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Original Article

Measurement of Bladder Volume following Cesarean Section using Bladderscan

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Abstract: Urinary dysfunction is common following delivery, especially after cesarean section. A large number of women may undergo catheterization to ascertain whether they are in retention, as ultrasound is not always available. The bladder volume in 50 women was estimated using a Bladderscan and compared to that measured by urethral catheterization. A close correlation was found ($r = 0.807$: $P = 0.610$). These results have resulted in the Bladderscan being used as an alternative to intermittent catheterization as a test of bladder overdistension following cesarean section in our unit.

Keywords: Bladderscan; Bladder volume; Pregnancy; Postpartum

Introduction

Ultrasound is increasingly being used in the detection of postoperative urinary retention. However, the equipment is heavy, cumbersome, relatively immobile and expensive, and not always readily available when required. For this reason portable ultrasound devices are becoming increasingly used as a ward or bedside management diagnostic tool. One such device is the Bladderscan (Diagnostic Ultrasound Corporation), which has been shown to have a very close correlation with bladder volumes measured by urethral catheterization [1]. However, it has also been shown that these machines are not quite so accurate if the bladder shape is distorted, when a constant underestimation of bladder volume is found [2]. Before a measurement is taken it is necessary to input into the machine whether it is a male or a female subject being examined. One unusual feature of these machines is that a woman who has previously had a hysterectomy must be input as a male because the uterus distorts the complex algorithms within the machine itself. Although standard ultrasonography used either transabdominally or transvaginally immediately postpartum gives accurate results [3], it is not clear whether the enlarged postpartum uterus has any adverse effects on the accuracy of the Bladderscan. It is known that a considerable restriction of urine flow is found up to 72 hours postpartum [4] and occurs in 14% of patients [5]. It is imperative to know that the bladder does empty adequately in the immediate postpartum phase, or potential long-term damage to the bladder can occur. At present our only option is to catheterize the patient, which is traumatic, uncomfortable and often unnecessary.

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Patients and Methods

Full ethical approval was obtained by the local Research and Ethics Committee before commencement of the study. Fifty caucasian women were enrolled in the study following full informed consent. The age range was 18–36 years (mean 27 years) and there were equal numbers of primiparous and multiparous women. Prior to an elective cesarean section, a 12 g indwelling Foley catheter was inserted and antibiotic cover given. The following morning the Foley catheter was clamped and the bladder allowed to fill naturally until the woman had a desire to void. A minimum of six measurements of bladder volume were then taken with a Bladderscan BVI 3000 using sterile aqueous gel over the Pfannenstiel incision and the largest volume recorded. The clamp on the Foley catheter was then immediately released and the

bladder volume measured and recorded, following which the catheter was removed. A further Bladderscan measurement was then taken and recorded. The Bladderscan volume was then compared with the bladder volume and statistical significance was obtained using non-parametric (Mann–Whitney) tests.

Results

The results show that the Bladderscan volumes correlate closely with the bladder volume ($r = 0.807$: $P = 0.610$) over a wide range of volumes (Table 1 and Fig. 1).

Table 1. Comparison of estimated Bladderscan volumes with actual bladder volumes in postpartum women

	Bladderscan volume (ml)	Catheter volume (ml)	Bladderscan residual volume (ml)
Min	10	22	0
Max	895	1050	250
Mean	331	347	21
Median	292	300	0
Standard deviation	190	212	52

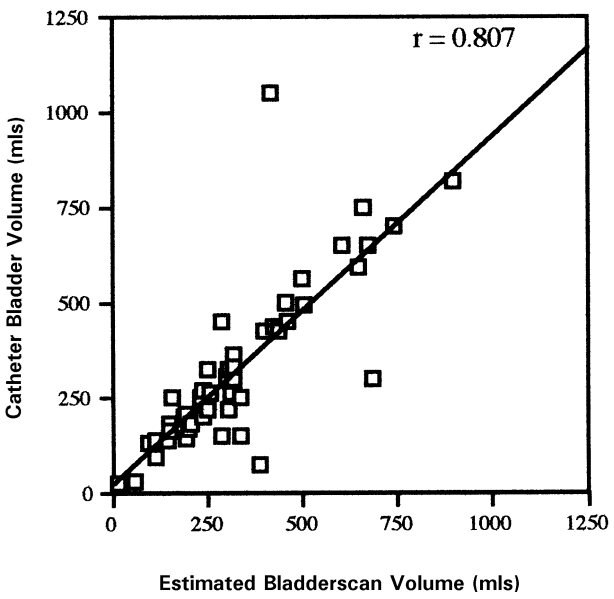

Fig. 1. Comparison between Bladderscan and catheter bladder volumes.

Discussion

This study has shown that the Bladderscan is overall extremely accurate in the measurement of postpartum bladder volume following cesarean section. There were a few isolated cases where the actual volume differed considerably from that of the Bladderscan volume, and this is potentially because the uterine cavity, which may be filled with fluid and blood, was measured instead. The bladder following delivery is elongated superiorally and compressed from anterior to posterior, and is often levorotated, so that if insufficient care and time is taken to locate it precisely a spurious reading may be obtained. Overall, however, the Bladderscan volumes are accurate enough to replace intermittent catheterization as a test to see if the woman has a distended bladder following cesarean section.

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EDITORIAL COMMENT: There is now ample evidence in literature that bladder volumes can be accurately measured with ultrasound. This paper demonstrates that even in the abnormal environment of the immediately postpartum pelvis, the ultrasound bladder scan volumes correlate very well with catheterized bladder volumes. One interesting side note to this study would have been 'did the bladder scan correlate well in smaller volumes which are typically seen as post-void residuals?'. It is comforting to know that the bladder scan can detect elevated bladder volumes which would represent pathologic post-void residuals, but it would also be interesting to know if the bladder scan correlated well with small volumes so that it could also be counted on to demonstrate normal post-volume residuals. If available, the ultrasound is a very humane way of checking post-void residuals that does not involve the discomfort of a catheter.