

**While necessary to improve visibility during flexible ureteroscopy, fluid irrigation may lead to increased intrarenal pressures (IRP) with potential complications.<sup>1-3</sup> IRP in the collecting system cannot be reliably monitored today.**

The current recommendation discussed in literature is to maintain IRP as low as possible while maintaining good visibility to prevent complications such as pyelovenous backflow and sepsis.<sup>1,2</sup>



## IRP featured evidence and contemporary views

### Need for IRP monitoring

"High [intrapelvic pressure] levels may be achieved during f-URS with on-demand irrigation systems. The impact of these high pressures on the risk of complications and long-term consequences still need to be evaluated adequately."

"...Monitoring [intrapelvic pressure] during f-URS could be of great interest. The high pressures are worrisome and they are difficult to estimate by visual recognition alone."

Doizi S, et al. *World J Urol.* 2021.

"IRP increase remains a neglected predictor of upper tract endourology complications and its intraoperative monitoring should be taken into consideration."

Tokas T, et al. *World J Urol.* 2019.

"Devices for monitoring intraluminal pressure during the procedures would be desirable."

Jung H, et al. *Springerplus.* 2015.

"High levels of IPP may be reached intraoperatively when inflow and outflow are not balanced and may cause pyelovenous backflow as well as rupture of the collecting system, leading to postoperative complications."

Doizi S, et al. *World J Urol.* 2021.

### Irrigation pressure and implications

Ureteral access sheaths help reduce IRP. Increased pressure in the renal pelvis can lead to complications such as pyelovenous backflow, infections and renal damage.<sup>6</sup>

"Taking into account the intraoperative needs of improved visibility and increased irrigation flow (IF) and irrigation pressure (IP), an endourologist must remain cognizant regarding the danger of increments in IRPs..."

Tokas T, et al. *Curr Urol Rep.* 2021.

### Potential complications of increased IRP

"To achieve better visibility during the procedure, IF and IPs have to be increased. Nevertheless, consequent intraoperative increments in IRPs are able to deteriorate any procedure. Yet, only a few endourologists remain cognizant and are aware of normal and pathological IRP values. Furthermore, the impact of increased IRPs in perioperative complications and the ways to prevent them by controlling IRPs remain obscure."

Tokas T, et al. *World J Urol.* 2019.

Complications of elevated IRP may include pain,<sup>8,9</sup> renal damage and pathological changes,<sup>1,8,10</sup> infection,<sup>1,2,8,11</sup> sepsis,<sup>1,2,8,11</sup> systemic inflammatory response syndrome (SIRS),<sup>1,11</sup> fever,<sup>1,11</sup> fluid absorption and pyelovenous backflow.<sup>1,8,12-14</sup>

Potential complications of increased IRP (cont.)

<b>Pain</b>	<p>“Reducing intrarenal pressures during ureterorenoscopy may, however, also have important implications with regard to pain, and should be addressed in future research.”</p> <p>Jung H, et al. <i>Springerplus</i>. 2015.</p>
	<p>“Traditionally increased endoluminal pressure is considered the main mechanism causing pain in the upper urinary tract but clinical data are sparse.”</p> <p>Pedersen KV, et al. <i>Urol Res</i>. 2012.</p>
<b>Kidney damage</b>	<p>Animal studies have shown high irrigation pressures result in significant pathological changes of the kidney.<sup>1,8,10</sup></p>
<b>Rupture</b>	<p>Pre-clinical studies have shown high levels of IRP due to the injection of fluids can lead to rupture of the collecting system.<sup>8,10</sup></p>
<b>Systemic inflammatory response syndrome (SIRS)</b>	<p>Irrigation volume during flexible ureteroscopy has been correlated with the risk of SIRS. A recent study suggests SIRS occurs in 8.1% of cases.<sup>11</sup></p>
<b>Fluid absorption</b>	<p>Fluid absorption during retrograde intrarenal surgery (RIRS) is thought to be due to increased intrapelvic pressure.<sup>12,14</sup></p>
	<p>Fluid absorption during ureteroscopy procedures has the potential to lead to serious complications such as sepsis.<sup>1,2,8</sup></p>
<b>Other</b>	<p>“Moreover, intrarenal backflow may be responsible for development of a pathological site for stone growth by causing papillary damage, forming, in that way, a vicious circle.”</p> <p>Tokas T, et al. <i>World J Urol</i>. 2019.</p>
	<p>It is thought that in some cases, high IRP may lead to subcapsular hematomas and potentially life-threatening perirenal bleeding.<sup>1,15,16</sup></p>

Role of different factors in complication development: Duration of elevated IRP

One study of 23 URS cases reported that approximately 1mL of irrigation fluid was absorbed per minute of URS time.<sup>17</sup> Additionally, PCNL studies have shown that the volume of fluid absorbed increases with increased procedure time<sup>18</sup> and have also correlated the accumulation of procedure time at elevated IRP and the duration of surgery with postoperative fever.<sup>19,20</sup>

References

1. Tokas T, Herrmann TRW, Skolarikos A, et al. Pressure matters: intrarenal pressures during normal and pathological conditions, and impact of increased values to renal physiology. *World J Urol*. 2019 Jan;37(1):125-31.
2. Gutierrez-Aceves J, Negrete-Pulido O, Avila-Herrera P. Perioperative Antibiotics and Prevention of Sepsis in Genitourinary Surgery. In Smith AD, Badlani GH, Preminger GM, Kavoussi LR (Eds.), *Smith's Textbook of Endourology*. New York, NY: Blackwell Publishing Ltd., 2012:38-52.
3. Proietti S, Dragos L, Somani B, et al. In vitro comparison of maximum pressure developed by irrigation systems in a kidney model. *J Endourol* 2017 May;31(5):522-7
4. Doizi S, Letendre J, Cloutier J, et al. Continuous monitoring of intrapelvic pressure during flexible ureteroscopy using a sensor wire: a pilot study. *World J Urol*. 2021 Feb;39(2):555-561.
5. Jung H, Osther PJS. Intraluminal pressure profiles during flexible ureterorenoscopy. *Springerplus*. 2015 Jul 24;4:373-7.
6. Kaplan AG, Lipkin ME, Scales CD Jr, et al. Use of ureteral access sheaths in ureteroscopy. *Nat Rev Urol*. 2016 Mar;13(3):135-40.
7. Tokas T, Tzanaki E, Nagele U, Somani BK. Role of intrarenal pressure in modern day endourology (Mini-PCNL and Flexible URS): a systematic review of literature. *Curr Urol Rep*. 2021 Oct 8;22(10):52.
8. Osther PJS, Pedersen KV, Lildal SK, et al. Pathophysiological aspects of ureterorenoscopic management of upper urinary tract calculi. *Curr Opin Urol*. 2016 Jan;26(1):63-9.
9. Pedersen KV, Liao D, Osther SS, et al. Distension of the renal pelvis in kidney stone patients: sensory and biomechanical responses. *Urol Res*. 2012 Aug;40(4):305-16.
10. Schwalb DM, Eshghi M, Davidian M, et al. Morphological and physiological changes in the urinary tract associated with ureteral dilation and ureteropyeloscopy: an experimental study. *J Urol*. 1993 Jun;149(6):1576-85.
11. Zhong W, Leto G, Wang L, et al. Systemic inflammatory response syndrome after flexible ureteroscopic lithotripsy: a study of risk factors. *J Endourol*. 2015 Jan;29(1):25-8.
12. Kottooran C, Twum-Ampofo J, Lee J, et al. Evaluation of fluid absorption during flexible ureteroscopy in an *in vivo* porcine model. *BJU Int*. 2022. Online ahead of print.
13. Loftus C, Byrne M, Monga M. High pressure endoscopic irrigation: impact on renal histology. *Int Braz J Urol*. 2021 Mar-Apr; 47(2):350-6.
14. Guzelburc V, Balasar M, Colakogullari M, et al. Comparison of absorbed irrigation fluid volumes during retrograde intrarenal surgery and percutaneous nephrolithotomy for the treatment of kidney stones larger than 2 cm. *Springerplus*. 2016 Oct 4;5(1):1707.
15. Meng H, Chen S, Chen G, et al. Renal subcapsular hemorrhage complicating ureterolithotripsy: an unknown complication of a known day-to-day procedure. *Urol Int*. 2013 Jul;91(3):335-9.
16. Xu L, Li G. Life-threatening subcapsular renal hematoma after flexible ureteroscopic laser lithotripsy: treatment with superselective renal arterial embolization. *Urolithiasis*. 2013 Oct;41(5):449-51.
17. Cybulski P, Honey RJ, Pace K. Fluid absorption during ureterorenoscopy. *J Endourol*. 2004;18(8):739-742.
18. Kukreja RA, Desai MR, Sabnis RB, Patel SH. Fluid absorption during percutaneous nephrolithotomy: does it matter?. *J Endourol*. 2002;16(4):221-224.
19. Zhong W, Zeng G, Wu K, Li X, Chen W, Yang H. Does a smaller tract in percutaneous nephrolithotomy contribute to high renal pelvic pressure and postoperative fever?. *J Endourol*. 2008;22(9):2147-2151.
20. Doğan HS, Sahin A, Cetinkaya Y, Akdoğan B, Ozden E, Kendi S. Antibiotic prophylaxis in percutaneous nephrolithotomy: prospective study in 81 patients. *J Endourol*. 2002;16(9):649-653.

Bench test and pre-clinical results may not necessarily be indicative of clinical outcomes. Results from case studies are not necessarily predictive of results in other cases. Results in other cases may vary. All images are the property of Boston Scientific. All trademarks are the property of their respective owners.



Boston Scientific Corporation  
300 Boston Scientific Way  
Marlborough, MA 01752-1234  
www.BostonScientific.com

©2022 Boston Scientific Corporation or its affiliates. All rights reserved.

URO-1180505-AA NOV 2022