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A 66-Year-Old Woman with Achondroplasia and Quadriparesis with an Ovarian Cyst Erroneously Diagnosed as Urinary Retention by an Automated Bladder Scan

Authors' Contribution:

Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
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Patient: Female, 66-year-old
Final Diagnosis: Ovarian cyst
Symptoms: Urinary retention
Medication: —
Clinical Procedure: Automatic bladder scan
Specialty: Genetics • Geriatrics • General and Internal Medicine • Obstetrics and Gynecology • Radiology • Urology

Objective: Mistake in diagnosis
Background: Automated bladder scanning has become a principal tool in the assessment and management of chronically debilitated patients residing in skilled nursing facilities, hospices, and acute inpatient settings. To a large extent, the bladder scan, generally performed by nursing staff, has replaced physical examination while addressing the differential diagnoses of anuria or voiding disturbances that require consideration of urinary catheterization. Health care providers can quickly master this easily performed technique, and currently, due to confidence in the bladder scan finding, physical examination with suprapubic palpation and percussion may be carelessly omitted. The case description presented here illustrates how not performing a physical examination can lead to misdiagnosis caused by misinterpretation of bladder scan findings.
Case Report: A 66-year-old, quadriparetic, chronically ventilated female patient with achondroplasia underwent repeated hospital referrals and bladder catheterizations for presumed flaccid, neurogenic bladder with urinary retention. This postulated diagnosis was based on occasional reports of urinary catheter obstruction as well as on automated bladder scanning indicating a markedly distended bladder. However, the bladder could not be drained by insertion of urinary catheters. Eventually, a proper physical examination excluded the presence of suprapubic fullness compatible with distended bladder and contradicting bladder scan findings, prompting re-examining an overlooked evaluation of computed tomography that reported a huge ovarian cyst. The patient was found to have intact voiding capabilities and is now weaned from the catheter.
Conclusions: This case and the literature review underscore drawbacks in automated bladder scanning. This technique should be used as an adjunctive measure rather than a replacement for a physical examination in the evaluation of voiding disturbances, especially when there are discrepancies between bladder scan findings and the volume of urine drained by catheterization.

Keywords: Achondroplasia • Ovarian Cysts • Ultrasonography • Urinary Bladder • Urinary Retention

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Background

Major, non-invasive, bedside technologies complement or even replace physical evaluation of patients. Medical students who are trained to perform echocardiography diagnose cardiac anomalies more accurately than trained cardiologists performing physical examinations [1]. Pelvic ultrasound has become an indispensable part of gynecological assessment, and bedside point-of-care ultrasound has evolved into an important diagnostic tool in emergency settings [2].

Automated bladder scanning has become a principal tool in the assessment and management of chronically debilitated patients residing in skilled nursing or rehabilitation facilities, hospices, or acute inpatient settings [3,4], with acceptable accuracy [5]. The automated bladder scanning procedure consists of placing of a probe on the lower abdomen and pressing a button. The estimated bladder volume is shown on a screen. No knowledge of abdominal sonography is necessary to use this device. To a large extent, the bladder scan has replaced the physical examination while addressing differential diagnoses of oligo-anuria or voiding disturbances requiring the consideration of urinary catheterization. However, there are clinical conditions that can generate erroneous interpretation of bladder scan findings, leading to a false-positive detection of bladder distention [6-20]. Significantly, the impact of the age-old practice of physical examination on the clinical assessment of retained urine volume has not been addressed in any of these cases.

We report a fully incapacitated patient on long-term, invasive, respiratory support who underwent repeated unnecessary urinary catheterizations for presumed flaccid neurogenic bladder with urinary retention, due to misidentification of a huge ovarian cyst as a distended fluid filled urinary bladder on automated bladder scanning. This case illustrates how a proper physical examination is invaluable in arriving at the correct diagnosis.

Case Report

A 66-year-old female patient with achondroplasia developed quadriplegia that worsened following unsuccessful surgical management of cervical and lumbar spinal stenosis. Upper airway anomalies, including vocal cord paralysis and restrictive lung disease, required invasive ventilation, with the patient managed in a long-term, assisted, ventilatory care facility. An indwelling urinary catheter had been inserted 1 year earlier for the management of sacral pressure sores and for presumed (but not evaluated) flaccid neurogenic bladder. Gradual improvement in motor function of both hands was noted in our facility during a 4-month course of physical and occupational

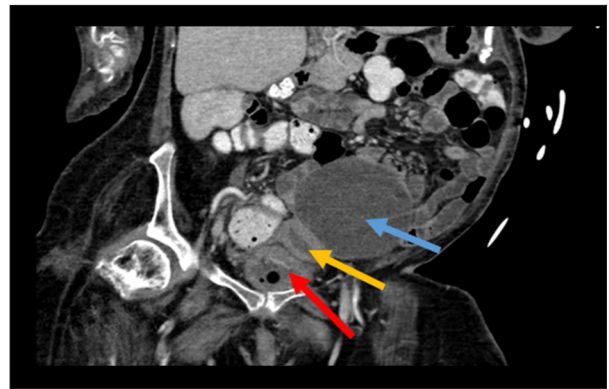


Figure 1. Computed tomography (CT), illustrating a huge (9.5×7.7 cm) ovarian cyst placed to the left (blue arrow) and behind a fluid-containing uterus (yellow arrow) and a drained bladder (red arrow). The large, round filling defect within the bladder represents an air bubble within the inflated balloon of a Foley catheter.

therapy. However, catheter management required repeated replacement, occasionally due to obstruction or evaluation of fever spikes. It was repeatedly met with technical difficulties and inability to drain a 420-440 ml distended bladder as detected by automated bladder scanning (CUBEScan™, BioCon-700, Mcube Technology Co., Ltd., Seoul, Korea). Bedside ultrasonic evaluation performed 5 weeks after admission to our facility also suggested a distended bladder with a misplaced indwelling catheter. On several occasions, the patient was evaluated for assessment of fever and failure to drain the bladder in a tertiary care hospital. Ten weeks after admission to our facility, in one of the referrals to the acute care hospital for evaluation of fever an abdominal computed tomography (CT) was performed. The discharge letter from the hospital did not mention any pathological findings in the CT. Two weeks following this referral, a physical examination that was performed during grand rounds, in parallel with automated bladder scanning, did not reveal the anticipated dullness on percussion or fullness on palpation of the suprapubic region. These conflicting observations raised questions about the validity of the bladder scanning findings. Re-evaluation of the previously performed CT at the tertiary hospital disclosed an overlooked large left ovarian cyst (9.5×7.7 cm), with a Foley catheter in place, within a well-drained bladder (Figure 1). This new perspective explained the enigma of repeated failures to drain a presumably neurogenic distended bladder, detected by bladder scanning. Subsequently, the patient was successfully weaned from the catheter, and with an entirely intact voiding capacity, the diagnosis of a flaccid neurogenic bladder was ruled out.

Due to preserved kidney function and normal voiding capacity, we did not perform further urodynamic studies for evaluation of neurogenic bladder. Incidentally, a recent follow-up CT performed 3 months after discharge from our facility (7 months

after admission to our facility) to home ventilation disclosed a moderate, left hydroureter and mild left hydronephrosis not initially present, suggesting the need for an interventional procedure addressing mechanical compression by the ovarian cyst.

Discussion

Automated bladder scanning is a very convenient procedure that can be easily learned and performed by physicians, nurses, and other trained medical personnel. It is a very sensitive tool for the detection of urinary retention and provides an accurate estimate of retained or post-voiding residual volume [21,22].

However, as outlined in technical guidelines, caution is warranted in the presence of peritoneal ascitic fluid or following pelvic surgery, conditions that may give rise to erroneous readings and interpretation [23,24]. Our patient and previous reports indicate that additional, unexpected pathologies may lead to a misdiagnosis of bladder scan readings. Large ovarian cysts are the most common anatomical anomalies disguised as the bladder on scanning. Indeed, Cooperberg et al [6] and Dunn and Palmer [7] studied 3 middle-aged female patients and Tan et al [8] reported a small series of 5 elderly female patients, all of whom were inaccurately diagnosed by post-voiding automated bladder scanning as having urinary retention. All were eventually diagnosed with cystic pelvic pathology, 7 of which were found to be ovarian cysts. Comparable erroneous diagnoses were reported in 2 adolescent females with ovarian cysts [9]. In a few additional reports, erroneously diagnosed residual volume by bladder scanning was found to represent ovarian and renal cysts as well as myoma, uterine adenomyosis, ascitic fluid, bowel obstruction, iliac artery aneurysm, and peritoneal inclusion cyst [10-20,25].

The accuracy of portable bladder scanners has been evaluated in a few studies. Marks et al [26] reported a correlation (R^2) of 0.90 between an automated bladder scan (BVI-2500) calculated bladder volume and the results of urinary catheterization among 182 adult male and female outpatients. Using 100 cc of bladder volume as a cut-off point measurement, the sensitivity, specificity, and accuracy were 97%, 91%, and 94%, respectively. Brouwer et al [27] assessed bladder volume using the BladderScan® BVI-9400 device in 111 surgical patients as an indicator for the need of catheterization, using a threshold of 500 ml. The proportion of true negative (both estimated and actual bladder volumes, determined by catheterization ≤ 500 ml) and true positive (both estimated and actual volumes > 500 ml) was 1.0 and 0.91, respectively. Jalbani and Ather [21] evaluated the accuracy of the three-dimensional bladder scan (BVI 3000, Verathon, WA, USA) in 34 adult ambulatory patients undergoing catheterization for the determination of residual volumes. They reported a correlation (R^2) of

0.97 between estimated and determined urine volumes irrespective of age, gender, or body mass. A comparable high correlation coefficient (0.92-0.94) was reported by Choe et al [22] using the BME-150A™ device (S&D Medicare Co., Seoul, Korea) and the BladderScan™ BVI 3000 (Diagnostic Ultrasound Co., Bothell, WA, USA). They reported a substantial overestimation of residual volume in 6 out of 89 adult male and female patients that were all related to misdiagnosis of pelvic cystic lesions. Finally, the accuracy and precision of the portable bladder scanner, the BioCon-700 (the same scanner that was used in our case) was evaluated in 125 female patients with voiding disturbances. The correlation coefficient between estimated and actual volumes in this study was 0.87, with overestimation by scan reading principally attributed to pelvic cysts in 16 patients [28].

Our case report, similar to previous reports, illustrates that huge cystic lesions might be especially prone to being misdiagnosed as substantial urine retention, whereas small cysts might be considered as incomplete micturition with post-voiding residual volume. Our patient presented an exceptional setup for misdiagnosis, being quadriparetic as a complication of achondroplasia, which is associated with a high probability of neurogenic bladder [29]. In addition, due to anatomical changes in the pelvis, there were technical difficulties in insertion of a urinary catheter. This led to the suspicion that the catheter had been misplaced, with repeated reports of “failed bladder catheterization” with an un-evacuated bladder on scanning. She was repeatedly referred to emergency facilities for urological aid, since we failed to identify a cause for repeated misdiagnosis, evident on an abdominal CT. Fortunately, the traditional practice of physical examination done in conjunction with bladder scanning revealed dis-concordant findings that prompted re-evaluation of previous imaging, with the identification of an overlooked ovarian cyst.

Urine retention in excess of 400 ml, as noted in our patient, should be able to be detected by palpation, percussion, and auscultatory percussion [30] at the suprapubic region, often associated with local discomfort. By contrast, pelvic cystic masses (similar to the one our patient had) may have a more posterior location, and may not be detected by examination of the suprapubic region, but are likely to be noticed by rectal or vaginal examination. Thus, in addressing voiding disturbances and the possibility of obstructive uropathy, a physical examination should complement automated bladder scanning, particularly in nursing homes and in geriatric, palliative, and rehabilitation facilities. The methodology of examining a distended bladder requires clinical skills that should be thoroughly taught to junior staff, who often fail to detect a moderately enlarged bladder [31]. In that respect, a bladder globe suggesting urinary retention was correctly detected by nurses in 34.8% of hospitalized patients with a determined

bladder volume of 300-499 ml, while the ability to detect a distended bladder increased to 62.5% with bladder volumes >500 ml [32]. Point-of-care ultrasound should be used as an adjunctive measure to physical examination (if a specific diagnosis is not made). It provides direct visualization of the pelvic organs and the catheter [33]. The catheter balloon can be identified to ensure the placement of the catheter into the structure identified as the bladder. This method has also been shown to decrease errors of automated bladder scanning [34] that simply displays the automatically computed volume of any fluid-containing structure that falls within its range [7,22]. Unfortunately, the detection of a “misplaced” catheter noted by bedside ultrasound in our patient did not alert the medical staff to the possibility of confusing cystic pelvic lesion as a distended bladder. The patient’s anatomic pelvic distortion possibly contributed to that error.

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Conclusions

With the available automated bladder scanning methods, confirmation of a distended bladder by physical examination is seldom performed. This may lead to erroneous diagnoses of cystic pelvic masses or other lower abdominal fluid collections as a distended bladder. Unsuccessful bladder drainage “detected” by scanning should raise the suspicion of misdiagnosis. Using the traditional practice of physical examination might be of value in these circumstances, and may enable correct diagnosis.

Institution Where Work Was Done

Herzog Medical Center, Jerusalem, Israel.