

De Gennaro M¹, Di Ciommo V², Capitanucci M L³, Mosiello G¹, Orazi C⁴, Schingo P⁵, Adorasio O⁶, Tubaro A⁷

1. Bambino Gesù' Children's Hospital, Dept Nephro-Urology, Urodynamic Unit, 2. Bambino Gesù' Children Hospital, Epidemiology and Statistics Unit, 3. Bambino Gesù' Children's Hospital, Dept Nephro-Urology, 4. Bambino Gesù' Children's Hospital, Dept Radiology, 5. Bambino Gesù' Children's Hospital, Dept of Radiology, 6. Mayer Children's Hospital, Pediatric Surgery Unit, 7. Urology Dept "La Sapienza" University of Rome

ACCURACY OF BLADDER VOLUME DETERMINATION BY BLADDERSCAN IN PEDIATRIC AGE

Hypothesis/ Aim of the study

Ultrasound imaging has been used and widely accepted as an alternative to catheterisation to evaluate bladder volume in children with voiding dysfunction. Recently, a small portable automated unit, the BladderScan, has been introduced to measure bladder volume. BladderScan is simple to use and non-invasive instrument which provides a direct evaluation of bladder volume expressed in ml; it can be used by physicians, nurses and patients themselves. Nevertheless, there are conflicting evidences regarding the accuracy of BladderScan in determining bladder volume. Particularly, in children a low systematic versus an high mean absolute error has been found comparing BladderScan and Ultrasound measurement of bladder volume(1). In order to assess the accuracy of BladderScan in children, we compared and analysed the results of bladder volume evaluation performed with ultrasound imaging and BladderScan.

Study design, materials and methods

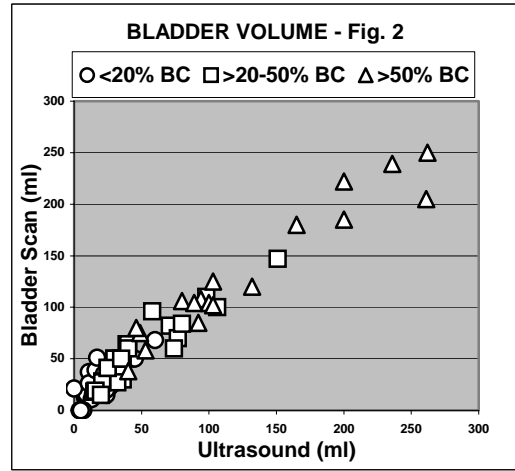
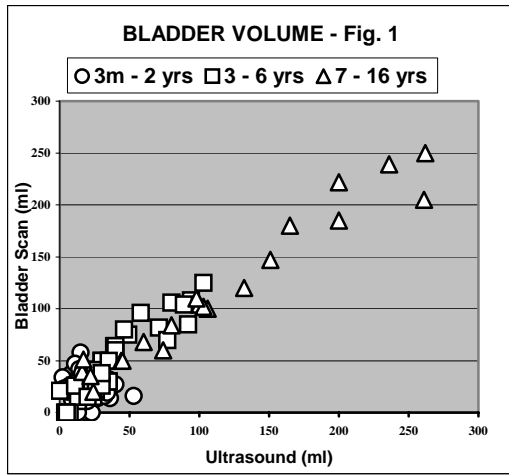
Bladder volume was measured using both ultrasound and BladderScan, during the same session, in 92 (42 females and 51 males) children (average age: 4.6 ± 3.9 years; range: 4 months – 16 years). Children underwent ultrasound for different pathologies: hip dysplasia n=23, recurrent urinary tract infections n=25, hydronephrosis =38, recurrent abdominal pain n=6. BladderScan evaluation was carried out by the same operator, using a standard instrument for adults; ultrasound was performed by two operators using the same formula to measure bladder volume in ml [(anterior-posterior x superior-inferior x transverse dimension) / 2]. Evaluations were made with patients in supine position and not changing position between measurements. Patients were classified into subgroups according with age: 0.3 to 2 (n= 34, average age: 0.9 ± 2) years, 3 to 6 (n= 37, average age: 4.3 ± 1.2) years, 7 to 14 (n=21, average age: 9.5 ± 2) years. Moreover, in children > 2 years, bladder volume was grouped as follows: < 20%(n=31), 20-50% (n=18), >50% (n=25) of the expected bladder capacity (BC) for age [(30 x age in years) + 30]. The data recorded with ultrasound and BladderScan in age and bladder volume subgroups were compared by calculating the Pearson's correlation index (IR) and statistically analysed (Fischer's z).

Results

An overall correlation index of 0.98 ($p < 0.0001$) was found between ultrasound and BladderScan. The results of comparison between ultrasound and BladderScan among the subgroups by age and the subgroups by bladder volume in respect to BC are shown in figure 1 and 2. The data obtained matching age and bladder volume subgroups are reported in table 1.

Table 1: Subgroups by age matched with subgroups of bladder volume defined in respect to expected bladder capacity for age.

Age Subgroups	<u>Expected Bladder Capacity for Age</u>	
	<u>≤20%</u>	<u>>20%</u>
3 – 6 years	IR=0.73 (n= 16)	IR= 0.63 (n=15)
7 – 16 years	IR=0.69 (n= 7)	IR= 0.98 (n=26)



Interpretation of results

We found a statistically significant ($p < 0.0001$) correlation index (IR) among the age (0.3 –2 years: IR= 0.73; 3 - 6 years: IR= 0.92; 7-16 yaers: IR= 0.97) and the bladder volume(<20%: IR= 0.75; 20-50%: IR= 0.96; > 50%: IR= 0.92) subgroups. Nevertheless, analysing data, we found a lower Pearson's correlation index between the two methods in children younger than 3 years (IR=0.73) and if bladder is filled below 20% (IR= 0.75) of BC. Matching subgroups by age with those of bladder volume, the correlation index resulted significant ($p < 0.000001$) in children aged 7-16 years and with bladder volume greater than 20% of BC (IR=0.98), only.

Concluding message

BladderScan seems to be applicable with good accuracy in evaluating children older than 6 years and with bladder greater than 20% of the expected bladder capacity for age. The data collected in infants and in children with low bladder volume indicates the need of a more accurate pediatric Bladderscan.

References

- 1) Clinical agreement between automated and calculated ultrasound measurements of bladder volume. The British Journal of Radiology, 76: 832-834, 2003