Systematic Review

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Abstract: Background: Across the world, many populations have limited access to urology care resulting in local general surgeons performing emergency urology procedures. This systematic review aims to evaluate the nature and outcomes of emergency urological surgeries performed by general surgeons. Methods: A systematic review was undertaken according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines with MEDLINE, Embase, Web of Science, and Google Scholar searched from inception to June 2024 for studies where general surgeons performed emergent urological surgery. We excluded studies on paediatric urology, acute scrotum, and Fournier's gangrene. The Downs and Black checklist was used to assess risk of bias. Results: From 2093 initial results, six studies were included after screening. Two studies were from Australia, two from the United States of America, and one each from India and South Africa. For 977 emergency urological interventions, general surgeons (n = 486) and urologists (n = 491) each performed approximately half of the surgeries. Mortality rates for general surgeon-performed urology ranged from 0 to 8.0%. One study compared outcomes between the two surgical specialties, showing no significant difference for mortality or complication rates. No follow-up data was reported. The most performed procedures by general surgeons were traumatic bladder repair, ureteric stent insertion, and percutaneous nephrostomy. Conclusions: General surgeons perform a wide spectrum of emergency urological surgery when needed. Targeted training and utilisation of general surgeons could improve patient access to emergency urological surgery.

Keywords: urology; general surgery; emergency surgery; global surgery; rural surgery



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1. Introduction

The trend of subspecialisation within surgery has led to concerns regarding the distribution of surgical care especially in rural, underserved, or low resource settings [1,2]. Healthcare institutions in these settings often do not have sub-specialist surgeons (such as urologists) on site, and therefore general surgeons are called upon to perform emergency surgery in specialties that lie outside the realm of traditional general surgery [3].

With an ageing global population, the burden of common urological emergencies as a proportion of all surgical emergencies has increased [4]. There is a significant burden of urological disease in low resource settings, which often requires emergent surgical treatment [5,6]. In the context of lower-resource settings having more limited access to specialist urological care, compounded by financial constraints, limited infrastructure, or needing to travel vast geographical distances, the utilisation of a less-specialised workforce may help reduce inequitable urological outcomes.

Understanding the procedures and outcomes of emergency urological surgery performed by general surgeons has important implications for future service planning in under resourced communities. The training of general surgeons may require experience and competency in performing emergency urological procedures via an appropriate training case mix [7,8]. For patients, there are implications for distributive justice and global

health as patients in the lowest resource settings are the most likely to encounter the need for a general surgeon (rather than a urologist) to perform emergency surgery [4].

The aim of this study is to understand the spectrum of emergency urological surgery that may be required of general surgeons and to assess and compare the outcomes of emergency urological surgery performed by general surgeons compared to those of urological surgeons and trainees.

2. Materials and Methods

A systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol. This study was prospectively registered in the International Prospective Register of Systematic Reviews (PROSPERO; CRD42022356423) [9,10].

2.1. Inclusion and Exclusion Criteria

The inclusion criteria for studies were randomised controlled studies, retrospective or prospective cohort studies, case control studies, and surgical audits. The population was any patients requiring emergency urological surgery. The intervention was any procedure performed by a general surgeon or general surgery trainee. The comparator (for comparison studies only) was the same intervention as performed by a urological surgeon/urologist or a urology trainee. The outcomes examined were intervention success rate, complications and mortality, if reported. Studies were excluded if they were case reports, not in English, related to non-emergency urology surgeries, or did not explicitly state that procedures were performed by a general surgeon. Studies investigating paediatric urology, the acute scrotum, or Fournier's gangrene were excluded given their pathologies' accepted scope within general surgery, so that the procedures of focus are those which are infrequently performed by general surgeons within their traditional practice [11–15]. In our setting, the acute scrotum is currently considered a core scope of practice for Australian and New Zealand general surgeons [16]. Endourology was defined as urinary tract surgery via cystoscope or ureteroscope.

2.2. Search Strategy

MEDLINE, Embase, Web of Science, and Google Scholar were searched from inception until 2 June 2024 (see Supplementary Tables S1–S5 for the full list of search terms and retrievals).

2.3. Data Extraction and Analysis

Two reviewers (PM, JAP) independently completed title and abstract screening for all the search retrievals using Covidence systematic review software (Veritas Health Innovation, Melbourne, Australia, 2024). Full text screening and data extraction was performed independently by two reviewers (PM, JAP). Any disputes were resolved by a third reviewer (JB). Data were extracted independently by two reviewers (PM, JAP) into Excel spreadsheets. Discrepancies between the data sets were discussed between all reviewers. Variables and characteristics extracted included the following: publication year, study design, country, setting of study (rural or metropolitan), follow-up, total number and type of interventions performed (by general surgeon or urologist), outcomes, complications, and mortality. For any studies in which relevant data were missing or required further clarification, we contacted the corresponding authors for information. Only one author responded to this request and provided additional data. For the analysis, we used descriptive statistics via narrative and tabular formats. Quality assessment was completed independently by two reviewers (PM, JAP) using the Downs and Black checklist, and any discrepancies were discussed among all reviewers (see Supplementary Table S6) [17]. A meta-analysis was planned, but this was not possible due to the heterogeneity of the data.

3. Results

The search strategy returned 2093 results. Following duplication removal and title and abstract screening, 90 full texts were screened. Six studies met the inclusion criteria as shown in Figure 1.

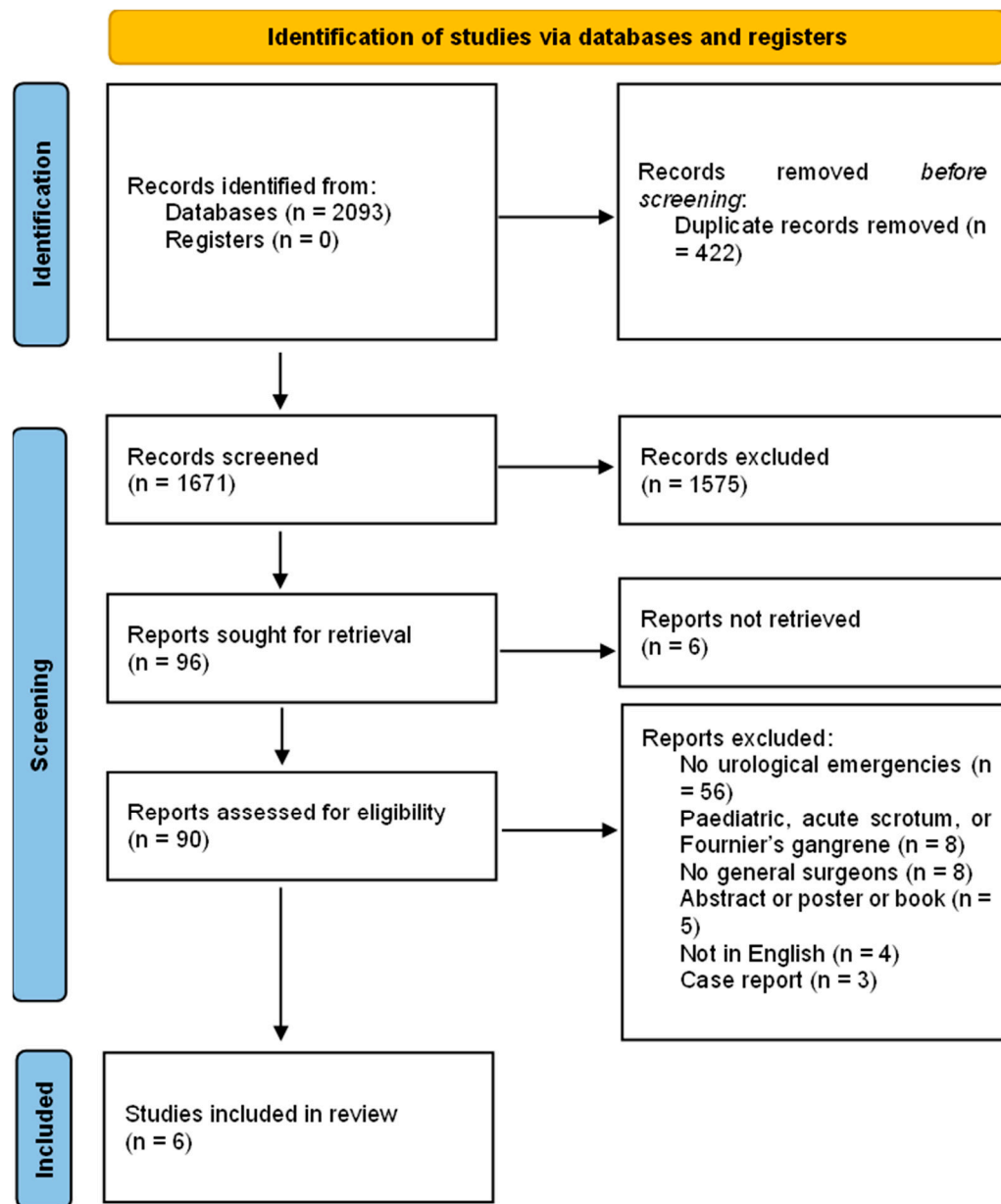


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart.

3.1. Location of Studies

Six studies were included in the review [18–23]. Of the six studies, the majority (n = 4) were set in World Bank high-income countries (Australia n = 2, United States n = 2) [18,19,21,23]. One study was conducted in each of the lower-middle (India) and upper-middle (South Africa) income countries, and no studies were set in low-income countries [20,22]. The majority (n = 5) of studies were published from 2011 onward [18–21,23], with one study published prior in 2006 [22]. As shown in Table 1, of the six studies, three studies were retrospective reviews of general surgical unit caseloads [18,20,23], one undertook a retrospective cohort analysis of the Pennsylvania Trauma Outcome Study

database [19], and the remaining two were retrospective reviews of general surgeon-performed ureteric stent and percutaneous nephrostomy insertions [21,22].

Table 1. Study characteristics and quality assessment.

Author	Year of Publication	Title	Study Population	Country	Setting	Rural or Metropolitan	Study Design	Quality Assessment ¹
Bappayya [18]	2019	Caseload distribution of general surgeons in regional Australia: is there a role for a rural surgery sub-specialization?	General surgery audit including urological cases	Australia	Single hospital	Rural only	Retrospective	41%
Leong [19]	2019	Assessing the role of urologists and general surgeons in the open repair of bladder injuries: Analysis of a large, statewide trauma database	Patients requiring open bladder repairs	United States	Multiple hospitals	Rural AND Metropolitan	Retrospective	45%
Quene [20]	2022	Referral of District Level Operations to Regional Hospitals in South Africa	General surgery audit including urological cases	South Africa	Multiple hospitals	Rural AND Metropolitan	Retrospective	47%
Rizvi [21]	2016	Role of general surgeons in acute urinary obstruction	Patients requiring ureteric stent insertion	Australia	Single hospital	Rural only	Retrospective	41%
Sood [22]	2006	Ultrasound guided percutaneous nephrostomy for obstructive uropathy in benign and malignant diseases	Patients requiring percutaneous nephrostomy for obstructive uropathy	India	Single hospital	Rural only	Prospective	41%
Stinson [23]	2021	Current Trends in Surgical Procedures Performed in Rural General Surgery Practice	General surgery audit including urological cases	United States	Multiple hospitals	Rural only	Retrospective	33%

¹ As per Downs and Black Checklist scored as a percentage out of 32 averaged between both reviewers [17].

3.2. Surgeries and Surgeons

Diagnoses, interventions, surgical outcomes, and mortality of the studies are reported in Table 2. Across the six studies, 977 emergency urological interventions were performed with an equal distribution between urologists (486) and general surgeons (491). All studies provided an exact breakdown of procedures performed. The most common general surgeon-performed procedures were repairs of bladder laceration/injury from trauma (n = 231), ureteric stent insertion (n = 83), and percutaneous nephrostomy insertion (n = 50). In total, 170 endourological procedures were performed, of which 106 were by general surgeons, accounting for 21.5% of urological procedures performed by general surgeons. The qualification and training parameters of both general surgeons and urologists was determined by the authors of each included study and are unable to be verified by this review. It was indeterminate whether any of the general surgeons had previously trained in urology. Only one study explicitly stated that the general surgeons had been specifically trained to perform a urological procedure, whereby general surgeons had been trained and accredited for ureteric stenting [21].

Table 2. Diagnoses, interventions, surgical outcomes, and mortality.

Author	Interventions (n)	Diagnoses (n)	Complication and Failure Rate (n, %)	Mortality (n, %)
Bappayya [18]	Total (80; 13 major, 67 minor): Major: Endoscopic resection of a bladder lesion (2), Nephroureterectomy (1), Other repair of bladder (6), Partial excision of bladder (2), Retrograde pyeloscopy (1), Transurethral resection of prostate [TURP] (1) Minor: Bladder catheterisation (9), Closed biopsy of kidney (1), Control of haemorrhage following male circumcision (1), cystoscopy (9), Dilatation of urethral stricture (1), Dorsal or lateral slit of prepuce (2), Endoscopic biopsy of bladder (1), Endoscopic insertion of ureteric stent (16), Endoscopic lavage of blood clots from bladder (2), Endoscopic removal of indwelling urinary catheter (1), Endoscopic removal of ureteric stent (2), Endoscopic replacement of indwelling urinary catheter (1), Endoscopic replacement of ureteric stent (2), bilateral Endoscopic ureteric catheterisation with fluoroscopic imaging of upper urinary tract (5), unilateral Endoscopic ureteric catheterisation with fluoroscopic imaging of upper urinary tract (5), unilateral Endoscopic ureteric catheterisation (1), male circumcision (1), other repair of penis (1), Other repair of scrotum or tunica vaginalis (1), Other repair of testis (2), Replacement of cystostomy tube (2), Suture of laceration of scrotum or tunica vaginalis (1)	Not reported	Not reported	Not reported
Leong [19]	Urologists: Other cystostomy (44), partial cystectomy (2), suture of laceration of bladder (333), closure of cystostomy (6), cystourethroplasty and plastic repair of bladder neck (3), reconstruction of urinary bladder (0), other anastomosis of bladder (1), other repair of bladder (3), control of (postoperative) haemorrhage of bladder (6)	Not reported	Urologists: UTI (44, 10.5%), AKI (11, 2.6%), Sepsis (25, 6%), CAUTI (0, 0%)	Urologists: 22, 5.3%
	General surgeons: Other cystostomy (20), partial cystectomy (0), suture of laceration of bladder (231), closure of cystostomy (2), cystourethroplasty and plastic repair of bladder neck (2), reconstruction of urinary bladder (3), other anastomosis of bladder (0), other repair of bladder (95), control of (postoperative) haemorrhage of bladder (2)		General surgeons: UTI (31, 11%), AKI (8, 2.8%), Sepsis (12, 4.3%), CAUTI (1, 0.4%)	20, 7.1%
Quene [20]	Total (6): Suprapubic catheter (6)	Not reported	Not reported	Not reported

Table 2. Cont.

Author	Interventions (n)	Diagnoses (n)	Complication and Failure Rate (n, %)	Mortality (n, %)
Rizvi [21]	Total (132): Ureteric stent insertion (general surgeon, 67), (urologist, 65)	Not reported	Two failed stent insertion by general surgeons (2.6%) were both were subsequently failed by urologists	0
Sood [22]	Total (50): Ultrasound guided percutaneous nephrostomy (50)	Benign (21): calculus (8), UPJ obstruction (7), pyonephrosis (4), chyluria (2) Cancer (29): bladder (10), cervix (6), endometrial cancer (4), rectum (5), ovarian (2), renal cell carcinoma (2)	Unsuccessful insertion (8, 16%) Tube displacement (6, 12%), post-procedure urine leak (1, 2%)	General surgeon (4, 8%); urologist (not applicable)
Stinson [23]	Total (8): Cystoscopy (6), suprapubic catheter (1), transurethral resection of a bladder tumour (1)	Not reported	Not reported	Not reported

UTI = urinary tract infection, AKI = acute kidney injury, CAUTI = catheter-associated urinary tract infection.

3.3. Outcomes

Three studies reported the outcomes of emergency urology procedures performed by general surgeons [19,21,22]. In a study assessing the role of general surgeons in inserting emergency ureteric stents, general surgeons successfully inserted 65 out of 67 stents (97%). In another study evaluating general surgeons performing emergency percutaneous nephrostomies, successful insertion occurred in 42 out of 50 cases (84%). Only one study compared outcomes between urologists and general surgeons, with a comparison of open bladder repairs secondary to trauma using the statewide Pennsylvania Trauma Outcome Study database [19].

3.4. Complications and Failure of Procedure

In one study of Australian rural general surgeons, failure of ureteric stent insertion was reported at a rate of 2.6% (2/67). The study noted that in both instances, the on-call urologist also failed in their attempts to insert a ureteric stent in these two patients [21].

In a study examining 50 percutaneous nephrostomy insertions, failure of nephrostomy insertion was documented at 16% (8/50). These patients subsequently underwent open nephrostomy. In the same study, seven cases reported complications including tube displacement (12%, 6/50) and post-procedure urine leak (2%, 1/50). Four patients died (8%), but none were reported as procedure related [22].

Leong et al. showed no statistically significant differences in complications between general surgeon- and urologist-performed open bladder repairs. Complications reported included urinary tract infection ($p = 0.84$), acute kidney injury ($p = 0.87$), sepsis ($p = 0.32$), septicaemia ($p = 0.57$), and catheter-associated urinary tract infection ($p = 0.40$) [19]. Mortality rate was reported in three studies ranging from 0 to 8.0% [19,21,22]. There was no significant difference ($p = 0.31$) in mortality following open bladder repair in the urologist-performed cohort (5.3%) versus the general surgeon-performed cohort (7.1%) ($p = 0.31$) [19].

3.5. Follow-Up

No studies reported any patient follow-up.

3.6. Risk of Bias

The risk of bias as determined by the Downs and Black checklist ranged from 33 to 45% (see Supplementary Table S6) [17].

4. Discussion

The knowledge that general surgeons often need to perform emergent procedures in the domain of other subspecialties is well-established [24].

Even in high income countries with relatively good access to subspecialty surgery, general surgeons are often tasked to perform emergency urological surgery; this is especially true in rural settings where subspecialty surgeons are not on site. The situation is often worse in low- or lower-middle income countries where nine in ten people cannot access basic surgical care, and we aimed to investigate and translate these findings into the field of urology [25].

Bappayya et al., [18] looked at the general surgery caseload in a regional Australian hospital (Albury) over eight years and noted that only 58.7% of their 21,652 procedures represented traditional general surgery and that the most performed non-general surgery discipline was in urology (30.9% of such cases), with endoscopic insertion or ureteric stent, cystoscopy, and bladder catheterisation being the most common procedures performed. Three other studies also explored the urological caseloads of general surgical units. The most common urological procedures performed were endoscopic ureteric stent insertion, repair of traumatic bladder laceration, and emergency cystoscopy. This case load corresponded to what has been documented in low-income settings. In a single-centre study of 2345 emergency urological admissions in India, the three most commonly performed procedures were percutaneous nephrostomy, suprapubic catheterisation, and ureteric stenting [26]. Another single-centre study of 681 patients at a tertiary hospital in Nigeria showed that, excluding acute scrotum, the two most common emergency urological procedures performed were suprapubic catheterisation and percutaneous nephrostomy [27].

Three studies analysed single interventions performed by general surgeons including the insertion of suprapubic catheters, endoscopic ureteric stent insertions, and ultrasound-guided percutaneous nephrostomies. Whilst percutaneous nephrostomy in resource-rich settings is generally performed under the domain of interventional radiology, we have found in this review that general surgeons have performed such procedures and have documented these cases as part of our review as a reflection of real-world practice where both interventional radiologists and urologists may not be available. As previously discussed, we believe this set of emergency urological procedures are both common enough to warrant knowledge and training and also lie within the technical proficiency of general surgeons as described by the studies in this review.

A critical question is whether there are acceptable outcomes of urology procedures performed by general surgeons. This review has shown that the data is limited, with only one study directly comparing outcomes between the two subspecialties [19]. In this study, the mortality rate was higher (7.1%) for general surgeons compared to urologists (5.3%), although this was not statistically significant. Since urologists in the study were more likely to manage patients with a concomitant pelvic fracture or a higher Injury Severity Score, the study ultimately recommended that general surgeons may manage bladder injuries in patients with an Injury Severity Score of 15 or lower. Whilst the results showed no statistically significant outcomes between general surgeons and urologists repairing bladder lacerations in certain cases, these findings may not be generalisable to other procedures described in this review. It remains important to recognize that the repair of a bladder laceration, as a hollow viscus repair, does not have the same unique technical skill requirement of an endourological procedure, such as endoscopic stent insertion, which may contribute to the safe translation of outcomes between the two specialties for this procedure.

For those who might need emergency surgery, the barrier of having to travel great distances poses significant challenges and risks. By having general surgeons perform emergency surgery in rural centres, major time delays to treatment and the expense and emotional stress of inter-hospital transfer can be avoided [21]. General surgeons in Albury (Australia) reported performing emergency urology to respond to time-critical emergencies and also in response to patient choice, including a lack of social supports and travel costs for family members if transferred to a major metropolitan urology unit.

General surgery training and skillset requirements vary globally. Australian rural general surgeons concluded that a rural fellowship, encompassing the skillset of emergency urology, would benefit the urological needs of rural Australians [18]. Despite this, the expectation for general surgery trainees to learn procedures pertaining to other surgical specialties is minimal in Australia. Under the current 2022 General Surgery Education and Training program guidelines (a five-year general surgery training program administered by General Surgeons Australia), Australian general surgical trainees are expected to be able to perform acute scrotal exploration, circumcision, and suprapubic catheterisation. Trainees are expected to understand the concept of emergency ureteric stent insertion but not perform the procedure. No other urological procedures are included in the curriculum [28]. Although this may adequately prepare surgeons for a career in metropolitan areas, surgeons who wish to practice in diverse settings (including rural or global health settings) will find their exposure to urological emergencies to be inadequate. For countries where the acute scrotum is poorly or incompletely managed, particularly in rural areas—reference and referral to the establishment of an Acute Scrotal Pain—Suspected Testicular Torsion guidelines may be useful. These guidelines specifically outline the scope of practice for the management of acute scrotum and empowers general surgeons to undertake this procedure [16].

Training a skilled rural general surgeon workforce is at odds with the current trend of subspecialisation within the field. Surgical training programs would find it valuable to deliver a specialised urological curriculum for general surgeons and trainees who wish to have this skillset. National and regional urological societies should also play a role in education for non-urologist surgeons, either through collaboration with general surgical societies or through independent educational programs. As a notable example, the Urolink program, conceptualised and founded under the purview of the British Association of Urological Surgeons in the 1990s, continues to provide ongoing urological care and educational programs to hospital staff in low- or lower-middle income partner countries [29]. A collaborative model provides bi-directional benefits; surgical care providers at primary- and secondary-care hospitals (including general practitioners, emergency physicians, rural generalists, and general surgeons) can receive targeted education and mentoring, whilst visiting urologists are able to gain experience with a broader spectrum of urological disease [30]. In addition to outreach visits, telementoring and telesurgery in urology is an exciting (though not novel) solution in low-income countries or in countries with large geographical distances that preclude immediate specialist access [31]. The COVID-19 pandemic has resulted in improvements in the technological quality of telesurgery and remote consultation services along with clinician proficiency with such products [32]. With access to real-time intraoperative audio and video, urologists could guide and advise general surgeons mid-surgery. This innovation could greatly reduce the barriers to accessing high-quality surgical care in resource-poor settings. Ongoing research into the logistical implementation and ethical considerations of these solutions is required [33].

To our knowledge, this is the first review to discuss the role of general surgeons performing emergency urological surgery. By capturing procedures and volumes, we have shown that general surgeons in various settings often perform emergency urology surgery, including in particular the endoscopic insertion of ureteric stents, cystoscopy, open bladder repair, and percutaneous nephrostomy. Five of the six studies were published in the last 8 years, which suggests that this is a current issue, possibly related to the sub-specialisation and centralisation of surgery to larger centres [1]. This study should be considered in the

context of multiple limitations. Firstly, no studies were from low-income countries, where our findings may have been most relevant. We expect that basic urological procedures may often be delivered by non-specialist physicians in low-income countries. However, due to a paucity of academic publication, we were unable to determine if this is true. Secondly, due to a lack of reliable translation, we excluded studies not in English. This may have consequently excluded some relevant articles, especially those from low-income countries where English is not the first language. Nonetheless, in our initial literature search, there were only four studies in languages other than English. This may have limited the assessment and applicability of global surgical care. Thirdly, few studies reported on outcomes and none reported follow-ups, which limits the assessments that can be made about the longer-term safety and efficacy of urological procedures performed by general surgeons. The poor response of corresponding authors for clarification of missing data further compounded this. Finally, due to study heterogeneity and the relatively small number of included articles, a meta-analysis could not be performed. The quality assessment of the studies was fair, but studies scored particularly poorly in terms of randomisation, accounting for confounding, and follow-up, though many of the retrospective study designs were not conducive to such analysis.

Further study into this area is warranted, including in particular the comparison of surgical outcomes of emergency urological procedures between the two surgical specialties (general surgery and urology), especially in low-income countries. The dearth of high-quality prospective research on this topic makes it difficult to draw robust conclusions about the safety and efficacy of the most commonly performed emergency urological procedures by general surgeons. Further research could help to determine which emergency procedures might safely fall within the scope of a general surgeon and thus enable recommendations on resource allocation and the safe triaging of cases. In settings where general surgeons are more readily available than urologists, this could minimise further stretching of already-sparse urological cover, allowing urologists to focus on more complex, specialised procedures as well as ensuring time critical emergencies, such as urosepsis secondary to obstruction, are treated urgently without major delays resulting from inter-hospital transfer.

5. Conclusions

This systematic review highlights the critical role of general surgeons in emergency urological surgery, especially in areas with limited specialist resources. One highly-powered study in a high-income country showed that general surgeons performing traumatic bladder repairs had similar outcomes to urologists; however, further research is needed to compare the outcomes for other procedures. We advocate that general surgical training programs incorporate some aspects of urological surgery where feasible, particularly for traumatic bladder repair and endoscopic ureteric stent insertion. Updating general surgery training curricula and expanding educational programs are pragmatic starts to address barriers to timely care in underserved areas.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/siuj5060059/s1>, Tables S1–S5: Search methodology; Table S6: Downs and Black checklist.

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