Is spinal anaesthesia a suitable technique for ultra-short outpatient procedures?

Andrea Fanelli[1], *Danila Ghisi*[1], *Massimo Allegri*[2]

[1] Istituti Ospitalieri di Cremona, Cremona; [2] Università di Pavia, Pavia, Italia

Abstract. Spinal anaesthesia is an easy and reliable technique. Factors limiting its use in the ambulatory setting include delayed ambulation, risk of urinary retention and pain after block regression. On the contrary, general anaesthesia with fast-acting drugs provides a fast recovery that facilitates an early discharge. Although recovery after spinal anaesthesia has been improved by reducing the dose of the commonly used long-acting local anaesthetics, discharge times are still prolonged compared with general anaesthesia. 2-Chloroprocaine is an amino-ester local anaesthetic with a very short half-life and a favourable evolution of spinal block for ultra-short outpatient procedures. Moreover, the preservative free 2-chloroprocaine solution showed a very low risk of urinary retention and transient neurological symptoms when compared with bupivacaine and lidocaine. The aim of this article is to evaluate if the neuraxial administration of short-acting local anaesthetics renders spinal anaesthesia a suitable technique for ultra-short surgical procedures. (www.actabiomedica.it)

Key words: spinal anaesthesia, 2-Chloroprocaine, ambulatory anaesthesia, TNS

Introduction

In the past decade, ambulatory surgery has grown worldwide: in fact in North America, 50%-70% of all surgical procedures are performed on an ambulatory setting (1).

An efficient anaesthetic technique in the ambulatory setting has to be able to provide rapid onset and offset of the anaesthetic effect leading to fast patient discharge with minimal side effects.

Spinal anaesthesia is a suitable anaesthetic option for ambulatory surgery of the lower abdomen and lower extremities, because it provides a reliable anaesthetic effect with a rapid onset of action (2). Factors limiting the use of spinal anaesthesia in the ambulatory setting include delayed ambulation, risk of urinary retention, and pain after block regression (2).

Recently, general anaesthesia with fast-acting drugs, as propofol, desflurane and remifentanil, has become popular and is well suited for ambulatory anaesthesia achieving a recovery profile that facilitates an early discharge (3). Although recovery after spinal anaesthesia has been improved by reducing progressively the dose of long acting local anaesthetic and/or adding adjuvants, discharge times are still prolonged compared with general anaesthesia (4-5).

The aim of this article is to evaluate if the neuraxial administration of short acting local anaesthetics renders spinal anaesthesia a suitable technique for ultra-short surgical procedures.

General versus spinal anaesthesia

In 2005 Liu et al published a meta-analysis comparing regional versus general anaesthesia for ambulatory surgery. They included fifteen randomised controlled trials with a direct comparison between central

neuraxial block and general anaesthesia for a total of 1003 patients. Spinal anaesthesia was associated with increased induction time by 8-9 minutes, but also lower Numerical Rating Score (NRS) and less analgesic consumption in the post anaesthesia care unit (PACU). However, spinal anaesthesia was not associated with decreased PACU time and it showed an increased discharge time by 35 minutes (6). Delay in achievement of several common discharge criteria, as ambulation without assistance and micturition, may explain the prolongation of the recovery time.

Casati et al published a prospective randomised study comparing total intravenous anaesthesia performed with propofol and remifentanil versus peripheral nerve blocks and versus 8 mg spinal hyperbaric bupivacaine for lower limb orthopaedic outpatient surgeries (7). They reported no differences in the quality of intraoperative anaesthesia, although regional anaesthesia techniques allowed to bypass the PACU more frequently than general anaesthesia. Nevertheless, patients receiving regional anaesthetic techniques, either peripheral nerve blocks or spinal, required a longer stay in the ambulatory surgery department (7). This may be due to the type and dose of the spinal local anaesthetic used.

In fact, a review published by Nair et al analysing different dosages of bupivacaine for ambulatory knee arthroscopy, showed that high doses (e.g. 10 or 15 mg) of bupivacaine significantly prolonged recovery. On the contrary, the lower dose (5 mg) has a higher incidence of failure (25%). However, doses of bupivacaine as low as 4-5 mg administered to the patient in the unilateral position can produce enough anaesthesia with no or very low incidence of failure. Increasing the dose to 6-7.5 mg may result in delayed recovery without any significant change in failure rate (8).

A possible complication after spinal anaesthesia is the potential development of postoperative urinary retention (9). Voiding after neuraxial anaesthesia requires resolution of the parasympathetic blockade, usually associated with the S2-4 nerve roots. With long-acting local anaesthetics, the bladder can be distended beyond its normal capacity during the prolonged duration of neural blockade leading to a possible dysfunction. Axelsson et al have shown that anaesthesia with 20 mg of bupivacaine may require 7 to 8 hours for resolution of sensory blockade and the return of detrusor function is delayed 1 to 3.5 hours beyond the resumption of ambulation (10). The risk of postoperative urinary retention related to spinal anaesthesia may be reduced with the use of short acting local anaesthetics (11).

Spinal 2-Chloroprocaine

The selection of the correct local anaesthetic for spinal anaesthesia in the ambulatory setting is of paramount importance. The majority of studies included into the meta-analysis of Liu et al used low dose of long acting or intermediate acting local anaesthetics, which may have delayed achievement of the discharge criteria. Spinal long-acting local anaesthetics such as bupivacaine, ropivacaine and levobupivacaine have the advantage of providing excellent intraoperative anaesthesia, but with the disadvantage of a potential delays in hospital discharge (12). Reducing the dose of such agents with or without adding adjuvants may improve the recovery profile of the spinal block. However, the reduction in dose may increase the failure rate (13). Short-acting agents may have significant benefits on early ambulation and shorter recovery time (14). Lidocaine has been used for several years for ambulatory spinal anaesthesia. Its use is actually limited by the phenomenon of transient neurological symptoms (TNSs), which is significantly higher than many of the commonly used local anaesthetics. The spinal administration of mepivacaine was also reported to be associated with a relatively high incidence of TNS (15).

2-Chlororprocaine is an amino-ester local anaesthetic with a very short half-life and a favourable evolution of spinal block for ultra-short outpatient procedures (14). Its pharmacological profile is very similar to that of lidocaine, as characterised by short latency and short duration but with a lower incidence of transient neurological symptoms (15). In literature, there are no reports of urinary retention after spinal anaesthesia with 2-chloroprocaine, consistently with previous experience with the use of 2-chloroprocaine for epidural anaesthesia (16-20). Patients with low risk of postoperative urinary retention can be successfully discharged home after short-duration spinal anaes-

thetics with procaine, chloroprocaine, lidocaine, and even very low doses of bupivacaine (9).

The first study of the use of chloroprocaine in a real clinical setting was published by Palas. In this series of patients, chloroprocaine (30 to 40 mg) was successfully used without complications in 500 consecutive patients scheduled for short surgical procedures (21).

In an attempt to find the minimum effective dose, Kopacz (22) tested two low dosages of chloroprocaine (10 and 20 mg) and compared the results with those of other studies which tested higher doses (23-25). Even though some sensory anaesthesia to pinprick and transient lower-extremity motor weakness could be detected, it should be considered that 10 mg of chloroprocaine was the no-effect dose for spinal anaesthesia. Similarly, the 20 mg dose did not reliably produce dense motor block, even though it was able to produce a cephalad level of sensory anaesthesia of at least L1 in all subjects.

Casati et al. tested three different doses (30, 40 and 50 mg) for intrathecal administration in 45 patients undergoing elective lower limb surgery. As expected, spinal block resolution and time to recovery of ambulation increased in a dose-dependent fashion. In the 30 mg group the 33% of patients required intraoperative analgesic supplementation as a result of insufficient analgesia. On the other side, patients in this group showed no advantage in terms of recovery profile and discharge time (26). Sell et al tested four different doses of spinal chloroprocaine (35, 40, 45 and 50 mg) in a cohort of 64 patients scheduled to undergo elective lower limb surgery. Even though the higher level blocked was similar in all four groups and no difference was observed in the mean time to complete block regression, sensory block regression and discharge were faster in the 35 mg and 40 mg group (27).

Kouri and Kopacz compared subarachnoid injection of 40 mg 2% lidocaine with 40 mg 2% chloroprocaine in 8 healthy volunteers. Chloroprocaine and lidocaine showed similar measures of anaesthetic efficacy with a tendency for chloroprocaine to show shorter duration of motor blockade, even though not significantly. However, chloroprocaine was associated with faster resolution of sensory block and a significantly shorter time to complete block regression and voiding (28). Casati et al compared equal doses of chloroprocaine and lidocaine in 30 patients undergoing knee arthroscopy. Their findings were similar to those found by Kouri and Kopacz in healthy volunteers. In particular, chloroprocaine showed a faster recovery profile as for both sensory/motor blockade and time-to-ambulation, even though no significant differences were noted as for time-to-void (29). When compared to small-dose bupivacaine (7.5 mg), 40 mg of chloroprocaine shows no difference in peak block height and tourniquet tolerance but significant shorter times to block regression, ambulation and voiding with consequently earlier hospital discharge (30). Similarly, 30 mg of chloroprocaine showed similar surgical efficacy to 80 mg of procaine but was associated to a significantly shorter sensory block and significantly shorter discharge times. In a study by Forster et al, both chloroprocaine and articaine proved to be successful for elective day-case knee arthroscopy but chloroprocaine showed a faster recovery and discharge (31).

In a recent retrospective examination of perioperative records of 601 patients who underwent spinal anaesthesia, chloroprocaine was found out to be the most frequently used anaesthetic (84% of cases) with a median dose of 40 mg. In the other patients, lidocaine (median dose 60 mg, range 30-100 mg) and, less frequently, bupivacaine, procaine and mepivacaine were used. The primary outcome measurements were time from injection to ambulation and discharge. Compared to lidocaine, chloroprocaine was associated with a significant shorter time to ambulation (107 ± 24 min vs. 155 ± 40 min) and time to discharge (171 ± 45 min vs. 224 ± 57 min). Incidence of urinary retention was similar between lidocaine and chloroprocaine groups while no transient neurologic symptoms were identified using routine post-operative follow-up (32).

Table 1 shows the ambulation and micturition times as reported in literature after the use of spinal 2-chloroprocaine in the ambulatory setting. Low-risk patients treated with short acting local anaesthetics are at no greater risk of urinary retention than after general anaesthesia, and may be discharged home with similar instructions regarding return if unable to void. Spinal 2-chloroprocaine provides also excellent intraoperative anaesthesia with resolution of motor block in less than two hours.

Table 1. 2-Chloroprocaine Spinal Block Profile

Author	Drugs	Motor Block Time until 90% recovery- - Bromage Scale	Discharge time Ambulation	Micturition
Kouri & Kopacz (28)	40 mg plain chloroprocaine vs 40 mg 2% lidocaine	79 ± 15 min vs 90 ± 14 min	104 ± 12 min* vs. 134 ± 14 min	104 ± 12 min* vs. 134 ± 14 min
Smith et al (23)	30, 45 and 60 mg hyperbaric chloroprocaine ± epinephrine	90 ± 30 min, 131 ± 46 min 120 ± 30 min* 72 ± 12 min 88 ± 15 min 100 ± 13 min	158 ± 33 min, 162 ± 33 min 151 ± 33 min* 100 ± 20 min, 119 ± 15 min 133 ± 20 min	167 ± 47 min, 161 ± 33 min 164 ± 24 min* 100 ± 21 min 132 ± 19 min 141 ± 21 min
Kopacz (22)	10 mg vs 20 mg chloroprocaine	16 ± 15 min* vs 48 ± 7 min	44 ± 19 min* vs 73 ± 9 min	50 ± 10 min* vs 73 ± 9 min
Davis & Kopacz (24)	30 mg chloroprocaine ± 15 g clonidine	79 ± 19 min* vs 65 ± 13 min	131 ± 15 min* vs 99 ± 18 min	131 ± 15 min* vs 99 ± 18 min
Gonter & Kopacz (25)	Chloroprocaine 30 mg vs procaine 80 mg	54 ± 23 min vs 55 ± 44 min	103 ± 12 min* vs 151 ± 26 min	103 ± 12 min* vs 156 ± 23 min
Casati et al (26)	Chloroprocaine 30, 40 and 50 mg	N.A.	85 (45-198) min,* 180 (72-281) min, 185 (90-355) min	182 (120-267) min 198 (123-271) min 203 (102-394) min
Casati et al (29)	Chloroprocaine 50mg vs lidocaine 50 mg	100 (60-140) min* vs 60 (45-120) §	152 (100-185) min* vs 103 (70-191)	190 (148–340) min vs 180 (100-354) min
Sell et al (27)	Chloroprocaine 35, 40, 45 and 50 mg	106 (91-121) min 100 (99-123) min 111 (99-123) min, 119 (102-137) min	117 (103-131) min* 116 (103-130) min* 127 (106-148) min 144 (128-161) min	123 (108-138) min* 122 (109-135) min* 137 (124-149) min 165 (141-189) min
Lacasse et al (30) vs bupivacaine 7.5mg	Chloroprocaine 40 mg vs 119 ± 93§	76 ± 25 min* vs 265 ± 65	225 ± 56 min* vs 338 ± 99	271 ± 96 min*
Forster et al (102)	Chloroprocaine 40 mg vs articaine 60 mg	75 (60/90) min* vs 135 (105/150) min§	318 ± 74.2 min vs 392 ± 93.2 min	204 ± 61.8 min vs 219 ± 71.6 min

Data are shown as mean ± SD or median (25th/75th percentiles), unless stated otherwise
*Significant versus other treatment/group

Conclusion

In summary, the right selection of the local anaesthetic makes spinal anaesthesia a suitable anaesthetic technique for ultra-short outpatient procedures. If short acting local anaesthetics are involved, spinal anaesthesia could be competitive versus general anaesthesia too. In fact, 2-chloroprocaine showed to be advantageous in terms of recovery profile and facilitate earlier ambulation and home discharge compared to low dose bupivacaine, lidocaine and articaine.

References

1. Apfelbaum JL, Walawander CA, Grasela TH, et al. Eliminating intensive postoperative care in same-day surgery patients using short-acting anesthetics. *Anesthesiology* 2002; 97: 66-74.

2. Mulroy M, Salinas F. Neuraxial Techniques for Ambulatory Anesthesia
3. Gupta A, Stierer T, Zuckerman R, et al. Comparison of recovery profile after ambulatory anesthesia with propofol, isoflurane, sevoflurane and desflurane: a systematic review. *Anesth Analg* 2004; 98: 632-4.
4. Casati A, Vinciguerra F. Intrathecal anesthesia. *Curr Opin Anesthesiol* 2002; 15: 543-51.
5. Cappelleri G, Aldegheri G, Danelli G, et al. Spinal anesthesia with hyperbaric levobupivacaine and ropivacaine for outpatient knee arthroscopy: a prospective, randomized, double-blind study. *Anesth Analg* 2005; 101: 77-82.
6. Liu SS, Strodtbeck WM, Richman J, Wu C. A Comparison of Regional Versus General Anesthesia for Ambulatory Anesthesia: A Meta-Analysis of Randomized Controlled Trials. *Anesth Analg* 2005; 101: 1634-42.
7. Casati A, Cappelleri G, Aldegheri G, Marchetti C, Messina M, De Ponti A. Total intravenous anesthesia, spinal anesthesia or combined sciatic-femoral nerve block for outpatient knee arthroscopy. *Minerva Anestesiol* 2004: 70: 493-502.
8. Nair GS, Abrishami A, Lermitte J, Chung F. Systematic review of spinal anaesthesia using bupivacaine for ambulatory knee arthroscopy. *BJA* 2009; 102 (3): 307-15.
9. Mulroy MF, Alley EA. Management of Bladder Volumes When Using Neuraxial Anesthesia.
10. Axelsson K, Mollefors K, Olsson JO, et al. Bladder function in spinal anaesthesia. *Acta Anaesthesiol Scand* 1985; 29: 315-21.
11. Mulroy MF, Salinas FV, Larkin KL, et al. Ambulatory surgery patients may be discharged before voiding after short-acting spinal and epidural anesthesia. *Anesthesiology* 2002; 97:
12. Liu SS, Ware PD, Allen HW, et al. Dose-response characteristics of spinal bupivacaine in volunteers: clinical implications for ambulatory anesthesia. *Anesthesiology* 1996; 85: 729-36.
13. Ben-David B, Solomon E, Admoni H, et al. Intrathecal fentanyl with small-dose dilute bupivacaine: better anesthesia without prolonging recovery. *Anesth Analg* 1997; 85: 560-5.
14. Forster JG and Rosenberg PH. Revival of old local anesthetics for spinal anesthesia in ambulatory surgery. *Current Opinion in Anesthesiology* 2011; 24: 633-7.
15. Zaric D, Pace NL. Transient neurologic symptoms (TNS) following spinal anaesthesia with lidocaine versus other local anaesthetics. *Cochrane Database Syst Rev* 2009; CD003006.
16. Casati A, Fanelli G, Danelli G, et al. Spinal anesthesia with lidocaine or preservativefree 2-chlorprocaine for outpatient knee arthroscopy: a prospective, randomized, double-blind comparison. *Anesth Analg* 2007; 104: 959-64.
17. Sell A, Tein T, Pitka¨nen M. Spinal 2-chloroprocaine: effective dose for ambulatory surgery. *Acta Anaesthesiol Scand* 2008; 52: 695-9.
18. Yoos JR, Kopacz DJ. Spinal 2-chloroprocaine for surgery: an initial 10-month experience. *Anesth Analg* 2005; 100: 553-8.
19. Forster JG, Kallio H, Rosenberg PH, et al. Chloroprocaine versus articaine as spinal anaesthetics for day-case knee arthroscopy. *Acta Anaesthesiol Scand* 2011; 55: 257-8.
20. Mulroy MF, Larkin KL, Hodgson PS, et al. A comparison of spinal, epidural, and general anesthesia for outpatient knee arthroscopy. *Anesth Analg* 2000; 91: 860-4.
21. Palas T. 1% chloroprocaine for spinal anesthesia. *Reg Anesth Pain Med* 2003; 28: A52.
22. Kopacz DJ. Spinal 2-chloroprocaine: minimum effective dose. *Reg Anesth Pain Med* 2005; 30: 36-42.
23. Smith KN, Kopacz DJ, McDonald SB. Spinal 2-chloroprocaine: a dose-ranging study and the effect of added epinephrine. *Anesth Analg* 2004; 98: 81-8.
24. Davis BR, Kopacz DJ. Spinal 2-chloroprocaine: the effect of added clonidine. *Anesth Analg* 2005; 100: 559-65.
25. Gonter AF, Kopacz DJ. Spinal 2-chloroprocaine: a comparison with procaine in volunteers. *Anesth Analg* 2005; 100: 573-9.
26. Casati A, Danelli G, Berti M, Fioro A, Fanelli A, Benassi C, et al. Intrathecal 2-chloroprocaine for lower limb outpatient surgery: a prospective, randomized, double-blind, clinical evaluation. *Anesth Analg* 2006; 103: 234-8.
27. Sell A, Tein T, Pitkanen M. Spinal 2-chloroprocaine: effective dose for ambulatory surgery. *Acta Anaesthesiol Scand* 2008; 52: 695-9.
28. Kouri ME, Kopacz DJ. Spinal 2-chloroprocaine: a comparison with lidocaine in volunteers. *Anesth Analg* 2004; 98: 75-80.
29. Casati A, Fanelli G, Danelli G, et al. Spinal anesthesia with lidocaine or preservative-free 2-chlorprocaine for outpatient knee arthroscopy: a prospective, randomized, double-blind comparison. *Anesth Analg* 2007; 104: 959-64.
30. Lacasse MA, Roy JD, Forget J, et al. Comparison of bupivacaine and 2-chloroprocaine for spinal anesthesia for outpatient surgery: a double-blind randomized trial. *Can J Anaesth* 2011; 58: 384-91.
31. Forster JG, Kallio H, Rosenberg PH, Harilainen A, Sandelin J, Pitkanen MT. Chloroprocaine vs. articaine as spinal anaesthetics for day-case knee arthroscopy. *Acta Anaesthesiol Scand* 2011; 55: 273-81.
32. Hejtmanek MR, Pollock JE. Chloroprocaine for spinal anesthesia: a retrospective analysis. *Acta Anaesthesiol Scand* 2011; 55: 267-72.

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Correspondence: Andrea Fanelli
Department of Anaesthesia, Istituti Ospitalieri di Cremona
Via Concordia, 1 - 26100 Cremona, Italy
Tel. 3403704860
E-mail: andrea.fanelli@gmail.com