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Patient Care

Fluid Bolus for Renal Colic: Current Practice

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Abstract

Introduction: Historically the administration of intravenous fluid boluses in patients with urolithiasis and acute renal colic has been a standardized practice in the emergency department as a part of a conservative approach. In theory, an intravenous fluid bolus may promote ureteral fluid flow. However, randomized, controlled trials have shown no benefit of fluid boluses in this setting. We assessed current fluid bolus practices in community and tertiary care emergency departments.

Methods: We analyzed all emergency department visits in the Cleveland Clinic health care network with an ICD-9 diagnosis of 592.0 and computerized tomography of the abdomen/pelvis between December 7, 2010 and May 6, 2013. The incidence of intravenous fluid bolus administration was assessed, and patient demographics, serum laboratory values and urinalysis were collected. Cases with a blood urea nitrogen-to-creatinine ratio greater than 20 were considered hypovolemic and urine specific gravity values greater than 1.030 were considered suggestive of hypovolemia.

Results: Overall 60.2% (3,037 of 5,048) of patients with nephrolithiasis and computerized tomography received intravenous fluid boluses. The majority of patients who received a fluid bolus (79.12%) did not meet the criteria for volume depletion based on blood urea nitrogen-to-creatinine ratio or urine specific gravity. In addition, there was no statistically significant difference in the proportion of patients with a blood urea nitrogen-to-creatinine ratio greater than 20 among those who received fluid boluses (25.50%, 617 of 2,420) and those who did not (25.45%, 408 of 1,603; p=1.00).

Conclusions: The use of forced fluids continues to be a common practice in emergency departments and they are frequently administered despite normal blood urea nitrogen-to-creatinine ratios. Thus, it is likely that fluids are not administered due to hypovolemia but rather due to practice approaches rooted in historical dogma and the lack of guidelines on this topic.

Key Words: emergency service, hospital; nephrolithiasis; ureterolithiasis; renal colic

Abbreviations and Acronyms

BUN = blood urea nitrogen

Cr = creatinine

CT = computerized tomography

ED = emergency department

IV = intravenous

In the United States the prevalence of urolithiasis is between 10% and 15%.[1] Patients presenting with nephrolithiasis comprise a large and growing proportion of emergency department visits. From 1992 to 2009 average ED visit rates for urolithiasis have increased from 178 to 340 per 100,000 individuals.[2] ED visits for urolithiasis

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during this time comprised 0.65% of all ED visits.[2] Traditionally the use of intravenous fluid boluses in patients with urolithiasis and acute renal colic has been a standard practice in the ED setting and has been viewed as a mainstay of conservative therapy. In theory the increased intravascular volume from these forced fluid boluses increases hydrostatic pressure and promotes ureteral fluid flow.[3] In turn, this flow has the potential to accelerate stone passage and possibly minimize painful renal colic.

However, the benefit and even safety of this practice have been called into question. A Cochrane systematic review highlighted 2 randomized controlled trials that showed no significant difference in pain scores, surgical intervention, stone clearance or opioid requirements when forced IV hydration was compared to minimal hydration or no fluid administration.[3] It is important to recognize that these studies are potentially limited by selection and attrition bias. In addition, while hypothetically increased intrarenal pressure and forniceal rupture are possible risks of forced fluid administration, neither of these studies described such events. Thus, there is no clear benefit to fluid bolus administration in urolithiasis.[3] Nevertheless, it is estimated that many emergency departments still implement this regimen. In this study we evaluated how common the practice of fluid bolus administration is in community and tertiary care emergency room departments.

Methods

We performed a quality analysis of 11 emergency departments in the Cleveland Clinic health care network. The emergency departments reviewed included Cleveland Clinic Main Hospital Emergency Department, Cleveland Clinic Florida, Twinsburg Family Health & Surgery Center, Marymount Hospital, Medina Hospital, Ashtabula County Medical Center, Richard E. Jacobs Health Center, Fairview Hospital, Lakewood Hospital, Lutheran Hospital and Broadview Heights Medical Center. A retrospective analysis of all ED visits associated with an ICD-9 diagnosis of 592.0 or 592.1 and CT of the abdomen/pelvis between December 7, 2010 and May 6, 2013 was performed. Patients were identified by ICD-9 code found in the encounter diagnosis or problem list in the electronic medical record. The search was performed using the SQL (structured query language) server. CT was used to confirm the diagnosis of nephrolithiasis. The administration of IV fluid boluses was identified via an order in the electronic medical record system as sodium chloride 0.9% IV bolus and its incidence was calculated. Patients were administered 1 L fluid boluses in a "wide open" manner. Patient demographic information including age and gender was obtained, and basic serum laboratory values and urinalysis results were collected.

Fluid boluses given to patients with laboratory findings suggestive of hypovolemia were considered appropriate. Specifically a BUN:Cr ratio was calculated. Patients with a pre-renal profile (BUN:Cr ratio greater than 20) were considered hypovolemic and, therefore, warranted IV fluid bolus. In addition, urine specific gravity was assessed, and values greater than 1.030 were considered abnormal and suggestive of hypovolemia.[4]

Results

A total of 5,048 records of patients with nephrolithiasis and CT of the abdomen/pelvis were identified. Based on the sample reviewed 46.96% of patients had at least 1 ureteral stone while the remaining 53.04% had only renal stones. Mean patient age was 44 years and 51.2% of patients were male. Overall 78% of patients presented to community hospitals and affiliated emergency departments while the remainder was seen at academic centers. Of the patients 2% (102) presented with gross hematuria and 52.6% (2,654) had microhematuria on urinalysis.

IV fluid boluses were administered to 60.2% of patients (3,037 of 5,048). Of the patients who received fluid boluses 2% (60 of 3,037) presented with gross hematuria while 55.4% had microhematuria on urinalysis. Of these patients who received IV fluid boluses 94.9% (2,882 of 3,037) had BUN and creatinine and 61.31% (1,862 of 3,037) had a urine specific gravity available for review. Overall 21.4% (617 of 2,882) of patients had a BUN:Cr profile indicative of hypovolemia and, therefore, such IV hydration was justified. Only 1.1% (20 of 1,862) of patients had a urine specific gravity suggestive of dehydration. Thus, the majority of patients who received a fluid bolus (79.12%) did not meet the criteria for volume depletion based on BUN:Cr ratio or urine specific gravity and IV fluid resuscitation was not apparently indicated. Furthermore, 39.9% (409 of 1,025) of patients who did meet the criteria for hypovolemia based on BUN:Cr ratio did not actually receive a fluid bolus. In addition, there was no statistically significant difference in the proportion of patients with a BUN:Cr ratio greater than 20 among those who received fluid boluses (25.50%, 617 of 2,420) vs those who did not (25.45%, 408 of 1,603; p=1.00).

By Fisher's exact test there was no statistically significant difference in the proportion of fluid boluses that were unwarranted between community hospitals (80.4%, 1,969 of 2,450) and academic centers (76.80%, 451 of 587; $p = 0.0595$). However, there was a statistically significant