British Journal of Anaesthesia **92 (4)**: 544–6 (2004)
DOI: 10.1093/bja/aeh099 Advance Access publication February 20, 2004

BJA

Prevalence of postoperative bladder distension and urinary retention detected by ultrasound measurement

L. Lamonerie, E. Marret, A. Deleuze, N. Lembert, M. Dupont and F. Bonnet*

Service d'Anesthésie-Réanimation, Hôpital Tenon, Assistance Publique Hôpitaux de Paris, 4 rue de la Chine, 75970 Paris cedex 20, France

**Corresponding author. E-mail: francis.bonnet@tnn.ap-hop-paris.fr*

Background. Postoperative bladder distension and urinary retention are commonly underestimated. Ultrasound enables accurate measurement of bladder volume and thus makes it possible to determine the prevalence of postoperative bladder distension.

Methods. Using ultrasound, we measured the volume of the bladder contents at the time of discharge from the recovery room in 177 adult patients who had undergone thoracic, vascular, abdominal, orthopaedic or ENT surgery.

Results. Forty-four per cent of the patients had a bladder volume >500 ml and 54% of the 44%, who had no symptoms of bladder distension, were unable to void spontaneously within 30 min. The risk factors for urinary retention were age >60 yr (odds ratio (OR) 2.11, 95% confidence interval (CI) 1.01–4.38), spinal anaesthesia (OR 3.97, 95% CI 1.32–11.89) and duration of surgery >120 min (OR 3.03, 95% CI 1.39–6.61).

Conclusion. Before discharge from the recovery room it seems worthwhile to systematically check the bladder volume with a portable ultrasound device in patients with risk factors.

Br J Anaesth 2004; **92**: 544–6

Keywords: complications, bladder distension; complications, urinary retention; complications, postoperative; monitoring, bladder ultrasound scanner

Accepted for publication: November 28, 2003

Postoperative bladder distension and associated urinary retention may induce pain, restlessness and confusion in elderly patients and may delay hospital discharge.[1] Overdistension of the bladder could also be responsible for permanent changes in bladder contractility, leading to urinary dysfunction.[2] The prevalence of urinary retention ranges from 1% to more than 50%.[1 3] Such a wide range could be related on the one hand to different patient populations and operative conditions, and on the other hand to difficulties in estimating bladder volume and consequently in evaluating the prevalence of urinary retention. Ultrasound measurement of bladder volume at the bedside has been demonstrated recently to be a reliable method of measuring bladder content.[3 4] We used this technique to evaluate more accurately the prevalence of bladder distension in a cohort of postoperative adult patients, and we determined the prevalence of urinary retention and associated risk factors.

Methods

We conducted this prospective study over a 3-month period (August to October 2001) in patients older than 18 yr who were admitted successively to the recovery room after planned surgery. The study was approved by our institutional ethics committee, who considered that written consent by the patients was not necessary as the study represents a non-interventional analysis of our standard practice. Exclusion criteria were pre- or postoperative bladder catheterization, renal failure and emergency surgery. Patients were scheduled for orthopaedic, vascular, thoracic, abdominal or ENT, non-ambulatory, surgery. The specific techniques of anaesthesia were at the discretion of the anaesthesia care team. The bladder volume was measured by trained nurses when patients met the criteria for discharge from the recovery room (normal consciousness, stable vital signs, pain control, absence of nausea and vomiting, absence of sensory and motor block in cases

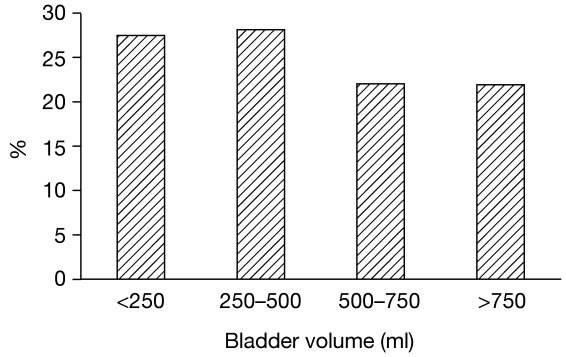

Fig 1 Distribution of patients according to bladder volume evaluated by ultrasound at the time of discharge from the recovery room.

Table 1 Comparison between patients with micturition impairment and other patients (univariate analysis). Values are mean (range) or mean (SD)

	Patients with impaired micturition (*n*=42)	**Other patients (*n*=135)**	***P*-value**
Age (yr)	59 (24–94)	50 (18–86)	<0.005
Duration of surgery (min)	134 (83)	86 (56)	<0.001
General anaesthesia	31	118	
Spinal anaesthesia	11	8	<0.001
Sex (M/F)	32/10	93/42	0.86
Orthopaedic surgery	8	22	0.47
Thoracic surgery	8	29	
Vascular surgery	8	12	
Abdominal surgery	4	16	
ENT surgery	14	56	

where regional anaesthesia was used), with a portable ultrasound device (BVI 3000; Diagnostic Ultrasound, Redmond, WA, USA) using a 2 MHz probe. When the bladder volume was >500 ml, patients were questioned about symptoms of discomfort, bladder stretching and the need to void. They were then asked to void and, if they failed within 30 min, they underwent transient bladder catheterization. We investigated age, sex, type and duration of surgery, and anaesthetic technique as potential risk factors for urinary retention.

Data presentation and statistical analysis

The data are expressed as mean (standard deviation). For statistical analysis we used the *t*-test, χ^2-test or Fisher's exact test as appropriate. The association of each potential risk factor with urinary retention was analysed by univariate and multivariate logistic regression analysis (Statview for Windows Version 5.0; SAS, Cary, NC, USA). A *P*-value of 0.05 or less was considered significant.

Results

One hundred and seventy-seven ASA I–III patients (124 males, 53 females) were included in the study. Their mean age was 52 (17) yr (range 18 – 91 yr). One hundred and fifty-eight patients received general anaesthesia and 19 received spinal anaesthesia with bupivacaine 0.5%. Ultrasound measurement of bladder volume was performed 135 (74) min (range 50–340 min) after arrival in the recovery room. Bladder distension (volume >500 ml) was noted in 44% of the cases (*n*=78) (Fig. 1). Half of the patients with bladder distension (*n*=39) had a bladder volume >750 ml. Forty-six per cent of the patients with bladder distension (*n*=36) had the feeling that the bladder was moderately full or stretched and that they could probably void or that they had the urge to void. Only one of these 36 patients failed to void. On the contrary, of the patients having no bladder sensation (*n*=42), none was able to void within 30 min and all underwent transient urinary catheterization. Urinary retention was thus observed in 23.7% of the patients on discharge from the recovery room. These patients were older and had undergone surgery of longer duration, and a greater proportion had received spinal anaesthesia compared with the other patients (Table 1). On the contrary, there was no difference in sex, duration of stay in the recovery room or type of surgical procedure between the two groups. Multivariate analysis confirmed that age >60 yr (odds ratio (OR) 2.11, 95% confidence interval (CI) 1.01–4.38), spinal anaesthesia (OR 3.97, 95% CI 1.32–11.89) and duration of surgery >120 min (OR 3.03, 95% CI 1.39–6.61) were risk factors.

Discussion

Using a reliable technique of bladder volume measurement, we found that almost one-quarter of adult patients experienced bladder distension without clinical symptoms and were unable to void at the time of discharge from the recovery room.

The prevalence of bladder distension, diagnosed by traditional methods, varies widely, but, as previously mentioned, the accuracy of the diagnosis is questionable.[1 3] Ultrasound allows an accurate measurement of bladder content.[1 4] Rosseland and colleagues[4] have recently documented a bias of –21 ml (95% CI –147 to 104 ml) when comparing ultrasound measurement with the urinary volume obtained by bladder catheterization in 39 patients. Pavlin and colleagues[1] reported that, in 15 patients, the difference between ultrasound measurement and urine collection was less than 15 ml. They also pointed out that the diagnosis of bladder distension by nurses agreed with diagnosis by ultrasound in only 54% of cases. When the bladder content exceeded 500 ml, bladder stretching was experienced by only half of our patients. This is in agreement with a 56% discrepancy between ultrasound and patient evaluation of bladder content in the study of Pavlin and colleagues[3] and may explain clinical underestimation of bladder distension in many previous studies and in daily clinical practice.

The prevalence of urinary retention depends on the bladder volume, the limit of tolerance and on the time

allowed to void. Normal bladder capacity ranges between 400 and 600 ml. Healthy subjects usually experience the first need to void at a bladder volume of 150 ml and the urge to void at 300 ml. When the bladder does not feel full or stretched at volumes exceeding 300 ml, one can consider that micturition is abnormal. In a previous prospective study, Mulroy and colleagues[5] found that urinary retention occurred when patients were unable to void at bladder volumes exceeding 400 ml, while others considered 600 ml as the bladder volume threshold:[3] we chose 500 ml. The bladder volume was >500 ml in 20.5% of the patients included in the study of Pavlin and colleagues[3] compared with 40.5% in the present study, but they included outpatients scheduled for shorter anaesthetic and surgical procedures. The prevalence of urinary retention was also higher in the present study (23.7%) than after ambulatory surgery (0.5–5%).[6] An association between bladder retention and the duration of surgery has been documented[1] and is confirmed by the present study. The shorter duration of surgical procedures in ambulatory surgery patients may explain the lower incidence of bladder distension.[1] Longer operations may be associated with the infusion of greater amounts of fluid and with the administration of higher doses of opioid drugs; both of these factors are likely to promote urinary retention.

In this study, inability to void was experienced more frequently by patients who had spinal anaesthesia. The parasympathetic innervation of the bladder is through the pelvic nerves (S2–S4), which promote detrusor contraction and bladder neck relaxation, and the pudendal nerves (S2–S4), which innervate the external sphincter of the bladder. The sympathetic innervation of the bladder, from the spinal cord between T10 and L2, has an inhibitory effect on the detrusor activity and an excitatory effect on the bladder neck. Stretching of the sensory receptors located in the bladder wall activates parasympathetic and inhibits sympathetic pathways to promote micturition. After spinal anaesthesia, persisting sacral block may thus inhibit voiding, and the patients recover the ability to void normally only when anaesthesia has regressed to the second sacral segment.[7] Kamphuis and colleagues[7] have also demonstrated that recovery of detrusor function depends on the duration of action of the local anaesthetic, being more rapid with lidocaine than with bupivacaine. Thus, spinal anaesthesia of short duration is associated with a low prevalence of urinary retention.[5]

Age and certain types of surgical procedure, such as perineal surgery and inguinal hernia repair, are also considered to be risk factors for urinary retention.[1 3 6] Our series of patients included too few who had such surgical procedures for us to be able to document them as risk factors, but the effect of age was confirmed.

Bladder distension and inability to void may have deleterious consequences for patients, especially if they are old.[2] If bladder distension persists for some hours it may affect the function of the detrusor, resulting in decrease in muscle strength and impairment of micturition.[2] It is likely that undiagnosed bladder distension may lead to urinary retention that lasts only 1 or 2 h in some patients. On the other hand, difficulties in micturition have also been observed several weeks after the surgical procedure.[2] Nevertheless, the relation between new urinary symptoms and bladder distension is not clear.

In conclusion, systematic monitoring of bladder content at the end of stay in the recovery room showed a 44% incidence of bladder distension and a 23.7% incidence of at least transient urinary retention in non-ambulatory patients. These results suggest that it is worth checking for postoperative bladder content with ultrasound in the recovery room, especially in older patients and after long operations.

References

1 Pavlin DJ, Rapp SE, Polissar NL, Malmgren JA, Koerschgen M, Keyes H. Factors affecting discharge time in adult outpatients. *Anesth Analg* 1998; **87**: 816–26

2 Tammela T, Kontturi M, Lukarinen O. Postoperative urinary retention. II Micturition problems after the first catheterization. *Scand J Urol Nephrol* 1986; **20**: 257–60

3 Pavlin JD, Pavlin EG, Gunn HC, Taraday JK, Koerschgen ME. Voiding in patients managed with or without ultrasound monitoring of bladder volume after outpatient surgery. *Anesth Analg* 1999; **89**: 90–7

4 Rosseland LA, Stubhaug A, Breivik H. Detecting postoperative urinary retention with ultrasound scanner. *Acta Anaesthesiol Scand* 2002; **46**: 279–82

5 Mulroy MF, Salinas FV, Larkin KL, Polissar NL. Ambulatory surgery patients may be discharged before voiding after short-acting spinal epidural anesthesia. *Anesthesiology* 2002; **97**: 315–9

6 Pavlin DJ, Pavlin EG, Fitzgibbon DR, Koerschgen ME, Plitt TM. Management of bladder function after outpatient surgery. *Anesthesiology* 1999; **91**: 42–50

7 Kamphuis ET, Ionescu TI, Kuipers PW, de Gier J, van Venrooij GEP, Boon TA. Recovery of storage and emptying functions of the urinary bladder after spinal anesthesia with lidocaine and with bupivacaine in men. *Anesthesiology* 1998; **88**: 310–6