



## **HAS THE SARS-COV-2 PANDEMIC IMPROVED THE MANAGEMENT OF ACUTE URETERIC COLIC?**

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### **ABSTRACT**

#### **Objective**

The WHO declared SARS-CoV-2 a pandemic on 11th March 2020 prompting a rapid change to surgical practice. This study focuses on how the management of ureteric colic has adapted in a major tertiary referral unit during the peak of the pandemic so that lessons be can be learned in case a second wave occurs.

#### **Materials and Methods**

We compared admission rates and treatment patterns against national and European guidelines in 20 weeks, divided into pre- and peri-pandemic.

#### **Results**

A total of 72 patients were admitted during the study period. 64% (46/72) were admitted pre-pandemic. 22% (10/46) of these were septic (5 stented, 5 nephrostomized) while 20% (9/46) were managed conservatively. 59% (27/46) of pre-pandemic admissions were suitable for active treatment, of which 48% (13/27) received definitive treatment (11 ureteroscopy (URS), 2 shockwave lithotripsy (SWL)) all within 48 hours of admission. 52% (14/27) had temporising procedures (11 stented, 3 nephrostomized) and underwent definitive treatment within 63 days.

Of the total patients, 36% (26/72) were admitted peri-pandemic. 23% (6/26) were septic (1 stent, 5 nephrostomized), while 31% (8/26) were managed conservatively. 46% (12/26) were suitable for active treatment. 75% (9/12) received definitive treatment (4 URS, 5 SWL) of which 33% (4/12) within 48 hours and the remaining treated and stone free within 12 days. 25% (3/12) had temporising procedures (2 stented, 1 nephrostomized), with the definitive treatment provided within 17 days.

#### **Conclusion**

Ureteric colic admissions were reduced by almost half during the pandemic. There has been increased primary treatment with a reduction in temporising procedures and time to receiving definitive treatment. In the 'new normal,' lessons learned must be carried forward to maintain high rates of definitive treatments.

**Key words:** *Stones, endourology, SARS-CoV-2, SWL, URS*

## INTRODUCTION

SARS-CoV-2 has spread rapidly to warrant its pandemic status from the World Health Organization (WHO) on 11<sup>th</sup> March 2020. Unparalleled changes to the management of patients across all specialties have arisen, with face-to-face clinics cancelled, elective surgeries postponed and staff redeployed to cope with the unprecedented number of SARS-CoV-2 related admissions.<sup>1,2</sup>

Before the pandemic, the management of acute ureteric colic was based on guidance from the National Institute of Clinical Excellence (NICE) and European Association of Urology (EAU). In January 2019, NICE recommended improved management through definitive treatment in the form of shockwave lithotripsy (SWL) or ureteroscopy (URS) within 48 hours of the patient's admission in those with uncontrollable pain or stones deemed unlikely to pass (Table 1).<sup>3</sup> EAU guidance mirrors this, suggesting renal decompression or ureteroscopic stone removal in cases of analgesic refractory pain.<sup>4</sup>

Whilst further treatments may be required for SWL, and occasionally URS, these treatment modalities are provided with the intent to cure the stone burden, with safe and efficacious outcomes shown when provided in the emergency setting.<sup>5,6</sup> Surgical treatments also include temporising procedures such as a ureteric stent or nephrostomy insertion with a subsequent URS or SWL typically performed 2–6 weeks after the temporising intervention.<sup>7</sup> Routine practice often varies nationally, with most centres opting for a temporising stent due to the ease of insertion in an

emergency theatre, shorter operating time, and fully booked elective theatre lists with little room to accommodate emergency interventions.<sup>8</sup> Limited uptake of primary treatment modalities and consequent use of temporising procedures leads to significant patient morbidity due to the presence of stents and their well-documented symptoms; potential infections related to the presence of a foreign body, and higher hospital costs.<sup>9</sup> At a time when all of the said pitfalls of temporising measures are likely to put an undue and unscheduled strain on the health care system, the need to adapt practice is pertinent.

During the SARS-CoV-2 pandemic, urological practice in the UK has been guided by government interventions, Public Health England, the Royal College of Surgeons (RCS), and organizations such as the British Association of Urological Surgeons (BAUS), with local divisional leads responsible for advising the change in practice across trusts. Guidance has evolved in response to increasing disease incidence, emerging advice, and evidence internationally. BAUS published guidance in the initial phase of the pandemic with a 4-stage prioritisation of urological cases (Table 2).<sup>10</sup> URS with stent or ureteric stones treatment was instructed to be the last operations to be cancelled, emphasizing its high priority irrespective of the pandemic.

We report on the management of acute colic patients during the peak of the UK SARS-CoV-2 pandemic and compare rates of admission, treatment modality, and outcomes to the pre-pandemic period.

## PATIENTS AND METHODS

Following institutional board approval of the project data for all acute colic admissions between 1st January 2020 and 20th May 2020 was collected and analysed. Based on the WHO classification of SARS-CoV-2 as a 'pandemic' on 11th March 2020 we categorized the analysis into 10-week periods, 'pre-pandemic' (1st January - March 11th, 2020) and 'peri-pandemic' (12th March – 20th May 2020). Admission criteria was based on locally agreed protocols for computerized tomography (CT) confirmed stone burden, with white cell count  $>16$  ( $\times 10^9/L$ ), intractable pain, or significant impairment of renal function.

**TABLE 1.** Nice recommendations for Definitive Treatment (January 2019)

Timing of surgical treatment (including SWL) for adults with ureteric stones and renal colic
Offer surgical treatment (including SWL) to adults with ureteric stones and renal colic within 48 hours of diagnosis or readmission, if: <ul style="list-style-type: none"> <li>• pain is ongoing and not tolerated or</li> <li>• the stone is unlikely to pass</li> </ul>

SWL = shockwave lithotripsy.  
NICE (2019)<sup>3</sup>

**TABLE 2.** BAUS 4-Stage Prioritisation of Urological Cases

STAGE 1 First cancellations	STAGE 2 Secondary cancellations	STAGE 3 Last to be cancelled	STAGE 4 Emergency cases only
• Day surgery (vasectomy, circumcision, scrotal surgery, cystoscopy)	• Cystectomy (for low-risk cancer)	• Cystectomy (for high-risk cancer)	• Obstructed, infected kidneys
• Possible RARPs (depending on Trust cancer decision)	• LA transperineal biopsies (for high PSA)	• Nephrectomy (time-sensitive)	• Emergency urology, abscesses, washouts, etc
• GA transperineal biopsies	• TURBT (low-risk cancer)	• TURBT (high-risk cancer)	• Torsion
• Benign nephrectomy or partial nephrectomy	• RARPs	• Orchidectomy	
• Andrology	• Nephroureterectomy (low-risk cancer)	• Nephroureterectomy (high-risk cancer)	
• Brachytherapy		• URS with stent or ureteric stones	
• Functional & reconstructive surgery		• Nephrectomy with IVC exploration	
• Elective URS & PCNL			
• TURP, HoLEP & other procedures for BPH			
• Ureterolysis			

BPH = benign prostatic hyperplasia; GA = general anesthesia; HoLEP = holmium laser enucleation of the prostate; IVC = inferior vena cava; LA = left-anterior; PCNL = percutaneous nephrolithotomy; RARP = robotic-assisted radical prostatectomy; TURP = transurethral resection of the prostate; TURBT = transurethral resection of the bladder; URS = ureteroscopy.

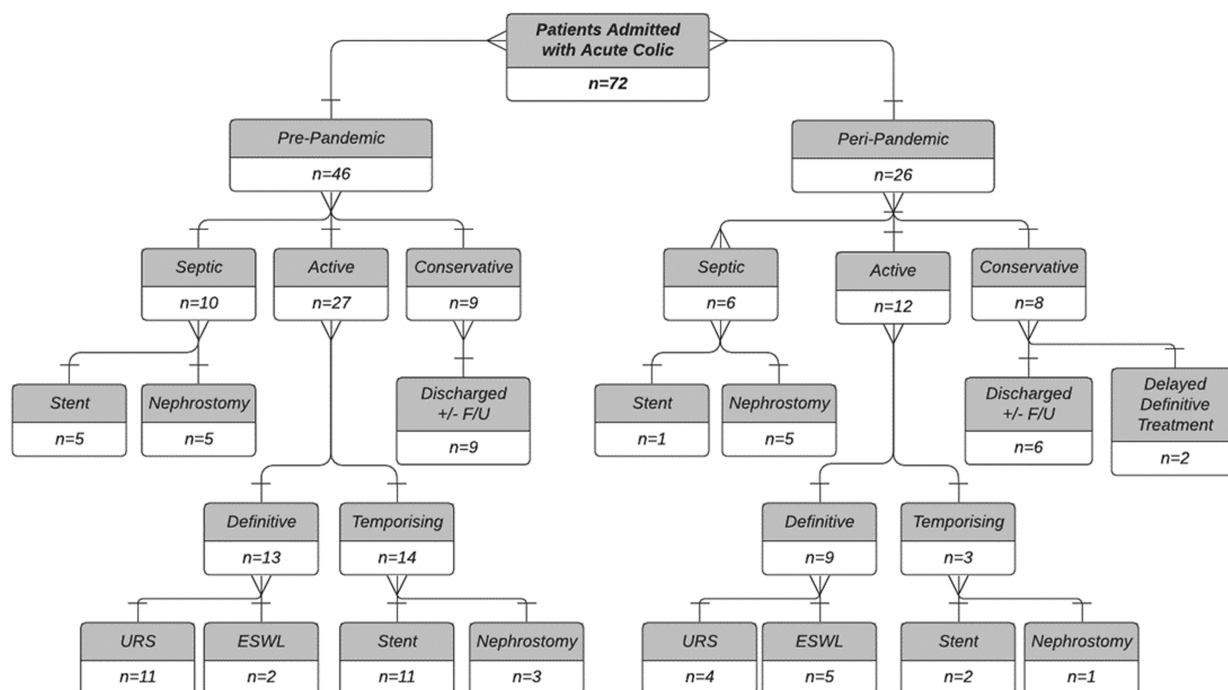
Patients were decompressed with a ureteric stent or nephrostomy if they showed signs of sepsis as per the WHO Sepsis-3 definition.<sup>11</sup> Per NICE guidance, active surgical treatment (URS or SWL, stent or nephrostomy) was offered if a stone was considered unlikely to pass, or there was impairment of renal function or ongoing intractable pain.<sup>3</sup> Definitive treatment was defined as URS or SWL. If stents were inserted following ureteroscopic clearance of a stone, this was coded as URS, as definitive treatment had been provided. Temporising treatments were defined as stent or nephrostomy insertion. All other patients were conservatively managed with either no follow up, virtual stone clinic follow up or stone multidisciplinary team (MDT) discussion; if treatment was

provided following these, this was recorded separately as delayed definitive treatment.

Patient demographics, stone characteristics, procedure and ureteric stent dwell time were obtained from electronic patient health records. Descriptive statistics were calculated, and when relevant, two proportion Z-test used ( $p < 0.05$ ; SPSS v26.0)

## RESULTS

In total, 72 patients were admitted with ureteric colic between January 1st and May 20th, 2020, with 46 in the pre-pandemic period and 26 in the peri-pandemic, showing a reduction of 43.5% in admissions. Admission details, including stone features, are shown in Figure 1 and Table 3.

**FIG 1.** Pre- and peri-pandemic admissions and outcomes.**TABLE 3.** Pre- and Peri-pandemic Stone Characteristics

Stone Characteristics		Pre-Pandemic	Peri-Pandemic
Stone Size*	≤ 5mm	15	8
	> 5mm	34	21
	Mean stone size (range) mm	6.7 (2–15)	8.2 (2–30)
Location	Proximal/PUJ	18	8
	Mid-ureter	1	3
	Distal/VUJ	27	15
Laterality	Right	24	12
	Left	21	12
	Bilateral	1	2

\*multiple/bilateral stones sizes given individually

PUJ = pelvic ureteric junction; VUJ = vesicoureteric junction.

### SEPSIS

Similar rates of septic patients were admitted in both periods, with 21.7% (10/46) pre-pandemic, compared to 23.1% (6/26) in the peri-pandemic period ( $p=0.44$ ).

Stenting reduced from 50% (5/10) to 16.7% (1/6) (pre vs peri-pandemic,  $p=0.09$ ), with nephrostomy insertion increasing from 50% (5/10) to 83.3% (5/6) (pre vs peri-pandemic,  $p=0.09$ ).

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## ACTIVE SURGICAL TREATMENT

### Definitive Treatment

Those suitable for definitive treatment were 58.7% (27/46) vs 46.2% respectively (12/26) (pre vs peri-pandemic,  $p=0.15$ ). 48.1% (13/27) received definitive treatment pre-pandemic vs 75% (9/12) peri-pandemic ( $p=0.06$ ); SWL rates increased from 15.4% (2/13) vs 55.6% (5/9) and URS reduced from 84.6% (11/13) vs 44.4% (4/9) (both  $p=0.02$ ) pre- vs peri-pandemic. All definitive primary treatments delivered pre-pandemic were within 48 hours (13/27). The remaining 14 patients received temporising measures and went on to have definitive treatment within 63 days. While 44.4% (4/9) of definitive procedures were performed within 48 hours in the peri-pandemic period ( $p<0.01$  compared to 13/13 pre-pandemic), the 5 other patients were discharged from hospital and returned for definitive treatments within 12 days (1 URS, 4 SWL). Of the 3/26 patients who received temporising procedures, 1 had a URS 17 days following, one had their procedure intentionally deferred due to significant co-morbidities necessitating further pre-operative optimization and one died before definitive treatment (unrelated to the procedure or SARS-CoV-2) (Figure 2).

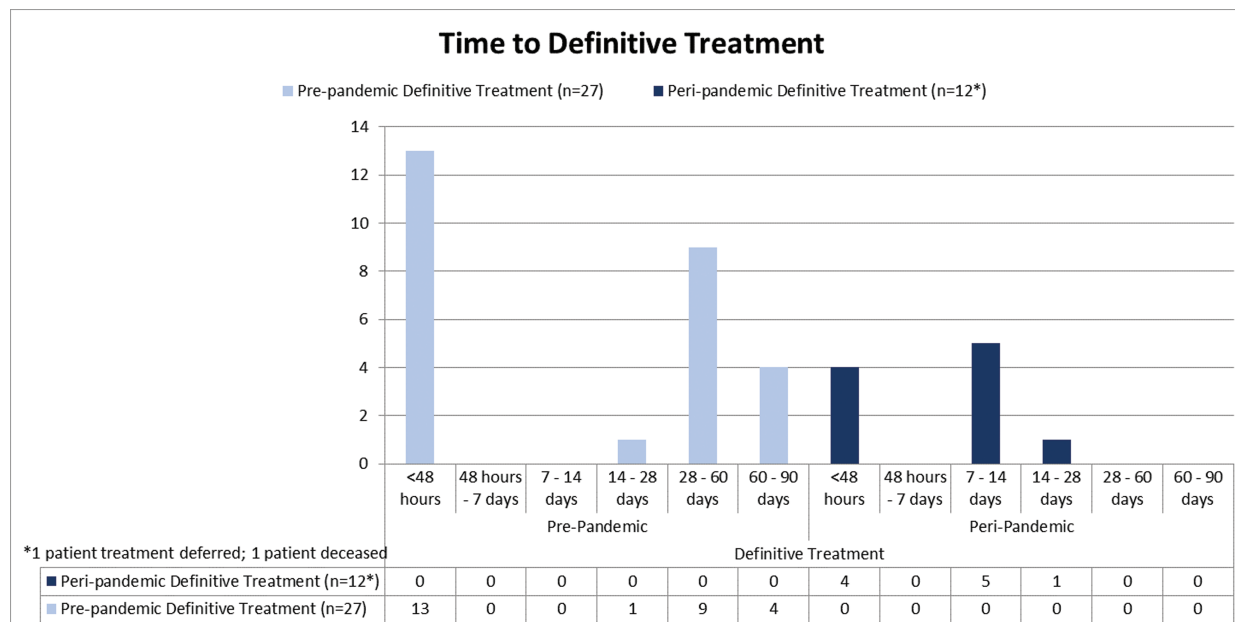
## TEMPORISING PROCEDURES

Of all patients, 51.9% (14/27) had a temporising procedure performed pre-pandemic period compared to 25% (3/12) peri-pandemic  $p=0.06$ ; stent 78.6% (11/14) vs 66.6% (2/3)  $p=0.32$  and nephrostomy 21.4% (3/14) vs 33.3% (1/3)  $p=0.32$  (pre vs peri-pandemic).

## CONSERVATIVE MANAGEMENT

A total of 19.6% (9/46) of stones were deemed likely to pass spontaneously pre-pandemic compared to 30.8% (8/26) peri-pandemic and were thus conservatively managed ( $p=0.14$ ) (see Figure 1). In the pre-pandemic period, none went on to have delayed primary treatment compared to 25% (2/8) peri-pandemic. Following discharge pre-pandemic, 44.4% (4/9) had no planned follow-up, 44.4% (4/9) had virtual stone clinic follow up and 11.1% (1/9) discharged with a plan for SWL, but then subsequently passed their stone before treatment. In the peri-pandemic period, 25% (2/8) had repeat imaging (US) showing the passage of the stone. 25% (2/8) were planned for virtual stone clinic follow up, with neither requiring definitive treatment. 12.5% (1/8) was discharged with no follow up planned. 12.5% (1/8) was discharged with multidisciplinary stone team

**FIG 2.** Time to definitive treatment.





(MDT) discussion planned, where the decision was made to continue conservative management. Of the two delayed definitive treatments, both were initially treated with SWL, with one later going onto require URS following multiple failed SWLs.

Of the 9/46 who were managed conservatively pre-pandemic, 44.4% (4/9) were given medical expulsive therapy (MET) on discharge. Of the 8/26 who were managed conservatively peri-pandemic, 62.5% (5/8) (pre vs peri-pandemic  $p=0.23$ ) were given MET.

### STENT VERSUS STENT-ON-STRING

In the pre-pandemic period, 81.8% (9/11) of the URS had a stent inserted during the procedure. None of these were on a string and subsequently required outpatient appointments for flexible cystoscopy and stent removal.

In the peri-pandemic period, 100% (4/4) of the URS had a stent inserted during their definitive procedure. 50% (2/4) were on a string and patients were taught how to self-extract, thus not requiring a further planned outpatient appointment. Of the 3 patients who were temporised, one went on to have a URS with a stent-on-string allowing for at-home removal.

### SARS-COV-2 TESTS

In the pre-pandemic period, no SARS-CoV-2 PCR nasopharyngeal swabs were performed. In the peri-pandemic period, 21 out of 26 patients were screened on admission with 1 patient having the virus detected. This patient was managed conservatively. Testing practices shifted based on government guidance, such that in the early period of the pandemic only symptomatic patients or those undergoing aerosol-generating procedures (AGPs) were swabbed. Currently, all patients are swabbed on admission.

Our institution implemented a strict testing policy for patients before any elective procedure, requiring a negative swab test within 48 hours of the procedure and a normal chest x-ray and/or CT chest if symptomatic. This included those patients who were discharged with a ureteric stone who were brought back for a definitive URS. Furthermore, all theatre staff adhered to full PPE measures including fit-tested FFP3 masks despite patients testing negative on swab test; this ensured patient and

staff safety were kept a priority. Of 4 patients who went on to have URS in the peri-pandemic period, all were swab negative. SWL in our department is performed with no anesthesia and so is not classified as an AGP; therefore, no patients were swabbed as per government guidance. No patients suffered COVID-19 related complications.

### DISCUSSION

We report on patients presenting to a busy tertiary referral centre and compare management strategies in the 10 weeks before the pandemic to the 10 weeks of its peak. The 43.5% reduction in the number of patients admitted with ureteric colic is comparable to the 46.4% fewer emergency urology attendances seen in a recent retrospective study in Portugal.<sup>12</sup> Similar reduction in rates of presentation have also been seen globally in patients with acute coronary syndrome and cerebrovascular accidents (CVAs).<sup>13,14</sup> The government's 'stay at home' and 'stay alert' messages and anxiety centred on leaving one's home have likely resulted in the reduced attendances to emergency departments for non-COVID-19 related reasons seen globally during this period.<sup>15</sup> With ir-retractable pain guiding admission as per local policy, it is likely that those who may have previously been admitted either tolerated their pain better or did not present to emergency services to confirm stone burden in the first instance, reflected by some degree in the 6.7-mm average stone size pre-pandemic compared to 8.2-mm peri-pandemic.<sup>16</sup> Whilst there is a dispute as to whether stone size directly reflects pain levels, it is often the only objective measure of predicting ureteric colic, alongside stone location. Furthermore, conservative management has been adopted as much as possible with the threshold for admitting patients raised during the SARS-CoV-2 pandemic, which likely influenced the reduction in admissions.<sup>17</sup> MET remains a controversial treatment option for those managed conservatively, with NICE recommending its unlicensed use in those patients with distal stones less than 10 mm.<sup>3</sup> With evidence supporting its benefits without significant side effects, its 40.8% increase in use (4/9 pre-pandemic vs 5/8 peri-pandemic) during this uncertain period is likely to continue beyond the peak of the pandemic.<sup>18</sup>

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A similar number of patients presented with an infected obstructed kidney across both groups respectively, with 21.7% (10/46) pre-pandemic compared to 23.1% (6/26) peri-pandemic. This is a reassuring finding, with many other medical specialties seeing a large reduction in patients presenting with other serious, acute, life-threatening emergencies such as strokes, with reduced numbers of patients arriving within the essential critical time frame required for thrombolysis.<sup>19</sup> Likewise, there has been a delay in patients with acute ST segment-elevation myocardial infarction seeking medical contact within the timeframe critical for successful primary percutaneous coronary intervention.<sup>20</sup> The increased use of nephrostomies and reduced ureteric stenting seen peri-pandemic reflects the RCS guidance advising the limitation of AGPs seen in general anesthetic required for stenting, and thus the increased use of nephrostomies performed under local anesthetic peri-pandemic.<sup>21</sup>

Importantly, those who qualified for active treatment were more likely to receive this in the peri-pandemic period, with just 48.1% (13/27) of patients receiving definitive primary treatment in the pre-pandemic period compared to the 75% (9/12) in the peri-pandemic. However, the proportion of treatments performed within 48 hours reduced from 100% to 33% (pre vs peri-pandemic) with the overall time to provide definitive treatment significantly shorter (63 days pre-pandemic vs 17 days peri-pandemic). This represents an interesting shift in practice such that more definitive treatments were performed, but outside of 48 hours despite this overall reduction in time to treatment. This is of particular note as a number of centres nationally report up to 50% of emergency admissions being stented pre-pandemic, and international studies such as Brubaker et al reporting median times to definitive stone treatment of 28 days.<sup>8,22</sup> This has resulted from re-prioritization of elective caseloads, such as delaying procedures in non-obstructed renal units, creating capacity for primary ureteroscopy, and other emergency endourological procedures such as overdue stent changes and management of new-onset malignant ureteric obstruction. Being able to discharge a patient knowing there is the capacity for a URS or SWL slot imminently provides confidence to the urologist and

patient, reducing reliance on temporising procedures and avoids the morbidity associated with them.

Comparatively we report an increased use of primary SWL (15.4% (2/13) vs 55.6% (5/9),  $p=0.02$ ) with reduction in primary URS (84.6% (11/13) vs 44.4% (4/9)  $p=0.02$ ). Furthermore, for those who received a temporising intervention, there was a shift from ureteric stenting under general anesthetic to local anesthetic nephrostomy procedures (stent 78.6% (11/14) vs 66.6% (2/3) and nephrostomy 21.4% (3/14) vs 33.3% (1/3) (pre vs peri-pandemic). These shifts reflect a culture change, with an emphasis on reducing dependence on already stretched resources during the pandemic such as anesthetists, ventilators, and operating theatres and limiting hospital staff exposure through subsequent minimization of AGPs. Such changes in practice patterns are likely being adopted globally, however, there is currently minimal published literature.<sup>23</sup> For those patients who required a stent post-URS, we adopted a stent-on-string approach with patient self-extraction. A nurse-led follow-up protocol was established to ensure patient tolerability and safety. Whilst this model is well established in some countries, this is not standard of care in many UK departments despite appearing to be a safe and well-tolerated pathway, which minimizes hospital visits and therefore patient exposure. To date, since the beginning of the pandemic, our department has adopted this strategy with 28 out of 36 stents on strings successfully removed by patients in their home minimizing hospital visits. The remainder of the stents migrated ( $n = 2$ ) or patients were too anxious to remove at home and therefore attended the clinic for nurse or physician-led extraction ( $n= 6$ ).

To our knowledge, this represents the first published report in the literature of acute colic management during the pandemic. Guidance on the management of onco-urolological patients has been published, with a similar overarching consensus that cases should be subdivided into categories that would allow deferral if possible and appropriate, echoing BAUS.<sup>24,25</sup> However, their advice surrounding 'benign' conditions such as nephrolithiasis suggests they should be deferred, with suggestions of placing a ureteric stent under local anesthesia or nephrostomy tube placement to spare the need for a ventilator. Yet neither of these

are definitive and will require planned readmission for treatment of the stone itself with the placement of ureteric stents under local anesthesia rare practice in the UK. Whilst the rationale is understandable given the need to mobilize resources including anesthetists, these temporising measures will simply add to the well-documented back-log of operations that will be seen once services can fully resume.<sup>26</sup> With the long-term impact of SARS-CoV-2 to hospital services unknown, the need for reducing re-admissions and preventing sub-optimal temporising procedures should not be underestimated.

The RCS has published evolving guidelines regarding the safety of performing surgical procedures in both the emergency and elective setting, with an initial focus on prioritising urgent surgery with recent evidence suggesting risks can be minimized with appropriate techniques.<sup>27</sup> In the same way, the advice surrounding testing of patients has evolved to its current recommendations; elective patients undergoing surgery in a COVID-cold site should self-isolate for 14 days and have a negative throat swab within 72 hours of surgery; acute patients with unknown status should have a CT chest unless 'equally reliable and rapid alternative testing methods are locally available.'<sup>28</sup> Comparable protocols have been undertaken globally to maintain patient and staff safety with good effect.<sup>29</sup>

Our department facilitated the use of COVID-cold sites during the peak such as private hospitals, with a 'COVID-protected' area for continued semi-elective work onsite now in operation. Whether other departments can make similar provisions will likely reflect the ability to provide timely URS and SWL. Such provisions may also encourage collaboration among units to allow access to SWL to those trusts outside of usual catchment areas. With safe and efficacious outcomes shown by our trust whilst using such sites, these findings could be used in supporting the continued use of COVID-cold sites nationally. Similar multicentre collaboration looking at how the practice has adapted and changed during the pandemic will also serve to see if our findings reflect practice nationally and internationally, with limited literature currently available.

Limitations to this study include the single-centre nature and the relatively short time. However, at the time of writing, the 10-week 'pre' and 'peri' pandemic periods reflected an appropriate time frame that was demonstrative of the observed changes in patient health-seeking behaviour as well as local clinical practice. Whilst a longer pre-pandemic retrospective data collection period may have improved the statistical significance of some results, it would not have accounted for the more recent pre-pandemic changes to services in our department, and thus the comparability of the two time periods. Whilst this is a single-centre study, its tertiary hospital status in London, the epicentre of the pandemic, is likely to reflect the practicality of achieving timely definitive treatment whilst still operating with a reduced service. This is in contrast to papers promoting the deferral of definitive treatment until after the pandemic, which at this stage is difficult to predict ending.<sup>17,25,30</sup>

## CONCLUSION

In the 'new normal', where SARS-CoV-2 remains a daily challenge to the management of acute ureteric colic, we report increased use of nephrostomy insertion in the septic patient and increased utilization of primary SWL, with URS reserved as a second-line procedure to limit the number of AGPs. Where a stent is required post-URS, patient self-extraction of a stent-on-string can limit hospital exposures. Timely management of acute colic presentations with high rates of definitive primary treatments is realistic despite the constraints caused by the pandemic.

## CONFLICTS OF INTEREST

The author(s) declare(s) that there is no conflict of interest

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## INFORMED CONSENT

Not applicable.



## ETHICAL APPROVAL

Not applicable.

## AUTHOR CONTRIBUTIONS

Authors Nimlan Shanmugathas and Hamid Abboudi designed the study. Author Nimlan Shanmugathas was responsible for data collection. Authors Nimlan Shanmugathas, Christopher Khoo and Hamid Abboudi were responsible for drafting the manuscript. Authors Mitra Kondjin-Smith, Milad Hanna, Tamer El-Husseiny and Ranan Dasgupta revised it critically. All authors read and approved the final version of the manuscript.

## REFERENCES

1. COVIDSurg Collaborative. Global guidance for surgical care during the COVID-19 pandemic. *Br J Surg*. 2020 Apr;
2. Wosik J, Fudim M, Cameron B, Gellad ZF, Cho A, Phinney D, et al. Telehealth Transformation: COVID-19 and the rise of Virtual Care. *J Am Med Inform Assoc*. 2020 Apr;
3. NICE. Renal and ureteric stones: assessment and management [Internet]. 2019. Available at: <https://www.nice.org.uk/guidance/ng118/chapter/Recommendations>
4. EAU. Urolithiasis. 2020; Available at: [https://uroweb.org/guideline/urolithiasis/#note\\_112](https://uroweb.org/guideline/urolithiasis/#note_112)
5. Kumar A, Mohanty NK, Jain M, Prakash S, Arora RP. A prospective randomized comparison between early (<48 hours of onset of colicky pain) versus delayed shockwave lithotripsy for symptomatic upper ureteral calculi: a single center experience. *J Endourol*. 2010 Dec;24(12):2059–66.
6. Zargar-Shoshtari K, Anderson W, Rice M. Role of emergency ureteroscopy in the management of ureteric stones: analysis of 394 cases. *BJU Int*. 2015 Jun;115(6):946–50.
7. Ghoneim IA, El-Ghoneimy MN, El-Naggar AE, Ham-moud KM, El-Gammal MY, Morsi AA. Extracorporeal shock wave lithotripsy in impacted upper ureteral stones: a prospective randomized comparison between stented and non-stented techniques. *Urology*. 2010 Jan;75(1):45–50.
8. Getting It Right First Time. GIRFT Urology National Speciality Report [Internet]. 2018. Available at: <https://gettingitrightfirsttime.co.uk/wp-content/uploads/2018/07/GIRFT-Urology.pdf>
9. Chew BH, Lange D. Ureteral stent symptoms and associated infections: a biomaterials perspective. *Nat Rev Urol*. 2009 Aug;6(8):440–8.
10. BAUS. BAUS COVID-19:Information for Members [Internet]. 2020. Available at: [https://www.baus.org.uk/mybaus/covid19\\_members\\_information.aspx](https://www.baus.org.uk/mybaus/covid19_members_information.aspx)
11. Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). *JAMA*. 2016 Feb;315(8):801–10.
12. Madanelo M, Ferreira C, Nunes-Carneiro D, Pinto A, Rocha MA, Correia J, et al. The impact of the COVID-19 pandemic on the utilization of emergency urological services. *BJU Int*. 2020 May;
13. Metzler B, Siostrzonek P, Binder RK, Bauer A, Reinstadler SJ. Decline of acute coronary syndrome admissions in Austria since the outbreak of COVID-19: the pandemic response causes cardiac collateral damage. *Eur Heart J* [Internet]. 2020 Apr 16;41(19):1852–3. Available at: <https://doi.org/10.1093/eurheartj/ehaa314>
14. Rudilosso S, Laredo C, Vera V, Vargas M, Renú A, Llull L, et al. Acute stroke care is at risk in the era of COVID-19: Experience at a comprehensive stroke center in Barcelona. *Stroke*. 2020 May;STROKEAHA120030329.
15. Giamello JD, Abram S, Bernardi S, Lauria G. The emergency department in the COVID-19 era. Who are we missing? *Eur J Emerg Med Off J Eur Soc Emerg Med*. 2020 Apr;
16. Lallas CD, Liu XS, Chiura AN, Das AK, Bagley DH. Urolithiasis location and size and the association with microhematuria and stone-related symptoms. *J Endourol*. 2011 Dec;25(12):1909–13.
17. Proietti S, Gaboardi F, Giusti G. Endourological stone management in the era of the COVID-19. *European Urology*. 2020.
18. Sun Y, Lei G-L, Yang L, Wei Q, Wei X. Is tamsulosin effective for the passage of symptomatic ureteral stones: A systematic review and meta-analysis. *Medicine (Baltimore)* [Internet]. 2019 Mar;98(10):e14796–e14796. Available at: <https://pubmed.ncbi.nlm.nih.gov/30855496>
19. Teo K-C, Leung WCY, Wong Y-K, Liu RKC, Chan AHY, Choi OMY, et al. Delays in stroke onset to hospital arrival time during COVID-19. *Stroke*. 2020 May;STROKEAHA120030105.
20. Tam C-CF, Cheung K-S, Lam S, Wong A, Yung A, Sze M, et al. Impact of Coronavirus Disease 2019 (COVID-19) Outbreak on st-segment-elevation myocardial infarction

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- care in Hong Kong, China. Vol. 13, *Circulation. Cardiovasc Qual Outcomes*. 2020; 006631.
21. Royal College of Surgeons (England). COVID-19: Good Practice for Surgeons and Surgical Teams [Internet]. 2020. Available at: <https://www.rcseng.ac.uk/standards-and-research/standards-and-guidance/good-practice-guides/coronavirus/covid-19-good-practice-for-surgeons-and-surgical-teams/>
22. Brubaker WD, Dallas KB, Elliott CS, Pao AC, Chertow GM, Leppert JT, et al. Payer type, race/ethnicity, and the timing of surgical management of urinary stone disease. *J Endourol*. 2019 Feb;33(2):152–8.
23. Tefik T, Guven S, Villa L, Gokce MI, Kallidonis P, Petkova K, et al. Urolithiasis practice patterns following the COVID-19 pandemic: Overview from the EULIS Collaborative Research Working Group. *Eur Urol* [Internet]. 2020 Apr 27;S0302-2838(20)30325-0. Available at: <https://pubmed.ncbi.nlm.nih.gov/32362496>
24. Stensland KD, Morgan TM, Moinzadeh A, Lee CT, Briganti A, Catto JWF, et al. Considerations in the triage of urologic surgeries during the COVID-19 Pandemic. *Eur Urol*. 2020;77: 663–6.
25. Ficarra V, Novara G, Abrate A, Bartoletti R, Crestani A, De Nunzio C, et al. Urology practice during COVID-19 pandemic. *Minerva Urol Nefrol*. 2020 Mar;
26. Stahel PF. How to risk-stratify elective surgery during the COVID-19 pandemic? *Patient Safety Surg*. 2020;14:8.
27. Vigneswaran Y, Prachand VN, Posner MC, Matthews JB, Hussain M. what is the appropriate use of laparoscopy over open procedures in the current COVID-19 climate? *J Gastrointest Surg Off J Soc Surg Aliment Tract*. 2020 Apr;1–6.
28. RCS. RCS-Joint Guidance for Surgeons [Internet]. Available at: <https://www.rcseng.ac.uk/coronavirus/joint-guidance-for-surgeons-v2/>
29. Papalia R, Cataldo R, Alloni R, Pang KH, Alcini A, Flammia G, et al. Urologic surgery in a safe hospital during the COVID-19 pandemic scenario. *Minerva Urol Nefrol*. 2020 Jun;
30. Simonato A, Giannarini G, Abrate A, Bartoletti R, Crestani A, De Nunzio C, et al. Clinical pathways for urology patients during the COVID-19 pandemic. *Minerva Urol Nefrol*. 2020 Jun;72(3):376–83.